CHARACTERIZING MOBILITY OF MANUAL WHEELCHAIR USERS

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Introduction
- The activity of full time wheelchair users can be reflected by wheelchair usage
- Inertial changes, including starting and stopping, should be documented as well as distance traveled
- Bouts of wheelchair movement are defined as volitional transitions between functional activities
- Because bouts of movement embody inertial transitions, they may better reflect physical exertion
- Characterizing wheelchair usage can impact the design, coverage policy and prescription of mobility equipment

Aim
To measure wheelchair usage of full-time manual wheelchair users and to characterize usage patterns

Methods
- Subjects: 28 adults, 22 to 67 years old (median 34.5)
- Multiple diagnoses (SCI = 20)
- Manual wheelchair used as the primary mobility device

Protocol
- A solid-state, triaxial, MEMS-based acceleration sensor with a ±2g range was mounted on one of the wheels
- Sampling rate: 10 Hz
- Data collection period varied between 2 & 16 days per subject

Data Processing
- Radial & tangential acceleration used for movement detection
- Linear speed was then used to detect wheelchair motion
- Movement detection accuracy exceeds 90% (1)
- Bouts of wheelchair movement defined as:
  - Wheeling for at least 5 seconds
  - Speed greater than or equal to 0.12m/s
  - Bout ends when wheeling <0.76m within 15 seconds

Record Summary
- 29256 bouts of mobility
- 296 hours of wheeling
- 595 km wheeled
- 342 subject-days

Results

Discussions
- Variation of wheelchair use is great across and within people
- Short bouts of movement dominate wheelchair usage
  - >63% of bouts are shorter than 30 seconds & 13 meters
- Because short bouts of mobility are common, starting, stopping and maneuverability are key activities
- This finding can inform research into propulsion efficiency
  - secondary complications of wheelchair use
  - clinical prescription of wheelchairs

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(2) By definition, the minimum bout duration is 5 seconds