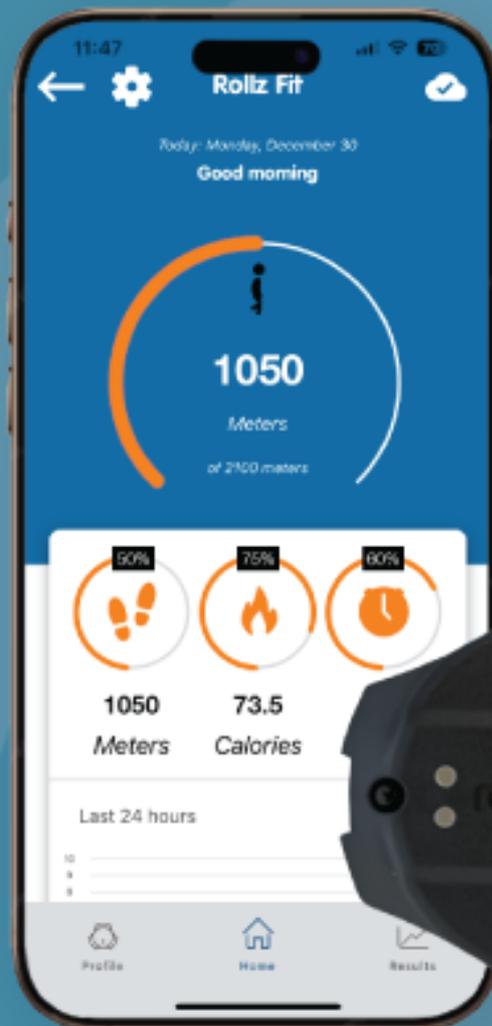


Enhancing physical activity for rollator users:

A data-driven approach for
users & healthcare providers

rollz fit



Executive summary & scope

This white paper explores how recent advancements in wearable technology have transformed the way consumers and healthcare institutions utilize data analytics to gain insights into physical activity (PA) levels for individuals and specific patient groups.

While wearable technology has proven beneficial for many users, it has practical limitations for individuals who rely on walking aids due to physical disabilities (PD). Many PD patient groups have been excluded from the health benefits of activity trackers due to design limitations that fail to accommodate their mobility needs.

This paper highlights these challenges using scientific evidence and expert user feedback. It also introduces a contemporary, rollator-specific mobile health solution designed to enhance the user experience, integrate underrepresented PD populations, and promote increased physical activity. By providing accurate data insights, this innovation aims to support better long-term health outcomes for both users and healthcare providers.

Introduction

As of 2023, an estimated 94% of adults in the UK own a smartphone. The integration of app-based technology within healthcare has steadily increased among consumer population, enabling users to seamlessly connect "smart" wearable devices to track their PA (defined as "any bodily movement produced by skeletal muscles that results in energy expenditure" - Langhammer et al., 2018). These data insights can help reduce sedentary behaviour and promote overall health maintenance.

Wearable technology empowers individuals to actively participate in self-care by promoting healthy habits and motivation (Hickmann et al., 2022). Recent estimates suggest that wearable fitness trackers will continue to see widespread adoption over the next 25 years, with total worldwide healthcare cost savings projected to exceed \$200 billion due to improved efficiency and reduced clinician-patient interaction time (Vijayan et al., 2021).

Devices such as Fitbit and Garmin have significantly enhanced our understanding of individual exercise parameters, including active minutes, calories burned, and step count. These wearables rely on inertial measurement unit (IMU) sensors, such as accelerometers, gyroscopes, and magnetometers, to track kinetic movement. Accelerometers translate motion into step counts, while gyroscopes and magnetometers measure orientation and angular movement, providing valuable data for users and healthcare professionals.



Such devices are increasingly used for healthcare monitoring, often paired with smartphone app-based technology. Estimates suggest that over 200 million wearable devices are in use worldwide, with up to 92% of smartwatch users utilizing their devices for personal health maintenance (Ruby D, 2023).

More advanced FDA-approved wearables can also monitor vital signs such as heart rate and oxygen saturation (oximetry) and detect medically significant events. Healthcare professionals can leverage this data to establish baseline measurements, enable early intervention, and improve health outcomes. These devices have proven particularly valuable for patients with epilepsy, cardiovascular conditions, and other chronic diseases (Regalia et al., 2017).

Current challenges with wearable technology for walking frame and rollator users

Individuals with long-term health conditions who rely on assistive mobility devices such as walking frames or rollators face significant challenges with wearable technology, particularly regarding data accuracy.

Walking frame users move by fixing their arms onto handlebars and pushing the aid forward, enhancing dynamic stability and balance. However, wrist-worn wearable devices often misinterpret their movement, leading to inaccurate data collection. The lack of typical arm swings may cause underreporting of distance traveled and energy expenditure, resulting in unreliable insights into physical activity.

Conversely, excessive kinetic movement, as seen in individuals with hyperkinetic disorders, can lead to overestimation of energy expenditure. For example, studies have shown that Huntington's disease patients using wearables may receive inflated calorie burn estimates due to involuntary movements (Tortelli et al., 2021).

Target groups in the consumer market: Prevalence of age- and condition-related mobility deficits and the importance of maintaining physical activity levels

The US National Institutes of Health (NIH) estimates that 11.6% of community-dwelling individuals over the age of 65 currently use a walker to assist with mobility. This number is expected to increase significantly due to the growing aging population facing age- and condition-related mobility challenges.

Reducing a sedentary lifestyle is crucial, as even brief periods of physical activity have been shown to positively impact overall health (Keadle et al., 2017).

Additionally, PA offers a multi-factorial protective benefit against chronic conditions such as cardiovascular disease, stroke, and diabetes. Improved cardio-respiratory fitness has also been linked to a delay in the onset of dementia. A recent longitudinal study of individuals aged 39-70 years, all in good health, showed that those with higher PA levels had a 35% reduced risk of developing dementia, even when considering genetic predisposition (Wang et al., 2024).

The positive effect of walking

Improves productivity



Taking regular walks revitalizes the mind, enhancing focus, creativity, and overall cognitive function.

Increases energy



Walking stimulates circulation and oxygenates the body, resulting in a revitalized and invigorated feeling.

Reduces stress



Promoting endorphins' release, movement offers a mood boost and facilitates relaxation.

The importance of improving physical activity in chronic conditions

Chronic Obstructive Pulmonary Disease (COPD) is one of the most prevalent chronic conditions in the UK and the second most common cause of emergency hospital admissions (Malnutrition Pathway, 2023). The financial burden of COPD is estimated to exceed £800 million per year (Wright A, Vioix H, de Silva S, et al., 2022).

COPD is characterized by breathlessness, fatigue, and reduced exercise tolerance, all of which contribute to a decline in physical activity levels. For many COPD patients, the use of ambulatory oxygen has been shown to improve exercise tolerance and reduce exertional dyspnoea (shortness of breath), as evidenced by improvements in the 6-minute walking test when using a walking aid (Crissafulli, 2007).

Higher physical activity levels in COPD management are linked to lower risks of hospital admission, reduced COPD-related and all-cause mortality, and improved health-related quality of life. A 2016 study on patient-centered walking programs involving 115 COPD patients found that just 60 minutes of walking per day reduced hospitalizations by 50%. Additionally, intervention groups using pedometers recorded 36% more steps than non-intervention groups, demonstrating the effectiveness of wearable technology in promoting PA (Bender, 2016).

Using accurate data to increase activity levels in paediatric patient groups

According to a 2018 WHO status report, 81% of adolescents aged 11–17 do not meet the recommended 60 minutes of moderate-to-vigorous PA per day (Lancet, 2022). Among adolescents with PD, PA levels are often even lower, with a strong correlation between reduced activity and an increased risk of unhealthy lifestyles (Jung, 2023).

Children with conditions such as cerebral palsy and spina bifida typically engage in significantly less PA than their non-disabled peers. Many rely on assistive mobility devices, such as rollators, to maintain independence and mobility. While recent studies have explored the use of Fitbit devices to track PA in ambulatory children with cerebral palsy, results indicate that wearable trackers may not be entirely feasible for children who use walking aids, as they often underestimate the distance travelled (Chugh & Alderson, 2024).

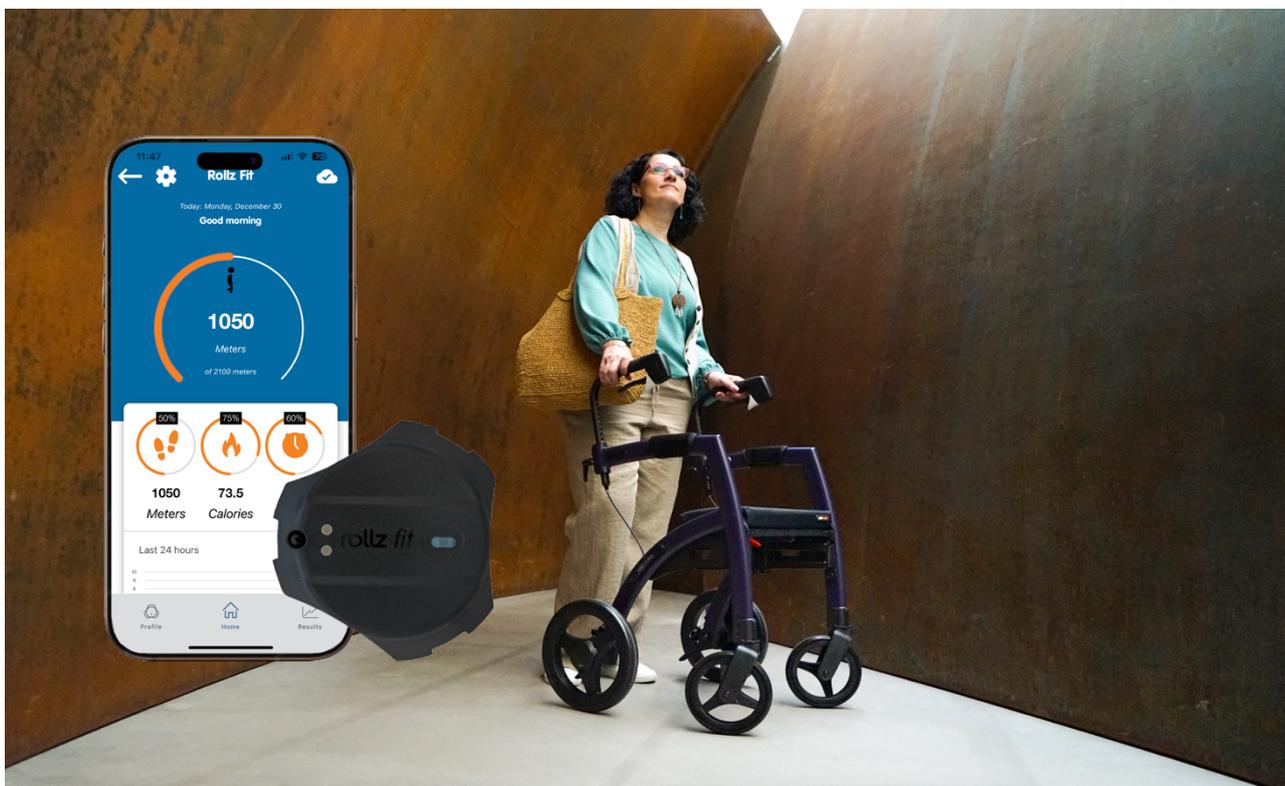
Additional research has highlighted similar data accuracy challenges due to the absence of characteristic arm swings, which motion-detecting algorithms rely on for tracking movement. Broader pilot studies in rollator users found that wrist-worn devices achieved only 10% accuracy compared to validated ground-truth data (Mathies et al., 2018).

A contemporary solution for rollator users to promote and maintain physical activity

Rollz International (The Netherlands) is renowned for designing and manufacturing innovative rollator technology that aligns with its mission: *"Everyone, regardless of disability or physical impairment, should have the opportunity to live an enriched and active lifestyle."*

For individuals requiring mobility aids, taking the first step - both figuratively and literally - can be challenging. However, increased mobility and independence significantly enhance quality of life. With [Rollz Fit](#), Rollz aims to make this progress visible to users by not only displaying the actual distance travelled but also putting it into perspective. Users can see their total distance walked compared to well-known landmarks while also receiving an estimated calorie burn calculation for added motivation.

As highlighted in this paper, current wearable technology lacks specificity for rollator users. The Rollz Fit sensor addresses this gap by providing a dedicated, rollator-mounted solution. Users can integrate the sensor with their existing Rollz Motion rollator by simply attaching it to the wheel hub. Additionally, for new Rollz Motion and Rollz Motion Performance rollators, the Rollz Fit sensor will come pre-installed as a standard feature.



Rollz Fit promotional video on Youtube

Rollz Fit accuracy

The Rollz Fit utilizes Inertial Measurement Unit (IMU) sensor technology, which incorporates Micro-Electromechanical Systems (MEMS) to detect rotation and acceleration. The IMU data is processed using an Attitude and Heading Reference System (AHRS) algorithm, which applies a complementary filter to combine acceleration and gyroscope data. This allows the system to calculate Euler angles - representing roll, pitch, and yaw - similar to how an airplane's movement is measured.

By tracking rotation over the axle of the rollator, Rollz Fit can accurately determine distance traveled. Since the wheel size and circumference are known, the system calculates distance per revolution and, consequently, total distance and speed over time. Data is stored in the Rollz Fit hardware module every 10 minutes. Users can then synchronize their device with a smartphone app, transferring the recorded data to provide real-time insights into their mobility metrics.



Wheel rotation captured



10 minutes



Live data display

To maximize battery life and functionality, Rollz Fit employs a "wake on motion" system. When not in use, the device enters sleep mode to conserve energy and automatically activates upon detecting movement.

Rollz Fit: social inclusion & positive behaviour change

Rollz Fit is designed to enhance social inclusion and promote health for individuals with physical disabilities and mobility challenges. At its core, Rollz Fit recognizes that every rollator user should have the same access to health-promoting opportunities as their non-disabled peers. Rollz aims to ensure equitable and fair access to physical activity tracking for all rollator users. The device can be used in condition-specific PA programs and incorporated by healthcare professionals into both acute and community rehabilitation settings to accurately measure improvements in activity levels.

Beyond physical benefits, staying active plays a crucial role in social engagement and mental well-being. Mobility limitations often lead to social isolation, but Rollz Fit encourages independent movement, making it easier for users to participate in community activities, social events, and daily routines with confidence. By tracking and celebrating progress, Rollz Fit empowers users to take an active role in their health and social lives, fostering a greater sense of belonging.

A meta-analysis of 41 Fitbit studies highlighted that setting activity goals is the most effective component of interventions aimed at improving healthy behaviours (Ringeval, 2020). Rollz Fit supports personalized daily goal setting, which can be easily adjusted via the Rollz app. Upon reaching their goals, users receive reward notifications, designed to motivate, encourage, and empower them to maintain an active lifestyle.

Having tools to accurately measure clients' exercise output is critical to building tailored exercise programs and progression plans to create physiological change

As Reneu Health kinesiologists with specialties in neurological disorders and physical disabilities, our mission is to help our clients achieve their highest level of health. We utilize therapeutic exercise and activity-based therapy as main interventions to produce physiological adaptation. This adaptation can come in various forms: neuroplasticity for motor learning; musculoskeletal strengthening; increased endurance; and improved emotional wellbeing, etc.

Having tools to accurately measure clients' exercise output is critical to building tailored exercise programs and progression plans to create physiological change. Typically, smart watches are the standard "go-to" tools to monitor activity production. However, they are not designed specifically for rollator users. And because many of our clientele at Reneu Health use rollators to aid their walking, it can be challenging to correctly measure and track their exercise output. The Rollz Fit is a solution to that problem.

The Rollz Fit is the world's first activity monitoring system made specifically for rollators. Reneu Health is excited to incorporate this new tool into our kinesiology practice as it presents a variety of benefits for us. First, the Rollz Fit is easy to use. With a few taps of our smartphones, we can instantly connect to the device and begin monitoring caloric output, distance traveled, and duration of activity. This quick connection is critical for us when working with our rollator users as many of them are at increased risk of falls. The quick set-up means optimal safety and time utilization for our clients.

Furthermore, the Rollz app makes it simple to read output. The mobile splash page contains all the important info we need; no scrolling involved. Our clients and staff alike can easily monitor activity with a quick glance. The metrics are useful and complete and require no additional analysis to determine outcomes. The Rollz Fit allows us to set real-time, and longer-term, goals, precisely build programs, and accurately monitor progression. This ultimately boosts client engagement and motivation and improves overall outcomes.

Additionally, the Rollz Fit's ability to accurately monitor exercise output enables us to identify clear activity patterns in our clients. We can see which days they tend to move more, what time of day is their most active, and if they are maintaining, progressing or declining in activity. These patterns help us determine when changes occur, quantify that change and, at times, provide us with early detection warnings of potential health issues. And because the Rollz Fit output reports are easy to access and share via text or email, our clients' medical teams can instantly be informed of these changes, as well.

Finally, the Rollz Fit helps to establish accountability for our rollator users, which means better compliance and follow-through when working on their own. Clients can track and report their output through the app, bolstering their exercise regimen and bettering their outcomes. Less considered, but of equal importance, the Rollz Fit can expand accountability to other care staff or care assistants of rollator users. This is a need we at Reneu Health often see in our line of work.



Many of our clientele have caregivers to assist them in their daily lives, as we work in partnership with numerous home health and caregiving agencies. Staff compliance and accountability are critical components to a complete care program. The Rollz Fit can help home health and caregiving agencies ensure their staff are implementing and following through on exercise programs prescribed to their patients.

The Rollz Fit is a simple, but effective innovation that elevates the rollator experience. It brings accuracy and clarity to our Reneu Health practice, is easily integrated into our work, and enhances our ability to provide our clients with the highest care and service possible.

Christel Mitrovich, Clinical Kinesiologist at [Reneu Health](#).

Future development

Rollz is committed to the ongoing evolution of the Rollz Fit digital program, ensuring continuous improvement for its community members. App-based digital solutions present an opportunity to create tailored exercise programs and customized content to meet the specific needs of different user groups, including condition-specific patient subsets.

A key focus for future development is the integration of social features, allowing users to:

- Share progress and results with friends or healthcare providers.
- Connect with other users for motivation, advice, and success stories.
- Engage in a supportive community, reducing social isolation and promoting shared experiences.

Rollz is also enhancing data visualization and reporting, making the Rollz Fit and Rollz app more than just measuring tools. Improved data summaries will enable more meaningful conversations between users and therapists, ensuring that personalized PA programs are data-informed and outcome-driven.

In addition, UK-based feasibility studies are currently in development and will begin reporting in Q1 2025. These studies will focus on neurorehabilitation user groups, encompassing both adolescent and adult populations, to evaluate how rollator users can benefit from personalized interventions. This research will further demonstrate the potential of Rollz Fit in enhancing physical activity inclusion and intelligent data-driven healthcare solutions.

Privacy and data security

Ensuring data security and privacy is a top priority when designing hardware and software that handle individual data informatics. In Europe, Rollz complies with the General Data Protection Regulation (GDPR), which classifies fitness tracker data as sensitive health information requiring strict protection.

To protect the data of Rollz product users, compliance is ensured as the Rollz Fit and accompanying Rollz app are designed to anonymize user data before being shared. Within GDPR, the primary focus is the protection of personal data, but anonymized or aggregated data is not classified as personal data since it cannot be used to identify an individual. Therefore, all user-generated data is anonymized and will remain so, which is fundamental to the use case.

Like most apps, the Rollz app must function properly, and potential crashes or errors must be addressed swiftly. To achieve this, app performance metrics and some user information are collected to improve user experience and enhance the overall functionality of the app.

Users have full control over their data and can choose whether to connect to the Rollz Fit and view their results. Only when opted in is anonymized data collected to generate overall usage statistics. For instance, on www.rollz.com, a combined, anonymized figure representing the total distance walked by all users is displayed.



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