

Epidemiology and patient-reported measurement outcome of pelvic fractures in children and adolescents - A population-based cohort study from the Swedish fracture register

YD Hailer^{a,†,*}, LA Larsson^{a,†}, T Hellström^a, JE Chaplin^b, O Wolf^a

^a Section of Orthopaedic Surgery, Department of Surgical Sciences, Uppsala University, Uppsala, Sweden

^b Department of Pediatrics, Institute of Clinical Sciences, University of Gothenburg, Gothenburg, Sweden

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ABSTRACT

Background and purpose: Pediatric pelvic fractures are uncommon, representing 0.2–3% of total pediatric fractures. The long-term patient-reported outcome in the pediatric population has not been evaluated yet. The purpose of the study was to describe the epidemiology of pelvic and acetabular fractures in pediatric patients including long-term patient-reported outcomes.

Patients and methods: The Swedish Fracture Register (SFR) was used to identify all patients aged 6–17 years at injury with a pelvic fracture between 2015 and 2021. All patients were invited to answer Patient-Reported measurement instruments in 2021.

Results: The study cohort consisted of 223 patients with a median age at fracture of 15 years and with 62 % boys. 201 sustained a pelvic and 22 acetabular fractures. Falls were the leading cause of fracture, followed by transport accidents. Most fractures (both pelvis and acetabulum) were type A (73 %), and 21 fractures (9 %) could not be classified according to AO. 85 % of fractures were treated non-surgically. All Type C fractures were treated surgically. Seven PROMIS® profile domains were completed by 31 % of the sample at a mean follow-up time of 3.5 years after pelvic/acetabular fracture. Most patients had “no concern” or “mild concern” but those who had surgery had an inferior t-score in most domains.

Conclusion: Most fractures occurred in older individuals, with falls during sports activities being the most common cause. This raises important questions about prevention strategies. The PROMIS-Pain-Interference scale indicated that the younger the age at fracture, the more pain was reported at follow-up.

Introduction

Pediatric pelvic fractures are rare with a described proportion of 0.2–3 % of all pediatric fractures [1,2]. The annual incidence is estimated to be 10/100,000 [3], with motor vehicle accidents as the leading cause [1,4]. The majority are treated non-surgically and the surgical treatment rate is reported to be 5.1–18.3% of pelvic fractures [2,5,6]. Generally, pediatric pelvic fractures are reported to heal well without long-term morbidity [7]. In adults with pelvic ring fractures, long-term quality of life (QoL) studies indicate lasting impairments in functional, well-being, and socio-economic aspects [8]. The long-term patient-reported outcome in the pediatric population has not been evaluated yet. The purpose of the study was to describe the epidemiology of pelvic

and acetabular fractures in pediatric patients including age and sex-distribution, injury mechanism, and treatment. In addition, we investigated the long-term patient-reported outcomes with the PROMIS® questionnaire. We explored further if patient-reported outcomes were associated with sex, injury age, follow-up time, type of pelvic fracture, and treatment of choice.

Methods

This national population-based cohort study reported on pediatric patients with pelvic fractures registered in the Swedish Fracture Register (SFR). The SFR is a web-based national quality register that was established in 2011 for adult patients, and included pediatric patients (from

* Corresponding author.

E-mail address: Yasmin.hailer@uu.se (Y. Hailer).

† shared first authorship.

birth) since 2015 [9,10]. Data are registered in the online module by the treating orthopedic surgeon including variables such as age at the time of injury, sex, open/closed physes, fracture mechanism, fracture type, and treatment. Coverage reached 100 % in 2021 when all orthopedic departments in Sweden started registering in the SFR [10]. The completeness is compared to the National Patient Register and has increased annually and was 57 % in 2022 for all fractures in adults, and 53 % for femur fractures in children.

Patient-reported measurement instruments

PROMIS® is an internationally used measurement system that was developed and evaluated with National Institutes of Health (NIH) funding. It is generic and not disease-specific and has been translated and modified for Swedish children [11]. Based on the answers in the PROMIS® questionnaire a T-score is calculated. T-scores are standardized scores based on a reference population (U.S. general population) with a mean of 50 and a standard deviation of 10 [12].

We used two PROMIS® short-form questionnaires with approved Swedish translations. The PROMIS® v1.1 Profile 25 Children/adolescents for patients <17 years at follow-up with seven domains (Mobility, Anxiety, Depression, Fatigue, Peer relationships, Pain interference, Pain intensity) and the PROMIS® adult version of the same domains, with 25 questions. These were drawn from the adult Profile-29 v1.1 for participants ≥17 years at follow-up. The PROMIS® questionnaire contained 25 questions regarding the last 7 days and is divided into 6 domains; physical function and mobility, anxiety, depression, fatigue, peer relationships, pain interference, and a single-item question regarding pain intensity. The physical function and mobility questions can be answered on a five-level scale from “able to do so without any problems” to “have not been able to do so”. The rest of the topics also have a five-level scale from “never” to “almost always/always”. Pain intensity is assessed on a scale from 0 (“no pain at all”) to 10 (“the most imaginable pain”).

Additionally, the patients were asked to estimate their self-perceived health by a generic quality of life visual analog scale (VAS) from 0 (“worst health imaginable”) to 100 (“the best health imaginable”). Patients were also asked whether their walking distance was impaired and if they used walking aids.

Study population

The study population included all patients aged 6–17 years ($n = 223$) at injury with a registered pelvic fracture (pelvic ring or acetabular) in the SFR between January 2015 and February 2021. The ICD-codes used for the fracture identification were those coded for either pelvic or acetabular fracture.

The Patient-Reported Measurement Instruments were sent out to 198 patients. In 25 patients no Swedish address could be found or postal mail was returned as undeliverable. The respondents had the choice to answer the questionnaires in paper form or electronically. In alignment with the ethical approval patients older than 12 years were asked to fill in the questionnaires by themselves while younger children were asked to answer the questions together with their guardian(s).

Variables and stratification

Mechanism of injury was divided into 5 groups: 1) “Transport accidents” included car, motorcycle, bike, truck, terrain vehicles, and horse riding injuries; 2) “Fall” included falls in the same level, falls from more than one level as well as unspecified falls; 3) “Non-traumatic injuries” were fractures coded as stress fracture or spontaneous fractures; 4) Other mechanism of injury included assault, sports-related injuries, unspecified living force, pressed between objects, intentional self-harm etc.; and 5) patients with no registered injury mechanism.

Fractures were classified according to the AO/OTA-classification for fractures in adults from 2007 used in the SFR [13]. Fractures were

grouped into three groups for pelvic and acetabular fractures, respectively: Pelvic fractures A-C and acetabular fractures A-C. Some fractures were either classified as non-classifiable or had not been classified at all by the treating orthopaedic surgeon. These were classified as a combined group. Avulsion fractures are not included in the SFR and this study.

Primary treatment was divided into non-surgical and surgical, or missing (in cases where the treatment had not been reported to the register).

The reporting of this observational register study follows the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines [14].

Statistics

Descriptive statistics were reported as mean or median and percentages. PROMIS® T-scores were calculated using a calculation sheet provided by the NIH and categorized using general guidelines for cut points into “no or mild concern”, “moderate concern” and “considerable concern” for all domains [15,16]. These categories can be used as a tool in clinical practice. When “moderate” or “considerate concerns” are present the patient would benefit from a referral to manage pain or issues with depression [15,16]. Furthermore, we conducted linear regression analyses to detect possible associations between PROMIS® scores and the variables from SFR such as fracture age, sex, follow-up time, fracture localization, and treatment choice. Patients were also divided into two by reported open and closed physes. All analyses were conducted in R statistics (R 4.3.1.).

Ethics

The study was approved by the Swedish Ethical Review Authority (DNR 2020-06382). The study was conducted following the ethical principles of the Declaration of Helsinki.

Results

Demographics

In total 226 fractures of 223 patients (62 % males) were registered in the SFR during the study period. 201 pelvic ring fractures, 22 acetabular fractures, and 3 combined pelvic and acetabular fractures. The mean age at fracture was 14 years (SD: 3) and fractures were more common with increasing age (Fig. 1). In 134 patients (60%) one or more physes were considered open.

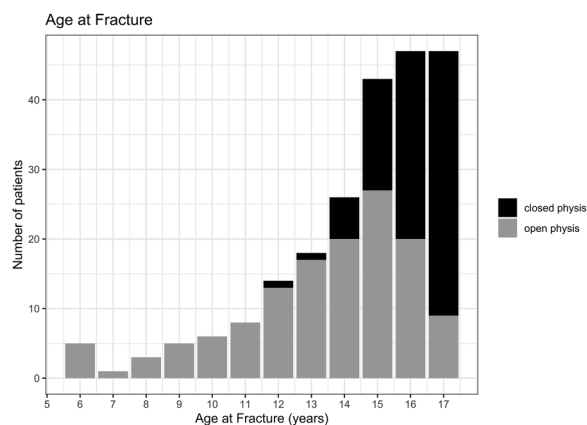


Fig. 1. Number of pelvic fractures in relation to age at injury and maturity (grey: open physes, black: mature pelvis).

Injury mechanism and fracture classification

The most common registered injury mechanisms were a fall with 93 (42%), transport accidents with 56 (21%) patients, and “other” with 30 (14%) patients.

In the “fall” category the most common type was a same-level fall, followed by unspecified fall. Among transport accidents, the most common cause was motorcycle accidents. (Supplemental Table 1 and 2)

When dividing by sex, two-thirds of falls and traffic-related injuries were sustained by boys.

(Supplemental Figure 1). In contrast, fractures from horse riding were almost exclusively seen in girls.

In 140 patients (60 %) information on activity at the time of injury was registered. Of these 50 % occurred during sports and 23 % during leisure activity.

The fracture occurrence was categorized by energy level: 91 fractures (41 %) were reported as low-energy fractures and 81 fractures (36 %) as high-energy fractures. For 51 fractures, the energy level was either not applicable or missing.

An open physis was registered in 134 patients (60 %) of these 8 were classified as “pediatric fracture” and 2 were “non classifiable”. The remaining 124 fractures in 124 patients with open physis were classified according to the adult AO classification system [13]. The most common type of fracture was type A pelvic fracture (Table 1). All of the 10 reported type C injuries occurred in older children (>13 years). Two-thirds of the type A fractures were in patients with reported open physes. For type B and C fractures, it was almost the reverse, with 61% having closed physes.

13 % of all patients had reported associated fractures. 83 % of the patients with associated fractures were reported as high-energy injuries.

Treatment

There were 189 (85 %) patients who were treated non-surgically, whilst 20 patients (9 %) were treated surgically. For 14 patients (6 %) no treatment was reported to the SFR.

All of the 10 patients with type C fractures (9 pelvic and 1 acetabular) were treated surgically (Table 1). The proportion of surgical treatment decreased with lesser fracture severity (C to B to A). The majority of the acetabular fractures were surgically treated.

Patient-reported measurement instruments

Of 198 receiving the questionnaire 63 (31 %) responded. The mean follow-up time was 3.5 years after the pelvic fracture (1–10 years) with a mean age at follow-up of 18 years (9 - 26 years). Comparing the characteristics between the responders and the original cohort, girls were more likely to respond than boys (36 % versus 23 %). Likewise, patients

Table 1
AO class of the acetabular and pelvis fractures (based on patients).

	Location	Overall N (%)	Treated surgically N (% of total)	Answering PROM N (% of total)
AO class	Acetabular A	8 (4)	1 (0.4)	1 (0.4)
	Acetabular B	6 (3)	3 (1.3)	4 (2)
	Acetabular C	1 (0.4)	1 (0.4)	0
	Children’s fracture	8 (4)	0	4 (2)
	Unable to classify	13 (6)	0	2 (1)
	Pelvis A	164 (74)	3 (1.3)	44 (20)
	Pelvis B	14 (7)	4 (2)	6 (3)
Pelvis C		9 (4)	9 (4)	2 (1)
	Total	223 (100)	21 (8)	63 (28)

sustaining acetabular fractures and surgically treated patients responded to a higher extent, which aligns with the literature [17].

In the vast majority of respondents (>85 %), no or only mild concerns were present in all domains. In the domain “mobility” 12 % indicated moderate, and 3 % indicated considerable concerns. In the domain “pain interference” 11 % indicated that moderate, and 2 % that considerate concerns were apparent. (Supplemental Figure 2)

The t-scores of all domains in all patients are presented in Fig. 2. When focusing on the surgically treated patients; these had a higher impairment in mobility compared to the reference population and the non-surgically treated patients.

The adjusted T-score of the domain “pain interference” of all patients that answered, was associated with age at fracture and increased with decreasing age (Estimate [Est] –1.2, 95 % confident interval [CI] –2.4–(-0.04)). The adjusted T-score of the domain depression was associated with follow-up time (Est: 1.7, 95 % CI: 0.2–3.1) and female sex (Est: 5.2, 95 % CI: 0.7–10.0). The adjusted T-score for Fatigue was associated with female sex (Est: 7.0 95 %CI 1.1–12.8). Adjustment was done for sex, follow-up time, and fracture type.

The self-perceived health had a median of 76 (IQR 62–87) and was only associated with follow-up time by decreasing with increasing time to follow-up (Est: –4.4, 95 % CI -8.6–(-0.4)).

Extracting specifically the question “I have been physically able to do the activities I enjoy”, 63 % had no trouble, 20 % had little trouble, 10 % had some trouble, 5 % with a lot of trouble and 8 % were not able to do so.

25 % reported a reduced walking distance (75 % of these with a type A fracture) and 8 % still used walking aids, 4 patients with type A fractures, and 1 patient with type C fracture of the pelvis.

Discussion

In this population-based cohort study, we identified 223 pediatric pelvic fractures in 226 patients. In contrast to other studies, the main cause of fracture was falls. The injury mechanisms were closely associated with sex; fractures resulting from horse riding accidents were almost exclusively seen in girls while fractures resulting from traffic accidents and mechanical forces were observed mostly in boys. In the long-term follow-up with 7 domains from the PROMIS® self-reporting outcome system, most patients reported no or only mild concerns in all domains.

Demographics

In the SFR, the median age of pelvic fractures was 15 years, which is high compared to previous studies [7,18]. We excluded patients under the age of 6 to avoid the follow-up with PROMIS® to be answered by proxy, which can explain the somewhat higher mean age in our study. More than 60 % were boys, which is in accordance with previous research [18,19].

Injury mechanism and fracture classification

The most commonly reported injury mechanism was a fall, followed by transport accidents. This was in contrast to previous research, that overwhelmingly names motor vehicle accidents as their main cause of injury [1,4] when pedestrians were hit by motor vehicles or fractures occurred to passengers in vehicle accidents [20]. Of the traffic-related fractures, motorcycle accidents were the most common cause in the present study. The traffic safety situation might look different in other countries compared to Sweden, a large country with high-standard road conditions, low-speed limit, and few inhabitants. [21] Another interesting finding was that fractures caused by horse riding were seen almost exclusively in girls and made up 20 % of total fractures in girls.

As reported in previous studies, we also found that single fractures were more common in younger ages [1,18]. All cases of extensive

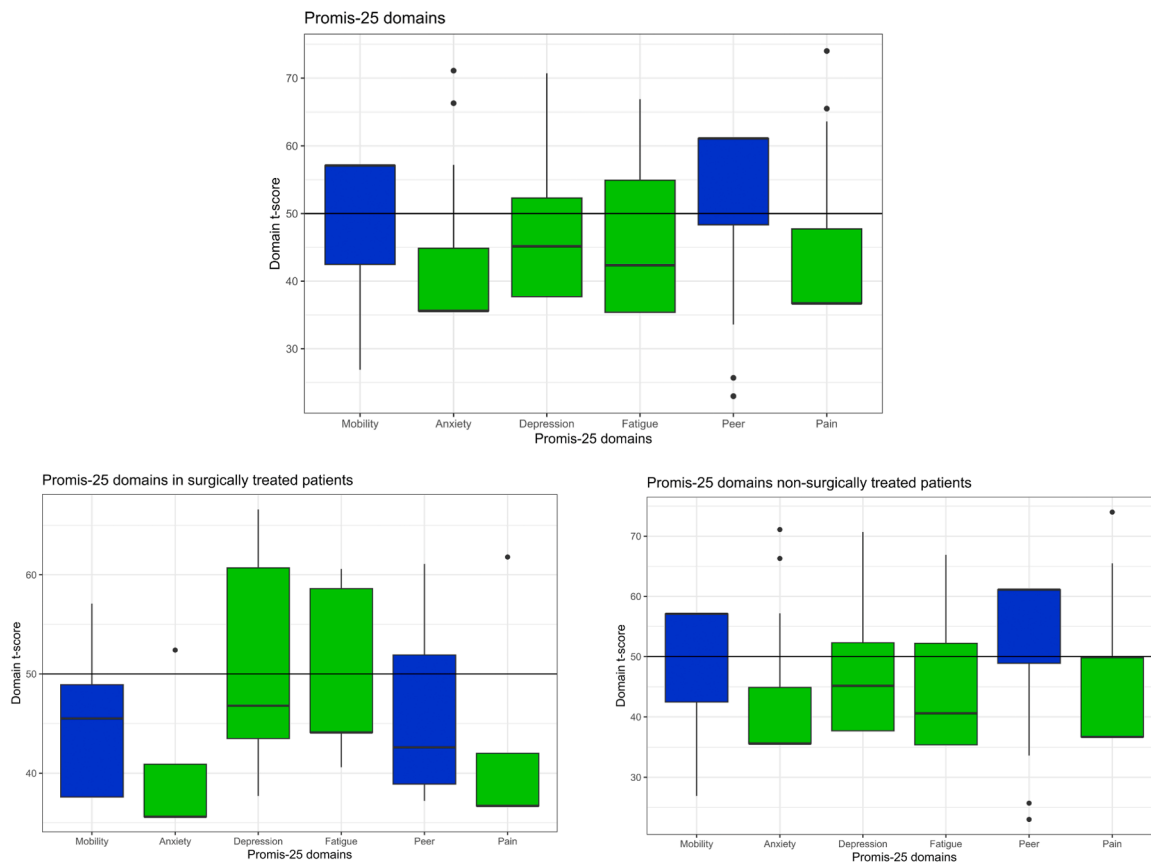


Fig. 2. PROMIS t-scores for all domains at follow-up for the total population (above) for surgically treated patients (left) and for non-surgically treated patients (right). A t-score of 50 corresponds to the US population mean. For the domains highlighted in blue, higher t-scores signify better outcomes. Conversely for the domains highlighted in green, higher t-scores indicate worse outcomes.

fractures of the pelvis, type C, were amongst adolescents. This might be the result of the fact that maturation of the pelvis is associated with more severe injuries, but also that older children are more frequently involved in transport-related injuries. Furthermore, all type C injuries were reported as high-energy injuries, implying that higher energy increases the risk of more severe injuries.

Multiple fractures were also found more commonly in older children/adolescents. When comparing open versus closed physes with single or multiple fractures, most patients with multiple fractures had closed physes. This is similarly reported in previous studies [1,4] and is a consequence of the decrease in elasticity when the pelvis ossifies.

Almost all reported associated fractures were related to high-energy injuries. Previous research has not specifically discussed the correlation between increased energy and associated fractures, but more severe fractures have an increased risk of associated injuries [1,4]. A slight majority of the fractures were low-energy injuries. This is in contrast with previous research, which suggests that pediatric pelvic fractures are often a result of high-energy trauma [1,2].

Treatment

1 in 10 of all fractures were treated surgically, which is in line with previous research [18,19]. Treatment patterns were in line with previous research where surgical treatment increased with increasing fracture severity [1,4].

PROMIS® profile-instruments

About a third of the study population answered the questionnaires representing all fracture types but one (acetabular C). Individuals with

surgically treated fractures, which in this study were shown to indicate more complex fractures, reported more problems with mobility than non-surgically treated. This partly aligns with studies in an adult population where a greater part, especially more complex fractures, lead to long-term decrease in self-reported health status [18]. But in general, the respondents had no or minimal discomfort. This might be due to the immature pelvis' elasticity and its ability to stay stable when it fractures which might make fractures heal better, as compared to a mature one [4].

Lower age at fracture was associated with increased self-reported pain. The cause of this is uncertain. One speculation is that a younger, more immature pelvis requires greater force to cause a fracture. A higher energy injury might lead to a greater extent of associated injuries, and a higher risk of pain as a long-term consequence.

Despite the generally high scores, 8 % answered that they were not physically able to do the activities they enjoy. 35 % had trouble doing the activities they enjoy. A considerably high proportion of type A fractures still reported an impaired walking distance.

Strengths and limitations

To our knowledge, this is the first nationwide population-based study on pediatric pelvic and acetabulum fractures including patient-reported outcome measurements. The SFR only holds data on patients with a Swedish personal identity number, and therefore there may be patients that could not be reported to the registry. As the registry is not specifically designed for pelvis fractures, there are varying degrees of quality in how the data was reported, with certain variables missing for certain patients. Also, pediatric fractures have a specific classification in the SFR for long bone fractures, and registration of pediatric fractures located

elsewhere is optional and done according to the “adult” classification systems. This introduces a selection bias with pediatric fractures not being completely registered.

The children and adolescents between 6 and 17 years of age have different stages of maturation of the pelvis. The registry has a dichotomous variable for reporting open versus closed physes. We chose to use this variable to compare injury profiles, but there was no specification in the registry on which physes were considered for the variable. The pelvic bone consists of many physes, with the triradiate cartilage being the best indicator for pelvic maturity. Neither did we have access to radiographs to examine the maturation of the triradiate cartilage ourselves. Therefore, one should interpret this result cautiously.

Furthermore, the lack of radiographic images made it impossible to validate the fractures, but the validation of the acetabular fracture classification in the SFR in 2022 [22] showed moderate accuracy, whereas the expert group had substantial to perfect inter- and intrarater agreement. Another caveat is the classification system used in the SFR: For pelvic ring fractures it is the same as for adults. But for acetabular fractures, there is a choice to register the fracture according to the adult classification or to tick the box of “unclassifiable pediatric fracture”. This adds a source of error when quantifying the acetabular fractures, as there may be fractures reported as unclassifiable that were not included in our data.

The questionnaires included up to 29 questions, which may have negatively impacted the response rate (31 %). The low response rate as well as a variation in the follow-up time from injury to reporting, was not optimal however, this was adjusted for in the statistical analyses. Furthermore, the sample indicated no significant deviation from the total population in the major characteristics, and all but one fracture type was represented. With this in mind, one should discuss and interpret the PROMIS® findings with some caution.

Conclusion

The majority of all fractures occurred in older children/adolescents and the most common cause of fracture was a fall during sports activities which raises the question of the need to train children to fall without injury or to update protective equipment for specific sports. Only 1 in 10 patients were treated surgically indicating that these fractures are different compared to adult pelvic ring and acetabular fractures. This however did not lead to significant self-identified problems for the children who achieved good mobility with only 3 % indicating considerable concerns at follow-up. Interestingly, the younger the age at fracture, the more pain was reported at follow-up.

The PROMIS® questionnaires were answered by 31 % of the population, which is in line with other studies that include voluntary questionnaires. To our knowledge, this is the first study using the PROMIS® patient-reported outcome instruments.

Data sharing plan

The authors are positive to sharing data but are legally restricted from doing so according to the law on Public Access and Secrecy, Chapter 21, Paragraph 7 and Chapter 25, Paragraph 1 (https://www.riksdagen.se/sv/dokument-lagar/dokument/svensk-forfattningssamling/offentlighets-och-sekretesslag-2009400_sfs-2009-400). After obtaining an approved ethical application, a separate data extraction application can be sent to the Center of Registers, Västra Götaland.

Supplemental

Supplemental Figure 1. Cause of pelvic fractures in boys and girls
Supplemental Figure 2. Promis® domains are shown in categories (in percent)

CRedit authorship contribution statement

YD Hailer: Writing – review & editing, Methodology, Formal analysis, Conceptualization. **LA Larsson:** Writing – original draft, Data curation. **T Hellström:** Writing – original draft, Data curation. **JE Chaplin:** Writing – review & editing. **O Wolf:** Writing – review & editing, Supervision, Data curation, Conceptualization.

Declaration of competing interest

The authors declare no potential conflicts of interest.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at [doi:10.1016/j.injury.2024.111700](https://doi.org/10.1016/j.injury.2024.111700).

References

- [1] Galos D, Doering TA. High-Energy Fractures of the Pelvis and Acetabulum in Pediatric Patients. *J Am Acad Orthop Surg* 2020;28:353–62.
- [2] Holden CP, Holman J, Herman MJ. Pediatric pelvic fractures. *J Am Acad Orthop Surg* 2007;15:172–7.
- [3] DiCenso SM, Kaelber DC, Mistovich RJ. Pediatric pelvic fractures: an epidemiological analysis of a population-based database. *J Pediatr Orthop B* 2021.
- [4] DeFrancesco CJ, Sankar WN. Traumatic pelvic fractures in children and adolescents. *Semin Pediatr Surg* 2017;26:27–35.
- [5] Zwingmann J, Eberbach H, Strohm PC, Südkamp NP, Lauritsen J, Schmal H. Decision-making, therapy, and outcome in lateral compression fractures of the pelvis - analysis of a single center treatment. *BMC Musculoskelet Disord* 2019;20:217.
- [6] Karunakar MA, Goulet JA, Mueller KL, Bedi A, Le TT. Operative treatment of unstable pediatric pelvis and acetabular fractures. *J Pediatr Orthop* 2005;25:34–8.
- [7] Blasler RD, McAtee J, White R, Mitchell DT. Disruption of the pelvic ring in pediatric patients. *Clin. Orthop. Relat. Res.* 2000;87–95.
- [8] Hernefalk B, Eriksson N, Larsson S, Borg T. Patient-reported Outcome in Surgically Treated Pelvic Ring Injuries at 5 Years Post-surgery. *Scand J Surg* 2021;110:86–92.
- [9] Wennergren D, Ekholm C, Sandelin A, Möller M. The Swedish fracture register: 103,000 fractures registered. *BMC Musculoskelet Disord* 2015;16:338.
- [10] Möller M, Wolf O, Bergdahl C, Mukka S, Rydberg EM, Hailer NP, et al. The Swedish Fracture Register - ten years of experience and 600,000 fractures collected in a National Quality Register. *BMC Musculoskelet Disord* 2022;23:141.
- [11] Carlberg Rindestig F, Wiberg M, Chaplin JE, Henje E, Dennyhag I. Psychometrics of three Swedish physical pediatric item banks from the Patient-Reported Outcomes Measurement Information System (PROMIS)®: pain interference, fatigue, and physical activity. *J Patient Rep Outcomes* 2021;5:105.
- [12] Rothrock NE, Amtmann D, Cook KF. Development and validation of an interpretive guide for PROMIS scores. *J Patient Rep Outcomes* 2020;4:16.
- [13] Marsh JL, Slongo TF, Agel J, Broderick JS, Creevey W, DeCoster TA, et al. Fracture and dislocation classification compendium - 2007: orthopaedic Trauma Association classification, database and outcomes committee. *J Orthop Trauma* 2007;21:S1–133.
- [14] von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP. The Strengthening of Reporting of Observational Studies in Epidemiology (STROBE) Statement: guidelines for reporting observational studies. *Int J Surg* 2014;12:1495–9.
- [15] Cella D, Riley W, Stone A, Rothrock N, Reeve B, Yount S, et al. The Patient-Reported Outcomes Measurement Information System (PROMIS) developed and tested its first wave of adult self-reported health outcome item banks: 2005–2008. *J Clin Epidemiol* 2010;63:1179–94.
- [16] NIH. Promis Health Measure score.
- [17] Yue J, Guo X, Wang R, Li B, Sun Q, Liu W, et al. Reliability and repeatability of 2021 ARCO classification and its guiding significance in treatment of nontraumatic osteonecrosis of the femoral head. *BMC Musculoskelet Disord* 2023;24:469.
- [18] Grisoni N, Connor S, Marsh E, Thompson GH, Cooperman DR, Blakemore LC. Pelvic fractures in a pediatric level I trauma center. *J Orthop Trauma* 2002;16:458–63.

- [19] Mulder MB, Maggart MJ, Yang WJ, Perez EA, Namias N, Sola JE, et al. Outcomes of Pediatric Pelvic Fractures: a Level I Trauma Center's 20-Year Experience. *J Surg Res* 2019;243:515–23.
- [20] Guillaume JM, Pesenti S, Jouve JL, Launay F. Pelvic fractures in children (pelvic ring and acetabulum). *Orthop Traumatol Surg Res* 2020;106:S125–Ss33.
- [21] OECD.
- [22] Albrektsson M, Wolf O, Enocson A, Sundfeldt M. Validation of the classification of surgically treated acetabular fractures in the Swedish Fracture Register. *Injury* 2022;53:2145–9.