# Are PROMIS scores sensitive to functional differences in children with lower limb amputations?

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## Objectives:

PROMIS measures are used in monitoring pediatric orthopedic conditions, but normative values for children with lower limb amputations (LLA) are not well established. If PROMIS scores are sensitive to functional differences, they could help assess treatment impact. This study evaluated whether PROMIS scores reflect differences based on amputation level and laterality (unilateral (UNI) vs. bilateral (BIL)).

## Methods:

Patients with LLA were identified using the LEADeR database, a Shriners Children's registry of patients from 7 locations, who had completed PROMIS questionnaires [Mobility (MOB), Pain Interference (PI), Peer Relationships (PR), Upper Extremity (UE)] as part of their clinical care were identified. Specific diagnostic characteristics included whether LLA was congenital or acquired, bilateral or unilateral, and the level of amputation. Demographics included age and gender at time of PROMIS assessment. Descriptive statistics were used for group analyses. One-way ANOVAs tested differences in laterality and amputation level (Significance $p<0.01$). Mobility Groups (MOB_Grp) were formed based on PROMIS interpretation cutpoints: normal (≥45); mild(40-44.99), moderate(30-39.99), severe(≤29.99) to assess prevalence of the population with scores in that category.

## Results:

- Mean PROMIS scores from 794 Patients with LLA with a mean age of 14.6±3.2 years by sex and diagnostic characteristics are reported in Table 1. Statistical (not clinical) differences were found between M/F for MOB and PI and between Congenital/Acquired for PR. Patients with BIL amputations scored significantly worse than those with UNI on MOB and UE.
- Distribution of PROMIS Impairment scores (MOB_Grp) are shown in Figure 1. Those in the BIL group scored worse than UNI.
- PROMIS scores by level of amputation are shown in Figure 2A (Congenital) and Figure 2B (Acquired). MOB scores significantly differed between levels of amputation, with scores decreasing with higher level of amputation.
- BIL/UNI amputees were separated and scores compared by amputation level (Table 2): MOB scores for those with *UNI* Involvement with Ankle Disarticulation were statistically better than those with Knee Disarticulation and for those with *BIL* involvement those with partial foot scored significantly better than those with Knee Disarticulation and TransFemoral amputations.
- PRO score comparisons based on MOB_Grp for BIL and UNI groups Figure 3 revealed significant differences between levels for PI, UE, and PR scores, with scores worsening with increasing MOB impairment level.

## Conclusions:

Overall pediatric patients with LLA score well on PROMIS MOB, UE, PI and PR, yet 50% of UNI and 78% of BIL patients reported at least mild MOB impairment. MOB has clinical utility as it was shown to be sensitive to differences between laterality and amputation level. MOB measured the expected decreased mobility in patients with bilateral and more proximal amputations.

| PROMIS Domain | Entire Cohort (N=794) | Female (N=340) | Male (N=454) | Congenital (N=591) | Acquired (N=203) | Unilateral (N=656) | Bilateral (N=138) |
|---|---|---|---|---|---|---|---|
| Mobility | 44.8±9.5 | **43.7±9.2** | **45.6±9.6** | 45.0±9.6 | 44.0±9.3 | **45.8±9.4** | **39.2±8.4** |
| Pain Interference | 46.4±9.8 | **47.5±10.1** | **45.5±9.5** | 45.9±9.7 | 47.8±10.1 | 46.2±9.8 | 46.9±9.6 |
| Upper Extremity | 49.4±9.9 | 48.5±9.9 | 50.0±9.5 | 49.2±9.9 | 49.8±10.1 | **50.6±9.1** | **44.6±11.7** |
| Peer Relationship | 51.2±9.9 | 50.7±10.0 | 51.5±9.9 | **51.7±9.3** | **49.4±11.4** | 51.2±9.9 | 50.6±10.1 |

**Bold:** statistically significant ($p < 0.01$)

Table 1: Mean PROMIS Scores

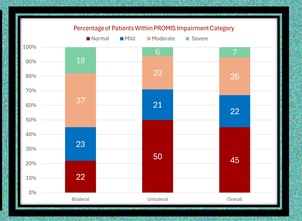


Figure 1


Figure 2A

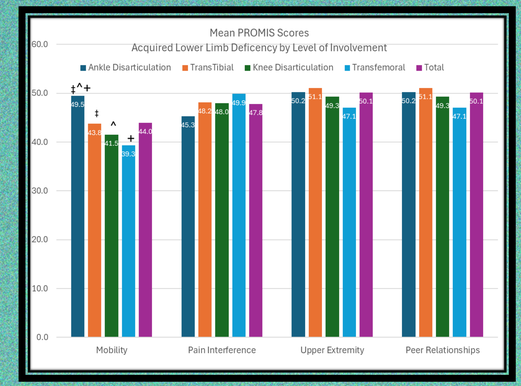


Figure 2B

| BILATERAL Involvement | | | | |
|---|---|---|---|---|
| | **Mobility** | **Pain Interference** | **Upper Extremity** | **Peer Relationships** |
| PFFD (N=2) | 38.5±3.5 | 52.5±3.2 | 57.0±0 | 46.2±9.1 |
| TransFemoral (N=6) | 33.3±8.9^ | 52.5±10.8 | 34.3±14.6 | 50.8±11.2 |
| Knee Disarticulation (N=44) | 36.6±7.5* | 44.2±9.4 | 44.6±11.7 | 50.7±9.6 |
| TransTibial (N=27) | 40.0±7.2 | 47.6±9.7 | 45.6±10.9 | 49.7±11.1 |
| Ankle Disarticulation (N=33) | 40.6±8.5 | 49.0±9.1 | 45.0±11.0 | 51.0±11.2 |
| Partial Foot (N=9) | 47.0±11.1*^ | 48.3±10.1 | 47.8±10.0 | 51.3±7.4 |
| Total (N=124) | 39.2±8.4 | 46.9±9.6 | 44.6±11.7 | 50.6±10.1 |
| | | | | |
| **UNILATERAL Involvement** | | | | |
| | **Mobility** | **Pain Interference** | **Upper Extremity** | **Peer Relationships** |
| Hip Disarticulation+Pelvis (N=8) | 42.8±5.1 | 44.4±12.5 | 42.9±10.2 | 48.0±7.7 |
| PFFD (N=66) | 45.5±8.4 | 47.7±9.6 | 51.1±8.1 | 52.6±9.3 |
| TransFemoral (N=16) | 41.4±10.1 | 48.9±12.1 | 51.1±8.0 | 49.8±12.4 |
| Knee Disarticulation (N=87) | 43.7±9.2* | 45.7±9.9 | 48.6±10.4 | 51.1±10.0 |
| Van Ness (N=11) | 46.3±9.8 | 47.0±7.8 | 51.8±7.6 | 55.1±7.9 |
| TransTibial (N=138) | 44.8±9.5 | 47.6±10.2 | 51.2±8.8 | 51.1±10.1 |
| Ankle Disarticulation (N=238) | 47.6±9.5* | 45.0±9.3 | 51.4±8.3 | 51.6±9.7 |
| Partial Foot (N=78) | 46.3±99.3 | 46.8±10.3 | 50.2±10.4 | 50.0±10.4 |
| Total (N=644) | 45.8±9.4 | 46.2±9.8 | 50.6±9.1 | 51.2±9.9 |

Table 2

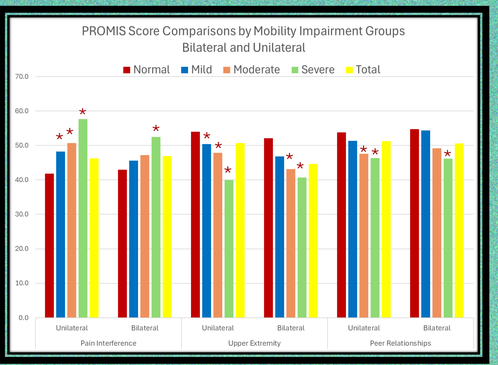


Figure 3

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