OneStep

WHITE PAPER · BENCHMARK

Comparing OneStep's Gait Analysis to Apple HealthKit

OneStep analyses abnormal gait patterns, while Apple HealthKit is limited to patterns within healthy ranges

ONESTEP RESEARCH | APRIL 2023 | ONESTEP.CO/RESOURCES

OneStep

COVER LETTER

RE Comparing OneStep's Gait Analysis to Apple HealthKit: OneStep Analyses Abnormal Gait, Apple HealthKit Is Limited to Healthy Ranges

The phone already measures gait. Why a clinical system is still needed.

Every iPhone reports walking speed, stride length and double support. This paper puts those numbers next to OneStep's, on the same patients, on the same days.

377	9,000+	≤ 0.37	3
Patients with data from both systems	Patient-days compared	Highest r^2 between the two systems	Clinical case studies

The two systems agree only weakly. More importantly, they disagree exactly where it matters: after a hip replacement or a fall, OneStep shows the expected deterioration and recovery while HealthKit reports values in the healthy range, or nothing at all. HealthKit measures gait when the user walks "steadily over flat ground", which is a curated best-case walk; OneStep's background analysis captures the whole day.

What separates a clinical gait system from a wellness metric

Range

OneStep detects and reports gait values well outside the healthy range, where clinical events live. HealthKit's design and validation datasets sit mostly inside it.

Real-world capture

Background walks reflect the variety of a patient's day: outdoors, in a store, carrying things. Curated walks reflect the patient's idealized walk.

Breadth and reach

OneStep reports many more parameters, including asymmetries, cadence variability, hip range of motion and walk consistency, and runs on iOS and Android.

THE GAP BEFORE THE FALL

In the fall case study, HealthKit **stopped reporting gait a month before the patient fell.** Whether because the walk deteriorated beyond what it could analyse or because the patient walked less, the signal disappeared when it was most needed.

This comparison reflects both systems as of April 2023. To discuss how OneStep complements consumer health data in your program, contact us at hello@onestep.co or through our contact form.

© 2026 OneStep

The full white paper follows.

WHITE PAPER · APRIL 2023

Comparing OneStep's Gait Analysis to Apple HealthKit

OneStep analyses abnormal gait patterns, while Apple HealthKit is limited to patterns within healthy ranges

OneStep Research Team
OneStep · Correspondence: info@onestep.co

ABSTRACT

Background. OneStep's mobile application and Apple HealthKit are two technologies that measure gait while a person walks with a smartphone in their pocket. Summary accuracy statistics for each have been published, but no direct comparison on the same subjects had been performed.

Objective. To compare gait parameters from OneStep (in-app and background) and Apple HealthKit measured on the same patients on the same days, and to examine how each system behaves around clinical events.

Methods. OneStep's database was searched for patients who shared Apple Health data with the app. Analysis was restricted to the three parameters both systems define identically: velocity, stride length and double support. Daily values were compared for 377 patients (4,383 days) with in-app OneStep and HealthKit data and 275 patients (4,891 days) with background OneStep and HealthKit data. Correlation (r^2), distributions and summary statistics were computed, and three case studies (two total hip arthroplasties and one fall) were examined with 5-measurement rolling trends.

Results. Correlation between systems was low to moderate (r^2 0.135–0.371), lowest for double support. Mean values were similar, but OneStep's distributions were wider, particularly for double support, and background walks showed lower velocity and stride length than HealthKit. In all three case studies OneStep showed the expected deterioration and recovery of gait after surgery or a fall, while HealthKit showed little change, reported values in healthy ranges, or reported no data for extended periods.

Conclusions. OneStep captures gait across real-world circumstances and across the full clinical range, including gait that deviates from the norm after surgery or a fall; Apple HealthKit appears designed for measuring healthy walks. OneStep also reports more parameters and runs on iOS and Android.

KEY POINTS

Question	How do OneStep's gait parameters compare with Apple HealthKit's on the same patients, and do the systems differ around clinical events?
Findings	In 377 patients, the systems correlated weakly (r^2 0.14–0.37). OneStep reported a wider range of values and, in post-surgery and post-fall cases, showed deterioration and recovery that HealthKit did not reflect or did not measure.
Meaning	Consumer gait metrics describe healthy walking; a clinical system is needed to measure and track abnormal gait where it matters for care.

KEYWORDS Apple HealthKit · smartphone gait analysis · double support · velocity · stride length · background monitoring · post-surgery recovery · falls

Note on timing. The analysis and the description of Apple HealthKit's behaviour reflect both systems as of April 2023. Apple's mobility metrics continue to evolve; the methods described here can be re-run on current data.

1 Introduction

Gait analysis plays a crucial role in the diagnosis and management of conditions affecting the entire body. It can identify specific gait abnormalities and their severity, measure recovery and monitor people at risk of falling or other adverse events.[1–3] Methods include observational analysis, video, instrumented analysis and wearable

© 2026 OneStep · www.onestep.co

sensors;[4] smartphone-based gait analysis is among the newest and offers a significant advantage in ease of use.

OneStep is available on iOS and Android and provides smartphone-based gait analysis validated against several gold-standard methods.[5–7] Apple HealthKit, included with all iPhones, tracks a variety of health information including several gait parameters.[8,9] Although the accuracy of each system has been reported, no direct comparison had been performed.

Here we compare OneStep and Apple HealthKit on the same subjects on the same days. With OneStep, in-app walks are those the user initiates in the app and takes while conscious of being measured (45 seconds to 45 minutes). Background walks are passive data collection whenever a patient walks with the phone in their pocket without initiating a measurement.

2 Methods

2.1 Patient selection and data processing

OneStep's database contains Apple HealthKit gait data for patients who choose to share Apple Health data with the app. Because the two methods do not analyse the same walking bouts, all walks taken on the same day were compared. For in-app OneStep and HealthKit walks, the daily mean was used. For background OneStep walks, the mean was used for velocity and stride length and the 25th percentile for double support, which has been found to be the best practice for aggregating background walks.

377 patients had at least one day with both in-app OneStep and HealthKit data: 3,984 patient-days with double support, 4,383 with velocity and 4,341 with stride length. 275 patients had at least one day with both background OneStep and HealthKit data: 4,198 days with double support, 4,891 with velocity and 4,840 with stride length.

2.2 Parameters compared

Both systems measure a variety of parameters (Table 1), but they define asymmetry differently and use different rules for deciding when to analyse a walk, so step count is not comparable. Analysis was therefore restricted to the three parameters defined identically: velocity (km/h), stride length (heel strike to next strike of the same heel) and double support (percentage of time both feet are in contact with the ground).

Parameter	Apple HealthKit	OneStep
Step count	✓	✓
Velocity	✓	✓
Stride length	✓	✓
Double support	✓	✓
Asymmetry	✓*	✓*
Left and right step length		✓
Step length asymmetry		✓
Cadence		✓
Cadence variability		✓
Left and right stance		✓
Left and right single support		✓
Hip range of motion		✓
Stride width		✓
Walk consistency		✓

Table 1. Gait parameters extracted by each system. *The systems use different definitions of asymmetry.

2.3 Case studies

The database was searched for patients who underwent surgery, had a fall, or had double support ≥ 40%, to find cases likely to show differential results. Three cases that clearly demonstrated differences were chosen. Trends were calculated as the mean of 5-measurement centred rolling windows, broken at the medical event.

3 Results

3.1 Correlation between systems

Correlation values were moderate to low (r^2 0.135–0.371), lowest for double support (Figure 1). Values were similar whether in-app or background OneStep walks were compared with HealthKit.

© 2026 OneStep · www.onestep.co

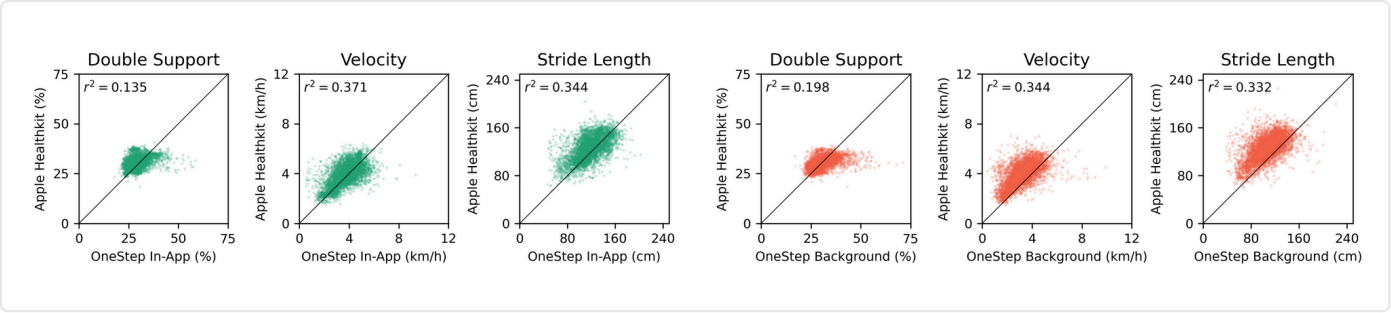


Figure 1. Distribution and correlation of OneStep versus Apple HealthKit. Top: in-app OneStep walks versus HealthKit. Bottom: background OneStep walks versus HealthKit. Double support, velocity and stride length, with r^2.

3.2 Distribution of parameters

Velocity and stride length distributions were broadly similar between in-app OneStep and HealthKit; background OneStep walks had lower velocity and stride length than HealthKit. For double support, both in-app and background OneStep distributions differed from HealthKit (Figure 2, Table 2): mean values were similar but OneStep's distribution was wider. OneStep is more likely to detect and report double support values outside the typical range when they occur.

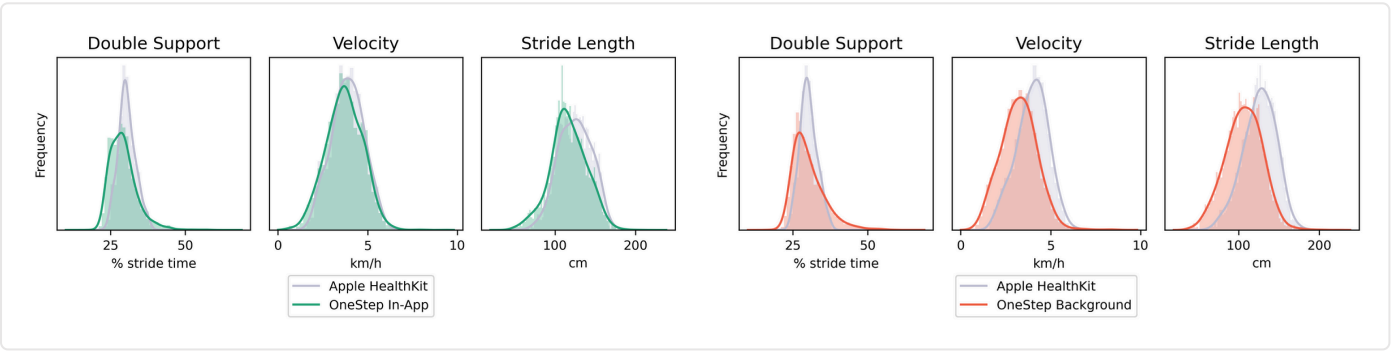


Figure 2. Distribution of gait parameters. Top: OneStep in-app (green) versus HealthKit (grey). Bottom: OneStep background (red) versus HealthKit. Distributions from days with at least one walk of each type.

Parameter	OneStep in-app	HealthKit[1]	OneStep background	HealthKit[2]
Double support	29.25% (4.52)	30.51% (2.90)	30.29% (5.46)	30.24% (2.84)
Velocity	3.70 km/h (1.00)	3.89 km/h (0.89)	3.24 km/h (1.01)	3.97 km/h (0.89)
Stride length	116.87 cm (22.28)	125.13 cm (20.18)	106.56 cm (22.62)	126.03 cm (20.21)

Table 2. Summary statistics, mean (SD). [1]HealthKit data from days with in-app OneStep walks. [2]HealthKit data from days with background OneStep walks.

3.3 Case studies

Case 1: post-surgery, in-app walks only. The patient underwent total hip arthroplasty in spring 2022 and had walks analysed by both systems before and after. Before surgery both methods show broadly similar parameters. Immediately after, OneStep shows a large jump in the unfavourable direction, as expected after major hip surgery, followed by recovery toward pre-surgery levels. HealthKit shows little change in double support and an increase in velocity and stride length, contrary to expectation, with very few days of data in the weeks after surgery (Figure 3).

© 2026 OneStep · www.onestep.co

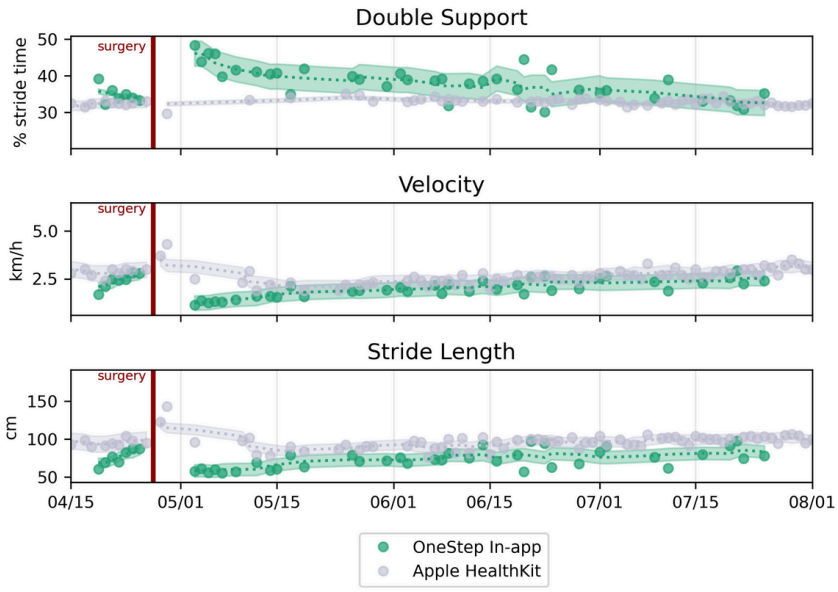


Figure 3. Case 1. Daily double support, velocity and stride length from OneStep in-app walks (green) and Apple HealthKit (grey) around total hip arthroplasty (red line). Dotted lines show trends; shaded areas one standard deviation.

Case 2: post-surgery, in-app and background walks. This patient underwent total hip arthroplasty in summer 2022. For both background and in-app OneStep walks the parameters jump unfavourably after surgery and then recover; HealthKit shows no such pattern (Figure 4).



Figure 4. Case 2. OneStep in-app (green), OneStep background (red) and Apple HealthKit (grey) around total hip arthroplasty.

Case 3: before and after a fall. This patient fell in late 2022 and began using OneStep afterwards; HealthKit measured gait both before and after. Before the fall HealthKit showed steady parameters in a healthy range, followed by a gap in gait data beginning about a month before the fall. After the fall, OneStep's in-app and background parameters were initially outside healthy ranges (increased double support, decreased velocity and stride length) and improved over the following two months. HealthKit's parameters did not change over those two months, stayed close to pre-fall values, and were available on only a few days (Figure 5).

© 2026 OneStep · www.onestep.co

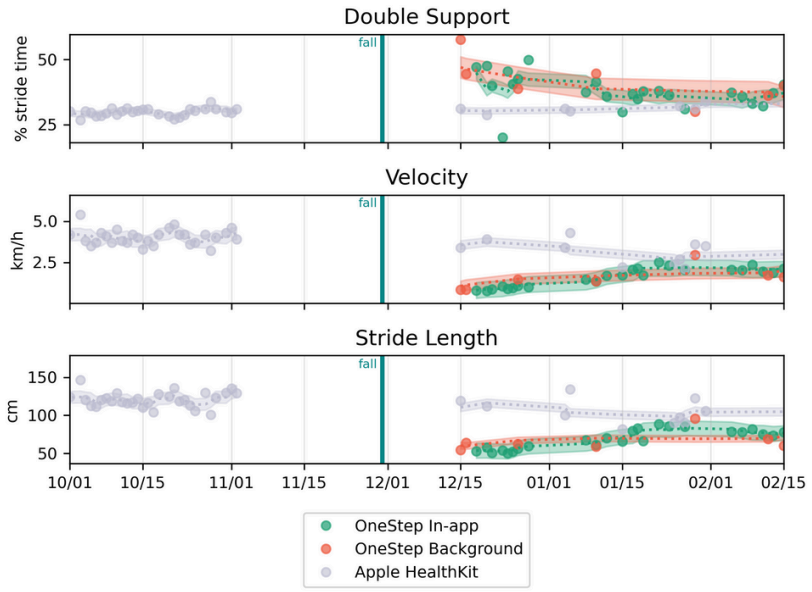


Figure 5. Case 3. OneStep in-app (green), OneStep background (red) and Apple HealthKit (grey) before and after a fall (teal line).

4 Discussion

Although both systems analyse walks from the motion of a pocketed phone, their results differ characteristically. OneStep detects a wider range of gait parameters, and correlations between the systems were low to moderate. Some variation is expected because the systems do not measure identical bouts, but the differences appear to stem from the strengths and limitations of the analysis methods themselves.

4.1 OneStep captures gait across real-world circumstances

OneStep's background analysis shows a distinct shift in values compared with HealthKit even though both record natural, unaware walking. According to text within the Apple Health app, HealthKit records gait when the user "walk[s] steadily over flat ground", while OneStep records background walks whenever it detects locomotion. OneStep's background walks therefore reflect the variety of a patient's day, whereas HealthKit selects a curated group of walks that in fact resemble OneStep's in-app walks: the patient's idealized walk.

4.2 OneStep captures values outside typical ranges

In the case studies OneStep captured gait in unhealthy ranges at the times one would expect (after surgery, after a fall), while HealthKit gave values in healthy ranges or no values at all. Both OneStep's in-app and background analyses showed the pattern, so the difference is not simply that HealthKit measures unaware gait. HealthKit's gaps could reflect patients walking less while recovering, or difficulty analysing walks far outside normal ranges. In Apple's own white paper on HealthKit's gait accuracy,[8] the design and validation datasets fall largely within the healthy range, suggesting a system designed for measuring healthy walks rather than the walks of people with gait abnormalities or after a traumatic event.

HealthKit also stopped measuring gait in the month leading up to the fall in Case 3. The patient may have stopped carrying the phone, perhaps because of pain or discomfort that contributed to the fall; the gait may have deteriorated beyond what HealthKit could analyse; or technical issues may have interrupted collection.

5 Conclusion

Both systems provide valuable information about gait. OneStep has three advantages: it captures passive data across real-world circumstances; it analyses pathological gait and parameters outside typical healthy ranges; and it runs on both iOS and Android. These make it a valuable tool for tracking and treating patients in physical therapy, recovering from surgery or adverse events, and living with diagnoses that affect gait and mobility.

© 2026 OneStep · www.onestep.co

References

1. Wren TA, Gorton GE, Ounpuu S, Tucker CA. Efficacy of clinical gait analysis: a systematic review. *Gait Posture*. 2011;34(2):149–153.
2. Ewen AM, Stewart S, St Clair Gibson A, Kashyap SN, Caplan N. Post-operative gait analysis in total hip replacement patients: a review of current literature and meta-analysis. *Gait Posture*. 2012;36(1):1–6.
3. Kwon MS, Kwon YR, Park YS, Kim JW. Comparison of gait patterns in elderly fallers and non-fallers. *Technol Health Care*. 2018;26(S1):427–436.
4. Muro-de-la-Herran A, Garcia-Zapirain B, Mendez-Zorrilla A. Gait analysis methods: an overview of wearable and non-wearable systems, highlighting clinical applications. *Sensors*. 2014;14(2):3362–3394.
5. Christensen JC, Stanley EC, Oro EG, et al. The validity and reliability of the OneStep smartphone application under various gait conditions in healthy adults with feasibility in clinical practice. *J Orthop Surg Res*. 2022;17:417.
6. Shahar RT, Agmon M. Gait analysis using accelerometry data from a single smartphone: agreement and consistency between a smartphone application and gold-standard gait analysis system. *Sensors*. 2021;21:7497.
7. Shema-Shiratzky S, Beer Y, Mor A, Elbaz E. Smartphone-based inertial sensors technology: validation of a new application to measure spatiotemporal gait metrics. *Gait Posture*. 2022;93:102–106.
8. Apple. Measuring walking quality through iPhone mobility metrics. 2022. apple.com/healthcare/docs/site/Measuring_Walking_Quality_Through_iPhone_Mobility_Metrics.pdf
9. Werner C, Hezel N, Dongus F, et al. Validity and reliability of the Apple Health app on iPhone for measuring gait parameters in children, adults, and seniors. *Sci Rep*. 2023;13:5350.

Suggested citation. OneStep Research Team. Comparing OneStep's gait analysis to Apple HealthKit. OneStep White Paper; April 2023. Available at onestep.co/resources.

© 2026 OneStep · www.onestep.co