FINAL REPORT

SCIRF #2016 PD-01

PI: Craig A. Velozo, PhD, OTR/L

Grant Title: Application of state-of-the-art measurement in monitoring long-term outcomes of spinal cord injury in South Carolina

This SCIRF award supported successful submission/publication of the following scientific abstracts and articles. SCIRF#2016 PD-01 grant award has been duly acknowledged in all peer-reviewed publications.

Peer-reviewed publications:

Published abstracts:

Manuscripts in preparation:

Presentations:
5. **Hand, B.N.,** Krause, J.S., & Simpson, K. *Opioid utilization and overdose rates in propensity-score matched, privately insured individuals with and without spinal cord injury,* Poster accepted for presentation at American Occupational Therapy Association Conference 2018, Salt Lake City, UT.


**Grants submitted:**
- **Mechanism:** MUSC Center on Aging Pilot Project
  - **Title:** Modeling person responses to activity of daily living (ADL) items as a function of adjusted MET values: Towards optimizing activity interventions to maintain/improve independence of older adults
  - **PI:** Brittany N. Hand, PhD, OTR/L
  - **Co-I:** Craig A. Velozo, PhD, OTR/L
  - **Status:** Not funded

- **Mechanism:** SCIRF Seed Funding
  - **Title:** Health Outcomes of Community-Based Rehabilitation Post-SCI
  - **PI:** Brittany N. Hand, PhD, OTR/L
  - **Status:** Withdrawn

**Study Overview**

The purpose of this proposal was to train a promising postdoctoral research fellow in state-of-the-art measurement methodologies for monitoring the impact of spinal cord injury (SCI) among individuals in South Carolina. The foundation of this work is that the field of SCI lags behind other healthcare fields in the application of “modern” measurement approaches such as item response theory (IRT) and Rasch measurement. This is especially evident in SCI longitudinal databases which, by their nature, have applied and continue to apply variables and instruments that precede the application of contemporary psychometric approaches. Our lab has recently addressed the measurement limitations in SCI longitudinal databases by applying Rasch analytics to existing variables in these databases to generate Rasch-based measures that have many of the psychometric qualities of contemporary measures. The advantage of these newly-generated measures include: 1) interval level values, the ideal measurement form for monitoring SCI change; 2) reducing respondent burden for future SCI data collection by generating short-forms and computerized adaptive tests; and 3) adding meaning to measures by placing SCI person measures and item calibrations on the same linear continuum. In a preliminary study, our lab demonstrated the effectiveness of this approach by generating a Rasch-based measure from the SCI Longitudinal Aging Study which clearly demonstrates the dramatic loss of activities of daily living function over a 20-year period, especially by individuals with C1-C4 SCI injuries. The application of the state-of-the-art measurement in monitoring long-term outcomes of SCI in South Carolina will dramatically advance SCI measurement science and formed the foundation of this postdoctoral research fellowship training.
Aim 1: Train a postdoctoral fellow in state-of-the-art measurement methodologies for monitoring the impact of SCI among individuals in South Carolina.

**Status:** The primary purpose of Aim 1 was the professional development and training of the postdoctoral fellow funded on this grant, Dr. Brittany Hand. During the funding period, Dr. Hand engaged in daily collaboration and discussion of project development with Dr. Velozo. Additionally, Dr. Hand assisted with instruction of Dr. Velozo’s graduate level course “Introduction to Rasch Measurement” in the College of Health Professions, at the Medical University of South Carolina (MUSC). She also sought out and completed continuing education opportunities to further her training including the MUSC Summer Institute on longitudinal analysis and an 8-week webinar on repeated measures analysis with ANOVA and mixed model approaches. These statistical training courses were fundamental to analytic approaches that were used in SCI studies of repeated measures Rasch analysis.

In addition to training in statistical methodologies, Dr. Hand completed training in grant proposal writing to develop skills that will be germane to securing future funding for SCI research as a PI. Dr. Hand completed an MUSC Proposal Development Workshop on career development grants for pre- and post-doctoral fellows. She also audited the Fundamentals of Grant Writing course offered through the College of Health Professions at MUSC during the Spring semester of 2017. Dr. Hand completed two grant applications (one internal, one external) during the funding period. First, Dr. Hand completed an application for internal funding through the MUSC Center on Aging. This funding mechanism was selected due to not having an alternative SCI-specific funding mechanism available. The purpose of the proposal was to elucidate an underlying measurement theory common to all instruments that measure independence in activities of daily living (ADL). Findings of the proposed study have direct relevance to work that Dr. Hand is doing with the SCI databases, as previous findings from our lab revealed significant decline in ADLs independence 20 years after cervical SCI. While the proposal was not selected for funding, it did receive very positive feedback from reviewers. Second, Dr. Hand completed an application for the SCIRF Seed Funding mechanism for partial salary support in a Research Associate position at MUSC. Ultimately, Dr. Hand accepted a tenure-track faculty position outside the state of South Carolina and, as such, this grant application was withdrawn.

**Products:**

Grants submitted:

- **Mechanism:** MUSC Center on Aging Pilot Project
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Aim 2: Generate item-response-theory measures of attendant care, pain, social support/environment, quality of life, depression/stress, personality, walking measures from the South Carolina SCI outcomes database that have psychometric qualities similar to those of contemporary outcomes measures.

**Status:** During the award period, we generated Rasch measures from the South Carolina SCI outcomes databases for the following questionnaires: 1) Pain Medication Questionnaire, and 2) Depression, Anxiety, and Stress Scales. Studies completed under this aim resulted in one presentation at a leading international rehabilitation conference (American Congress of Rehabilitation Medicine [ACRM]), and one peer-reviewed publication. Figure 1 is a photograph of Dr. Hand at ACRM, where she was disseminated research findings related to this aim, as well as networked with both senior and early-career researchers interested in SCI research.
Figure 1 shows postdoctoral fellow, Dr. Hand [left] at ACRM, where she disseminated research findings related to this aim. Dr. Hand is pictured with Lauren Wengerd, OTR/L [middle] and Julie Faieta, OTR/L [right] who are early-career researchers studying neural underpinnings of spasticity in SCI, and pressure ulcer management in SCI, respectively.

**Products:**

Peer-reviewed publications:


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**Aim 3: Generate efficient and precise short forms of measures from the South Carolina SCI outcomes database that will reduce respondent burden and maximize measurement precision for future South Carolina SCI survey respondents.**

**Status:** During the funding period, a short form was generated for the Brief Pain Inventory interference scale. Development of this short form included removing items not appropriate for all persons with SCI (i.e., those related to walking), as well as misfitting items. This resulted in a reduction in number of items from 7 to 4 items. *The study completed under this aim resulted in a peer-reviewed publication that is currently under review (Australian Occupational Therapy Journal).*
**Products:**
Peer reviewed publications:


**Aim 4:** Generate SCI outcome reports that can be directly used to guide SCI interventions/accommodations to maximize the health and well-being of South Carolina citizens with SCI.

**Status:** This aim was addressed using two different approaches: 1) longitudinal Rasch measurement, and 2) archival analysis of national, population-based databases. Results of two studies completed under this aim have been accepted for publication (Spinal Cord, Archives of Physical Medicine and Rehabilitation), and a third manuscript is in preparation. Additionally, findings were presented at an international conference (International Conference on Health Policy Statistics [ICHPS]), and accepted for presentation at two national conferences (American Occupational Therapy Association, American Spinal Injury Association). The poster presented at ICHPS is shown in Figure 2.

**Figure 2**

Opioid utilization patterns differ between individuals with spinal cord injury and propensity score matched controls

Brittany N. Hand, PhD, OTR/L, James S. Krause, PhD, Kit N. Simpson, DrPH

College of Health Professions, Medical University of South Carolina

**Background**

- Opioid misuse is linked to increased emergency department utilization, hospitalizations, and annual healthcare costs.
- The economic burden of opioid misuse in the United States is estimated at $55.7 billion.
- Risks associated with opioids are driven by dose, duration of use, and type of opioid prescribed.
- Patients with spinal cord injury (SCI) may be particularly vulnerable to the risks of opioid misuse due to high prevalence of pain.
- Opioids have limited documented efficacy for improving perceived quality of life for persons with SCI.
- Opioid use in SCI is associated with:
  - Increased risk of falls for ambulatory individuals
  - Lower extremity fractures
  - Fatigue

**Objectives**

1. Compare opioid utilization patterns in opioid users with SCI to a propensity score matched general population of opioid users without SCI.
2. Identify characteristics of persons with SCI associated with long-term and/or high-dose use of opioids

**Methods**

**Data Source:**
- Thompson Reuters MarketScan® Commercial Claims and Encounters Databases 2012-2013

**Participants:**
- Age 18-64 with opioid prescriptions during 2012
- 18 months of continuous insurance coverage
- Propensity score matched

**Outcome Measures:**
- Average daily morphine equivalent dose
- High dose users: ≥ 120 mg, Low dose users < 120 mg
- Duration of use
- Long term: > 90 days, Short term: ≤ 90 days

**Statistical Analysis:**
- Multivariable logistic regression

**Discussion**

- Individuals with SCI were significantly more likely to have high-doses and long-term use of opioids than controls
- Among high-dose users, individuals with SCI at lower levels had more days supply of long-acting opioids
- Individuals with lower levels of injury may have more preserved sensation and experience greater pain
- Opioid epidemic in the general population may be magnified after SCI

**Methodologic Considerations**

- Medication compliance is unknown
- Variables not included in the data may have confounded results
- Included only individuals with private health insurance
- Propensity score matching approximates, but cannot replace, randomization
- Next steps should include examining patient reported outcomes and other indicators of long-term efficacy of opioids in SCI

**Figure 2**

Figure 2 depicts the scientific poster presented at ICHPS as a result of studies completed under this aim.
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