



A step forward in hearing aid step tracking



Physical activity is an essential part of healthy aging and well-being. A study completed by Starkey Research evaluated step tracking accuracy for Starkey Evolv AI hearing aids, using standardized procedures outlined by the American National Standards Institute (ANSI) and the Consumer Technology Association (CTA)¹. **By using these standardized procedures, it was demonstrated that Starkey Evolv AI hearing aids with embedded inertial measurement unit (IMU) sensors can provide accurate step counts.**

The Importance of Physical Activity

Previous research has shown that moderate to severe degrees of hearing impairment in older adults is associated with decreased levels of physical activity². Tracking steps is a simple way to monitor and motivate physical activity. Literature shows that using step counters can help inactive individuals increase their step count by 2,500 steps per day³. Technological advances in hearing aids allow for tracking steps using embedded motion sensors.

Methods

Twenty participants with no self-reported physical disabilities were recruited for this study (Age 22–58, Mean = 38.2, Standard Deviation = 9.3). Evolv AI 2400 RIC rechargeable hearing aids were best fit to a 20 dB HL flat hearing loss using the eSTAT fitting formula. Data collection procedures specified in ANSI/CTA-2056 were strictly followed. Each participant wore an Evolv AI hearing aid and was instructed to walk and run, naturally, for five minutes each on a treadmill with no incline. Walking speed was between 2.5–4 mph, and running speed was between 5–12 mph. Step count data was read from the Starkey Thrive Hearing Control mobile app. Video recordings were taken to complete manual counting of steps and determine "ground truth."

Results

Results were analyzed by correlating the manual count of "ground truth" with the number of steps reported by the Thrive mobile app. Results of this analysis are shown in Figure 1 (on next page). The data points are mostly on the main diagonal line, indicating that the step counts from the hearing aids match the ground truth well. In addition, distributions of absolute step count deviation from ground truth for 5-minute walking and 5-minute running are also shown in Figure 2 (on next page). It is seen that for a 5-minute walk of about 550 steps and a 5-minute run of about 850 steps, the majority of the difference values are within 20 steps. Finally, the mean absolute percentage error (MAPE) was used to quantify measurement accuracy, which is calculated based on the difference between ground truth and the device reading. According to ANSI/CTA-2056, the acceptance criteria is that MAPE should be within 10% of the ground truth values for walking and running. The MAPE values for the Evolv AI hearing aids for walking and running were 3.5% and 2.6% respectively.

Step Tracking Accuracy

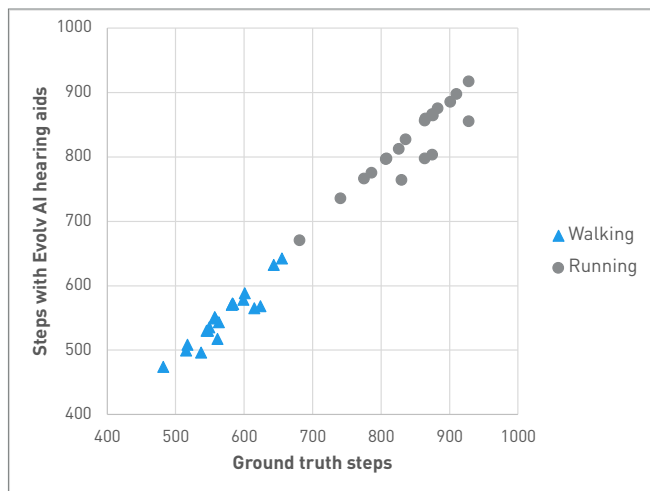


Figure 1: Relationship between the ground truth step count (manually counted) and the steps counted by the Evolv AI hearing aids.

Conclusions

Step tracking accuracy can be influenced by factors such as the speed of movement, the position of the sensor, and the motion of the body. The procedures described in ANSI-CTA 2056 provide a standardized way to evaluate step tracking accuracy, which ensures that the tracking device can provide valid information. By using these standardized procedures, it was demonstrated that Starkey Evolv AI hearing aids with embedded inertial measurement unit (IMU) sensors can provide accurate step counts. Accuracy in step counting is an important element to encourage the use of fitness tracking capabilities in hearing aids and motivate physical activity.

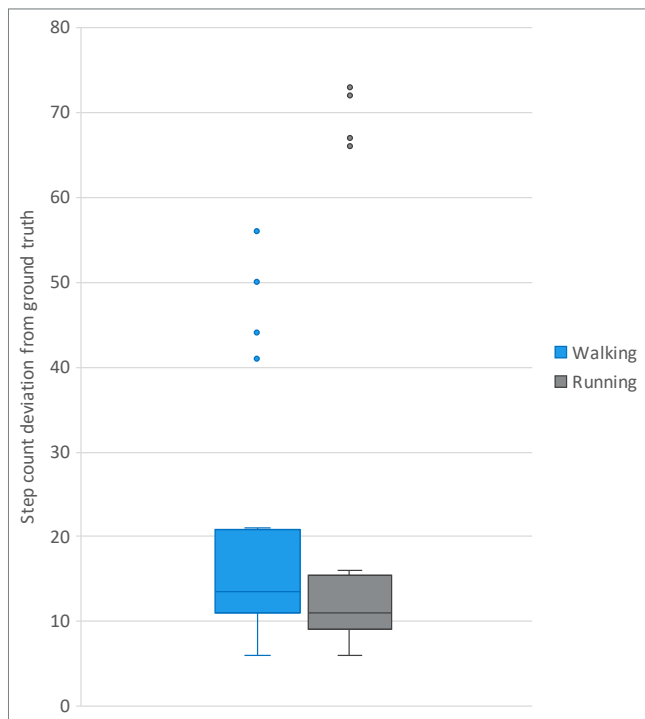


Figure 2: Distribution of absolute step count deviation from ground truth for 5-minute walking and 5-minute running.

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REFERENCES

- 1 Consumer Technology Association. ANSI/CTA-2056-Physical Activity Monitoring for Fitness Wearables: Step Counting. 2016.
- 2 Gispén, F.E., Chen, D.S., Genter, D.J., Lin, F.R. (2014). Association of Hearing Impairment with Lower Levels of Physical Activity in Older Adults. *J. Am. Geriatr. Soc.*, 62(8), 1427-1433.
- 3 Bassett, D. R., Toth, L. P., LaMunion, S. R., & Crouter, S. E. (2017). Step counting: a review of measurement considerations and health-related applications. *Sports Medicine*, 47(7), 1303-1315.

