

Step Count Accuracy of Several Commercial Activity Trackers While Riding a Motorcycle

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BACKGROUND

- Sedentary time, especially prolonged sitting time, has been shown to have negative consequences on an individual's health, even if they regularly exercise [1].
- In order to combat excessive sedentary time, as well as recording the amount of movement one achieves throughout the day, many consumers are turning to activity trackers to help achieve better overall health [2].
- Use of activity trackers has exploded in popularity in the recent years. It's estimated that 368.2 million wearables will ship in 2020 [3].
- Use of an activity tracker has been shown to increase movement and physical activity for some individuals, but abandonment of these devices is high [4,5].
- Health and fitness professionals are often asked "Which device should I purchase?" and "How accurate are the devices?"⁴ It has been noted that if a device is perceived as more accurate, it has a higher adoption and usage rate [6,7].
- Though many devices have been studied across a variety of conditions[8], no study to date has looked at the accuracy of these devices while riding a motorcycle.



STUDY AIM

To determine whether several commercially-available activity trackers will misclassify movement from riding a motorcycle as step activity

DEVICES



Apple Watch

Fitbit Charge HR

Fitbit Zip

METHODS

PROCEDURE:

- For all trials, the motorcyclist wore the Apple Watch® (Generation 1) on their dominant hand, the Fitbit Charge HR® was worn on their nondominant hand, and the Fitbit Zip® was placed in their left pocket.
- Height and weight, along with sex, birth date, and dominant hand, were entered into each device via the corresponding phone application.
- Before riding the approximate 28 mile route, the motorcyclist sat astride the motorcycle, with both feet on the ground and each hand on the handlebar. The displayed device step counts were recorded.
- The motorcyclist then rode the route, riding within the prescribed traffic control and speed limits, until reaching the midpoint of the trial.
- At the midpoint, and without removing his hands from the handlebars or dismounting the motorcycle, the displayed step counts were recorded.
- The motorcyclist then rode back to the starting point, again not moving from the riding position, where the final step counts were recorded.

Ten total round-trip trials were complete.

DATA ANALYSIS:

- The difference between the number of steps measured by the device and the actual number of steps taken by the motorcyclist (zero in all cases) were recorded.

RESULTS

- The mean number of steps miscounted by the Apple Watch was 12.9 steps, while the range varied from 0 to 53 steps. The Apple Watch completed one trial portion without miscounting any steps.
- The mean number of steps miscounted by the Fitbit Charge HR was 211.0 steps, while the range varied from 136 to 323 steps.
- The mean number of steps miscounted by the Fitbit Zip was 305.3 steps, while the range varied from 20 to 811 steps.
- Because the actual step count was equal to zero in all cases, the mean absolute percent error (MAPE) for the Apple Watch, Fitbit Charge HR, and the Fitbit Zip would be 100%.

TABLE 1: MEAN STEP DIFFERENCE

All trials	Mean	Standard Deviation	P Value	Range
Apple Watch	12.9	15	.011	0 to 53
Fitbit Charge HR	211.0	53.1	<.01	136 to 323
Fitbit Zip	305.3	309.3	<.01	20 to 811

TABLE 2: MEAN STEP DIFFERENCE

"Out" Portion	Mean	Standard Deviation	Range
Apple Watch	19.2	20	0 to 53
Fitbit Charge HR	189.2	45.8	136 to 226
Fitbit Zip	149.8	121.9	20 to 291

TABLE 3: MEAN STEP DIFFERENCE

"Back" Portion	Mean	Standard Deviation	Range
Apple Watch	6.6	3.4	2 to 11
Fitbit Charge HR	232.8	55.3	180 to 323
Fitbit Zip	460.8	374.1	55 to 811

DISCUSSION

- This study, the first of its kind known to the authors, investigated the accuracy of several commercially-available activity trackers while riding a motorcycle over a moderate distance.
- Our results noted that each of the studied activity trackers miscounted steps. Only the Apple Watch had one trial where the true step count was exactly matched.
- Because each device has a proprietary algorithm for assessing step counts, we can only speculate as to why each device performed as it did during the motorcycling trials.
- Previous research has noted that newer algorithms and additional sensors, such as optical heart rate (photoplethysmography) may increase step accuracy [9,10]. This may be why the Fitbit Zip did poorly compared to the other two activity trackers.

CONCLUSIONS

- In this study, commercially-available activity trackers were shown to misclassify riding a motorcycle as step activity.
- Researchers should be cautious when utilizing consumer-grade activity tracker step counts in avid motorcyclists.
- For the consumer, the total miscounted steps are relatively small when riding over a moderate distance, and the small metabolic cost of choosing to ride a motorcycle verses drive a vehicle, may overcome these miscounted steps [11,12].

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