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Validity and Reliability Evidences of Objective Physical Activity Measures and Wearable Monitors: A Meta-Systematic Review

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INTRODUCTION:
The purpose of this study was to conduct a meta-systematic review related to the validity and reliability evidences of objective physical activity (PA) measures, focusing on accelerometers and wearable activity monitors for adults.
METHODS:
The objective measures of physical activity for the review were including ActiGraph accelerometers (i.e., GT3X+, wGT3X+, wGT3X-BT and GT9X) and ActivPAL due to the most frequently employed for several decades. In addition, wearable devices and Smartphone applications (mHealth APP) were also included. All data were collected from PubMed, Medline (OVID), and Web of Science.
The topic keywords were including 'PA measurement tool name' AND 'accuracy' OR 'validity' OR 'reliability' as well as 'smartphone app' OR 'wearable device' AND 'physical activity' for the smartphones and wearable devices related topics. Four measurement and statistics experts were reviewed the final 156 papers among a total of 2,280 research articles including articles of systematic reviews and meta-analyses based on the review guidelines classified by categories of validity and reliability evidences related to the PA measures. The most current publication for 10 years between 2012 and 2022 were selected for the review.
RESULTS:
1) There were numbers of validity and validation studies of ActiGraph in different versions, and GT3X and GT9X were relatively accurate. Freedson cut-points (1998) has been still widely employed in the PA researches as well as combination equations (Lyden et al., 2011). Wearing the PA devices on the waist were the most accurate compared to other wear-positions. Enough evidences were provided to include weekends and weekdays, at least four days per week and at least 10 hours a day of PA should be measured. The Length of the epoch was frequently set to 60 seconds.
2) ActivPAL was more accurate to wear on the thigh than on the arm. Estimating walking and light activity was more precise than moderate-to-vigorous PA (MVPA).
3) Validation studies of wearable devices were compared to ActiGraph, and seldomly K4b2 (Italy). Among various wrist-worn wearable devices (i.e., Fitbit, Jawbone, Apple Watch, Garmin, Xiaomi Band), Jawbone UP was relatively accurate in light activity and SB, while Fitbit models were accurate during MVPA.
4) Smartphone employed Behavior Change Technology (BCT) including the topics of goal and plan settings, behavior feedbacks, and behavior comparisons, or the utility of the Mobile App Rating Scale (MARS). The higher ranked application provided real-time energy consumption, heart rate, and visualization services, while the lower ranked model provided the number of steps only.
CONCLUSION:
The ActiGraph accelerometer has provided acceptable qualities of the validity and reliability evidences to measure PA. Smartphone and wearable devices were able to promote participating in PA in free living, but still not to measure accurately enough.
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Topic: **Health and Fitness**

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