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Electronic Devices and Applications to Track Physical Activity

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To the Editor

Advances in physical activity monitoring provide clinicians and researchers with opportunities to further understanding of the health benefits of physical activity, yet the proliferation of wearable device technology has created a black box in terms of accuracy and reliability. Manufacturers create proprietary algorithms to estimate steps, distance, and energy expenditure from measured acceleration, making it impossible to compare raw acceleration data between devices. Moreover, these algorithms are created using younger, healthier populations,[1] making their validity in older, sicker individuals unclear.

A study by Ms Case and colleagues[2] compared the accuracy of smartphone applications and wearable devices with direct observation of treadmill step counts. Although this research is needed to better understand wearable device technology, there are problems with the study.

First, participants wore devices at the waist, wrist, and in each pants pocket. Movement differences at the wrist and hip confound comparison of device measurement by body placement.[3] Moreover, in the general population there are differences in modes of carrying cell phones (ie, in the pocket, purse, waist-clip, etc) that contribute to measurement differences, limiting the translation of these results to the real world. Results are consistent only if the device is placed in the same location every day, both within and between persons.

Second, participants in the study were young, healthy volunteers. Differences in speed of movement, gait mechanics, and body composition greatly affect raw acceleration measurement and interpretation into steps and energy expenditure metrics, which may prove problematic when translating results to older or obese populations.

Third, testing was conducted on a motorized treadmill. Treadmills alter gait mechanics by shortening stride length, increasing step cadence, and reducing normal gait variability.[4] Thus steps measured on a treadmill may not accurately translate to steps in a free-living environment.

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Fourth, these devices measure movement and acceleration, not steps, yet any movement registered by the device may be categorized as steps, even if not biomechanically consistent with a stepping motion. Wrist measurement is particularly problematic, because any type of upper body movement may be classified as steps.[3]

The consumer market is burgeoning with new smart devices, yet little research has supported their accuracy, and problems abound with placement and data interpretation.[5] Although wearable devices present exciting new opportunities, more methodological research is needed to ensure their accuracy and reliability, and proper interpretation of the data into clinically meaningful recommendations.

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