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CAN WE USE THE WII TO MEASURE WEE?

Hypothesis / aims of study

The Wii Fit™ video game has sold millions of copies throughout the world since its launch by Nintendo in 2007. The Balance Board (Figure 1) is an accessory to the Wii Fit, used during gaming to measure the weight and centre of mass of the person standing on it. A load cell urine flowmeter measures the increasing weight of urine expelled by the body and derives from this volume and flow rate. By instead measuring the decreasing weight of the body during voiding, could a home flowmeter be implemented using the Wii Balance Board (WiiBB)?

Study design, materials and methods

A software application was created to continuously read and record the weight output from the WiiBB via Bluetooth. A conversion of 1 g:1 ml was assumed to obtain volume.

Measuring known volumes Whilst standing on the WiiBB, one author poured out known volumes of water (50 ml to 1000 ml in 50 ml intervals) from a handheld jug. On the resulting traces, flow start and end points were marked and the end point volume subtracted from the start point volume (Figure 2).

Figure 1. The WiiBB.

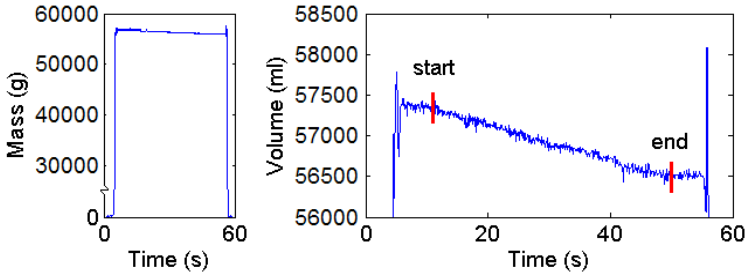

Figure 2. Output from the WiiBB.

Measuring volumes and flow rate during genuine use In order to assess the accuracy of volume and flow measured by the WiiBB during genuine use, 18 voids were recorded from two male volunteers in their homes. The volunteers stood on the WiiBB before voiding into a portable home flowmeter assembled in their bathrooms. Voided volumes (V_{void}) from the WiiBB were calculated using the method described in *Measuring known volumes* above, with this analysis blinded to the results from the home flowmeter.

Results

Measuring known volumes The measurements obtained from the WiiBB showed good accuracy, with mean [SD] difference 4 [29] ml compared to known volumes (Figure 3). This error can be attributed mainly to noise on the signal from the WiiBB with SD 25 ml.

Measuring volumes and flow rate during genuine use Volumes measured by the WiiBB during genuine use also showed good accuracy, with mean [SD] difference 13 [42] ml compared to the home flowmeter. Again due to noise on the signal from the WiiBB, a usable flow trace could not be obtained; Figure 4 compares a flow trace obtained from the home flowmeter (blue) and WiiBB (red). However, by dividing V_{void} by voiding time, average flow rate (Q_{ave}) was calculated for each void. For Q_{ave} the mean [SD] difference was 0.8 [3] ml/s compared to the home flowmeter (Figure 5.). The average of all 18 Q_{ave} measurements from the WiiBB was 14.5 ml/s compared to 13.7 ml/s from the home flowmeter.

Table I summarises the results, along with p values for Wilcoxon signed rank tests, indicating no differences between the WiiBB measurements and known volumes / home flowmeter.

Comparison	Mean difference	SD difference	p
Known volumes (0–1000 ml, 50 ml) v WiiBB	4 ml	29 ml	0.5
WiiBB v home flowmeter: V_{void}	13 ml	42 ml	0.2
WiiBB v home flowmeter: Q_{ave}	0.8 ml/s	3 ml/s	0.1

Table I. Comparisons between the WiiBB and known volumes / measurements from the home flowmeter.

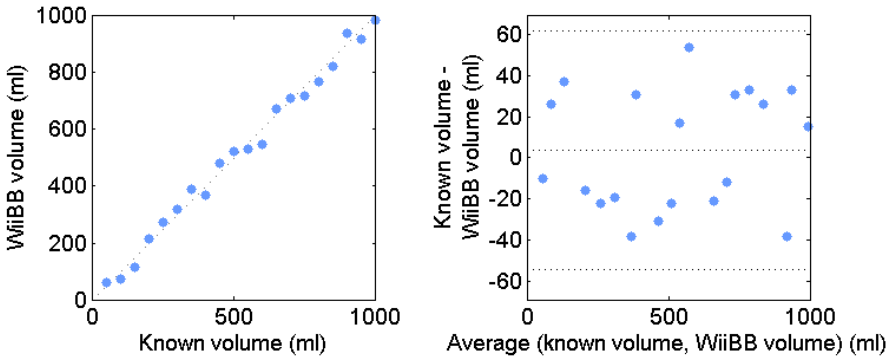

Figure 3. Scatter plot (left) and Bland-Altman plot (right) for known volume versus WiiBB volume.

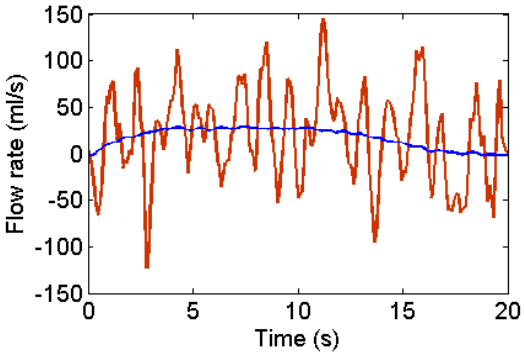

Figure 4. A flow trace obtained from the home flowmeter (blue) and WiiBB (red).

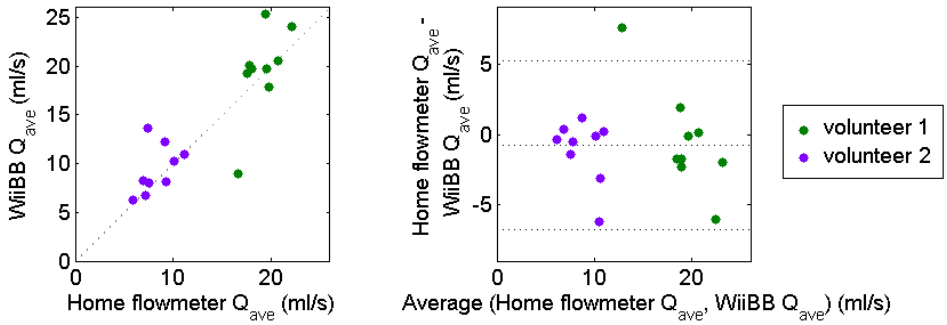

Figure 5. Scatter plot (left) and Bland-Altman plot (right) for home flowmeter Q_{ave} versus WiiBB Q_{ave}.

Interpretation of results

The WiiBB obtains a surprisingly accurate automated voiding diary, with the added bonus of average flow rate information and even weight! No collecting vessel is required as the man can void straight into the toilet as normal, which is likely to both improve compliance and allow more representative voiding. With a battery life of approximately 60 hours, the WiiBB could record 2-3 days' worth of voiding data, or much longer if switched off between uses.

Concluding message

We can use the Wii to measure wee. For the millions of homes who already own or have access to a Wii Fit, could this be the future of voiding diaries?

Disclosures

Funding: The Wellcome Trust **Clinical Trial:** No **Subjects:** HUMAN **Ethics not Req'd:** The two subjects were healthy staff volunteers. **Helsinki:** Yes **Informed Consent:** No