Poster presentation

# EVALUATING THE VALIDITY OF A SMARTPHONE STEP-COUNTER IN ADULTS WITH ASTHMA: A PROOF-OF-CONCEPT STUDY

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**Introduction:** Regular physical activity and structured exercise are often reported to be associated with improved asthma control - however the majority of published evidence is limited by short-term studies employing subjective measures of assessment (i.e. self-report / questionnaires). Modern smartphones typically include built-in activity sensors (i.e. possess the capability to monitor daily step-count) and thus may offer a cost-effective and pragmatic solution to the assessment of physical activity in clinical practice and/or research trials. The primary aim of this proof-of-concept study was therefore to evaluate the validity of the iPhone® (Apple Inc, USA) step-counter in adults with asthma and healthy controls.

**Methods:** The study was conducted as a cross-sectional laboratory based-trial. Ten healthy adults with no prior history of respiratory disease and ten adults with a prior physician diagnosis of asthma were enrolled. All completed baseline clinical assessment followed by a standardised walking treadmill challenge consisting of 3 x 3-minute stages at pre-determined speeds: 2.5kph, 5.0kph and 7.5kph. Steps were recorded using the following devices: (i) Yamax Digiwalker™ SW-200 Pedometer (Yamax, UK), (ii) iPhone® step-counter (upper body arm-band), (iii) iPhone® step-counter (lower body trouser pocket) - and evaluated against a video-verified manual step-count (i.e. gold-standard comparator) conducted by the investigator (CR).

**Results:** No difference was observed in manual total step-count between individuals with asthma (1018 steps) and healthy controls (1038 steps) (P=0.44). The iPhone® step-counter (both upper and lower body) provided close agreement with video-verified manual step-count, and importantly, outperformed the Yamax Digiwalker® SW-200 Pedometer across the majority of test stages. Specifically, the iPhone® (lower body) correlated strongly (r = 0.96; P<0.006) and produced the highest level of agreement with video-verified total step-count (mean bias: -11; limits of agreement: -43 to 21) (Table 1).

**Conclusion:** Our findings indicate that the iPhone® provides an accurate estimate of step-count in adults with asthma and healthy controls completing a standardised laboratory-based treadmill test. Prior to implementation, further research is required to determine the validity and reliability of this approach during daily active / free living conditions.

**Table 1.** Comparison of step-count devices during a standardised walking treadmill challenge.

| Device (speed) | Step-count (mean SD) | P-value | ICC | Mean bias | LOA |
|---|---|---|---|---|---|
| Video-verified manual count (2.5kph) | 253 (18) | - | - | - | - |
| iPhone upper | 242 (42) | 0.24 | r = 0.33 | -11 | -89 to 67 |
| iPhone lower | 253 (21) | 0.99 | r = 0.77 | 0 | -27 to 27 |
| Digiwalker | 179 (70) | <0.0001 | r = 0.37 | -74 | -203 to 55 |
| Video-verified manual count (5.0kph) | 337 (17) | - | - | - | - |
| iPhone upper | 336 (18) | 0.86 | r = 0.88 | -1 | -17 to 16 |
| iPhone lower | 333 (16) | 0.003 | r = 0.96 | -4 | -14 to 6 |
| Digiwalker | 329 (28) | 0.23 | r = 0.40 | -8 | -59 to 44 |
| Video-verified manual count (7.5kph) | 439 (29) | - | - | - | - |
| iPhone upper | 431 (30) | 0.009 | r = 0.91 | -8 | -33 to 17 |
| iPhone lower | 430 (35) | 0.009 | r = 0.93 | -9 | -33 to 17 |
| Digiwalker | 433 (31) | 0.004 | r = 0.97 | -6 | -20 to 9 |
| Video-verified manual count (total) | 1028 (56) | - | - | - | - |
| iPhone upper | 1009 (67) | 0.08 | r = 0.74 | -19 | -108 to 70 |
| iPhone lower | 1017 (58) | 0.006 | r = 0.96 | -11 | -43 to 21 |
| Digiwalker | 942 (99) | <0.0001 | r = 0.66 | -86 | -233 to 60 |

**Definition of abbreviations:** ICC, Intra-class correlation; LOA, Limits of agreement