THE ABILITY TO PARTICIPATE IN SOCIAL ROLES AND ACTIVITIES IN WEARERS OF UNILATERAL TRANSRADIAL PROSTHESES

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ABSTRACT

The literature related to upper limb prosthetic rehabilitation has largely focused on body structure and function. The constructs of activity limitation and participation restriction are comparatively under represented. The intent of this effort was to assess the related constructs of activity and participation among a cohort of individuals using unilateral transradial prostheses and correlate these findings against measures of upper limb function, satisfaction, quality of life, prosthetic wear time and pain interference.

We observed the strongest correlation of patient reported activity and participation to be an individual's perceived bimanual upper limb function as measured by a custom PROMIS short form (r=0.74). Additionally, strong correlations were observed between activity and participation values and perceptions of both quality of life (r=0.44) and satisfaction with life (r=.37). The additional constructs of pain interference (r=.34) and reported prosthesis wear times (r=.32) also demonstrated weaker correlations with activity and participation.

INTRODUCTION

The World Health Organization's (WHO) International Classification of Functioning and Health (ICF) facilitates a comprehensive understanding of the challenges faced by individuals coping with illness or disability. As with many other physical disabilities, upper limb amputation is associated with immediate and profound impairments within the realm of body functions and structures. However, the ICF model encourages additional consideration of both activity limitations and restrictions to participation [1].

Gallagher et al identified frequently encountered activity limitations for this population. These included getting dressed (52.9%), taking care of household responsibilities (52.9%), and day-to-day work/school activities (40.0%) [2].

Additionally, in consideration of restrictions to participation, the most frequently identified restrictions have been suggested in employment or job seeking (91.7%), family life (41.2%), leisure/cultural activities (41.2%), sports or physical recreation (38.5%), shopping (35.3%), living with dignity (35.3%) and socializing (23.5%) [2].

In addition to the disability considerations identified within the ICF Model, Wurdeman, Stevens, and Campbell have reported upon the increases in individual quality of life and satisfaction associated with the use of lower limb prostheses [3]. Of particular interest to the present study is whether this relationship holds true for a population of upper limb prosthetic users as well, and what correlations may exist between perceived activity and participation and reported satisfaction and quality of life.

In 2004, the National Institutes of Health (NIH) launched the Patient Reported Outcomes Measurement Information System® (PROMIS®) "Roadmap Initiative" [4]. This effort sought to leverage modern psychometric techniques to improve the measurement of symptoms and health outcomes by generating and refining item banks across a range of health-related constructs. The initiative ultimately created numerous patient-reported outcome measures covering a wide range of both symptoms and functionalities as well as establishing a standardized scoring framework that could be used across illnesses, chronic health conditions, and the general population [4].

Among these instruments are a small series of short forms addressing an individual's perceived ability to perform their usual social roles and activities, appropriately entitled the PROMIS® Ability to Participate in Social Roles and Activities (PROMIS-APSRA). This construct aligns well with the considerations of activity limitation and participation restriction proposed by the ICF and has been assessed and published across a range of illnesses and disabilities.

Also within the available PROMIS measures is the PROMIS Physical Function Upper Extremity measure or PROMIS®-UE. This is a measure of an individual's

perceived ability to complete tasks that require the use of one's upper limb. The PROMIS®-UE utilizes item-response theory to generate a probability-algorithm to measure both the response to an individual question, as well as the concurrent relationship between said item and domain specific items This provides a more advanced and holistic view of an individual's physical function both in terms of the response to an individual item and the relationship of the item to the entire measure.

In the case of the customizable PROMIS®-UE test bank, items can be selected to provide a psychometrically sound representation of an individual's overall perceived function level, rather than simply a measure of an individual's ability to perform a given isolated task. Item-response theory algorithms reduce the required number of items that must be administered while maintaining test validity, thus reducing the time burden for both the clinician and test taker.

The purpose of this paper is to report upon the ability of individuals using upper limb prostheses to participate in social roles and activities and those factors that may be closely correlated to this construct. Examined factors include upper extremity function, hours of wear time, quality of life, and post amputation satisfaction with life. A relationship between an individual's APSRA and upper extremity function and was hypothesized. Participation and activity was further hypothesized to be related to quality of life and post amputation satisfaction with life. Finally, hours of prosthesis wear time was hypothesized to be related to APSRA.

METHOD

Study design

During routine patient care, patient outcomes were collected from patients receiving maintenance or replacement of an upper limb prosthesis. The present data represents a multi-site review of all outcomes collected from May 2017 through December 2018.

Participants

Of particular interest to the present study were individuals age 18 and older, with unilateral transradial amputations, who were actively using any type of prosthesis.

Procedure

To assess upper limb function in the sampled cohort a custom 9-item short form from the PROMIS®-UE v2.0 item bank consisting of bimanual activities was administered (PROMIS-9 UE). Patients were asked to report the level of difficulty associated with each item using a Likert scale ranging from 1 (unable to do) to 5 (without any difficulty). Items included such tasks as opening and closing a zipper, cutting food using utensils and lifting or passing heavy items.

Bimanual activities were intentionally chosen to attempt to isolate those activities where prostheses would be more likely to influence upper limb function. Raw scores were converted to t-scores using the healthmeasures.net scoring service such that a score of 50 corresponds the average scores of the United States population.

Additional survey items included the 4-item short form of the PROMIS-APSRA. This construct aligns well with the considerations of activity limitation and participation restriction proposed by the ICF. Using the Prosthesis Evaluation Questionnaire-Well Being [5], patients rated their satisfaction with life (SAT) and quality of life (QOL) over the prior 4 weeks. Scored range from 1 to 10, with higher scores indicating higher levels of well-being.

Patients were additionally asked about their prosthesis wear times: number of days per week or month and number of hours per day.

Analysis

Data were initially reduced with only individuals that met inclusion/exclusion criteria included. The resulting data were then assessed using Pearson Product-Moment correlations and group means. Of interest were the relationships among the variables. Therefore separate Pearson correlation coefficients were calculated for PROMIS-9 UE t-scores, PROMIS-APSRA t-scores, QOL, SAT and reported daily prosthesis wear times. Correlations were calculated at the 95th percentile, after 1000 repeated bootstrap iterations. Standard Cohen [6] effect sizes were used to assess the Pearson correlation coefficient effect size.

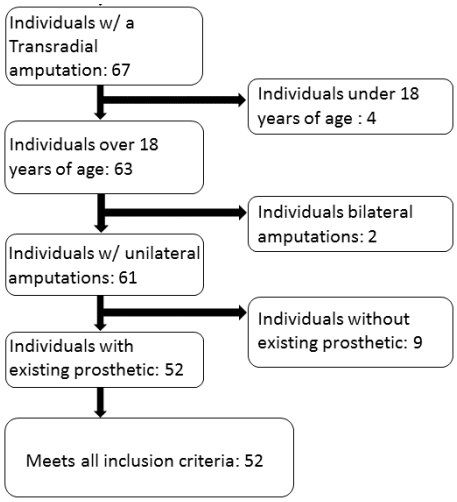

Figure 1: Data reduction flow chart resulting in 52 participants

RESULTS

Participants

Data were extracted from 67 patients that completed the outcomes assessments while visiting participating clinics. This number was further reduced to 52 users of TR prostheses (Figure 1). Demographic data is presented in Table 1.

Table 1: Patient demographics

Age (years)	48.9 ± 15.8
Gender	38 men; 14 women
Height (cm):	177.3 ± 9.9
Weight (kg):	85.7 ± 26.5
Time since amputation	44 ± 20.1 months
Reported prosthesis use	hours/day: 11.0 ± 5.0 days/week: 5.7 ± 2.3

Results

There was a large, significant, and positive correlation between the PROMIS-APSRA and the PROMIS-9 UE (r=0.738, Table 2). A large but lesser correlation was also observed between the PROMIS-APSRA and QOL (r=0.443) There were significant medium positive correlations between the PROMIS-APSRA and SAT (r=0.369), Pain interference (r=0.340), and reported daily prosthesis utilization rates (r=0.323).

Table 2: Correlation Coefficients

Variable	**PROMIS-APSRA**
PROMIS-9 UE	.738**
QOL	.443**
SAT	.369*
Pain Interference	.340*
Px Hours/Day	.323*

* Correlation is significant at the $p < 0.05$ level.
** Correlation is significant at the $p < 0.01$ level.

Discussion

The purpose of the present study was to assess correlates to reported participation in social roles and activities among individuals using a unilateral TR prosthesis. We observed percieved activity and participation values to correlate with reported bimanual upper limb capacity, reported quality of life and satisfaction with life, reduced reported interference from pain and increased prosthetic wear time.

We note that the strongest correlate to higher reported activity and participation scores was greater perceived bimanual capacity. Given the bimanual nature of the tasks in the PROMIS-9 UE and the inclusion criteria of an individual's active use of a prosthesis, we can reasonably assume that these scores represent the abilities of the sampled individuals to engage in bimanual activities with their respective prostheses.

Patients who exhibited the lowest level of perceived difficulty performing a range of bimanual tasks were found to have the highest PROMIS-APSRA scores. Further, PROMIS-9 UE scores correlated to PROMIS-APSRA scores much more strongly than to such variables as pain interference or reported prosthetic wear time. Accordingly, it would appear that the ability to perform a desired task when needed may be more closely related to activity and participation than either pain or prosthetic wear time.

The present paper suggests that the role of the clinical team is not limited to fitting an ideal prosthetic device but ultimately to ensuring that this device and the associated training facilitates the individual's ability to perform bimanual tasks when required.

The associations observed in the present study represent a starting point in connecting the goals of the clinical and rehabilitative teams, recognizing that upper extremity physical function is strongly connected to social function. Further, social function appears to be strongly connected to perceived quality of life, and moderately connected reported satisfaction with life. However, future studies are needed to further solidify these findings and better understand the influencing factors of these connections.

Limitations

The previous results notwithstanding, it is important to note a limitations of data collected at multiple sites. It introduces a potential for human error as data was collected by multiple clinicians. However, steps were taken to alleviate this error potential as clinicians completed training sessions as part of broader, ongoing clinical outcomes data collection training.

Further, we note that our observations were exclusive to users of unilateral transradial prostheses. The extent to which these observations may translate to individuals with more proximal amputation levels is not clear from the current data set. Additional, no analyses of prostheses type on the observed variables was performed.

Conclusion

Among the sampled cohort, among users of unilateral transradial prostheses, the strongest predictor of an individual's reported ability to participate in their social roles and activities was their perception of their upper limb physical function across a range of bimanual tasks. Not surprisingly, activity and participation scores were also strongly correlated with both the QOL and SAT scores reported by the participants. While the additional constructs of prosthetic wear time and pain interference demonstrated moderate correlations with activity and participation scores, these correlations were much weaker than those observed with an individual's perceived capacity to accomplish bimanual tasks.

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