Scientific Foundation SPIROSKI, Skopje, Republic of Macedonia
Open Access Macedonian Journal of Medical Sciences. 2023 Feb 05; 11(G):53-62.
https://doi.org/10.3889/oamjms.2023.11434
eISSN: 1857-9655
Category: *G - Nursing*
Section: *Nursing in Surgery*

PedSQL™ Family Impact Module as an Instrument foe Quality of Life Assessment (PedsQL™) in Children with Chronic Postsurgical Pain

Yaroslav Semkovych[1], Dmytro Dmytriiev[2], Oleksandr Dobrovanov[3,4]*

[1]Department of Anesthesiology and Intensive Care, Ivano-Frankivsk Regional Children's Clinical Hospital of Ivano-Frankivsk Regional Council, Ivano-Frankivsk, Ukraine; [2]Department of Anesthesiology and Intensive Care, Vinnytsia National Pirogov Memorial Medical University, Vinnytsia, Ukraine; [3]A. Getlik Clinic for Children and Adolescents, Slovak Medical University and University Hospital of Medicine, Bratislava, Slovakia; [4]Department of Pediatrics, Slovak Medical University, Bratislava, Slovakia

Edited by: Mirko Spiroski
Citation: Semkovych Y, Dmytriiev D, Dobrovanov O. PedSQL™ Family Impact Module as an Instrument foe Quality of Life Assessment (PedsQL™) in Children with Chronic Postsurgical Pain. Open Access Maced J Med Sci. 2023 Feb 05; 11(G):53-62. https://doi.org/10.3889/oamjms.2023.11434
Keywords: Chronic pain; Quality of life; Children; Regional analgesia
***Correspondence:** MUDr. Oleksandr Dobrovanov, PhD., MBA, A. Getlik Clinic for Children and Adolescents, Slovak Medical University and University Hospital, Bratislava, Slovakia.
E-mail: brovan.oleksandr@gmail.com
Received: 24-Dec-2022
Revised: 24-Jan-2023
Accepted: 26-Jan-2023

Funding: This research did not receive any financial support
Competing Interests: The authors have declared that no competing interests exist

Abstract

BACKGROUND: The concept of quality of life (QoL) is today an integral part of the health-care system and clinical, medical, and social research. Untreated chronic pain in children increases the risk of developing mental disorders later in life. The pediatric QoL inventory 3.0 (PedsQL™) is one of the most valid and widely used tools for assessing pediatric QoL.

AIM: The study was to assess QoL in children with chronic postsurgical pain 7 days, 3 months, and 6 months after surgery with different analgesic techniques by means of the PedsQL™ 3.0 Family Impact Module questionnaires.

METHODS: Following the inclusion and exclusion criteria, a total of 80 children undergoing treatment at the surgical department of a Communal Non-Profit Enterprise "Ivano-Frankivsk Regional Children's Clinical Hospital of Ivano-Frankivsk Regional Council" were enrolled in the study. Among them, 60 children underwent anterior abdominal wall surgery with various types of anesthetic techniques. The patients were asked to fill in the questionnaires repeatedly 3 and 6 months after hospital discharge.

RESULTS: QoL in patients with chronic pain syndrome reduced significantly ($p < 0.001$) on the scales of physical functioning, emotional functioning, social functioning, cognitive functioning, communication, worry, daily activities, family relationships, as well as pediatric QoL summary score, parent QoL summary score, and family functioning summary score 3 and 6 months after surgery with conventional analgesic techniques.

CONCLUSIONS: Chronic pain syndrome reduces QoL in children aged 7–18 years after anterior abdominal wall surgery by reducing their physical, emotional, social, and cognitive functioning. The myofascial block in conjunction with general anesthesia accelerates patient's recovery, relieves pain, and reduces emotional stress.

Introduction

The concept of quality of life (QoL) is today an integral part of the health-care system and clinical, medical, and social research. In 1982, Kaplan and Bush introduced the term "health-related QoL" (HRQoL) that allowed for identifying parameters describing the state of health, care for health, and quality of medical care according to the general QoL concept [1], [2]. Furthermore, in children with chronic conditions, the effect of the disease and treatment on family functioning, alongside with the role of the family in child's adaptation to the pathological condition, is a serious issue [3], [4], [5]. Understanding the effect of chronic pain, postsurgical pain and chronic diseases on child's parents and family is critical for delivering comprehensive care to these families [6], [7], [8], [9]. However, the relationship between the disease, its clinical course, and its impact on child's parents and family is complex and dynamic. The previous studies have shown that parents/guardians of children with chronic conditions experience stress [1] and more family burden [2], need social support [3], and spend more time with their children [4]. Moreover, negative parental perception of child's health is associated with higher health-care utilization.

The pediatric QoL inventory 3.0 (PedsQL™) Family Impact Module provides for using a multidimensional tool that could be easily integrated into the PedsQL™ Measurement Model [10]. The PedsQL™ Measurement Model includes general HRQoL indicators [11], [12], [13], disease-specific QoL measurement tools [14], [15], [16], [17], [18], as well as general indicators of fatigue [19], satisfaction with health-care services [20], [21], and ecological momentary assessment.

Patient-reported outcomes (PROs) are self-assessment method that directly measures the patient's perception of the impact of the disease and treatment as clinical management endpoints, and includes multi-item HRQoL scales, as well as single-item measures

(e.g., the visual analog scale) [22]. Pediatric PROs should be sensitive to the child's cognitive development and include both the child's self-report and the parents' proxy-report to reflect their potentially unique perspectives [23]. HRQoL is a commonly used indicator of health and well-being that demonstrates the impact of health on QoL and reflects the desirability of health states relative to perfect health. In addition, HRQoL can be used to generate quality-adjusted life years – a standard outcome measure for cost-effectiveness of treatment and health-care resources [24].

We attempted to determine the psychometric properties of the PedsQL™ Family Impact Module, a tool designed to assess the impact of chronic conditions on children and their families, through studying physical functioning, emotional functioning, social functioning, cognitive functioning, and communication. In addition, QoL was analyzed on the following scales: Worry, daily activities, and family relationships. Changes in the pediatric QoL summary score, parent QoL summary score, and family functioning summary score were determined. Moreover, we compared that HRQoL reported by parents and HRQoL reported by children. We expected the PedsQL™ Family Impact Module to be efficient and reliable. We hypothesized that parents of children treated with conventional analgesia would have worse HRQoL and Family Function in gas compared to parents whose children underwent combined regional analgesia. In addition, we hypothesized that parents with worse HRQoL would report worse HRQoL in their children.

Since the PedsQL™ is one of the most valid and widely used tools for assessing pediatric QoL, this research compares the efficiency of the Family Impact Module with regard to the PedsQL™.

The study was aimed to assess QoL in children with post-surgical pain 7 days, 3 months, and 6 months after surgery with different analgesic techniques by means of PedsQL™ 3.0 Family Impact Module questionnaires.

Methods

The prospective study included 80 (45 boys and 35 girls) children at the age of 7–18 years treated for inguinal hernia, appendicitis at the surgical department of a Communal Non-Profit Enterprise "Ivano-Frankivsk Regional Children's Clinical Hospital of Ivano-Frankivsk Regional Council," Ivano-Frankivsk, Ukraine, during 2020–2022. Among them, there were 60 children who underwent anterior abdominal wall surgery with different analgesic techniques. The control group included 20 children with no surgical pathology. The age of 7 is considered the lower limit when a child is cap able of self-reporting pain. Inclusion criteria were children aged 7–18 years with inguinal hernia and appendicitis ASA grades I-II at the age of 7–18 years, with the mandatory parental consent to involve their child in clinical research. Exclusion criteria included children <7 years of age; those with ASA grade III or higher, mental disorders, neoplasms, or tumors, acute or inflammatory processes of any etiology and localization, sepsis, shock; those who previously underwent surgery on the lower abdomen; those who experienced pain for 6 months prior to surgery; those who refused to participate in the research; and children whose parents refused to give consent and children who gave no consent.

All patients were divided into four groups:

- Group 0, the control group, included 20 children who had no surgical pathology and met inclusion criteria
- Group I comprised 20 children who underwent anterior abdominal wall surgery under general anesthesia using the transversalis fascia plane block (TFPB)
- Group II included 20 children who underwent anterior abdominal wall surgery under general anesthesia using opioids, with the development of chronic pain syndrome
- Group III included 20 children who underwent anterior abdominal wall surgery under general anesthesia using the TFPB, combined with the quadratus lumborum block (QLB-4) through a single injection, with the development of chronic pain syndrome.

All clinical and laboratory studies were conducted in accordance with the World Medical Association Declaration of Helsinki "Ethical Principles for Medical Research Involving Human Subjects." According to the Law, before a subject's participation in the study, a written informed consent form was signed by each subject (parents/adult guardians). The manuscript was approved by the Ethics Committee of the Communal Non-Profit Enterprise "Ivano-Frankivsk Regional Children's Clinical Hospital of Ivano-Frankivsk Regional Council," as evidenced by an Excerpt from the Minute of the Committee Meeting No. 2 dated February 24, 2022.

The authors obtained official permission to use a licensed version of the PedsQL™ 3.0 Family Impact Module questionnaire from the Mapi Research Trust, as evidenced by a corresponding letter.

The Neuropathic Pain Diagnostic Questionnaire Douleur Neuropathique 4 (DN4) Questions and the leeds assessment of neuropathic symptoms and signs (LANSSs) Pain Scale (Bennett, 2001) were used to assess the presence of chronic or neuropathic pain.

After a telephone survey with patients under study or their parents/guardians on the presence of pain at surgery sites 3 and 6 months after surgery, children accompanied by their parents/guardians were

invited for a clinical examination at the hospital. First, patients were informed about the purpose of the study once again, then children, adolescents, their parents/guardians signed the informed consent form and the DN4 and LANSS questionnaires were applied to all the participants.

The results obtained were statistically processed using statistical measures of variation, correlation analysis, and Student's t-test. Differences were considered statistically significant at $p < 0.05$. The proportions were statistically compared using a z-test.

Results

The assessment of children's age, body weight, and gender found no difference that indicated a representative sample.

The assessment of gender revealed no difference between boys and girls in Group I and III, whereas, in Group II, there was found a significant male predominance, which had no effect on the study results (Table 1).

Table 1: Distribution of patients by age, body weight, and gender

Indicator	Group 0 n = 20	Group I n = 20	Group II n = 20	Group III n = 20
	M ± m	M ± m	M ± m	M ± m
Age, years	9.8 ± 0.48	9.78 ± 0.23	9.78 ± 0.45	9.12 ± 0.56
Body weight, kg	34.84 ± 0.68	36.6 ± 1.61	34.09 ± 1.34	35.11 ± 1.19
Boys, %	52.8 ± 0.22	51.4 ± 0.84	53.42 ± 1.31	56.21 ± 2.31
Girls, %	47.2 ± 0.33	48.6 ± 1.24	46.58 ± 1.27	43.9 ± 1.17* (4.754)

*a significant difference between boys and girls in corresponding groups ($p < 0.05$).

According to the analysis of the length of hospital stay in the surgical department, children, who received conventional anesthesia management, stayed at the hospital much longer as compared to those who received RA (3.28 ± 0.24 days in Group II versus 3.0 ± 0.30 days in Group I, and 2.1 ± 0.16 days in Group III, respectively, $p < 0.05$) (Table 2).

Table 2: Length of hospital stay in the surgical department

Indicator	Group I n = 20	Group II n = 20	Group III n = 20
	M ± m	M ± m	M ± m
Length of stay in the department	3.0 ± 0.30* (t = 2.647)	3.28 ± 0.24* (t = 4.09)	2.1 ± 0.16

*a significant difference as compared to Group I ($p < 0.05$).

When assessing the PedsQL™ 3.0 Family Impact Module questionnaires on the scales of physical functioning, emotional functioning, social functioning, cognitive functioning, communication, worry, daily activities, family relationships, pediatric QoL summary score, parent QoL summary score, and family functioning summary score, the following results were found.

On the 7th day of the study, the indicators of QoL on the physical functioning scale in Group I, Group II, and Group III reduced significantly, by 42.22%, 41.11%, and 42.89%, respectively, as compared to the control group ($p < 0.01$). The indicators in Group I did not differ significantly from those in Group II and Group III ($p > 0.05$). In Group II, the indicators did not differ significantly from those in Group III ($p > 0.05$).

Three months after surgery, the indicators of QoL on the physical functioning scale in Group I did not differ significantly from those in the control group ($p > 0.05$). At the same time, the indicators of QoL on the physical functioning scale in Group II and Group III reduced significantly, by 24.22% and 14.44%, respectively, as compared to the control group ($p < 0.01$). Moreover, the indicators in Group I increased significantly, by 24.56% and 14.82%, as compared to Group II and Group III, respectively ($p < 0.001$). In Group II, the indicators of QoL on the physical functioning scale reduced slightly, by 12.9%, as compared to Group III ($p < 0.01$).

Six months after surgery, the indicators of QoL on the physical functioning scale in Group I and Group III did not differ significantly from those in the control group ($p > 0.05$). The indicators in Group II reduced significantly, by 21.78%, as compared to the control group ($p < 0.01$). There was no significant difference between the indicators in Group I and Group III ($p > 0.05$). The indicators in Group I increased significantly, by 22.47%, as compared to Group II ($p < 0.001$). In Group II, the indicators reduced significantly, by 25.57%, as compared to Group III ($p < 0.001$) (Table 3).

Table 3: Quality of life on the physical functioning scale in the studied groups at different study periods

Time after surgery	Group I n = 20	Group II n = 20	Group III n = 20
Control group n = 20	93.75 ± 4.17		
7 days after surgery	$54.17 \pm 7.15^{\Delta CG}$	$55.21 \pm 8.21^{\Delta CG}$	$53.54 \pm 9.1^{\Delta CG}$
3 months after surgery	$94.17 \pm 4.6^{YG2;\ YG3}$	$71.04 \pm 7.7^{\Delta CG;\ \Delta G3;\ YG1}$	$80.21 \pm 9.26^{\Delta CG;\ \Delta G2;\ YG1}$
6 months after surgery	94.58 ± 5.59^{YG2}	$73.33 \pm 6.81^{\Delta CG;\ YG1;\ YG3}$	92.08 ± 4.46^{YG2}

CG – control group; G1 – Group I; G2 – Group II, and G3 – Group III. $^{\Delta}p < 0.01$; $^{Y}p < 0.001$ – a statistically significant difference in relation to the corresponding groups.

On the 7th day of the study, the indicators of QoL on the emotional functioning scale in Group I, Group II, and Group III reduced significantly, by 43.84%, 44.38%, and 44.93%, respectively, as compared to the control group ($p < 0.01$). The indicators in Group I did not differ significantly from those in Group II and Group III ($p > 0.05$). In Group II, the indicators did not differ significantly from those in Group III ($p > 0.05$).

Three months after surgery, the indicators of QoL on the emotional functioning scale in Group I did not differ significantly from those in the control group ($p > 0.05$). The indicators of QoL on the emotional functioning scale in Group II and Group III reduced significantly, by 21.64% and 12.6%, respectively, as compared to the control group ($p < 0.01$). The indicators in Group I increased significantly, by 22.49% and 13.55%, as compared to Group II and Group III, respectively ($p < 0.001$). In Group II, the indicators of QoL on the emotional functioning scale reduced slightly, by 11.54%, as compared to Group III ($p < 0.01$).

Six months after surgery, the indicators of QoL on the emotional functioning scale in Group I and Group III did not differ significantly from those in the control group ($p > 0.05$). At the same time, the indicators

in Group II reduced significantly, by 18.08%, as compared to the control group (p < 0.01). There was no significant difference between the indicators in Group I and Group III (p > 0.05). The indicators in Group I increased significantly, by 18.75%, as compared to Group II (p < 0.001). In Group II, the indicators reduced slightly, by 19.4%, as compared to Group III (p < 0.001) (Table 4).

Table 4: Quality of life on the emotional functioning scale in the studied groups at different study periods

Time after surgery	Group I n = 20	Group II n = 20	Group III n = 20
Control group n = 20	91.25 ± 3.93		
7 days after surgery	51.25 ± 9.01$^{\Delta CG}$	50.75 ± 6.13$^{\Delta CG}$	50.25 ± 8.35$^{\Delta CG}$
3 months after surgery	92.25 ± 4.44$^{YG2; YG3}$	71.5 ± 7.63$^{\Delta CG; \Delta G3; YG1}$	79.75 ± 8.5$^{\Delta CG; \Delta G2; YG1}$
6 months after surgery	92 ± 6.96^{YG2}	74.75 ± 9.8$^{\Delta CG; YG1; YG3}$	89.25 ± 5.45^{YG2}

CG – control group; G1 – Group I; G2 – Group II, and G3 – Group III. $^{\Delta}p < 0.01$; $^{Y}p < 0.001$ – a statistically significant difference in relation to the corresponding groups.

On the 7th day of the study, the indicators of QoL on the social functioning scale in Group I, Group II, and Group III reduced significantly, by 43.69%, 43%, and 44.37%, respectively, as compared to the control group (p < 0.01). At the same time, the indicators in Group I did not differ significantly from those in Group II and Group III (p > 0.05). There was no significant difference between the indicators in Group II and Group III (p > 0.05).

Three months after surgery, the indicators of QoL on the social functioning scale in Group I did not differ significantly from those in the control group (p > 0.05). The indicators in Group II and Group III reduced slightly, by 21.5% and 10.24%, respectively, as compared to the control group (p < 0.05). The indicators in Group I increased slightly, by 20.69% and 9.31%, as compared to Group II and Group III, respectively (p < 0.01). In Group II, the indicators of QoL on the social functioning scale reduced slightly, by 14.35%, as compared to Group III (p < 0.05).

Six months after surgery, the indicators of QoL on the social functioning scale in Group I and Group III did not differ significantly from those in the control group (p > 0.05). In addition, the indicators in Group II reduced significantly, by 19.45%, as compared to the control group (p < 0.01). There was no significant difference between the indicators in Group I and Group III (p > 0.05). The indicators in Group I increased significantly, by 18.34%, as compared to Group II (p < 0.001). In Group II, the indicators reduced significantly, by 21.19%, as compared to Group III (p < 0.001) (Table 5).

Table 5: Quality of life on the social functioning scale in the studied groups at different study periods

Time after surgery	Group I n = 20	Group II n = 20	Group III n = 20
Control group n = 20	91.56 ± 5.83		
7 days after surgery	51.56 ± 9.48$^{\Delta CG}$	52.19 ± 7.39$^{\Delta CG}$	50.94 ± 7.66$^{\Delta CG}$
3 months after surgery	90.63 ± 6.88$^{\Delta G3; YG2}$	71.88 ± 12.25$^{\bullet G3; \Delta CG; YG1}$	82.19 ± 9.35$^{\bullet CG; \bullet G2; \Delta G1}$
6 months after surgery	90.31 ± 7.71^{YG2}	73.75 ± 8.26$^{\Delta CG; YG1; YG3}$	89.38 ± 8.39^{YG2}

CG – control group; G1 – Group I; G2 – Group II, and G3 – Group III. $\bullet p < 0.05$; $^{\Delta}p < 0.01$; $^{Y}p < 0.001$ – a statistically significant difference in relation to the corresponding groups.

On the 7th day of the study, the indicators of QoL on the cognitive functioning scale in Group I, Group II, and Group III reduced significantly, by 40.97%, 40.43%, and 42.05%, respectively, as compared to the control group (p < 0.01). The indicators in Group I did not differ significantly from those in Group II and Group III (p > 0.05). There was no significant difference between the indicators in Group II and Group III (p > 0.05).

Three months after surgery, the indicators of QoL on the cognitive functioning scale in Group I did not differ significantly from those in the control group (p > 0.05). At the same time, the indicators in Group II and Group III reduced significantly, by 25.88% and 9.97%, respectively, as compared to the control group (p < 0.01). The indicators in Group I increased significantly, by 26.47% and 10.7%, as compared to Group II and Group III, respectively (p < 0.001). In Group II, the indicators of QoL on the cognitive functioning scale reduced significantly, by 21.45%, as compared to Group III (p < 0.001).

Six months after surgery, the indicators of QoL on the cognitive functioning scale in Group I and Group III did not differ significantly from those in the control group (p > 0.05). In addition, the indicators in Group II reduced significantly, by 23.99%, as compared to the control group (p < 0.01). At the same time, there was no significant difference between the indicators in Group I and Group III (p > 0.05). The indicators in Group I increased significantly, by 25.2%, as compared to Group II (p < 0.001). In Group II, the indicators reduced significantly, by 30.5%, as compared to Group III (p < 0.001) (Table 6).

Table 6: Quality of life on the cognitive functioning scale in the studied groups at different study periods

Time after surgery	Group I n = 20	Group II n = 20	Group III n = 20
Control group n = 20	92.75 ± 5.95		
7 days after surgery	54.75 ± 7.52$^{\Delta CG}$	55.25 ± 8.35$^{\Delta CG}$	53.75 ± 8.25$^{\Delta CG}$
3 months after surgery	93.5 ± 4.62$^{YG2; YG3}$	68.75 ± 8.72$^{\Delta CG; YG1; YG3}$	83.5 ± 4.62$^{\Delta CG; YG1; YG2}$
6 months after surgery	94.25 ± 4.67^{YG2}	70.5 ± 9.72$^{\Delta CG; YG1; YG3}$	92 ± 5.23^{YG2}

C – Control group; G1 – Group I; G2 – Group II, and G3 – Group III. $^{\Delta}p < 0.01$; $^{Y}p < 0.001$ – a statistically significant difference in relation to the corresponding groups.

On the 7th day of the study, the indicators of QoL on the communication scale in Group I, Group II, and Group III reduced significantly, by 43.24%, 44.14%, and 43.24%, respectively, as compared to the control group (p < 0.01). The indicators in Group I did not differ significantly from those in Group II and Group III (p > 0.05). There was no significant difference between the indicators in Group II and Group III (p > 0.05).

Three months after surgery, the indicators of QoL on the communication scale in Group I did not differ significantly from those in the control group (p > 0.05). In addition, the indicators in Group II and Group III reduced significantly, by 21.62% and 12.16%, respectively, as compared to the control group (p < 0.05). The indicators in Group I increased slightly, by19.82% and 10.14%, as compared to Group II and Group III, respectively (p < 0.05). In Group II, the indicators of QoL on the communication scale reduced significantly, by 12.07%, as compared to Group III (p < 0.05).

Six months after surgery, the indicators of QoL on the communication scale in Group I and

Group III did not differ significantly from those in the control group (p > 0.05). In addition, the indicators in Group II reduced significantly, by 18.02%, as compared to the control group (p < 0.01). There was no significant difference between the indicators in Group I and Group III (p > 0.05). The indicators in Group I increased significantly, by 17.27%, as compared to Group II (p < 0.001). In Group II, the indicators reduced slightly, by 18.13%, as compared to Group III (p < 0.001) (Table 7).

Table 7: Quality of life on the communication scale in the studied groups at different study periods

Time after surgery	Group I n = 20	Group II n = 20	Group III n = 20
Control group n = 20	92.5 ± 6.57		
7 days after surgery	52.5 ± 9.79$^{\Delta CG}$	51.67 ± 11.34$^{\Delta CG}$	52.5 ± 8.59$^{\Delta CG}$
3 months after surgery	90.42 ± 7.78$^{\bullet G3;\ YG2}$	72.5 ± 8.16$^{\bullet G3;\ \Delta CG;\ YG1}$	81.25 ± 12.05$^{\bullet CG;\ \bullet G1;\ \bullet G2}$
6 months after surgery	91.67 ± 7.65^{YG2}	75.83 ± 12.94$^{\Delta CG;\ YG1;\ YG3}$	89.58 ± 7.59^{YG2}

CG – control group; G1 – Group I; G2 – Group II, and G3 – Group III. $^{\bullet}$p < 0.05; $^{\Delta}$p < 0.01; ^{Y}p < 0.001– a statistically significant difference in relation to the corresponding groups.

On the 7th day of the study, the indicators of QoL on the worry scale in Group I, Group II, and Group III reduced significantly, by 41.85%, 42.66%, and 41.03%, respectively, as compared to the control group (p < 0.01). The indicators in Group I did not differ significantly from those in Group II and Group III (p > 0.05). There was no significant difference between the indicators in Group II and Group III (p > 0.05).

Three months after surgery, the indicators of QoL on the worry scale in Group I did not differ significantly from those in the control group (p > 0.05). At the same time, the indicators in Group II and Group III reduced slightly, by 20.38% and 11.14%, respectively, as compared to the control group (p < 0.05). The indicators in Group I increased slightly, by19.28% and 9.92%, as compared to Group II and Group III, respectively (p < 0.01). In Group II, the indicators of QoL on the worry scale reduced slightly, by 11.6%, as compared to Group III (p < 0.01).

Six months after surgery, the indicators of QoL on the worry scale in Group I and Group III did not differ significantly from those in the control group (p > 0.05). The indicators in Group II reduced significantly, by 17.12%, as compared to the control group (p < 0.01). There was no significant difference between the indicators in Group I and Group III (p > 0.05). In addition, the indicators of QoL on the worry scale in Group I increased slightly, by 16.67%, as compared to Group II (p < 0.001). In Group II, the indicators reduced slightly, by 16.72%, as compared to Group III (p < 0.001) (Table 8).

Table 8: Quality of life on the worry scale in the studied groups at different study periods

Time after surgery	Group I n = 20	Group II n = 20	Group III n = 20
Control group n = 20	92 ± 6.37		
7 days after surgery	53.5 ± 8.13$^{\Delta CG}$	52.75 ± 6.97$^{\Delta CG}$	54.25 ± 8.63$^{\Delta CG}$
3 months after surgery	90.75 ± 6.93$^{\Delta G3;\ YG2}$	73.25 ± 8.32$^{\Delta CG;\ \Delta G3;\ YG1}$	81.75 ± 7.99$^{\bullet CG;\ \Delta G1;\ \Delta G2}$
6 months after surgery	91.5 ± 7.63^{YG2}	76.25 ± 8.25$^{\Delta CG;\ YG1;\ YG3}$	89 ± 6.2^{YG2}

CG – control group; G1 – Group I; G2 – Group II, and G3 – Group III. $^{\bullet}$p < 0.05; $^{\Delta}$p < 0.01; ^{Y}p < 0.001 – a statistically significant difference in relation to the corresponding groups.

On the 7th day of the study, the indicators of QoL on the daily activities scale in Group I, Group II, and Group III reduced significantly, by 48.02%, 46.7%, and 45.81%, respectively, as compared to the control group (p < 0.01). The indicators in Group I did not differ significantly from those in Group II and Group III (p > 0.05). There was no significant difference between the indicators in Group II and Group III (p > 0.05).

Three months after surgery, the indicators of QoL on the daily activities scale in Group I and Group III did not differ significantly from those in the control group (p > 0.05). At the same time, the indicators in Group II reduced significantly, by 26.43%, as compared to the control group (p < 0.01). The indicators in Group I increased significantly, by 25.45% and 12.05%, as compared to Group II and Group III, respectively (p < 0.001). In Group II, the indicators of QoL on the daily activities scale reduced slightly, by 17.96%, as compared to Group III (p < 0.001).

Six months after surgery, the indicators of QoL on the daily activities scale in Group I and Group III did not differ significantly from those in the control group (p > 0.05). The indicators in Group II reduced significantly, by 23.79%, as compared to the control group (p < 0.01). There was no significant difference between the indicators in Group I and Group III (p > 0.05). At the same time, the indicators of QoL on the daily activities scale in Group I increased significantly, by 21.72%, as compared to Group II (p < 0.001). In Group II, the indicators reduced significantly, by 22.54%, as compared to Group III (p < 0.001) (Table 9).

Table 9: Quality of life on the daily activities scale in the studied groups at different study periods

Time after surgery	Group I n = 20	Group II n = 20	Group III n = 20
Control group n = 20	94.58 ± 6.77		
7 days after surgery	49.17 ± 9.33$^{\Delta CG}$	50.42 ± 12.82$^{\Delta CG}$	51.25 ± 11.56$^{\Delta CG}$
3 months after surgery	93.33 ± 7.93$^{YG2;\ YG3}$	69.58 ± 10.57$^{\Delta CG;\ YG1;\ YG3}$	82.08 ± 9.47$^{YG1;\ YG2}$
6 months after surgery	92.08 ± 7.87^{YG2}	72.08 ± 12.76$^{\Delta CG;\ YG1;\ YG3}$	88.33 ± 9.52^{YG2}

CG – control group; G1 – Group I; G2 – Group II, and G3 – Group III. $^{\Delta}$p < 0.01; ^{Y}p < 0.001 – a statistically significant difference in relation to the corresponding groups.

On the 7th day of the study, the indicators of QoL on the family relationships scale in Group I, Group II, and Group III reduced significantly, by 38.11%, 39.19%, and 38.38%, respectively, as compared to the control group (p < 0.01). The indicators in Group I did not differ significantly from those in Group II and Group III (p > 0.05). There was no significant difference between the indicators in Group II and Group III (p > 0.05).

Three months after surgery, the indicators of QoL on the family relationships scale in Group I did not differ significantly from those in the control group (p > 0.05). Moreover, the indicators in Group II and Group III reduced significantly, by 21.35% and 15.41%, as compared to the control group (p < 0.01). The indicators in Group I increased significantly, by 20.49% and 14.48%, as compared to Group II and Group III, respectively (p < 0.001). There was no significant difference between the indicators in Group II and Group III (p > 0.05).

Six months after surgery, the indicators of QoL on the family relationships scale in Group I and Group III

did not differ significantly from those in the control group (p > 0.05). At the same time, the indicators in Group II reduced significantly, by 19.19%, as compared to the control group (p < 0.01). There was no significant difference between the indicators in Group I and Group III (p > 0.05). The indicators of QoL on the family relationships scale in Group I increased significantly, by 17.4%, as compared to Group II (p < 0.001). In Group II, the indicators reduced slightly, by 17.39%, as compared to Group III (p < 0.001) (Table 10).

Table 10: Quality of life on the family relationships scale in the studied groups at different study periods

Time after surgery	Group I n = 20	Group II n = 20	Group III n = 20
Control group n = 20	92.5 ± 3.8		
7 days after surgery	57.25 ± 7.34$^{\Delta CG}$	56.25 ± 7.59$^{\Delta CG}$	57 ± 7.15$^{\Delta CG}$
3 months after surgery	91.5 ± 4.62$^{YG2;\ YG3}$	72.75 ± 6.97$^{\Delta CG;\ YG1}$	78.5 ± 9.77$^{\Delta CG;\ YG1}$
6 months after surgery	90.5 ± 5.1^{YG2}	74.75 ± 7.16$^{\Delta CG;\ YG1;\ YG3}$	87.75 ± 5.73^{YG2}

CG – control group; G1 – Group I; G2 – Group II, and G3 – Group III. $^{\Delta}p < 0.01$; $^{Y}p < 0.001$ – a statistically significant difference in relation to the corresponding groups.

On the 7th day of the study, the QoL summary score in children of Group I, Group II, and Group III reduced significantly, by 42.39%, 42.35%, and 42.61%, respectively, as compared to the control group (p < 0.01). At the same time, the indicators in Group I did not differ significantly from those in Group II and Group III (p > 0.05). There was no significant difference between the indicators in Group II and Group III (p > 0.05).

Three months after surgery, the QoL summary score in children of Group I did not differ significantly from that in the control group (p > 0.05). At the same time, the indicators in Group II and Group III reduced significantly, by 22.84% and 12.49%, as compared to the control group (p < 0.01). The QoL summary score in children of Group I increased significantly, by 22.52% and 12.13%, as compared to Group II and Group III, respectively (p < 0.001). In Group II, the indicators reduced slightly, by 13.42%, as compared to Group III (p < 0.001).

Six months after surgery, the QoL summary score in children of Group I and Group III did not differ significantly from that in the control group (p > 0.05). Moreover, the indicators in Group II reduced significantly, by 20.18%, as compared to the control group (p < 0.01). The QoL summary score in children of Group I increased slightly, by 19.91% and 2.63%, as compared to Group II and Group III (p <0.01). In Group II, the indicators reduced significantly, by 21.57%, as compared to Group III (p < 0.001) (Table 11).

Table 11: Quality of life summary score in children of the studied groups at different study periods

Time after surgery	Group I n = 20	Group II n = 20	Group III n = 20
Control group n = 20	92.57 ± 2.84		
7 days after surgery	53.33 ± 7.16$^{\Delta CG}$	53.37 ± 2.8$^{\Delta CG}$	53.13 ± 2.89$^{\Delta CG}$
3 months after surgery	92.19 ± 3.56$^{YG2;\ YG3}$	71.42 ± 7.09$^{\Delta CG;\ YG1;\ YG3}$	81.01 ± 3.51$^{\Delta CG;\ YG1;\ YG2}$
6 months after surgery	92.26 ± 1.99$^{\Delta G3;\ YG2}$	73.89 ± 2.63$^{\Delta CG;\ YG1;\ YG3}$	89.83 ± 2.34$^{\Delta G1;\ YG2}$

CG – control group; G1 – Group I; G2 – Group II, and G3 – Group III. $^{\Delta}p < 0.01$; $^{Y}p < 0.001$ – a statistically significant difference in relation to the corresponding groups.

On the 7th day of the study, the parent QoL summary score in Group I, Group II, and Group III reduced significantly, by 42.6%, 42.12%, and 43.48%, respectively, as compared to the control group (p < 0.01). The indicators in Group I did not differ significantly from those in Group II and Group III (p > 0.05). There was no significant difference between the indicators in Group II and Group III (p > 0.05).

Three months after surgery, the parent QoL summary score in Group I did not differ significantly from that in the control group (p > 0.05). The indicators in Group II and Group III reduced significantly, by 23.46% and 12.04%, as compared to the control group (p < 0.01). In addition, the parent QoL summary score in Group I increased significantly, by 23.77% and 12.39%, as compared to Group II and Group III, respectively (p < 0.001). In Group II, the indicators reduced slightly, by 14.93%, as compared to Group III (p < 0.001).

Six months after surgery, the parent QoL summary score in Group I and Group III did not differ significantly from that in the control group (p > 0.05). The indicators in Group II reduced significantly, by 20.96%, as compared to the control group (p < 0.01). There was no significant difference between the indicators in Group I and Group III (p > 0.05). The parent QoL summary score in Group I increased significantly, by 21.44%, as compared to Group II (p < 0.001). In Group II, the indicators reduced significantly, by 24.29%, as compared to Group III (p < 0.001) (Table 12).

Table 12: Parent quality of life summary score in the studied groups at different study periods

Time after surgery	Group I n = 20	Group II n = 20	Group III n = 20
Control group n = 20	92.44 ± 2.67		
7 days after surgery	53.06 ± 7.53$^{\Delta CG}$	53.5 ± 2.83$^{\Delta CG}$	52.25 ± 5.04$^{\Delta CG}$
3 months after surgery	92.81 ± 3.19$^{YG2;\ YG3}$	70.75 ± 7.45$^{\Delta CG;\ YG1;\ YG3}$	81.31 ± 4.15$^{\Delta CG;\ YG1;\ YG2}$
6 months after surgery	93 ± 3.33^{YG2}	73.06 ± 3.62$^{\Delta CG;\ YG1;\ YG3}$	90.81 ± 2.67^{YG2}

CG – Control group; G1 – Group I; G2 – Group II, and G3 – Group III. $^{\Delta}p < 0.01$; $^{Y}p < 0.001$ – a statistically significant difference in relation to the corresponding groups.

On the 7th day of the study, the family functioning summary score in Group I, Group II, and Group III reduced significantly, by 41.88%, 42.04%, and 41.21%, respectively, as compared to the control group (p < 0.01). At the same time, the indicators in Group I did not differ significantly from those in Group II and Group III (p > 0.05). There was no significant difference between the indicators in Group II and Group III (p > 0.05).

Three months after surgery, the family functioning summary score in Group I did not differ significantly from that in the control group (p > 0.05). The indicators in Group II and Group III reduced significantly, by 23.28% and 14.57%, as compared to the control group (p < 0.01). In addition, the family functioning summary score in Group I increased significantly, by 22.37% and 13.56%, as compared to Group II and Group III, respectively (p < 0.001). In Group II, the indicators reduced slightly, by 11.35%, as compared to Group III (p < 0.01).

Six months after surgery, the family functioning summary score in Group I and Group III did not differ significantly from that in the control group (p > 0.05). The indicators in Group II reduced significantly, by 20.94%, as compared to the control group (p < 0.01). There

was no significant difference between the indicators in Group I and Group III ($p > 0.05$). At the same time, the family functioning summary score in Group I increased significantly, by 19.04%, as compared to Group II ($p < 0.001$). In Group II, the indicators reduced slightly, by 19.28%, as compared to Group III ($p < 0.001$) (Table 13).

Table 13: Family functioning summary score in the studied groups at different study periods

Time after surgery	Group I n = 20	Group II n = 20	Group III n = 20
Control group n = 20	93.28 ± 3.83		
7 days after surgery	54.22 ± 6.9$^{\Delta CG}$	54.06 ± 7.73$^{\Delta CG}$	54.84 ± 5.87$^{\Delta CG}$
3 months after surgery	92.19 ± 4.81$^{YG2;\ YG3}$	71.56 ± 7.71$^{\Delta CG;\ \Delta G3;\ YG1}$	79.69 ± 6.29$^{\Delta CG;\ \Delta G2;\ YG1}$
6 months after surgery	91.09 ± 4.21^{YG2}	73.75 ± 6.28$^{\Delta CG;\ YG1;\ YG3}$	87.97 ± 4.89^{YG2}

CG – control group; G1 – Group I; G2 – Group II, and G3 – Group III. $^{\Delta}p < 0.01$; $^{Y}p < 0.001$ – a statistically significant difference in relation to the corresponding groups.

The results of multivariate analysis of variance (MANOVA) for comparing QoL indicators according to the PedsQL™3.0 Family Impact Module 3 months after surgery showed that the method of post-operative analgesia significantly affected QoL indicators on some questionnaire scales (Physical functioning, emotional functioning, social functioning, cognitive functioning, communication, worry, daily activities, family relationships - F (8.31) = 5.837; p = 0.00014; Wilk's $\Lambda = 0.399$), as well as integral QoL indicators (pediatric QoL summary score, parent QoL summary score, family functioning summary score (f [3.36] = 9.813; $p < 0.0001$; Wilk's $\Lambda = 0.55$)). Six months after surgery, the results of MANOVA demonstrated the positive effect of the chosen method for post-operative analgesia on both QoL indicators on some questionnaire scales (F [8.31] = 55.053; $p < 0.0001$; Wilk's $\Lambda = 0.066$) and integral QoL indicators (F [3.36] = 135.539; $p < 0.0001$; Wilk's $\Lambda = 0.081$) as well.

It is worth noting that the reliability of the differences in the studied QoL indicators depending on the chosen method of post-operative analgesia increased with time.

Discussion

The lack of adequate assessment of childhood-onset acute pain and its proper management can result in negative consequences that continue into adulthood, including chronic pain, and suffering [8]. Inadequate pain syndrome management at an early age affects the frequency, severity, and duration of chronic pain with subsequent maladaptive neurological changes in adulthood. Neuroimaging studies of acute pain in children and chronic pain in adults have revealed long-term changes in the structure and function of the nervous system, which, further, correlate with cognitive, behavioral, and somatosensory abnormalities [8].

Chronic pain affects the entire nervous system and leads to central sensitization (increased central nervous system response to painful and non-painful stimuli) [25]. Untreated chronic pain in children increases the risk of developing mental disorders later in life. A total of 17% of adult patients with chronic pain report a history of chronic pain in childhood or adulthood, with close to 80% indicating that pain from childhood continues today [26]. In the USA, adults with chronic pain have lower family income and higher risk of unemployment [27].

The results of our study confirmed that inadequate perioperative analgesia and neglecting the principles of multimodal analgesia could result in the development of chronic pain syndrome [28], [29], [30], [31].

The prevalence of chronic pain syndrome in children of Group I, Group II, and Group III was found to be 11.71 ± 0.13%, 19.81 ± 0.21%, and 9.24 ± 0.35%, respectively, with a male predominance.

On the 1st, 2nd, and 3rd days of hospital stay, pain intensity on the FLACC scale was greater in Group II (FLACC–5.5 ± 0.22, 4.92 ± 0.14, and 4.0 ± 0.16, respectively) as compared to Group III (FLACC–4.7 ± 0.17, 3.91 ± 0.28, and 3.22 ± 0.22, respectively, $p < 0.05$) and Group I (FLACC – 4.98 ± 0.37, 4.73 ± 0.45, and 3.6 ± 0.28, respectively, $p < 0.05$) (Table 3). The analysis of the scores of acute pain assessment scales in children revealed that children of Group II, while staying in the surgical department, had significantly higher FLACC and VAS scores as compared to those in Group I and Group III. There was determined a statistically significant difference in the VAS score at hospital discharge ($p < 0.05$). The Fisher's least significant difference (LSD) test for pairwise comparison of groups found that throughout the entire treatment period Group III had a significantly lower VAS score as compared to Group II and Group I ($p < 0.05$). As shown in Table 14, in Group I, Group II, and Group III, the VAS score decreased from the first 12 h following surgery to discharge by 1.13, 1.12, and 1.49 times, respectively. This may indicate that children who receive combined regional anesthetic block better react to analgesia. The following changes in the VAS scores throughout the treatment were observed: 4.26 ± 0.28 12 h following surgery, with a tendency to decrease 72 h after surgery and at discharge (3.58 ± 0.28 and 2.85 ± 0.1, respectively, $p < 0.05$).

Table 14: Acute pain assessment scales

Indicator	Group I n = 20	Group II n = 20	Group III n = 20
	M ± m	M ± m	M ± m
FLACC			
12 h after surgery	4.98 ± 0.37	5.5 ± 0.22*	4.7 ± 0.17
72 h after surgery	4.73 ± 0.45	4.92 ± 0.14*	3.91 ± 0.28
At discharge	3.6 ± 0.28	4.0 ± 0.16*	3.22 ± 0.22
VAS			
12 h after surgery	4.45 ± 0.11	5.36 ± 0.18***	4.26 ± 0.28
72 h after surgery	4.12 ± 0.1	5.0 ± 0.16*	3.58 ± 0.28
At discharge	3.92 ± 0.24	4.77 ± 0.12***	2.85 ± 0.1

*a significant difference between Group II and Group III ($p < 0.05$). **a significant difference between Group I and Group II ($p < 0.05$).

Children of Group II also had statistically higher VAS scores throughout the entire treatment period as compared to Group I and Group III ($p < 0.05$). When monitoring the VAS scores from the first 12 to 72 h

postoperatively, the tendency to their decrease was observed (Table 14). Despite the decrease in acute pain intensity at the time of discharge, normal VAS scores were, however, not observed.

The analysis of changes in acute pain and the quality of pain management in Group I found a positive effect of pain relief, that is, a decrease in pain intensity both within the 1st h following surgery and after discharge. The VAS score ranged from 4.45 ± 0.11 within the first 12 h postoperatively to 3.92 ± 0.24 at the time of discharge (Table 14).

The comparison of the studied groups revealed a statistically significant difference in the DN4 indicator 6 months after surgery and the LANSS pain scale indicator three and 6 months after surgery ($p < 0.001$). The Fisher's LSD test for pairwise comparison of groups found a statistically significant difference in the DN4 indicator 6 months after surgery between all the studied groups ($p < 0.001$). There was a statistically significant difference in the LANSS pain scale indicator 3 months after surgery between Group I and Group II ($p < 0.001$), as well as Group II and Group III ($p < 0.001$). The Fisher's LSD test for pairwise comparison of groups found a statistically significant difference in the LANSS pain scale indicator 6 months after surgery between all the studied groups ($p < 0.001$) (Table 15).

Table 15: Chronic pain assessment scales

Indicator	Group I n = 3	Group II n = 6	Group III n = 1
	M±m	M±m	M±m
DN4			
3 months after surgery	4.54 ± 0.18	4.62 ± 0.18	4.85 ± 0.19
6 months after surgery	8.69 ± 0.78*	13.69 ± 0.38** Δ	5.46 ± 0.42
LANSS pain scale			
3 months after surgery	7.38 ± 0.76	12.08 ± 0.31** Δ	6.62 ± 0.66
6 months after surgery	10.46 ± 0.35*	13.54 ± 0.33** Δ	6.38 ± 0.5

*a significant difference between Group I and Group III ($p < 0.001$). **a significant difference between Group I and Group II ($p < 0.001$). Δa significant difference between Group II and Group III ($p < 0.001$).

According to the analysis of questionnaires for acute pain assessment in children (DN4 questionnaire, LANSS pain scale), in children of Group II, the prevalence of chronic pain was greater (30%) as compared to those in Group III and Group I (5% and 15%, respectively), which again confirmed the efficacy of the QLB+TFPB for prevention and treatment of acute pain, as well as chronic pain syndrome (Table 15).

The results obtained may indicate the following: patients receiving conventional general anesthesia have high indicators of acute pain on the VAS and FLACC scales as well as are at higher risk for developing chronic pain syndrome as compared to those receiving regional anesthesia.

In a variety of childhood diseases, including sickle cell disease [32], rheumatic disease [33], and renal disease [34], QoL assessment has been used for a long time. To date, it has been found that the disease itself can reduce QoL in a child on various survey scales. Therefore, we wanted to confirm that fact, that uncontrolled acute perioperative pain, which can further result in chronic pain syndrome, directly affects QoL of patients in the post-operative period. According to the questionnaires for QoL assessment, patients receiving conventional opioid analgesia in the early post-operative period had significantly lower indicators on the scales of physical functioning, emotional functioning, social functioning, cognitive functioning, communication, worry, daily activities, and family relationships as compared to children treated with regional analgesia techniques.

This shows the need for using effective minimally invasive regional analgesia techniques in the perioperative period.

Conclusions

1. In children who underwent anterior abdominal wall surgery, chronic pain syndrome is a common phenomenon, which requires adequate control and management.
2. Chronic pain syndrome reduces QoL in children aged 7–18 years after anterior abdominal wall surgery by reducing the indicators on the scales of physical functioning, emotional functioning, social functioning, cognitive functioning, communication, worry, daily activities, family relationships, pediatric QoL summary score, parent QoL summary score, and family functioning summary score.
3. The TFPB and the QLB-4 through a single injection in conjunction with general anesthesia accelerate patient's recovery, relieve pain, and increase patient satisfaction at different stages of the post-operative period.
4. This combination shortens the length of hospital stay.

References

1. Varni JW, Seid M, Kurtin PS. Pediatric health-related quality of life measurement technology: A guide for health care decision makers. JCOM. 1999;6:33-44.
2. Matza LS, Swensen AR, Flood EM, Secnik K, Leidy NK. Assessment of health-related quality of life in children: A review of conceptual, methodological, and regulatory issues. Value Health. 2004;7(1):79-92. https://doi.org/10.1111/j.1524-4733.2004.71273.x
PMid:14720133
3. Varni JW, Wallander JL. Pediatric chronic disabilities. In: Routh DK, editor. Handbook of Pediatric Psychology. New York: The Guilford Press; 1988. p. 190-221.
4. Varni JW, Katz ER, Colegrove R Jr., Dolgin M. Family functioning predictors of adjustment of children with newly diagnosed cancer: A prospective analysis. J Child Psychol Psychiatry. 1996;37(3):321-8. https://doi.org/10.1111/j.1469-7610.1996.tb01409.x
PMid:8707915

5. Thompson RJ, Gustafson KE. Adaptation to Chronic Childhood Illness. United States: American Psychological Association; 1996. https://doi.org/10.1037/10188-000
6. Groenewald CB, Rabbitts JA, Schroeder DR, Harrison TE. Prevalence of moderate-severe pain in hospitalized children. Paediatr Anaesth. 2012;22(7):661-8. https://doi.org/10.1111/j.1460-9592.2012.03807.x
   PMid:22332912
7. Rabbitts JA, Fisher E, Rosenbloom BN, Palermo TM. Prevalence and predictors of chronic postsurgical pain in children: A systematic review and meta-analysis. J Pain. 2017;18(6):605-14. https://doi.org/10.1016/j.jpain.2017.03.007
   PMid:28363861
8. Eccleston C, Fisher E, Howard RF, Slater R, Forgeron P, Palermo TM, *et al*. Delivering transformative action in paediatric pain: A Lancet Child & Adolescent Health Commission. Lancet Child Adolesc Health. 2021;5(1):47-87. https://doi.org/10.1016/S2352-4642(20)30277-7
   PMid:33064998
9. Batoz H, Semjen F, Bordes-Demolis M, Bénard A, Nouette-Gaulain K. Chronic postsurgical pain in children: Prevalence and risk factors. A prospective observational study. Br J Anaesth. 2016;117(4):489-96. https://doi.org/10.1093/bja/aew260
   PMid:28077537
10. Varni JW, Seid M, Rode CA. The PedsQL™: Measurement model for the pediatric quality of life inventory. Med Care. 1999;37(2):126-39. https://doi.org/10.1097/00005650-199902000-00003
    PMid:10024117
11. 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. 2001;39(8):800-12. https://doi.org/10.1097/00005650-200108000-00006
    PMid:11468499
12. Varni JW, Seid M, Knight TS, Uzark K, Szer IS. The PedsQL 4.0 generic core scales: Sensitivity, responsiveness, and impact on clinical decision-making. J Behav Med. 2002;25(2):175-93. https://doi.org/10.1023/a:1014836921812
    PMid:11977437
13. Varni JW, Burwinkle TM, Seid M, Skarr D. The PedsQL 4.0 as a pediatric population health measure: Feasibility, reliability, and validity. Ambul Pediatr. 2003;3(6):329-41. https://doi.org/10.1367/1539-4409(2003)003<0329:tpaapp>2.0.co;2
    PMid:14616041
14. Varni JW, Seid M, Knight TS, Burwinkle TM, Brown J, Szer IS. The PedsQL in pediatric rheumatology: Reliability, validity, and responsiveness of the pediatric quality of life inventory generic core scales and rheumatology module. Arthritis Rheum. 2002;46(3):714-25. https://doi.org/10.1002/art.10095
    PMid:11920407
15. Varni JW, Burwinkle TM, Katz ER, Meeske K, Dickinson P. The PedsQL in pediatric cancer: Reliability and validity of the pediatric quality of life inventory generic core scales, multidimensional fatigue scale, and cancer module. Cancer. 2002;94(7):2090-106. https://doi.org/10.1002/cncr.10428
    PMid:11932914
16. Varni JW, Burwinkle TM, Jacobs JR, Gottschalk M, Kaufman F, Jones KL. The PedsQL in Type 1 and Type 2 diabetes: Reliability and validity of the pediatric quality of life inventory generic core scales and Type 1 diabetes module. Diabetes Care. 2003;26(3):631-7. https://doi.org/10.2337/diacare.26.3.631
    PMid:12610013
17. Varni JW, Burwinkle TM, Rapoff MA, Kamps JL, Olson N. The PedsQL in pediatric asthma: Reliability and validity of the pediatric quality of life inventory generic core scales and asthma module. J Behav Med. 2004;27(3):297-318. https://doi.org/10.1023/b:jobm.0000028500.53608.2c
    PMid:15259457
18. Uzark K, Jones K, Burwinkle TM, Varni JW. The pediatric quality of life inventory™ in children with heart disease. Prog Pediatr Cardiol. 2003;18(2):141-8. https://doi.org/10.1016/S1058-9813(03)00087-0
19. Varni JW, Burwinkle TM, Szer IS. The PedsQL multidimensional fatigue scale in pediatric rheumatology: Reliability and validity. J Rheumatol. 2004;31(12):2494-500.
    PMid:15570657
20. Varni JW, Quiggins DJL, Ayala GX. Development of the pediatric hematology/oncology parent satisfaction survey. Child Health Care. 2000;29(4):243-55. https://doi.org/10.1207/s15326888chc2904_2
21. Varni JW, Burwinkle TM, Dickinson P, Sherman SA, Dixon P, Ervice JA, *et al*. Evaluation of the built environment at a children's convalescent hospital: Development of the Pediatric Quality of Life Inventory parent and staff satisfaction measures for pediatric health care facilities. J Dev Behav Pediatr. 2004;25(1):10-20. https://doi.org/10.1097/00004703-200402000-00002
22. Sherman SA, Eisen S, Burwinkle TM, Varni JW. The PedsQL™ present functioning visual analogue scales: Preliminary reliability and validity. Health Qual Life Outcomes. 2006;4:75. https://doi.org/10.1186/1477-7525-4-75
    PMid:17020606
23. Varni JW, Katz ER, Colegrove R, Dolgin M. Adjustment of children with newly diagnosed cancer: Cross-informant variance. J Psychosoc Oncol. 1995;13(4):23-38. https://doi.org/10.1300/J077V13N04_02
24. Gold M, Siegel J, Russell L, Weinstein M. Cost-Effectiveness in Health and Medicine. United Kingdom: Oxford University Press; 1996.
25. Woolf CJ. Central sensitization: Implications for the diagnosis and treatment of pain. Pain. 2011;152(3 Suppl):S2-15. https://doi.org/10.1016/j.pain.2010.09.030
    PMid:20961685
26. Hassett AL, Hilliard PE, Goesling J, Clauw DJ, Harte SE, Brummett CM. Reports of chronic pain in childhood and adolescence among patients at a tertiary care pain clinic. J Pain. 2013;14(11):1390-7. https://doi.org/10.1016/j.jpain.2013.06.010
    PMid:24021576
27. Johannes CB, Le TK, Zhou X, Johnston JA, Dworkin RH. The prevalence of chronic pain in United States adults: Results of an Internet-based survey. J Pain. 2010;11(11):1230-9. https://doi.org/10.1016/j.jpain.2010.07.002
    PMid:20797916
28. Woolf CJ. Capturing Novel Non-opioid Pain Targets. Biol Psychiatry. 2020;87(1):74-81. https://doi.org/10.1016/j.biopsych.2019.06.017
    PMid:31399256
29. Dmytriiev D, Dmytriiev K, Stoliarchuk O, Semenenko A. Multiple organ dysfunction syndrome: What do we know about pain management? A narrative review. Anaesth Intensive Care. 2019;23(1):84-91.
30. Dmytriiev D. Assessment and treatment of postoperative pain in children. Anaesth Intensive Care. 2018;22(3):392-400.
31. Semenkovych Y, Dmytriiev D, Dobrovanov O, Vidiščák M, Šupinová M. Acute and chronic pain in children. A modern view of the issue. Lek Obzor. 2022;71(9):338-42.
32. Panepinto, JA, Hoffmann RG, Pajewski NM. A psychometric evaluation of the PedsQL™ Family impact module in parents of children with sickle cell disease. Health Qual Life Outcomes. 2009;7:32. https://doi.org/10.1186/1477-7525-7-32

PMid:19371442

33. Trapanotto M, Giorgino D, Zulian F, Benini F, Varni JW**.** The Italian version of the PedsQL™ in children with rheumatic diseases. Clin Exp Rheumatol. 2009;27:373-80.
PMid:19473585

34. Park KS, Hwang, YJ, Cho MH, Ko CW, Ha IS, Kang HG, ***et al***. Quality of life in children with end-stage renal disease based on a PedsQL ESRD module. Pediatr Nephrol. 2012;27(12):2293-300. https://doi.org/10.1007/s00467-012-2262-1
PMid:22832667