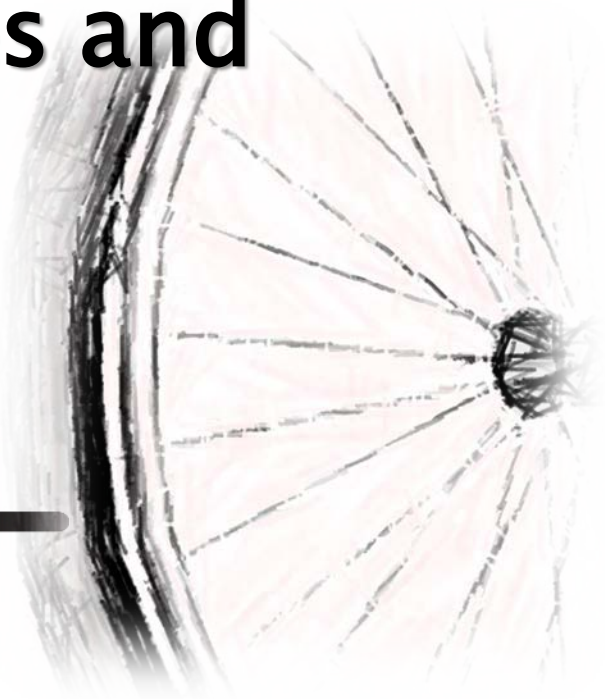
Manual Wheelchair Data Logging: Outcomes, Challenges and Barriers



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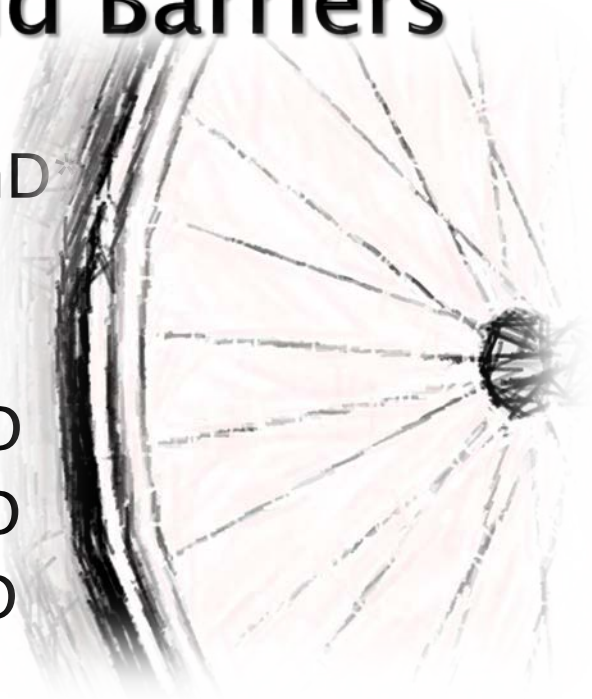

François Routhier, PEng, PhD*
Kate Keetch, PhD
Josiane Lettre, OT, MSc
Ian M. Mitchell, PEng, PhD
Jaimie Borisoff, PEng, PhD
William C. Miller, OT, PhD

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*francois.routhier@rea.ulaval.ca

Introduction

- Studies have increasingly employed data loggers to objectively document manual WC use
- Disparity in the literature may be confusing
- We undertook a scoping review:
  - To identify and describe data loggers, their underlying technologies and outcomes
- What outcomes are important to measure and how?

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Objectives

- To identify which outcomes are most important when objectively documenting manual wheelchair use
- To explore the differences between the perspective of clinicians and researchers
- To document challenges and barriers to the use of data loggers

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Scoping review

- 119 papers were included
- 91 different logging systems, comprising 217 sensing technologies:
  - 18.8% were accelerometers on the user
  - 12.4% were odometers on the WC
  - 9.7% were accelerometers on the WC
  - 9.7% were heart monitors
  - …..

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Scoping review

23 categories of measured outcomes:

- Distance (10.9%)
- Mobility events (10.4%)
- Heart rate (9.7%)
- Speed/velocity (9.0%)
- Acceleration (8.1%)
- Driving time (6.2%)
- …..

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Method

- 12 of the 23 categories of outcomes identified by the scoping review
- Sent to:
  - Authors of the selected papers of our scoping review
  - Other researchers and clinicians in the field of wheeled mobility
  - Listserves and groups such as RESNA
- Launched June 1st 2015 and closed October 31 2015

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Method

- 20 questions asked about:
  - Demographic information
  - Importance of the retained outcomes

    0 (not important at all) ⟶ 10 (extremely important)
  - Ranking of these outcomes

    1 (the most important) ⟶ 12 (the least important)
  - Challenges/barriers in collecting these outcomes
- Descriptive quantitative analyses

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Results

74 respondents:

- 57 researchers (77%) and 17 clinicians (23%)
- From different academic and professional backgrounds
- Mean years (SD) of experience:
  - Researchers: 16.2 (9.7)
  - Clinicians: 17.9 (9.2)

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Results

Importance

Variables	Mean importance for researchers (SD)	Mean importance for clinicians (SD)
Distance	7.5 (2.4)	7.9 (1.7)
Speed/Velocity	7.0 (2.1)	6.7 (1.9)
Driving Time	7.0 (2.4)	5.8 (2.4)
Acceleration	5.6 (2.8)	3.5 (1.6)
Mobility Events	7.2 (2.4)	6.4 (2.5)
Angular Velocity	4.7 (2.8)	3.6 (2.3)
Force/Torque/Power	6.5 (3.0)	6.2 (2.5)
Pressure-relief activities	4.7 (3.4)	8.9 (1.4)
Heart rate	6.6 (3.4)	5.6 (2.2)
Respiration	5.3 (3.2)	5.6 (2.3)
Seat pressure	5.3 (3.1)	7.9 (2.6)
Body temperature	4.6 (2.9)	4.6 (2.5)

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Results

Importance

Variables	Mean importance for researchers (SD)	Mean importance for clinicians (SD)
Distance	7.5 (2.4)	7.9 (1.7)
Speed/Velocity	7.0 (2.1)	6.7 (1.9)
Driving Time	7.0 (2.4)	5.8 (2.4)
Acceleration	**5.6** (2.8)	**3.5** (1.6)
Mobility Events	7.2 (2.4)	6.6 (2.5)
Angular Velocity	4.7 (2.8)	3.6 (2.3)
Force/Torque/Power	6.5 (3.0)	6.2 (2.5)
Pressure-relief activities	**4.7** (3.4)	**8.9** (1.4)
Heart rate	6.6 (3.4)	5.6 (2.2)
Respiration	5.3 (3.2)	5.6 (2.3)
Seat pressure	**5.3** (3.1)	**7.9** (2.6)
Body temperature	4.6 (2.9)	4.6 (2.5)

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Results

Ranking (importance)

All variables	Mean rank for researchers(SD)	Mean rank for clinicians (SD)
Distance	**3.7** (3.0)	**3.2** (2.7)
Speed/Velocity	4.8 (2.6)	5.4 (3.5)
Driving Time	4.4 (2.5)	5.9 (2.9)
Acceleration	6.3 (3.2)	9.2 (2.1)
Mobility Events	4.5 (2.5)	4.9 (2.4)
Angular Velocity	7.5 (2.6)	8.9 (2.5)
Force/Torque/Power	5.9 (3.4)	6.3 (2.9)
Pressure-relief activities	7.5 (3.2)	3.5 (2.3)
Heart rate	6.2 (3.4)	6.7 (2.5)
Respiration	8.5 (2.8)	7.8 (3.0)
Seat pressure	8.3 (3.4)	4.8 (3.0)
Body temperature	**9.7** (2.9)	**10.4** (3.0)

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Results

- Ranking of the outcomes (importance)

All variables	Mean rank for researchers(SD)	Mean rank for clinicians (SD)
Distance	3.67 (3.01)	3.19 (2.74)
Speed/Velocity	4.81 (2.56)	5.38 (3.52)
Driving Time	4.43 (2.51)	5.94 (2.90)
Acceleration	**6.28** (3.15)	**9.19** (2.10)
Mobility Events	4.54 (2.53)	4.94 (2.38)
Angular Velocity	7.52 (2.64)	8.88 (2.50)
Force/Torque/Power	5.92 (3.42)	6.31 (2.94)
Pressure-relief activities	**7.53** (3.21)	**3.47** (2.27)
Heart rate	6.20 (3.42)	6.71 (2.49)
Respiration	8.54 (2.75)	7.76 (2.95)
Seat pressure	**8.31** (3.43)	**4.82** (2.96)
Body temperature	9.69 (2.88)	10.41 (3.00)

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Results

Challenges and barriers

OK if:

Battery life: > 5 days

Installation: 5-20 minutes

Calibration: 1-5 minutes

Data extraction: Need connection

Cost: 50-100

Weight: 100-500 gr.

Discrepancy:

Time to review info

- Clinicians: 5 min
- Researchers: no limit

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Discussion and conclusion

- Researchers and clinicians agree on the importance of some variables (e.g. distance), but they disagree on others (e.g. pressure-relief activities and seat pressure).
- In terms of challenges or barriers, they have relatively similar needs/preferences, except for the time they want or can allocate to review info.
- To further the development and increase the functionality of data loggers for manual wheelchairs.

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