



A Validation and Reliability Study of the Fitbit Alta HR Activity Tracker Pilot Study

Carolina Digital Health Research Initiative

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Outline

Background and Objectives

Process and Study Design

Methodology

Results

Insights



21 clinical trials that are using Fitbit activity trackers

NIH research program will tap Fitbit data

By J

By Rachel Z.

A Los Angeles hospital is using Fitbits to help patients go home sooner

The Scripps part of the A project through characteristi

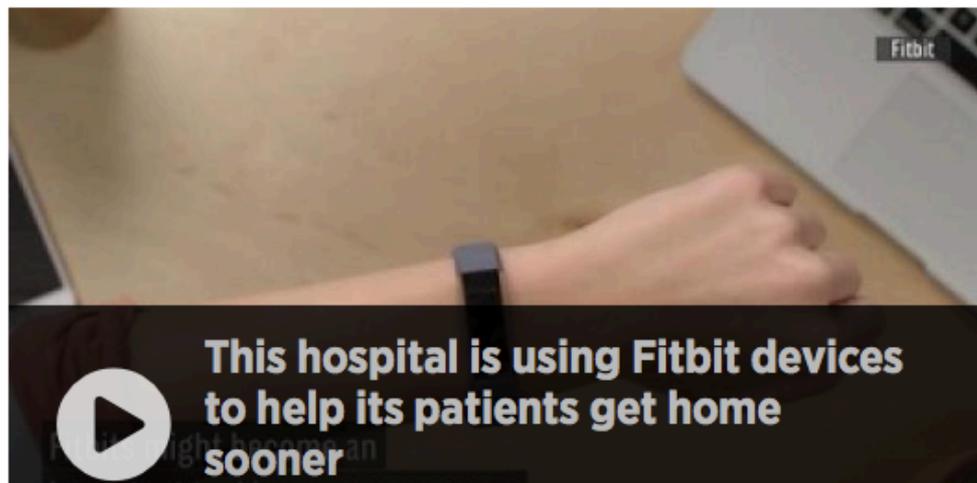
- Cedars-Sinai hospital in Los Angeles gives out free Fitbit devices to encourage patients to walk after surgery.
- While 10,000 steps is a typical target for healthy people, patients are aiming for 1,000.

Christina Farr | @chrissyfarr

Published 1:21 PM ET Sat, 2 Dec 2017



For a study
All of Us pro
the Charge 2
collect data
study ends,
wearables in
established



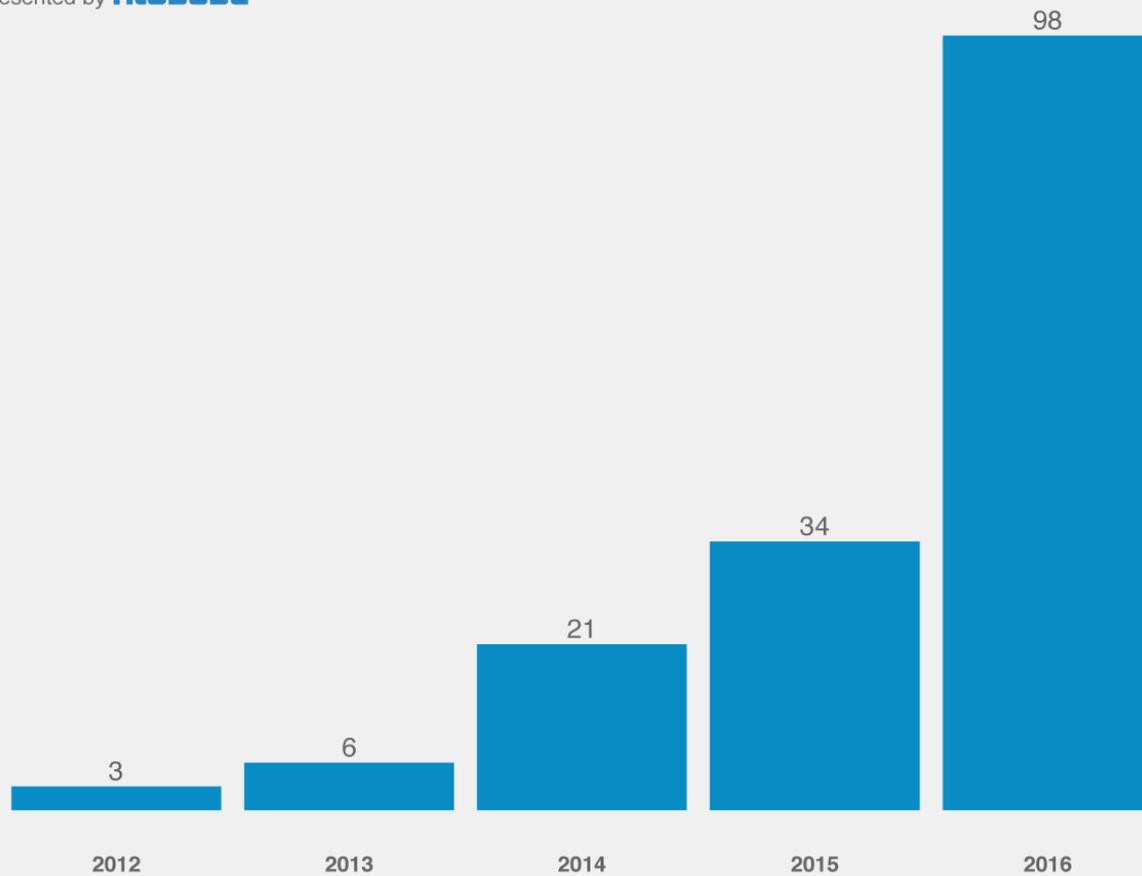
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Research Studies Relevant to Fitbit

Number of Published Studies Using Fitbit Devices as of 09/23/2016
Presented by **fitabase**

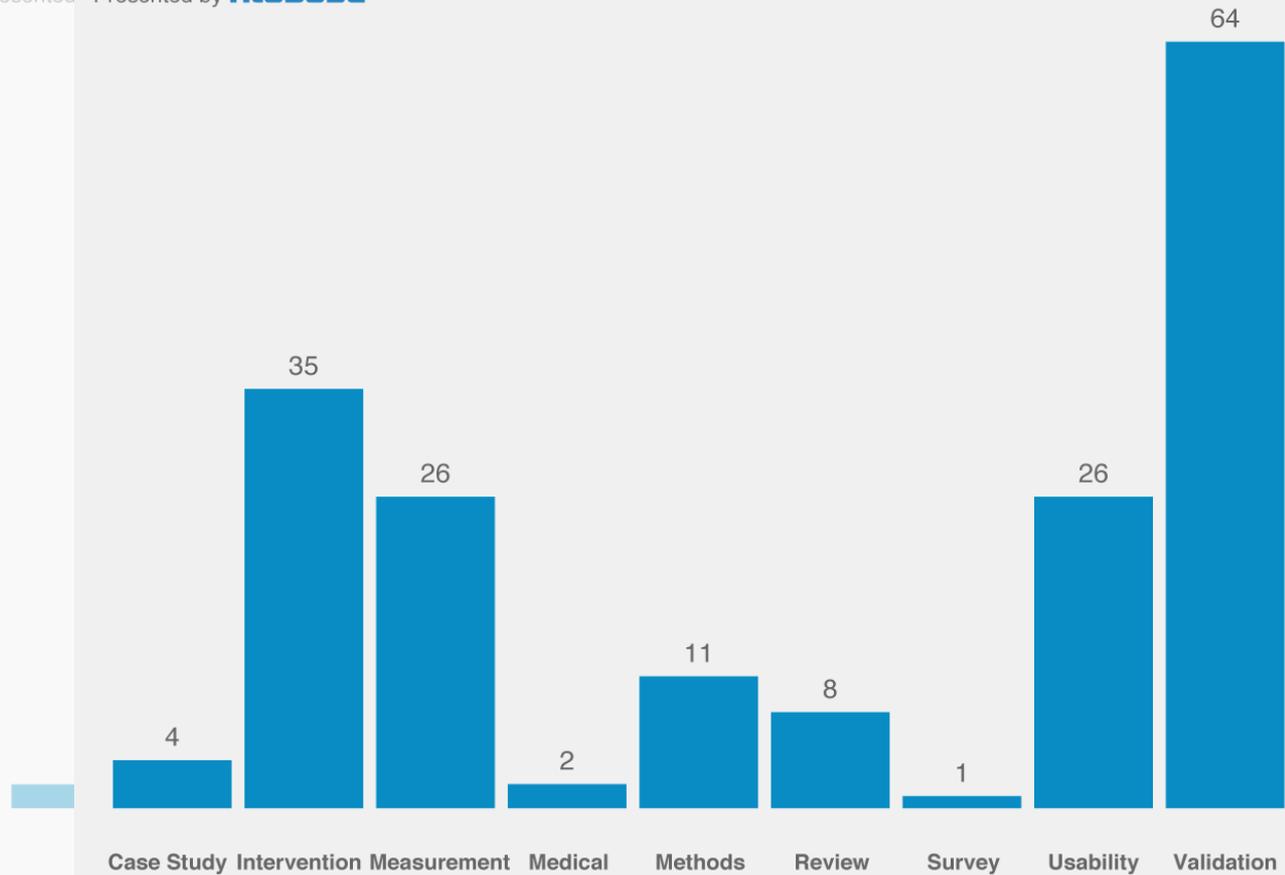


- Fitbit studies



Research Studies Relevant to Fitbit

Number of Published Studies by Study Type as of 09/23/2016
Presented by **fitabase**

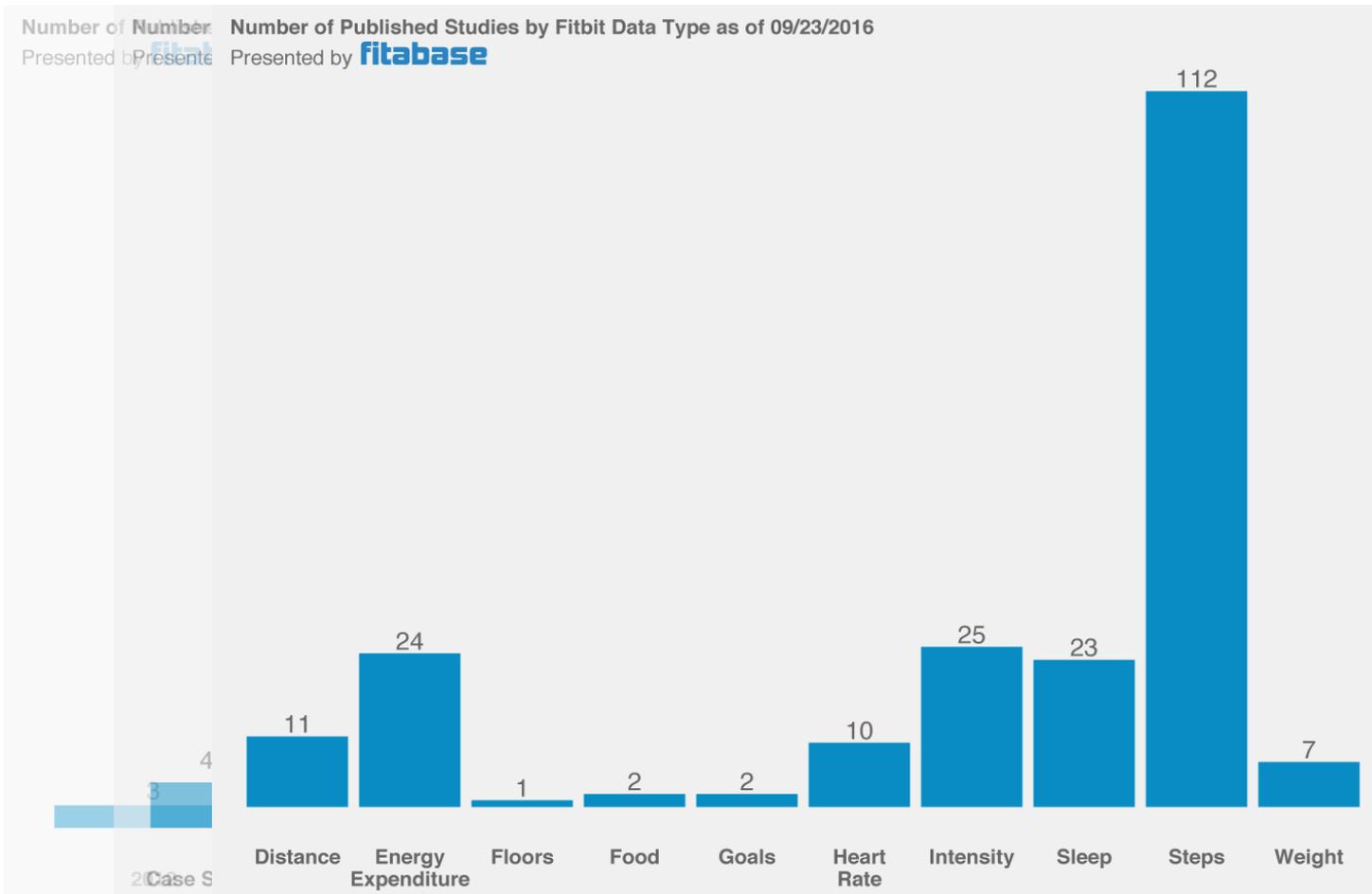


- Fitbit studies
- Validation



Research Studies Relevant to Fitbit

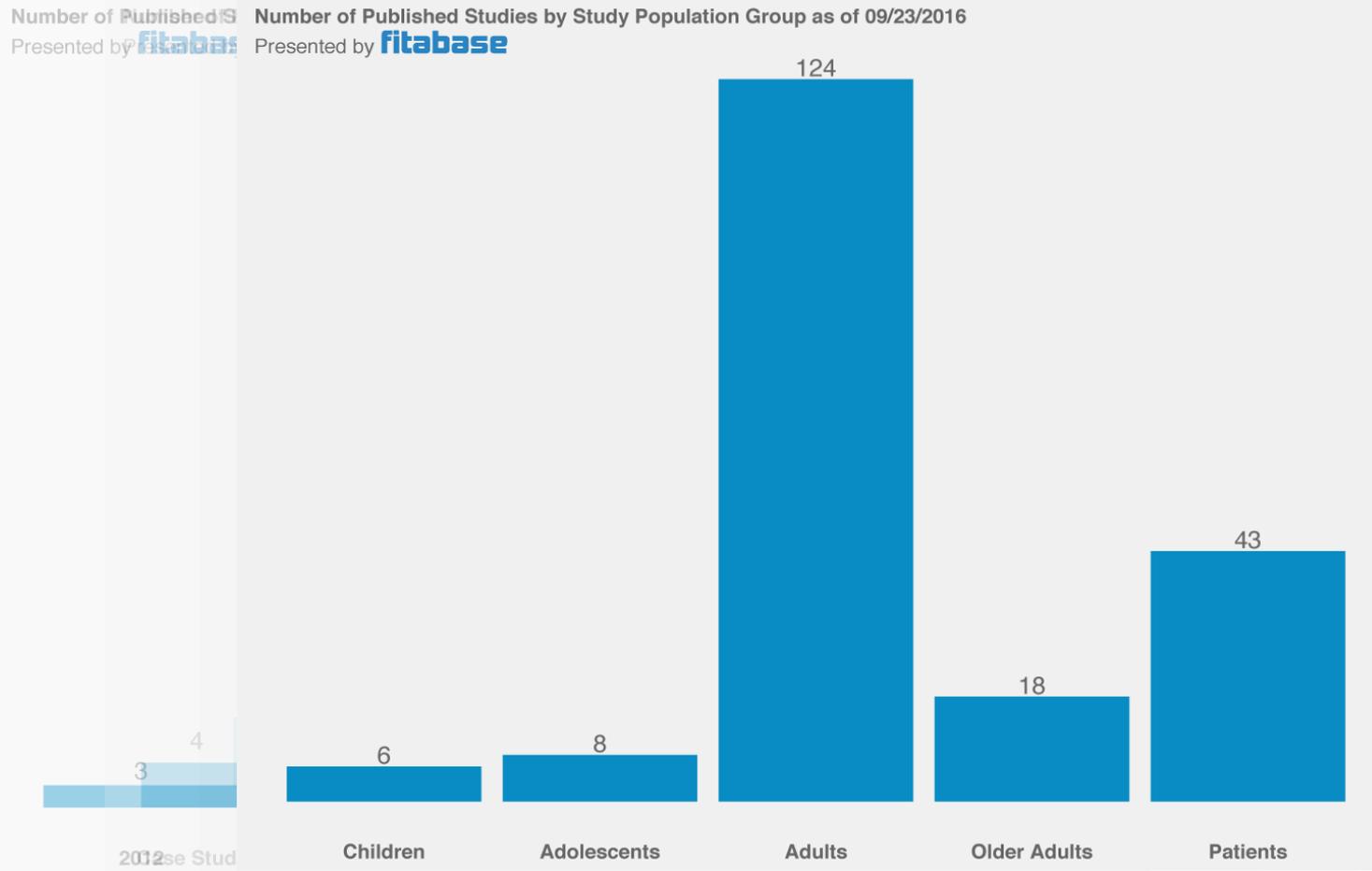
Number of Number of Published Studies by Fitbit Data Type as of 09/23/2016
Presented by Presented by **fitabase**



- Fitbit studies
- Validation
- Activity



Research Studies Relevant to Fitbit



- Fitbit studies
- Validation
- Activity
- Adults



Objectives

- Fitbit Alta HR validation for activity-tracking adult populations
- Standardized protocol for digital accelerometer device testing for dissemination
- IRB approval process and requirements for device validation





Protocol and Study Design

- Fitbit device validation protocol required to meet the UNC IRB review
- Methodologies were developed into three phases

Phase 1: Orbital Shaker Validation

- Highly controlled oscillation frequencies to simulate changes in movement for free-living environment





Phase 1 Results

- Data too little and too inconsistent to evaluate
- Suggests that the step count algorithm goes beyond simple xyz-axis movement
- Suggests the ability of Fitbits and actigraphs to record step count data at lower frequencies is insignificant





Phase 2: Structured Activity

Participant Recruitment

Sample Characteristics (N=8)	
Gender, n	
Female	4
Male	4
Occupation, n	
Undergraduate	4
Postgraduate	2
Staff	2
Age in years, mean (SD^a)	33.25 (8.6)
Body mass index in kg/m²	23.175 (2.9)
Number of valid 1-min epochs contributed (Sample 1 only)	Repeat ^b
Phase 1: Shaker table	200
Phase 2: Structured activity treadmill session	15843
Phase 3: 4-day free-living period	

Day 1	Day 7	Day 8	Day 9	Day 10	Day 11
Phase 2: Structured Activity, Treadmill Session 1	Phase 2: Structured Activity, Treadmill Session 2	Phase 3: Free-Living Activity, Day 1	Phase 3: Free-Living Activity, Day 2	Phase 3: Free-Living Activity, Day 3	Phase 3: Free-Living Activity, Day 4





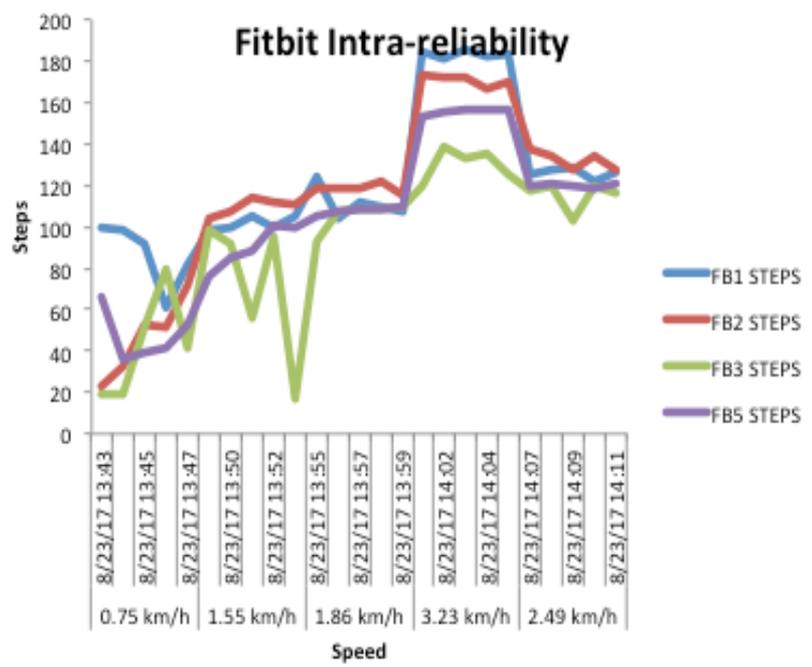
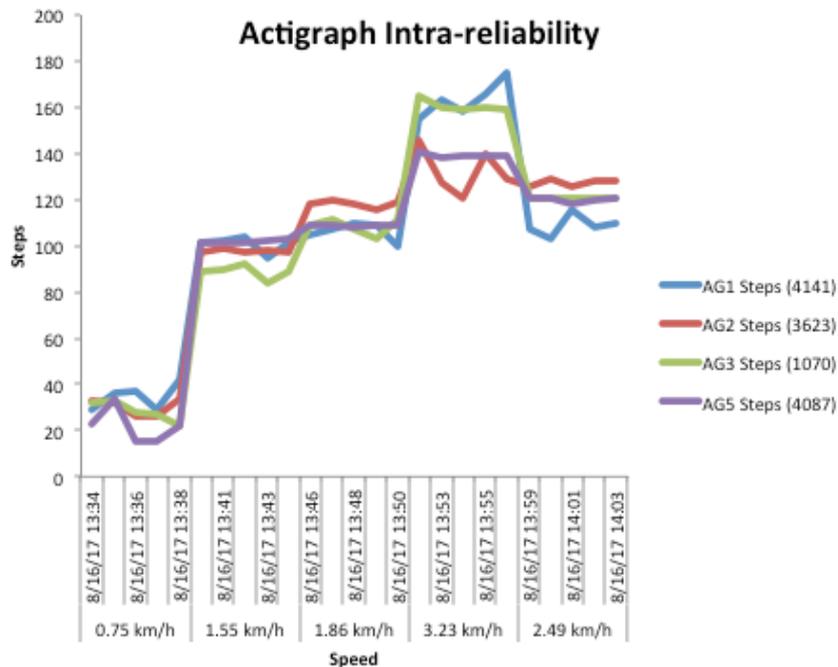
Phase 2: Study Design

- Measuring for construct and criterion validity
- 2 treadmill sessions with structured activity
- 5 speeds based on the systematic review
- Two actigraphs, 1 Fitbit, video step count



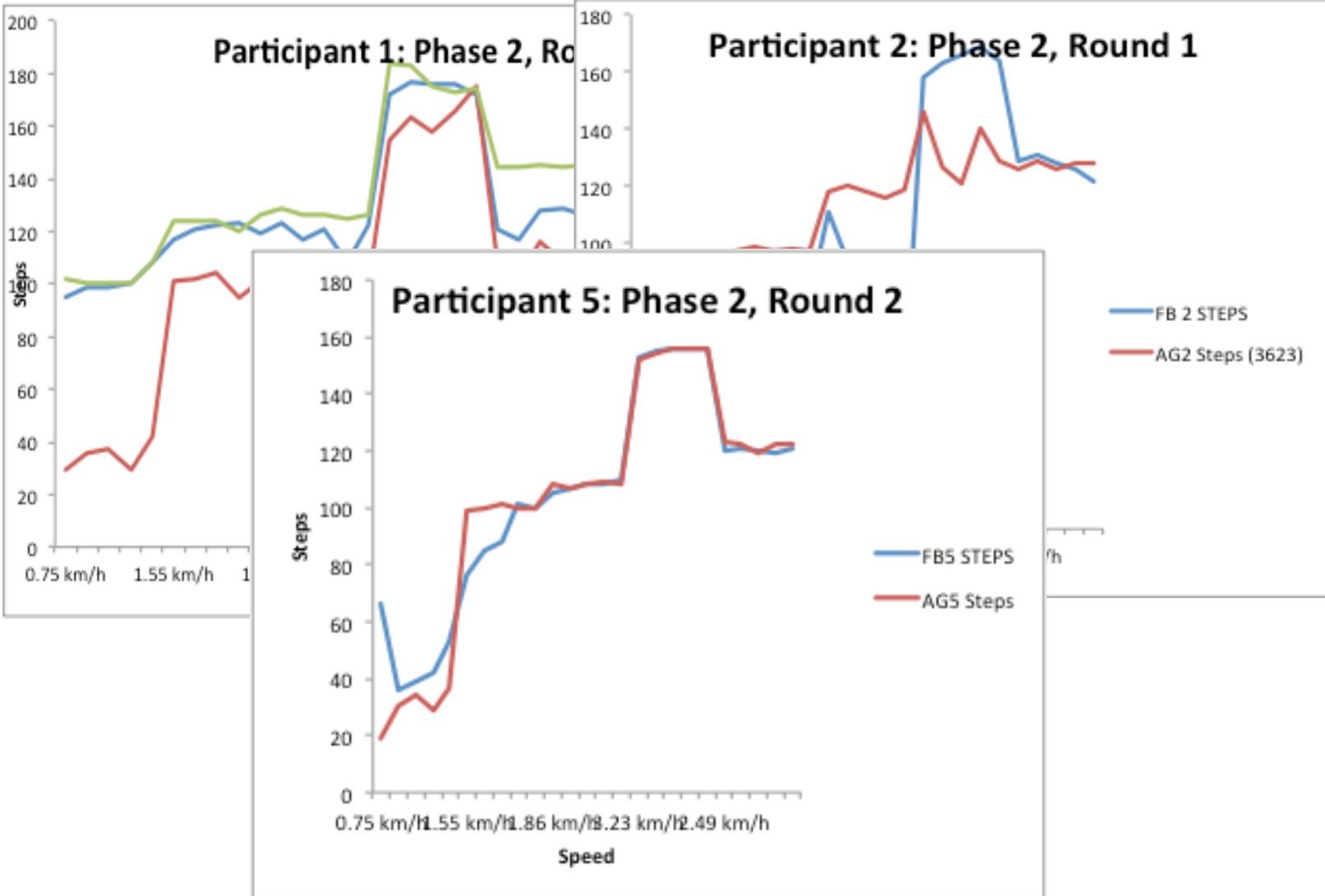


Phase 2: Results



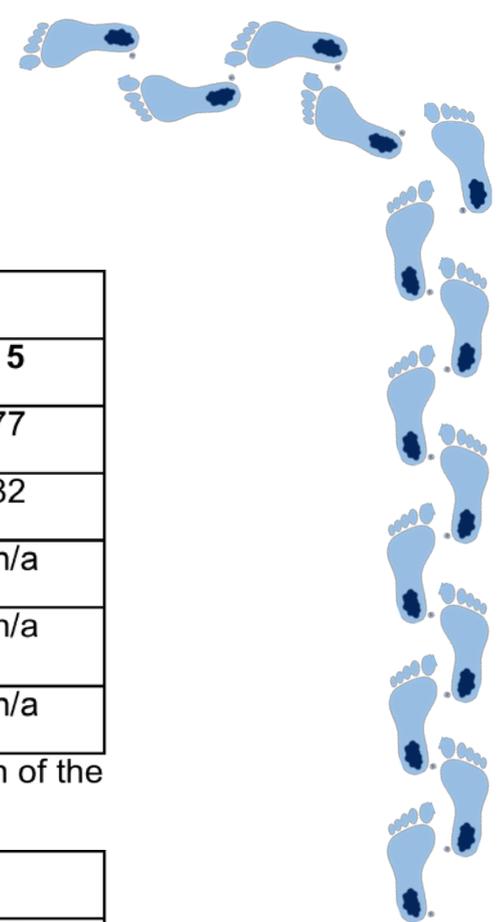


Phase 2: Results





Phase 2: Results



Spearman Rho Correlation Coefficients ($p < 0.001$)				
Participant	1	2	3	5
Fitbit/AG step count	0.729	0.774	0.928	0.877
Fitbit/AG vector magnitude*	0.824	0.845	0.927	0.882
Fitbit/Video step count	0.856	n/a	n/a	n/a
AG step count/Video step count	0.903	n/a	n/a	n/a
AG VM/Video step count	0.955	n/a	n/a	n/a

Table 4. Spearman's rho correlation coefficients were calculated for each of the 1-min epochs in Sample 1, Session 1.

Spearman Rho Correlation Coefficients ($p < 0.001$)				
Participant	1	2	3	5
Fitbit/AG step count	0.877	0.824	0.898	0.975
Fitbit/AG vector magnitude	0.824	0.943	0.924	0.972
Fitbit/Video step count	0.943	n/a	n/a	n/a
AG step count/Video step count	0.899	n/a	n/a	n/a
AG vector magnitude/Video step count	0.970	n/a	n/a	n/a

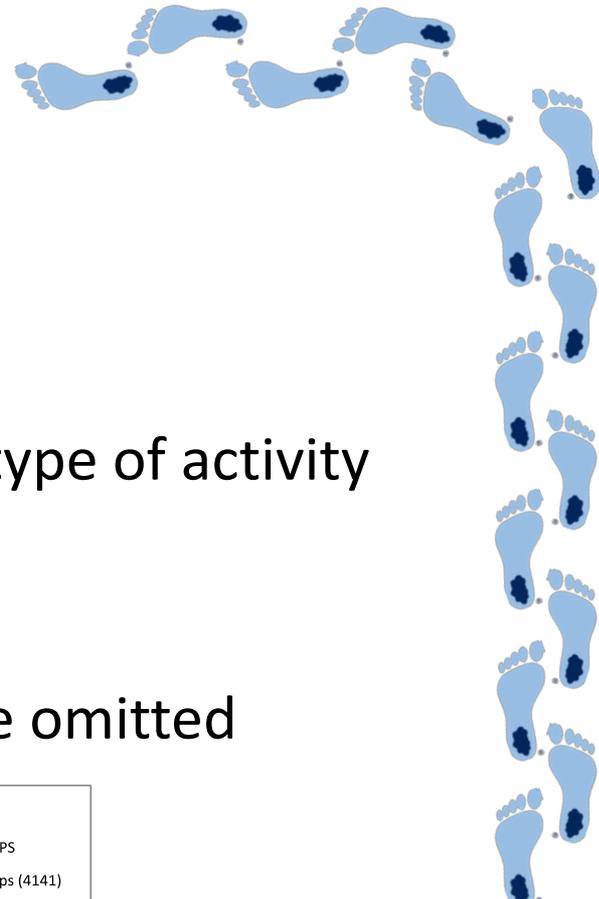
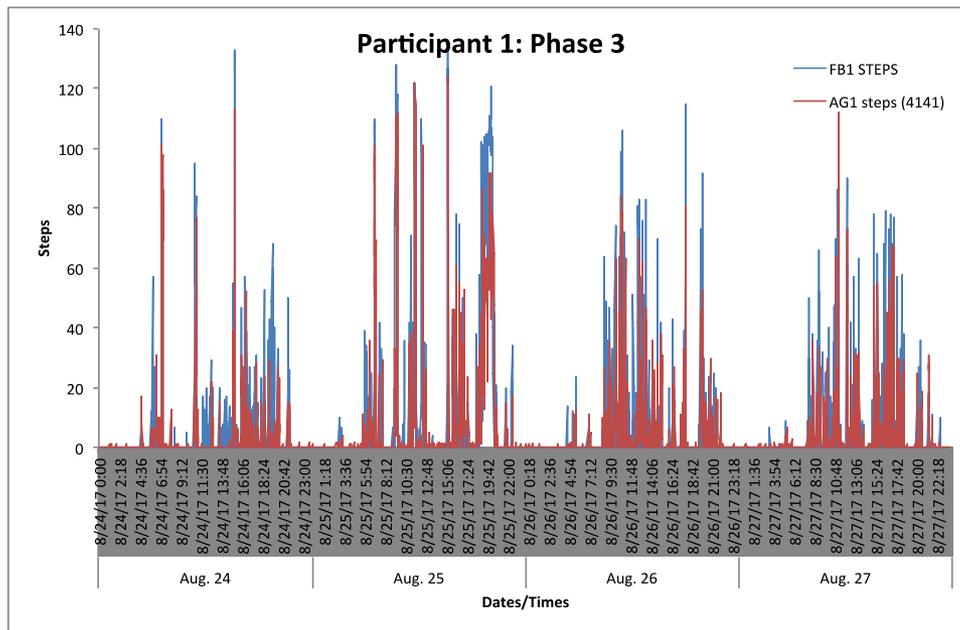
Table 5. Spearman's rho correlation coefficients were calculated for each of the 1-min epochs in Sample 1, Session 2.





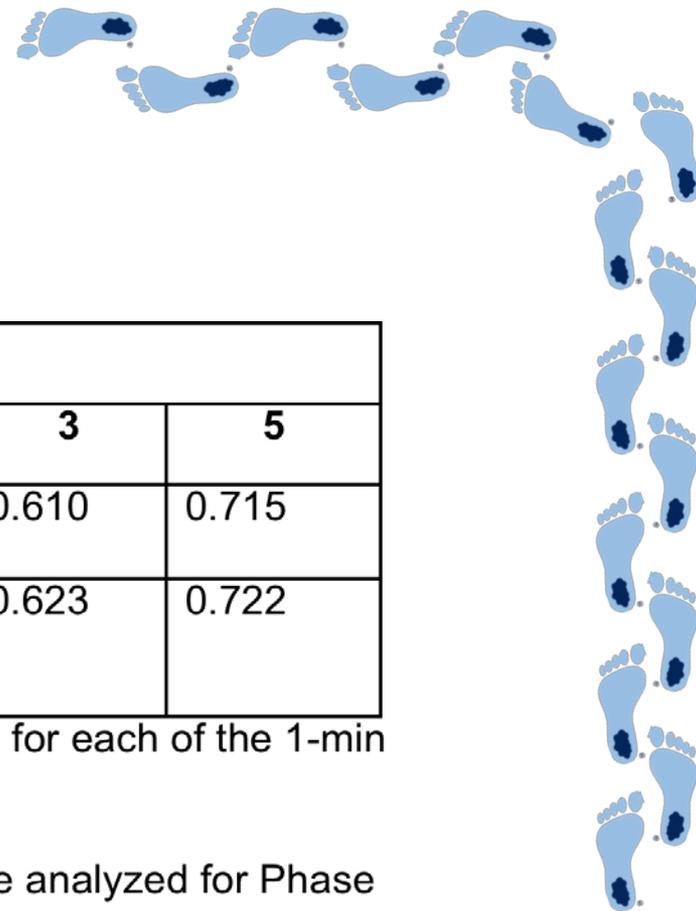
Phase 3: Free-Living Activity

- Measuring for construct validity
- Participants logged activity intensity and type of activity while wearing the devices for 4 days
- Waking hours, water-free
- More than 8 hours of non-wear time were omitted





Phase 3: Results



Pearson Correlation Coefficients ($p < 0.001$)				
Participant	1	2	3	5
Fitbit/AG step count	0.620	$p > 0.05$, insignificant	0.610	0.715
Fitbit/AG vector magnitude*	0.576	$p > 0.05$, insignificant	0.623	0.722

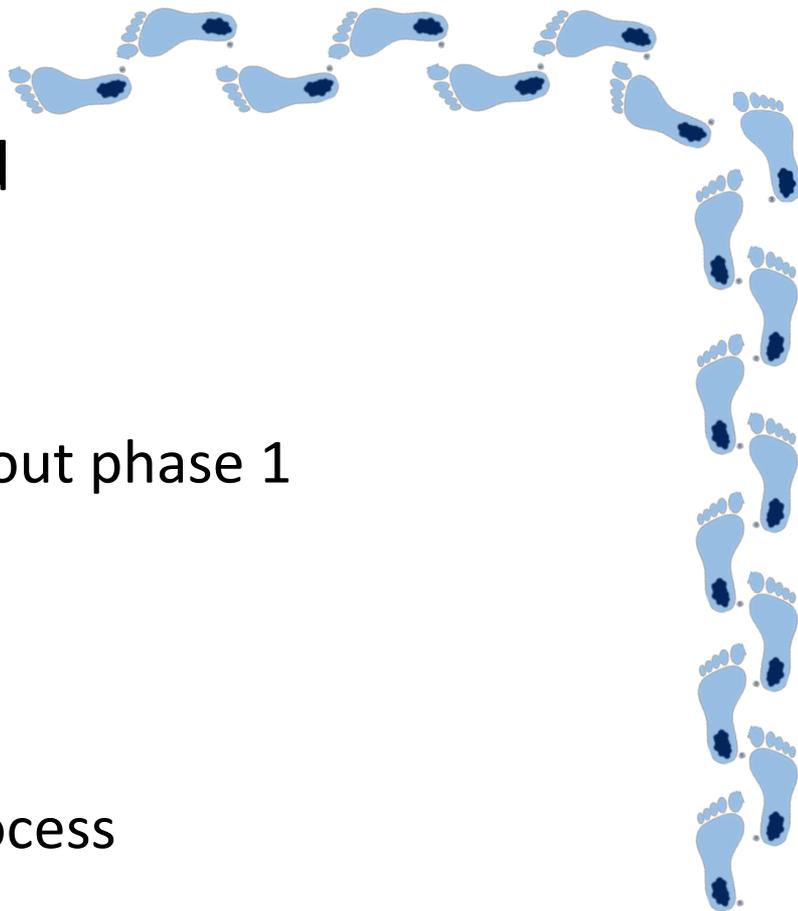
Table 6. Pearson's correlation coefficients were calculated for each of the 1-min epochs in over 4 Free-living days.

Further calculations with repeated linear models need to be analyzed for Phase 3.





Insights and Lessons Learned

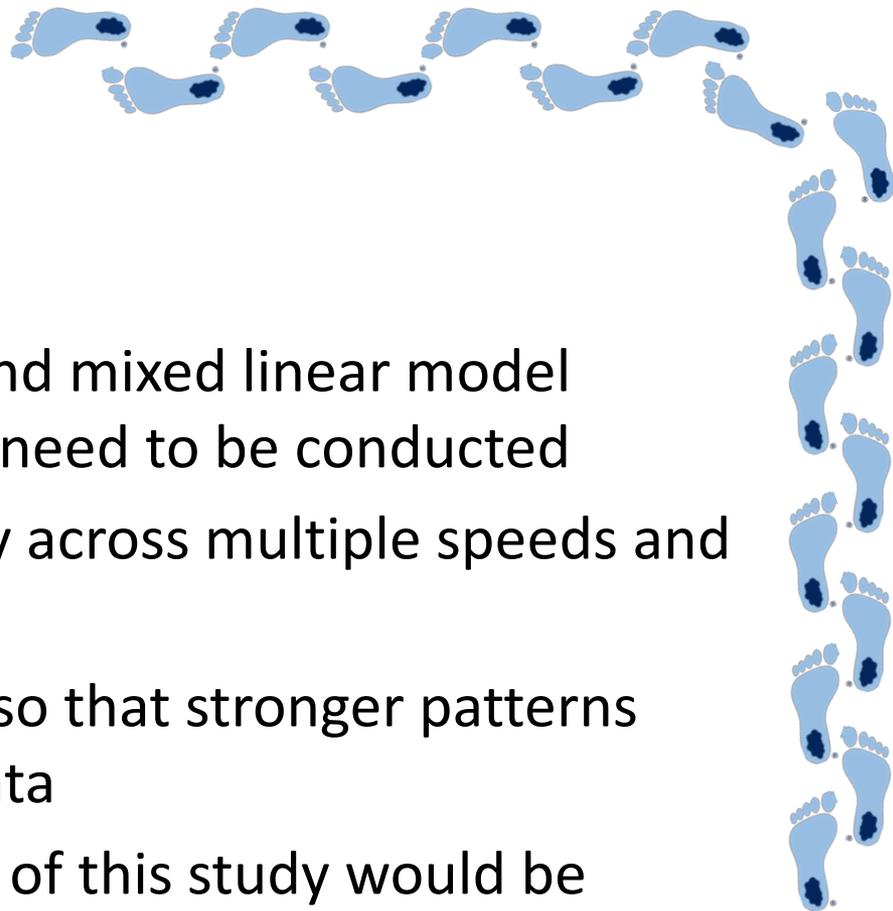


- “Failure”
 - proving the null hypothesis about phase 1
- Confirmation
 - data better at higher speeds
- Learning experience
 - creating a protocol and IRB process
- Challenges
 - access to study team and coordination
 - data extraction, problems and hacks
 - data quantity and short intervals





Future Steps



- Further in-depth correlation and mixed linear model analysis of the phases 2 and 3 need to be conducted
- Ascertain Fitbit Alta HR validity across multiple speeds and activities
- More participant recruitment so that stronger patterns may be concluded from the data
- Finally, a white paper protocol of this study would be disseminated upon its completion





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