

**Comportamentos físicos medidos através de acelerometria:
coleta, processamento e análise de dados**Profª. Drª. Ana Beatriz de Oliveira
Discente: Luiz Augusto Brusaca

22-Out-2024

**O que é um acelerômetro?**

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O que é um acelerômetro?

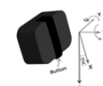
Acelerômetro piezoresistivo (Microelectromechanical Systems (MEMS))

- Mede a aceleração, ou seja, as variações de velocidade de um objeto em relação ao tempo.

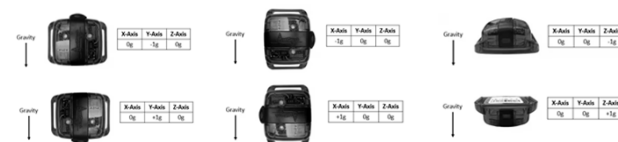
- Detecta aceleração (força da gravidade; geralmente $9,81 \text{ m/s}^2$ na Terra) com base em mudanças na resistência de um material (geralmente silício) quando ele é submetido a estresse ou deformação causados por forças de aceleração.



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Eixos

- Três eixos ortogonais (x = altura, y = largura e z = profundidade)
- Permitindo determinar a orientação do dispositivo em relação à gravidade.



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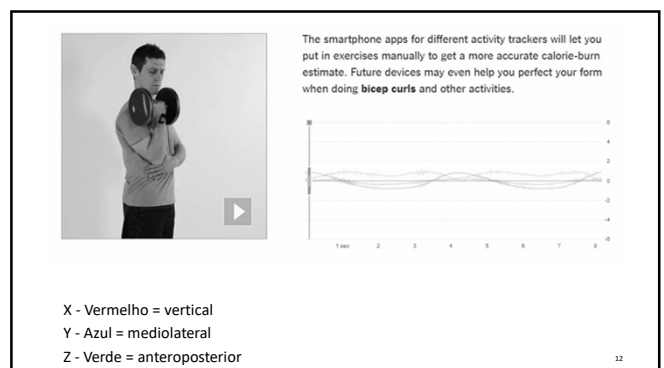
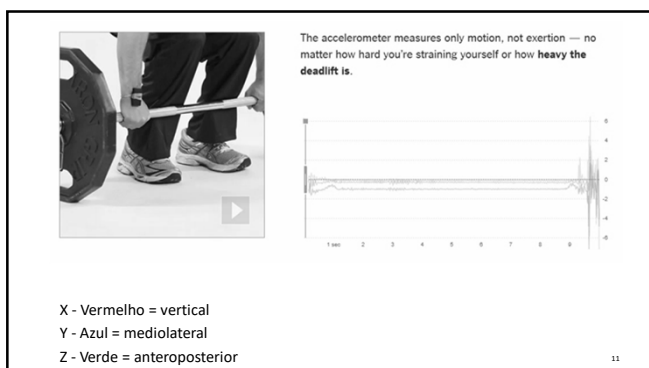
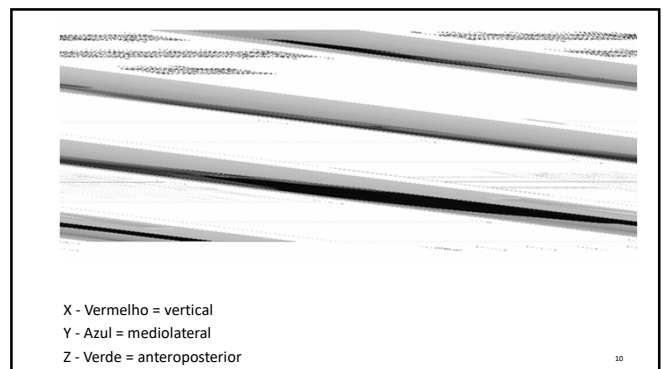
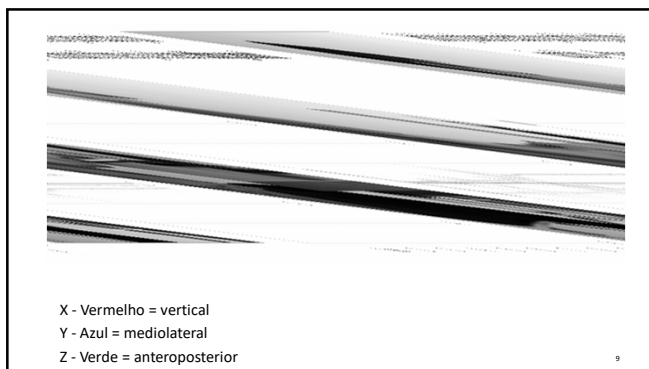
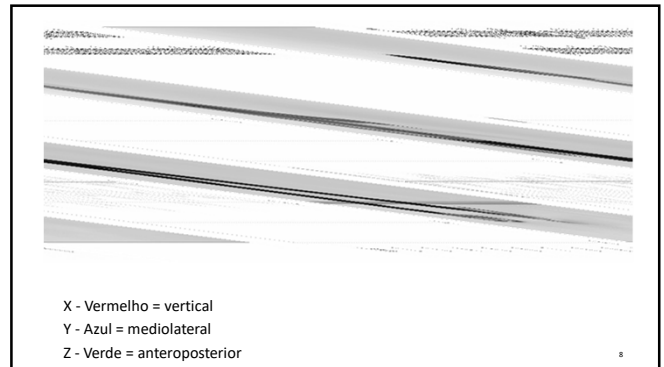
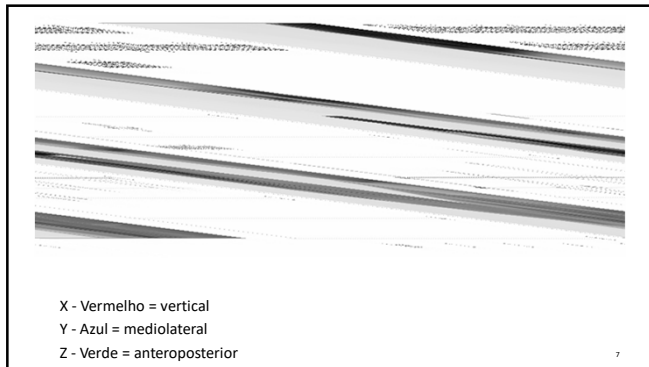
Nomenclatura

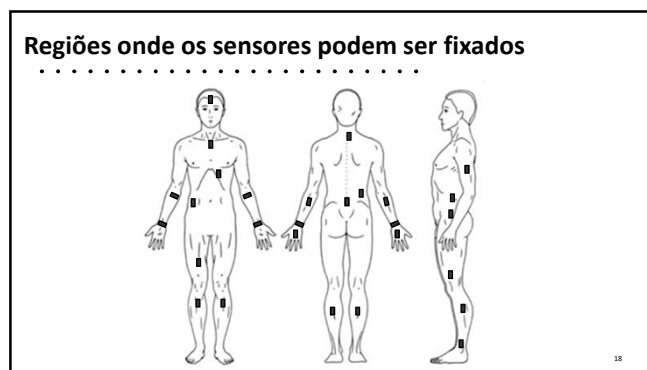
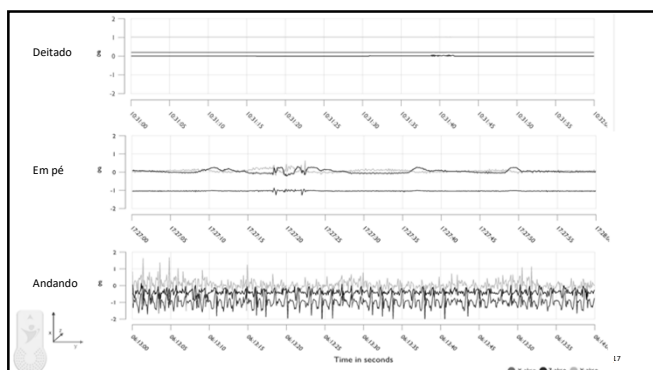
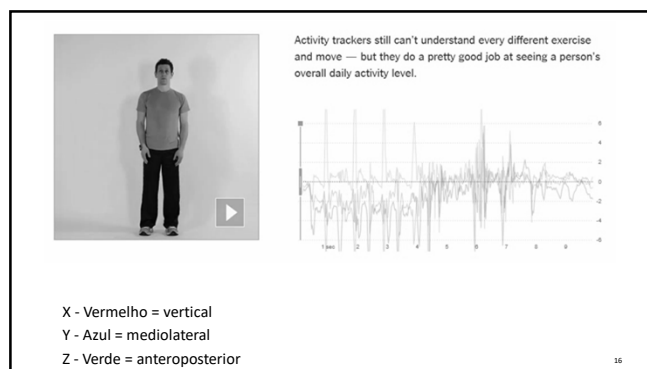
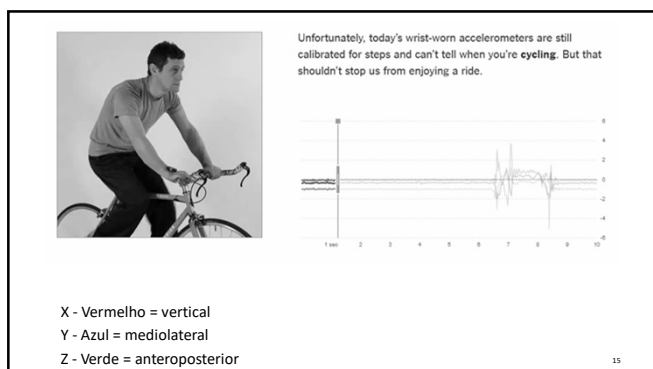
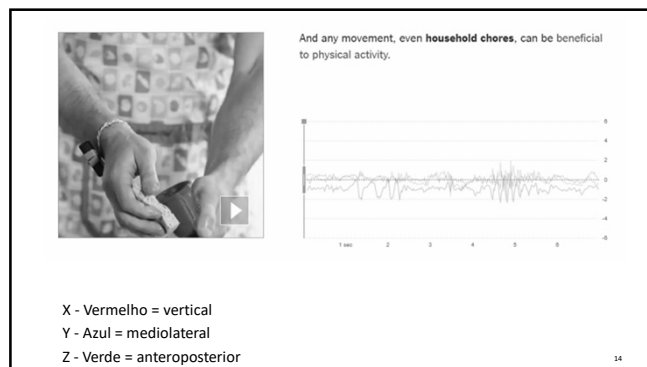
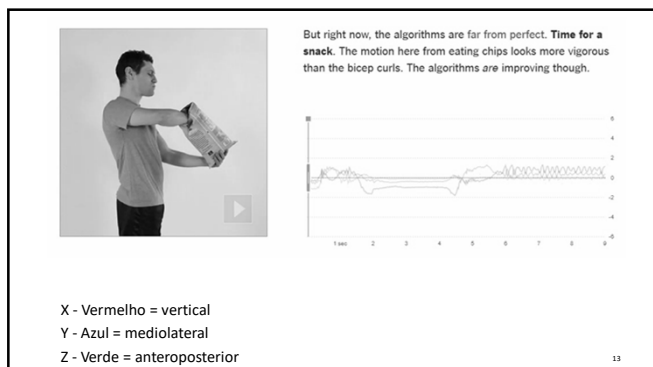
- Sensor
- Dispositivo
- Actígrafo
- Acelerômetro
- Sensor vestível (wearable sensor)
- Dispositivo vestível (wearable device)
- Medição baseado em dispositivo (device-based measurement)

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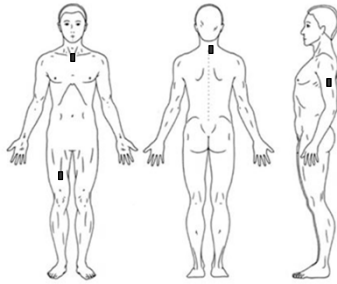
Será que o actígrafo consegue medir qualquer movimento?

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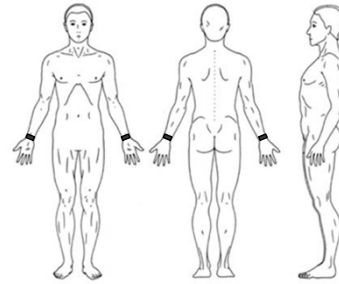


Local de fixação em pesquisas no LACO



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Região que a OMS quer priorizar



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Região que a OMS quer priorizar



- Fácil uso
- Maior aderência
- Maior cumprimento do protocolo
- Bom balanço entre acurácia e precisão
- Facilidade no desenvolvimento de algoritmo
- Fácil tradução dos resultados
- Fácil comunicação com a população

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Vamos pensar?



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Vamos pensar?

O local de fixação dos sensores é importante?

Existe alguma diferença nos dados registrados entre diferentes localizações anatômicas?

Qual o melhor local?

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O local de fixação dos sensores é importante?



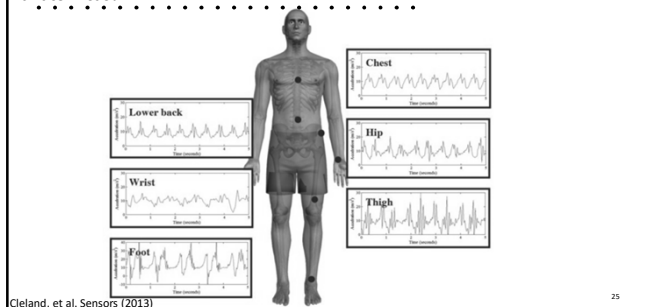
Definirá quais variáveis poderão ser extraídas do sensor.

Definirá qual algoritmo/software será usado.

Definirá quantos dias serão coletados.

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Existe alguma diferença nos dados registrados entre diferentes localizações anatômicas?



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Qual o melhor local?



Não existe um local melhor!
Todos os locais têm prós e contras.

Quais são as variáveis de interesse?
Qual é a população do estudo?
Quantos dias de medição?
Disponibilidade de algoritmo/software.

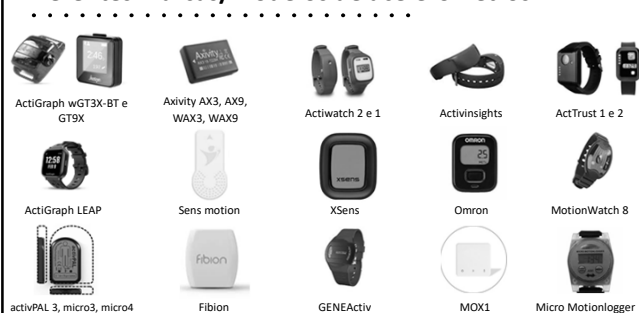
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Fixação dos sensores



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Diferentes marcas/modelos de acelerômetros



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Características a considerar

Uniaxial/triaxial

Unidade de medida inercial (IMU): Acelerômetro, giroscópio e magnetômetro - medem aceleração, velocidade angular (rotação) e campo magnético.

Sensor de luz

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Características a considerar

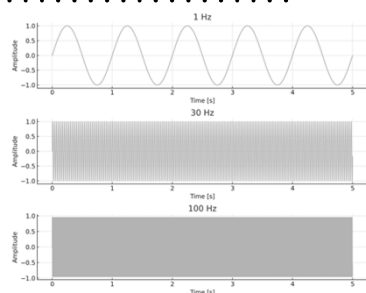
Sensor de temperatura

Resistência a água

Bateria e vida útil

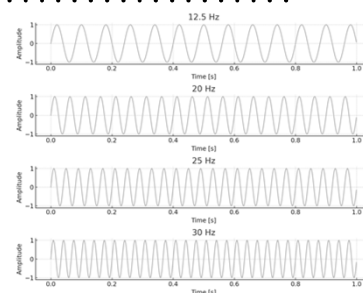
30

Frequência de coleta de dados



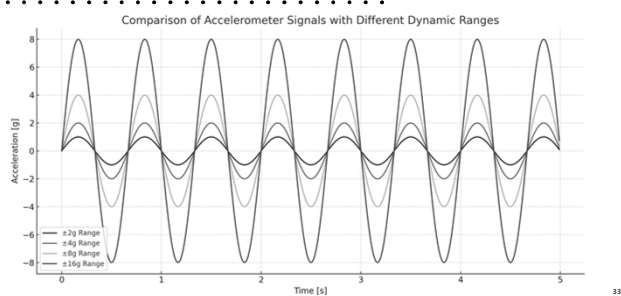
31

Frequência de coleta de dados



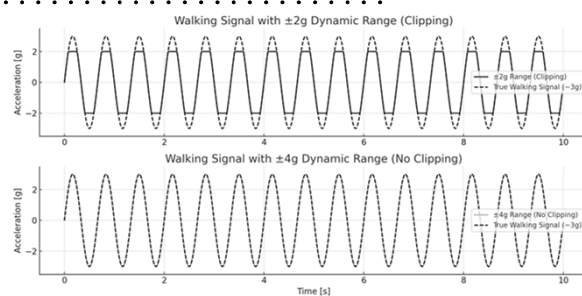
32

Faixa de aceleração dinâmica



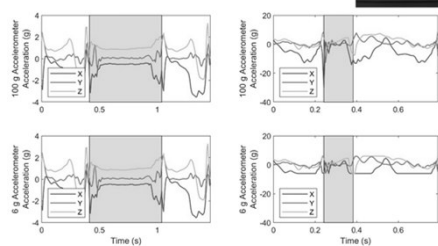
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Faixa de aceleração dinâmica



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Faixa de aceleração dinâmica



(a) Walking trial (mean speed 1.4 m/s)

(b) Running trial (mean speed 5.8 m/s)

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Resolução

Resolução de bits	Número de Bins (mensuráveis)	Faixa de medição ($\pm g$)	Menor nível de aceleração mensurável (g)
2-bit	$2^2 = 4$	$\pm 2g$	1.0
4-bit	$2^4 = 16$	$\pm 4g$	0.5
6-bit	$2^6 = 64$	$\pm 6g$	0.1875
8-bit	$2^8 = 256$	$\pm 8g$	0.0625
10-bit	$2^{10} = 1024$	$\pm 10g$	0.01953125
16-bit	$2^{16} = 65536$	$\pm 16g$	0.00048828125
8-bit	$2^8 = 256$	$\pm 2g$	0.015625
10-bit	$2^{10} = 1024$	$\pm 4g$	0.0078125

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Resolução

Exemplo

- ActivPAL micro4 coleta dados no modo aP4: 20Hz or 40Hz, 10 bits de resolução e faixa de aceleração dinâmica de +/-4G.
- ActivPAL micro3 coleta dados no modo aP3: 20Hz, 8 bits de resolução e faixa de aceleração dinâmica de +/-2G.

O que fazer?



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Resolução

Exemplo

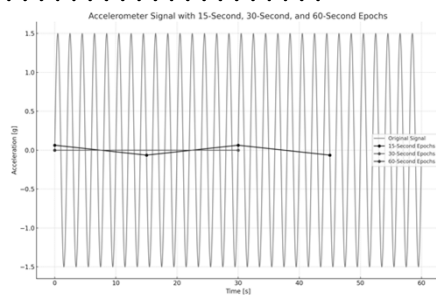
- ActivPAL micro4 coleta dados no modo aP4: 20Hz or 40Hz, 10 bits de resolução e faixa de aceleração dinâmica de +/-4G.
- ActivPAL micro3 coleta dados no modo aP3: 20Hz, 8 bits de resolução e faixa de aceleração dinâmica de +/-2G.

O que fazer?

Pode ser feita a conversão do dado (aceleração dos eixos x, y, e z) para uma resolução mais alta.

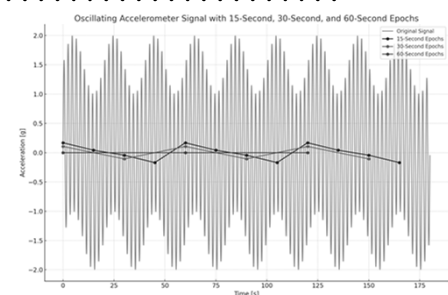
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Epoch lenght (cut-point)



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Epoch lenght (cut-point)



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Epoch lenght (cut-point)

Ayabe et al. BMC Research Notes 2013, 6:20
http://www.biomedcentral.com/1756-0500/6/20



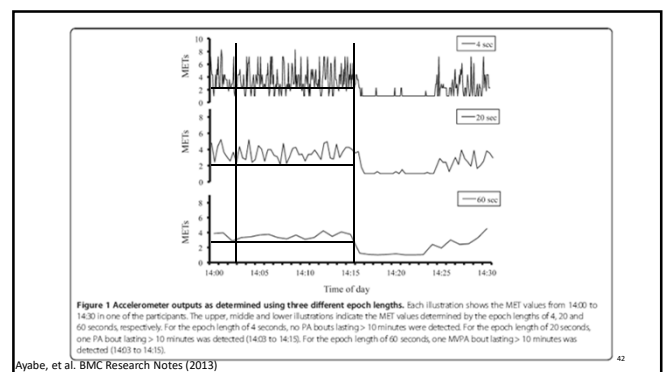
RESEARCH ARTICLE

Open Access

Epoch length and the physical activity bout analysis: An accelerometry research issue

Makoto Ayabe^{1*}, Hideaki Kumahara², Kazuhiro Matsumura³ and Hiroaki Tanaka⁴

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Epoch length (cut-point)

Table 2 Accelerometer's epoch length and the time spent in sporadic physical activity

	Epoch length		
	4 sec	20 sec	60 sec
LPA (min/day)	48.7 ± 15.9	104.2 ± 36.1**	178.7 ± 62.6***
MPA (min/day)	30.0 ± 14.9	33.2 ± 16.2	28.5 ± 15.9 [†]
VPA (min/day)	2.9 ± 5.2	1.1 ± 2.4**	0.9 ± 2.5**
MVPA (min/day)	32.9 ± 16.5	34.3 ± 17.1	29.4 ± 16.9 [†]

Data are expressed as the means with the standard deviation (mean ± SD). LPA: light intensity physical activity, MPA: moderate intensity physical activity, VPA: vigorous intensity physical activity, MVPA: moderate to vigorous intensity physical activity.

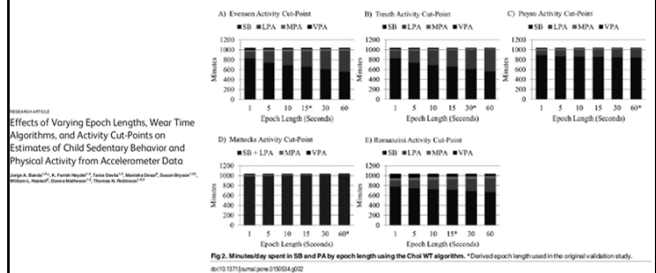
*Significantly different compared with 4 sec ([†]p < 0.05, **p < 0.01, ***p < 0.001).

[†]Significantly different compared with 20 sec ([†]p < 0.05, **p < 0.01, ***p < 0.001).

Ayabe, et al. BMC Research Notes (2013)

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Epoch length (cut-point)



Banda, et al. PLOS ONE (2016)

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Diário de anotação de tarefas/atividades?

Inserção de contexto nos dados

- Horário que início do trabalho/horário que término do trabalho
- Horas de não-trabalho/horas de lazer
- Horário de início do exercício programado/Horário de término do exercício programado
- Horário que deitou para dormir/horário que acordou
- Horário de transporte para o trabalho/escola
- Horário que não estava utilizando o sensor

Obs.: alguns *softwares* não oferecem a possibilidade de usar diários.

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Número mínimo de dias

The number of repeated observations needed to estimate the habitual physical activity of an individual to a given level of precision

Patric Bergman*

No one accelerometer-based physical activity data collection protocol can fit all research questions

Patric Bergman*† and Maria Hagström**

Number of Days Required to Estimate

Habitual Activity Using Wrist-Worn GENEActiv Accelerometer: A Cross-Sectional Study

Christina M. O'Brien*, Anthony P. Fitzgerald*, Patricia M. Kearney*, Ann J. Parnell*, Kristina L. Ross*, Robert Kozlowski*, Catherine W. Phillips*

How many days of monitoring predict physical activity and sedentary behaviour in older adults?

Teresa L. Hall*, Ann M. Swartz*, Susan E. Cohen* and Scott J. Strath*

Considerations when using the acti-PAL monitor in field-based research with adult populations

Charlotte L. Edwards^{1,2,3,4}, Elizabeth A.H. Walker^{1,2,3,4}, Danielle H. Bredenoord^{1,2,3,4}, Tom Yates^{1,2,3,4}, Melanie J. Davies^{1,2,3,4}, David W. Dunstan^{1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,74,75,76,77,78,79,80,81,82,83,84,85,86,87,88,89,90,91,92,93,94,95,96,97,98,99,100}, Genevieve N. Healy^{1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,74,75,76,77,78,79,80,81,82,83,84,85,86,87,88,89,90,91,92,93,94,95,96,97,98,99,100}

Accelerometer Data Collection and Processing Criteria to Assess Physical Activity and Other Outcomes: A Systematic Review and Practical Considerations

Jairo H. Miquel^{1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,74,75,76,77,78,79,80,81,82,83,84,85,86,87,88,89,90,91,92,93,94,95,96,97,98,99,100}, Christine Delisle Nystrom^{1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,74,75,76,77,78,79,80,81,82,83,84,85,86,87,88,89,90,91,92,93,94,95,96,97,98,99,100}, Jose Maria Gonzalez^{1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,74,75,76,77,78,79,80,81,82,83,84,85,86,87,88,89,90,91,92,93,94,95,96,97,98,99,100}, Maria Lopez^{1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,74,75,76,77,78,79,80,81,82,83,84,85,86,87,88,89,90,91,92,93,94,95,96,97,98,99,100}, Jonatan R. Ruiz^{1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,74,75,76,77,78,79,80,81,82,83,84,85,86,87,88,89,90,91,92,93,94,95,96,97,98,99,100}, Francisco B. Ortega^{1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,74,75,76,77,78,79,80,81,82,83,84,85,86,87,88,89,90,91,92,93,94,95,96,97,98,99,100}

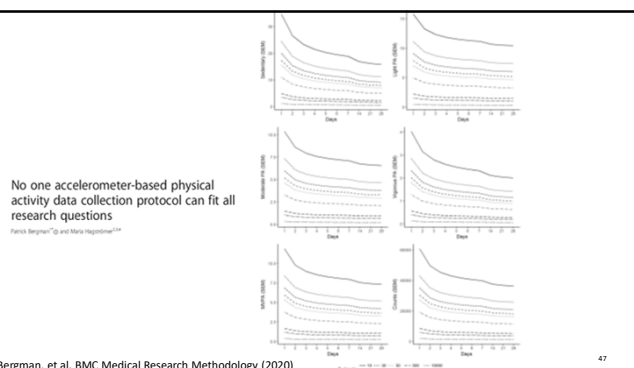
Assessing physical behavior through accelerometry – State of the science, best practices and future directions

Alexander Burchartz^{1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,74,75,76,77,78,79,80,81,82,83,84,85,86,87,88,89,90,91,92,93,94,95,96,97,98,99,100}, Bastian Ansdorff^{1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,74,75,76,77,78,79,80,81,82,83,84,85,86,87,88,89,90,91,92,93,94,95,96,97,98,99,100}, Tina Auerwald^{1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,74,75,76,77,78,79,80,81,82,83,84,85,86,87,88,89,90,91,92,93,94,95,96,97,98,99,100}, Marco Giorgi^{1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,74,75,76,77,78,79,80,81,82,83,84,85,86,87,88,89,90,91,92,93,94,95,96,97,98,99,100}, Holger Hill^{1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,74,75,76,77,78,79,80,81,82,83,84,85,86,87,88,89,90,91,92,93,94,95,96,97,98,99,100}, Sascha Kretschmer^{1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,74,75,76,77,78,79,80,81,82,83,84,85,86,87,88,89,90,91,92,93,94,95,96,97,98,99,100}, Simon Kolb^{1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,74,75,76,77,78,79,80,81,82,83,84,85,86,87,88,89,90,91,92,93,94,95,96,97,98,99,100}, Christoph Mall^{1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,74,75,76,77,78,79,80,81,82,83,84,85,86,87,88,89,90,91,92,93,94,95,96,97,98,99,100}, Kristin Manz^{1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,74,75,76,77,78,79,80,81,82,83,84,85,86,87,88,89,90,91,92,93,94,95,96,97,98,99,100}, Claudio R. Nigg^{1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,74,75,76,77,78,79,80,81,82,83,84,85,86,87,88,89,90,91,92,93,94,95,96,97,98,99,100}, Markus Reichert^{1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,74,75,76,77,78,79,80,81,82,83,84,85,86,87,88,89,90,91,92,93,94,95,96,97,98,99,100}, Ole Sprengeler^{1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,74,75,76,77,78,79,80,81,82,83,84,85,86,87,88,89,90,91,92,93,94,95,96,97,98,99,100}, Kathrin Wunsch^{1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,74,75,76,77,78,79,80,81,82,83,84,85,86,87,88,89,90,91,92,93,94,95,96,97,98,99,100}, Charles E. Matthews^{1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,74,75,76,77,78,79,80,81,82,83,84,85,86,87,88,89,90,91,92,93,94,95,96,97,98,99,100}

A Review of Accelerometer-based Activity Monitoring in Cancer Survivorship Research

CAROLYN A. PIERCE^{1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,74,75,76,77,78,79,80,81,82,83,84,85,86,87,88,89,90,91,92,93,94,95,96,97,98,99,100}, VINCE CAVALIERE^{1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,74,75,76,77,78,79,80,81,82,83,84,85,86,87,88,89,90,91,92,93,94,95,96,97,98,99,100}, TERRY BOYLE^{1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,74,75,76,77,78,79,80,81,82,83,84,85,86,87,88,89,90,91,92,93,94,95,96,97,98,99,100}, JOANNE A. MCNEIGH^{1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,74,75,76,77,78,79,80,81,82,83,84,85,86,87,88,89,90,91,92,93,94,95,96,97,98,99,100}, JIMMY JEFFERS^{1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,74,75,76,77,78,79,80,81,82,83,84,85,86,87,88,89,90,91,92,93,94,95,96,97,98,99,100}, BRENDAN D. LYNCH^{1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,74,75,76,77,78,79,80,81,82,83,84,85,86,87,88,89,90,91,92,93,94,95,96,97,98,99,100}, and JEFF K. VALLANCE^{1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,74,75,76,77,78,79,80,81,82,83,84,85,86,87,88,89,90,91,92,93,94,95,96,97,98,99,100}

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Bergman, et al. BMC Medical Research Methodology (2020)

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Número mínimo de horas

Minimum accelerometer wear-time for reliable estimates of physical activity and sedentary behaviour of people receiving haemodialysis

Sean Parnell^{1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,74,75,76,77,78,79,80,81,82,83,84,85,86,87,88,89,90,91,92,93,94,95,96,97,98,99,100}, James P. Traynor^{1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,74,75,76,77,78,79,80,81,82,83,84,85,86,87,88,89,90,91,92,93,94,95,96,97,98,99,100}, Nona Shihab^{1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,}

Desafios na estimativa de dias e horas

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INTEGRATING SLEEP, SEDENTARY BEHAVIOUR,
AND PHYSICAL ACTIVITY RESEARCH IN THE EMERGING
FIELD OF TIME-USE EPIDEMIOLOGY: DEFINITIONS,
CONCEPTS, STATISTICAL METHODS, THEORETICAL
FRAMEWORK, AND FUTURE DIRECTIONS

Željko Pešić¹, Dorothea Dammig², and Timothy S. Olds¹

How Many Days Was That? We're Still Not
Sure, But We're Asking the Question Better!

TOM BARANOWSKI¹, LOUISE C. MARRIS², BRIAN RAGAN³, and GREG WELK⁴

Time-Based Data in Occupational Studies:
The Whys, the Hows, and Some Remaining
Challenges in Compositional Data Analysis
(CoDA)

Nidhi Gupta¹, Charlotte Lund Rasmussen^{1,2}, Andreas Holtermann^{1,3}
and Svend Erik Mathiassen⁴

Compositional Data Analysis in Time-Use
Epidemiology: What, Why, How

Dorothea Dammig^{1,*}, Željko Pešić², Javier Palanca-Albaladejo^{1,2},
Josep Antoni Martín-Fernández^{4,5}, Karel Hoon^{1,5} and Timothy Olds^{1,5}

Obrigado

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