The SmartWheel®

We Don't Make the Wheelchair.
We Make the Wheelchair Better.

Improved Patient Outcomes and Clinical Business Model
The average person pushes on his/her wheelchair 2000-3000 times per day.
The SmartWheel
What is the SmartWheel?

For Each Push, the SmartWheel Measures:

- Push Forces
- Push Frequency
- Push Length
- Push Smoothness
- Speed and More

Automated Reports Allow You To:

- Review patient performance and outcomes
- Compare outcomes with a national database
- Compare with patient’s past performance
Sampling of Clinics with SmartWheels

The Mayo Clinic
Craig Hospital
Memorial Hermann | TIRR
Banner Health, Banner Good Samaritan Medical Center
Magee Rehabilitation
The Ohio State University Medical Center
The Miami Project
Rehabilitation Institute of Chicago
University of Pittsburgh
Kessler Medical Rehabilitation Research and Education Corp
Univ College London, Royal National Orthopaedic Hospital
Shriners Hospital for Children
Rancho Los Amigos
15 VA Medical Centers

- 70% of the top-ranked rehab hospitals have SmartWheels*
- 57% of the Spinal Cord Injury Model Systems have SmartWheels
- Active User Group formed in 2004 has 100 members (Clinicians, Doctors, Researchers, Industry Leaders)

*US News & World Report Rankings, 2009
Why Do We Care?

Over 2 Million People use Manual Wheelchairs in the US

Manual Wheelchair Pain and Injury:

- 75% of wheelchair users experience pain
- 65% have some type of shoulder injury
- Up to 70% have CTS

- These extraordinary numbers indicate a major problem
So What is the Problem?
Consequences of Pain & Injury

**Lifestyle Changes:**
- Decreased quality of life
- Functional decline
- Employment challenges

**Economic Cost Factors:**
- Treatment
- New equipment
Research conducted linked pain and injury to:

- How an individual pushes a wheelchair
- Over 20 published research papers

Clinical Practice Guidelines created:

- How to preserve the Upper Limb
- 10 panel members, 17 expert reviewers
- 21 organizations
- Recommendations based on research
The Tool for Investigating the Problem

- The SmartWheel: 25 years since the 1st prototype
- Three Rivers introduces the first Clinical Version of the SmartWheel in 2005

Key Factors Causing the Problem

**Key factors influencing pain and injury are:**

- Repetition (Frequency)
- Force
- Propulsion (Push) Style

The research and Clinical Practice Guidelines identified these key factors
The Problem Linked to The Wheelchair

Key factors affecting pain and injury...

- Repetition
- Force
- Push Style

...are influenced by the wheelchair:

- Selection (e.g. heavy vs. ultralight)
- Set-Up (e.g. axle position)
- Training (e.g. smooth strokes)

Long Smooth Strokes
Solving the Problem

Realizing the Wheelchair is an Orthotic:

- It must be properly prescribed:
  - Wheelchair selection
  - Set-up and fitting
  - Training
  - Proper prescription reduces repetitions and force and optimizes push style

Objective data is needed for proper prescription
Driving Factors:
Objective Key Data

The Key Data:

• Speed
• Push Force
• Push Frequency (Repetition)
• Push Length

- Speed is a Key Data point because a wheelchair user must achieve a minimal velocity for functional purposes

- The SmartWheel measures all the Key Data and more!

Key Data Questions

SmartWheel Key Data Questions:

Do you have Key Data reference (normative) values?
  • Yes, you do

Can you compare your client with a general population of people that use a wheelchair?
  • Yes, you can
The **SmartWheel User Group** formed in 2004

- Created a **Standard Clinical Protocol**
- Populated a database using the **Standard Clinical Protocol**
- Database creation resulted in reference values for:
  - Speed
  - Push Force
  - Push Frequency
  - Push Length

Cowan, et al., 2008.
Overview of Clinical Application:
(Prescribing the Wheelchair)

- Is the client able to push at a functional speed? (e.g., to safely cross a street?)

- Compare client test results to the Database for Push Force & Frequency

- Client is OK if they are at functional speed and compare favorably to the Database Population for Push Frequency and Force

- If not OK, the clinician designs an intervention(s) (e.g. strength or propulsion training, alterations of chair set-up etc.)

- If the OK status cannot be achieved, then alternatives like power mobility options may be considered
The SmartWheel “Standard”

- Upper Limb Preservation Clinical Practice Guidelines (CPG) supports importance of SmartWheel data

- Archives of Physical Medicine and Rehabilitation publishes The SmartWheel User Group Clinical Decision Making Model for Manual Wheelchair Prescription

- SmartWheel User Group has the largest database of Manual Wheelchair users in the World... and it’s growing

Cowan, et al., 2008.
More than a SmartWheel

- Membership in the SmartWheel User Group

- Periodic SmartWheel System Software updates to the SmartWheel User Group Database and Key Reference Values

- Opportunities for collaboration with over 90 leading institutions around the World that are currently using the SmartWheel
What Does a Push Look Like?

- **Time**: 2 [s]
- **Speed**: 1 [m/s]
- **Distance**: 1.1 [m]

**Peak Force**: 135 [N]
**Average Force**: 92 [N]
**Backwards Force**: -2 [N]

**Push Length**: 99 [deg]
**Push Smoothness**: 1.5 [ ]
**Push Frequency**: 0.9 [1/s]
The SmartWheel Automates the Clinical Data Analysis Process

Key Data from Client Session & Comparison to Database Averages

(These key parameters are calculated from all pushes except for the first 3. Database averages may not be available depending upon protocol chosen)

<table>
<thead>
<tr>
<th></th>
<th>Client Session 1</th>
<th>Client Session 2</th>
<th>Client Session 3</th>
<th>Client Session 4</th>
<th>Database Average †</th>
<th>Database Top 25% ‡</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speed [m/s]</td>
<td>1.35</td>
<td>0.90</td>
<td>1.17</td>
<td>0.79</td>
<td>1.2</td>
<td>1.50</td>
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<tr>
<td>Push Frequency [1/s]</td>
<td>0.80</td>
<td>1.08</td>
<td>1.26</td>
<td>0.45</td>
<td>1.0</td>
<td>1.14</td>
</tr>
<tr>
<td>Push Length [degree]</td>
<td>77.93</td>
<td>43.54</td>
<td>39.99</td>
<td>70.34</td>
<td>100.6</td>
<td>107.12</td>
</tr>
<tr>
<td>Force (Weight Normalized) %</td>
<td>9.32</td>
<td>5.59</td>
<td>10.99</td>
<td>6.78</td>
<td>9.7</td>
<td>11.34</td>
</tr>
</tbody>
</table>

† Database averages cited are from Archives of Physical Medicine and Rehabilitation 2008; 89:120-8. It is informational purposes only
‡ Speed, Frequency, Push Length and Force data are drawn from the database population but fall within the top 25% of speed (Upper-Quartile)
The Business Opportunity

Over 2 Million Manual Wheelchair Users

• Under-marketed population, not targeted
• Attract new patients with leading edge services
• Leads to referrals in other areas:
  • Orthopedic Evaluation and Treatment
  • Conditioning and Strength Training
  • Neuro Rehab

Opportunity to Increase Revenue and Profit
SmartWheel Business Model

- Measures functional outcomes

- Justifies skilled therapy time

- Multiple Billing Codes for SmartWheel Usage
  
  - PT Evaluation: 97001
  - PT Re-evaluation: 97002
  - OT Evaluation: 97003
  - OT Re-evaluation: 97004
  - Wheelchair Management and Training: 97542
  - Physical Performance Test or Measure: 97750
Who should be tested with The SmartWheel?

- Any person that is going to be a long term manual wheelchair user should be tested and analyzed with the SmartWheel.

The Analogy is Blood Pressure:

- You do not know if there is an issue without testing

Weight:

- You can see if there is an issue
- But harder to see outcomes or measure progress

Out-Patient Propulsion training example:

- Like gait evaluation and training
- Goal is to have efficient push
The following is an example of a 5 visit Wheelchair Fitting and Propulsion Training Program. Each visit is an hour.

**CPT Code Key:**
- 97001 or 97002 - PT or OT Evaluation
- 97542 – Wheelchair Management
- 97750 – Physical Performance Test/Measure

**Modified By Three Rivers Holdings, LLC, from a presentation made by Theresa F. Berner, MOT, OTR/L, ATP, Ohio State University Medical Center at the Therapy Leadership Council 2007**
## Business Model

### Training Program Revenue

<table>
<thead>
<tr>
<th>Summary Revenue from the above Five Visit Program</th>
<th>Time per Unit (minutes)</th>
<th>Reimbursement Value</th>
<th>Propulsion Training CPT Code Units</th>
<th>Propulsion Training CPT total Revenue</th>
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</thead>
<tbody>
<tr>
<td>PT/OT Evaluation: 97001 or 97003</td>
<td>60</td>
<td>$74.70</td>
<td>1</td>
<td>$74.70</td>
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<tr>
<td>Physical Performance Test or Measure: 97755</td>
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<td>$27.65</td>
<td>4</td>
<td>$110.60</td>
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<tr>
<td>Wheelchair Management, Training and Assessment: 97542</td>
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<td>$27.32</td>
<td>12</td>
<td>$327.84</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total per Patient Revenue for Complete Wheelchair Propulsion Training Program</td>
<td></td>
<td></td>
<td></td>
<td>$513.14</td>
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<tr>
<td>Estimated Number of Propulsion Training Patients per Month</td>
<td></td>
<td></td>
<td></td>
<td>12</td>
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<tr>
<td>Annual Revenue from Wheelchair Propulsion Training</td>
<td></td>
<td></td>
<td></td>
<td>$73,892.16</td>
</tr>
</tbody>
</table>

Modified By Three Rivers Holdings, LLC, from a presentation made by Theresa F. Berner, MOT, OTR/L, ATP, Ohio State University Medical Center at the Therapy Leadership Council 2007
- The level of pain and injury in manual wheelchair users is extraordinary

- Research has provided the basis for a clinical model to help reduce the level of pain and injury

- The SmartWheel simplifies and automates the clinical model application process

- SmartWheel use leads to improved patient outcomes and increased revenue and profit for the clinic
The SmartWheel: Clinical Benefit & Business Model

Questions?