



Testing the Accuracy of Two Accelerometers for Measuring Steps in Residential Care and Assisted Living Residents

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PURPOSE

The purpose of this study is to compare the accuracy of the Fitbit Motion Tracker® to the Actigraph® GT1M for measuring daily steps in residential care/assisted (RC/AL) residents. A secondary aim was to explore step counter error rates in participants with slow gaits and/or who used walking aids.

BACKGROUND

Slow gaits (e.g. <0.60 meters/second (m/sec)) and the use of walking aids, are common in RC/AL residents¹. These factors may reduce accuracy of accelerometers by undercounting steps in these populations. As accelerometers measure vertical accelerations and are generally recommended for wear at the hip, slow gaits and/or walking aids may prevent the accelerometer from meeting the threshold force needed to capture steps accurately in these populations. Accurately measuring daily steps is essential to the specific aims of an ongoing study: *Physical Activity and Disability in Residential Care/Assisted Living Residents* (NIH R15). This study uses the Fitbit Motion Tracker® to measure daily steps; however, the Fitbit may undercount steps in persons with slow gaits and/or who used walking aids.

SUBJECTS

Participants included those enrolled in the parent study without an unstable medical or psychiatric illness. Participants (n=50) were 90% female and 98% Caucasian with a mean age of 87 (SD=7.1) years. Most participants (n=39) used a walking aid (e.g. walker or cane). The mean walking speed was 0.65 (SD=0.23) m/sec overall, 0.58 (SD=0.20) m/sec for participants who used a walking aid, and 0.88 (SD=0.17) m/sec for those who did not use walking aids.

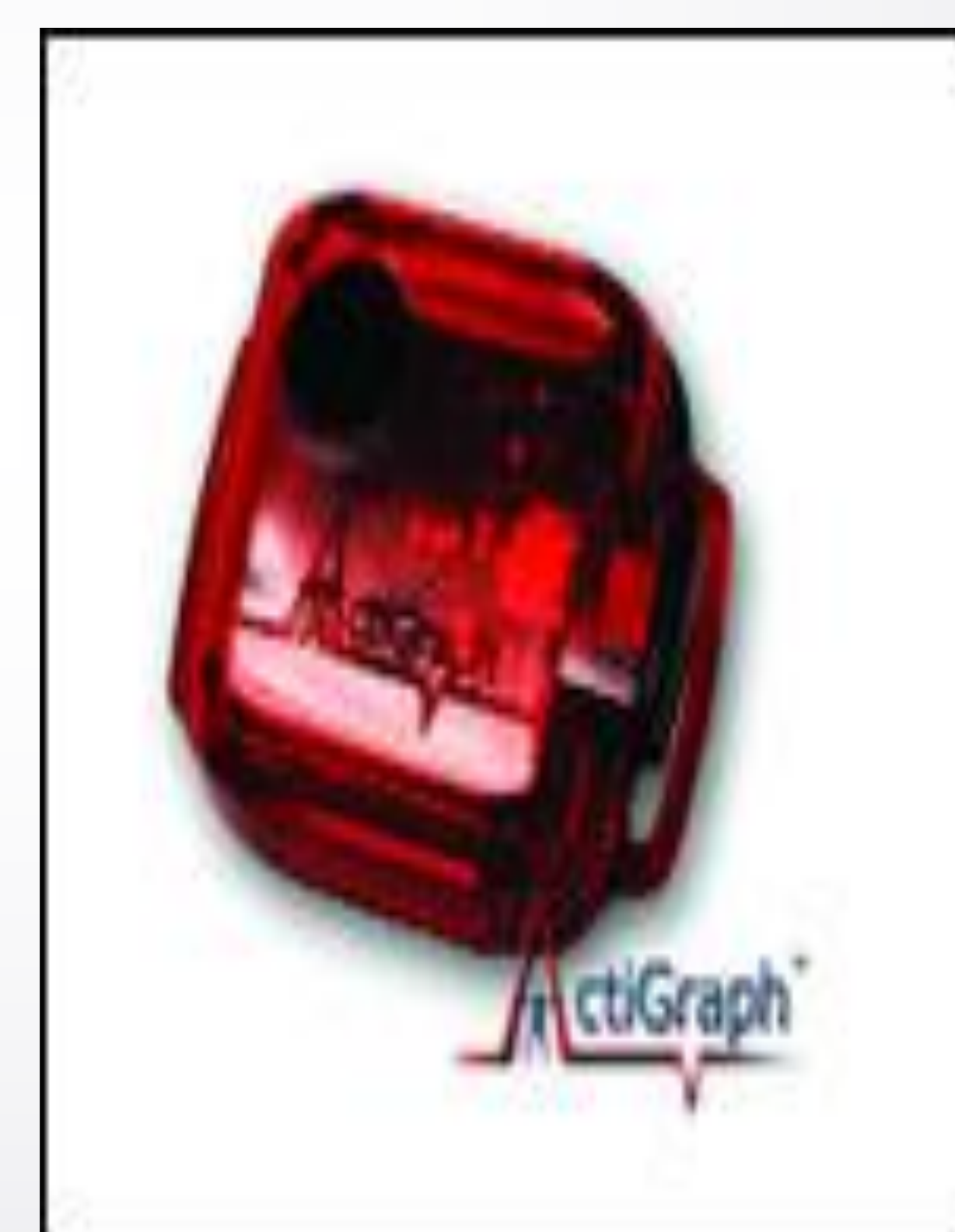
MATERIALS AND METHODS

METHODOLOGY

We utilized a cross-sectional correlational design. Participants wore four step counters (one waist-mounted, one wrist-mounted, and one ankle-mounted Actigraph and one waist-mounted Fitbit) while completing two sequential 100 foot walking trials in a common area of their RC/AL communities. A hand-tally counter was used to record observed steps. Percent error was calculated as [(step counter steps - observed steps)/observed steps] X 100 for each step counter used in testing¹.

INSTRUMENTS

Fitbit Motion Tracker® (lower left)
Actigraph GT1M® (lower right)
Hand tally counter



RESULTS

Instrument/ placement (n=50)	% Error (in absolute value) M (SD) (n=50)	% Error for Slow Gaits M (SD) (n=18)	% Error for Walking Aids M (SD) (n=39)
a. Fitbit (waist)	0.32 (0.38)	0.69 (0.41)	0.39 (0.40)
b. Actigraph (ankle)	0.19 (0.19)*	0.33 (0.23)	0.22 (0.21)
c. Actigraph (wrist)	0.81 (0.23)**	0.90 (0.14)	0.91 (0.12)
d. Actigraph (waist)	0.72 (0.19)**	0.83 (0.16)	0.74 (0.19)

Note: Compared to a. Fitbit (waist) *(p=0.003), ** (p<0.001)

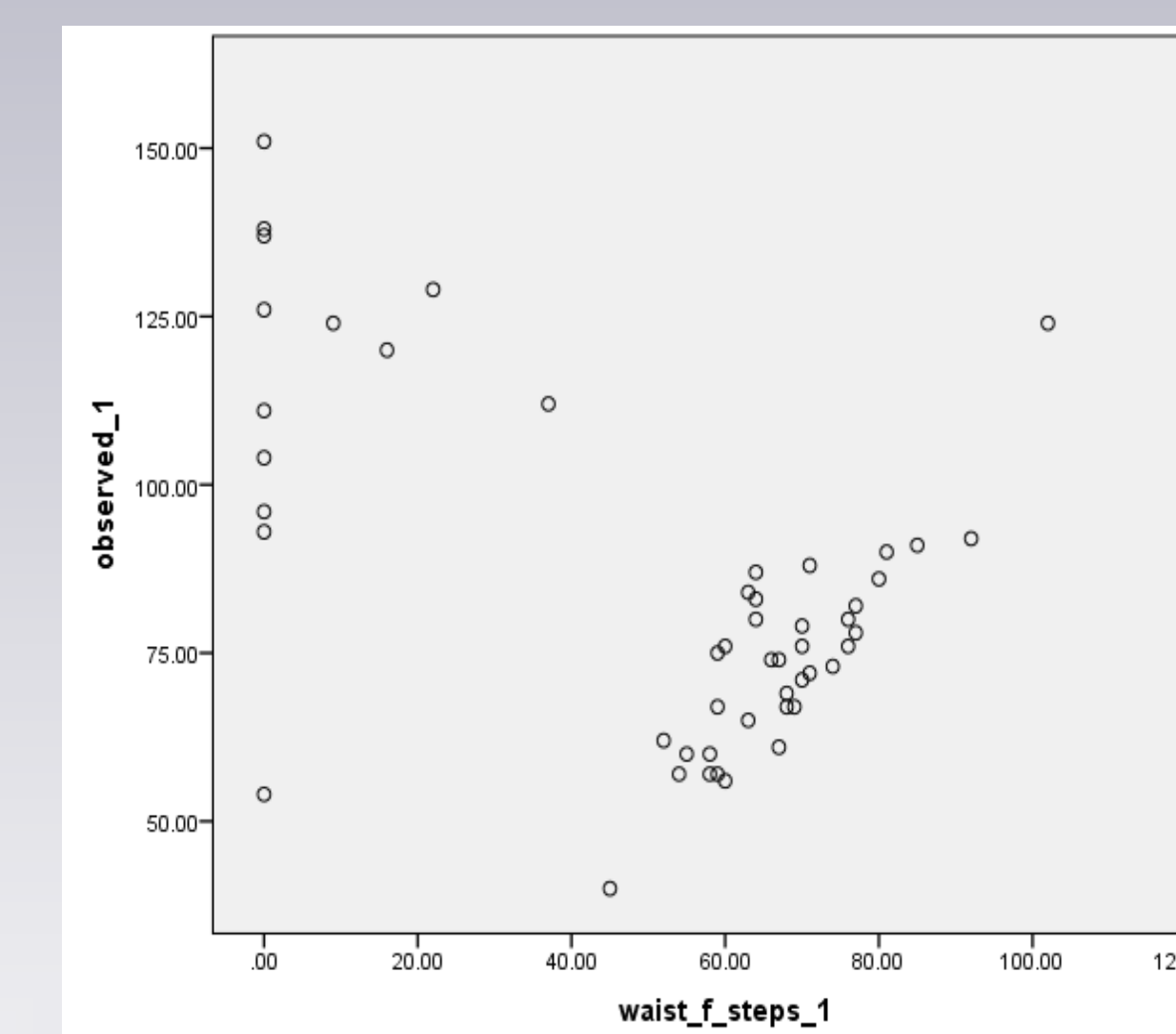


Figure 1. Fitbit at Waist vs. Observed Steps

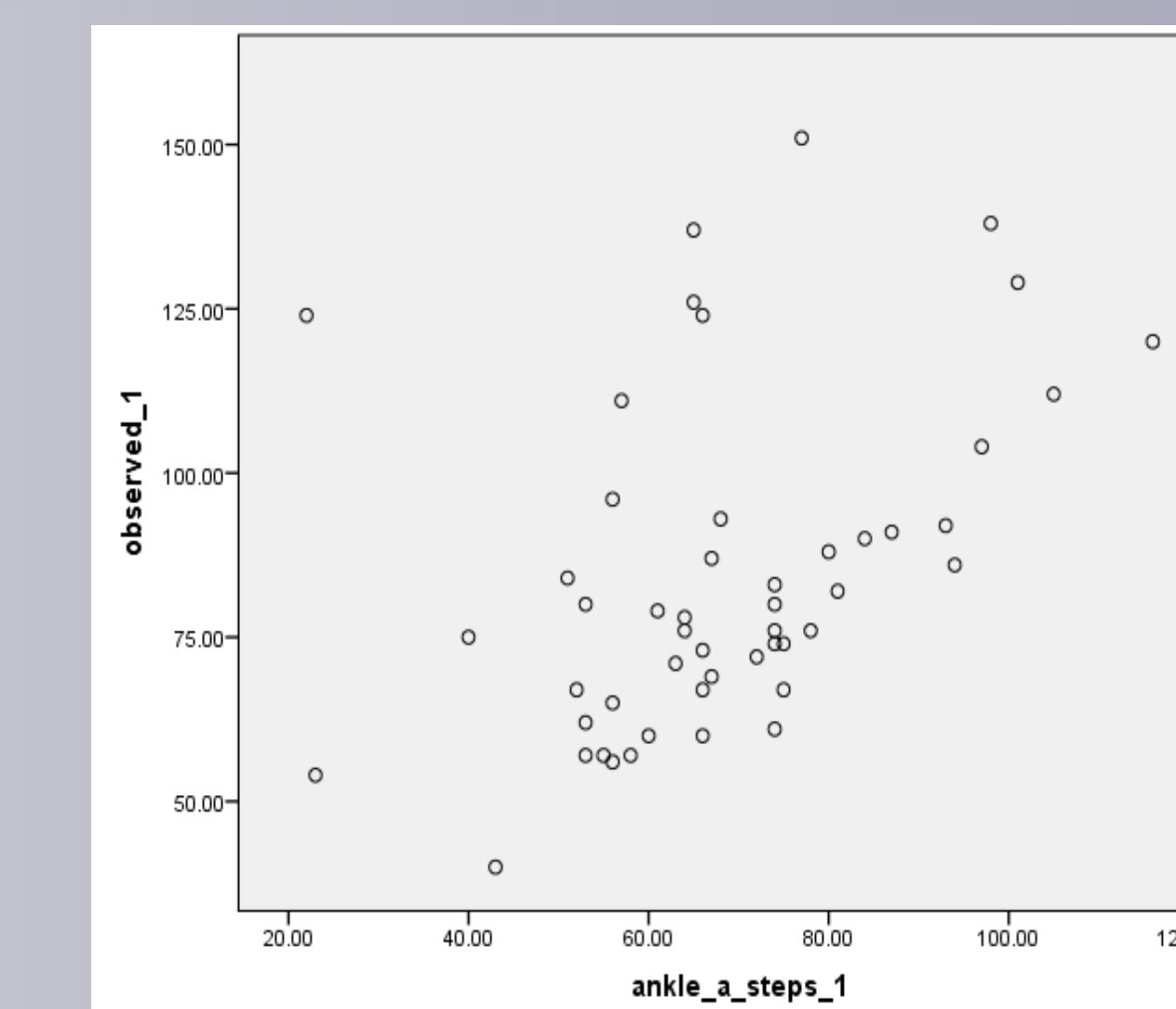


Figure 2. Actigraph at Ankle vs. Observed Steps

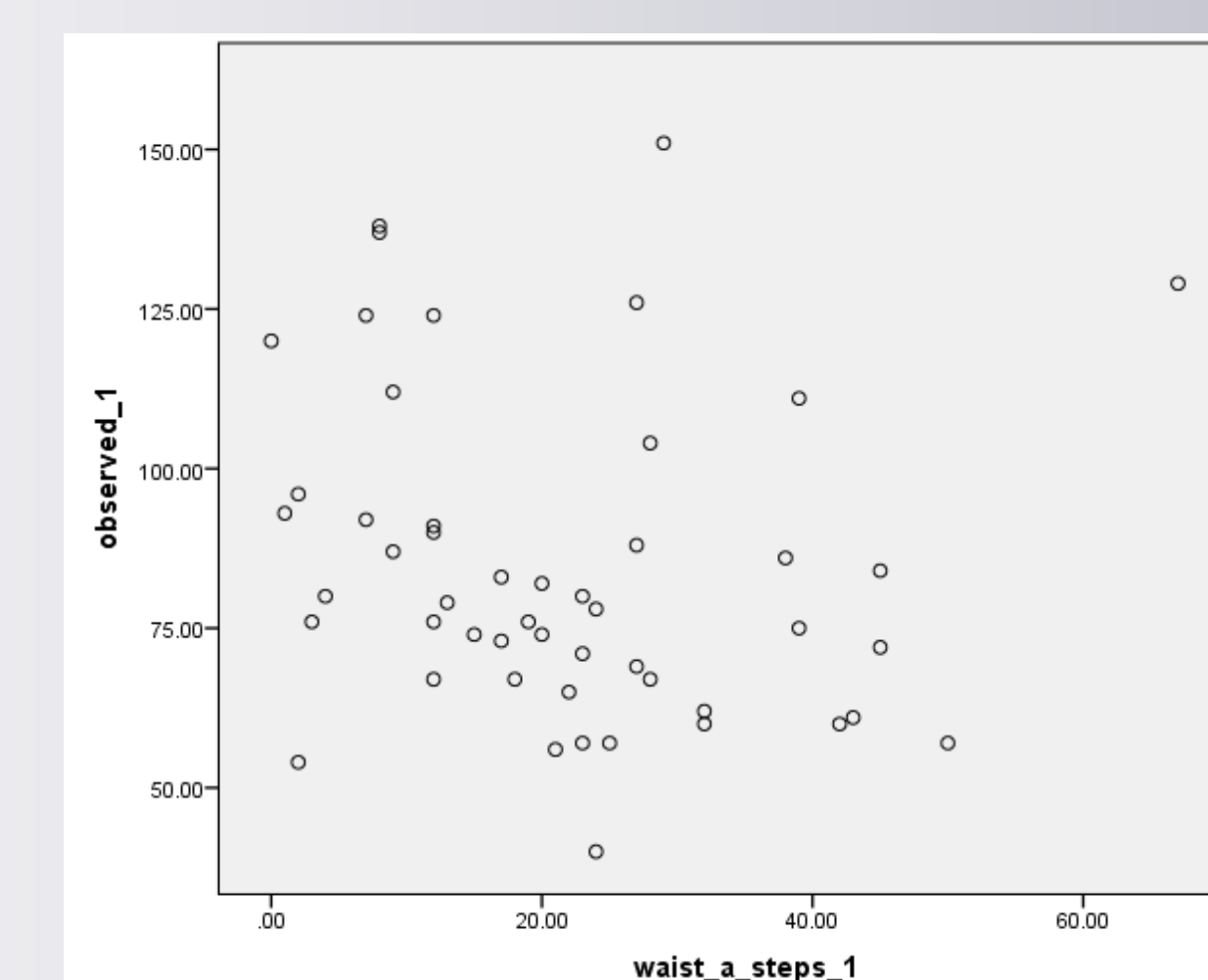


Figure 3. Actigraph at Waist vs. Observed Steps

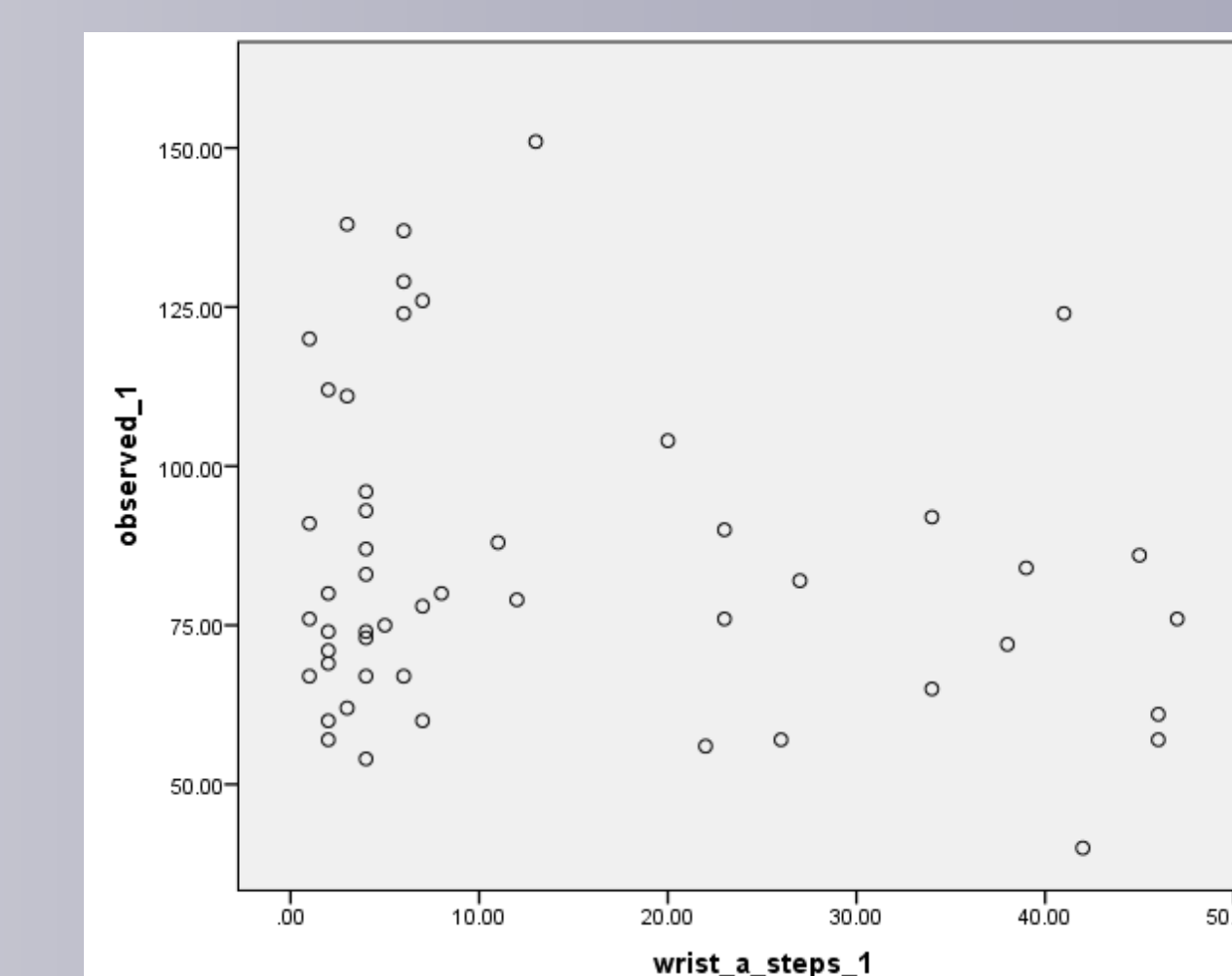


Figure 4. Actigraph at Wrist vs. Observed Steps

CONCLUSIONS

The ankle-mounted Actigraph demonstrated the lowest error rate overall when compared to the hand-tally counter and is more accurate than the waist-mounted Fitbit in capturing daily steps in RC/AL residents with slow gaits; however, the manufacturer recommends placement at the waist or wrist only². This study provides important information on the accuracy of the Fitbit and Actigraph for use in RC/AL residents. The Fitbit is an economical accelerometer which may be best for use in community-dwelling older adults without gait disturbances. As a result of this study, we have begun using the ankle-mounted Actigraph in addition to the Fitbit to better capture daily steps in participants with slow gaits and/or who use a walking aid in the parent study. Future research should evaluate accelerometer accuracy across a range of gait speeds in larger RC/AL samples.

References:

1. Cyarto, E. V., Myers, A. M., & Tudor-Locke, C. (2004). Pedometer accuracy in nursing home and community-dwelling older adults. *Medicine & Science in Sports & Exercise*, 36, 205-9. DOI: 10.1249/01.MSS.0000113476.62469.98.
2. ActiGraph (2012). Activity monitors. Retrieved from: <http://www.theactigraph.com/products/>.

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