



# Technological Devices as an Opportunity for People with Parkinson

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**Abstract.** The incidence of dementia in developed countries has been incessantly growing. Apart from new medication and medical equipment, a lot of effort is placed on developing modern information technologies. This contribution aims to analyse the areas of current research aimed at technologies supporting those suffering from Parkinson's disease, which is worldwide the second most common type of dementia. Then, it will be specified in what areas modern technologies may help improve care for patients with Parkinson's. The method to conduct this study was literature review of accessible sources in PubMed, Scopus, Web of Science and ScienceDirect databases. The results showed that technologies are beneficial for patients with Parkinson's disease in these areas: better personal health and quality of life; ability to better manage own health; receiving faster and more frequent feedback about one's health; and saving time of caregivers.

**Keywords:** Technology · Mobile application · Parkinson disease  
Medical device

## 1 Introduction

Parkinson's disease is one of the most common neurological disorders affecting 60-plus-year-old people. However, rare forms of this disease may develop even before 40 years of age [1]. The risk of developing Parkinson's disease increases with age. As more people reach senior age, the incidence of Parkinson's disease is higher, too [2].

Although pharmacological treatment significantly influences symptoms of the disease, they do not restore lost motor skills. Therefore, treatment includes adjusting daily routines and treatment of gait-related problems. Modern technologies may further improve the state of PD patients. Current assistive technology products involve devices that address specific needs, such as "wayfinding", social interaction, memory support and health management, but to be truly beneficial for dementia sufferers they need to work together in an intelligent way [3]. Technology development is also supported by the fact that 85% would want to stay living in their home if diagnosed with dementia, which would be impossible without either personal assistance or intelligent systems.

This contribution aims to analyse the areas of current research focusing on technologies supporting PD patients and specifies what areas of development may benefit PD patients.

## 2 Methods

For the purpose of this study a method of literature review of available sources describing current modern information technologies and their role in the stages of Parkinson's disease was used. The authors worked with databases like PubMed, ScienceDirect, Web of Science and Scopus, where they reviewed original studies linked to their topic on the basis of the keywords "Parkinson's disease AND technology", "Parkinson's disease AND wearables", "Parkinson's disease AND Mobile technology" in the period from 2010 to 2016. First, all duplicities were eliminated. Many results were focused too widely and they were connected with the use of modern technologies in healthcare. In addition, they were connected with different types of dementia or, on the contrary, the articles concentrated exclusively on Parkinson's disease and the issue of technologies was solved only marginally. Therefore, the authors examined only those research studies which were closely connected with the explored topic. The total number of used sources corresponding with these criteria was 21.

## 3 Results and Discussion

Table 1 explores the randomized clinical studies which examine the use and effectiveness of technological devices in the care or treatment of Parkinson's disease. Although the findings from Table 1 are short-term with a small size of subjects, they show that technologies might be beneficial for patients with Parkinson's disease:

- better personal health and quality of life;
- ability to better manage own health;
- receiving faster and more frequent feedback about one's health;
- and saving time of caregivers [3].

The use of these applications should respect the patient's technological knowledge and skills. It remains to be solved how to ensure safety of mobile medical applications, allay fears about the abuse of collected data, and improve interoperability of accessible solutions. There are also problems like:

- protecting and treating sensitive information;
- burden of application;
- impact on clinical care;
- and negative impact on health, reminded cloud cause exacerbation.

**Table 1.** The use of technological devices in the care or treatment of Parkinson's disease

Study	Subjects, method	Technology	Benefits/limitations
Feasibility and effects of home-based smartphone-delivered automated feedback training for gait in people with Parkinson's disease: a pilot randomized controlled trial [4]	N = 40, training for 30 min, three times per week for six weeks	Inertial measurement units combined with a smartphone application (CuPiD-system) to provide real-time feedback on gait performance	Study describes, that this technology is an effective approach to promote gait training. This benefit may be ascribed to the real-time feedback, stimulating corrective actions and promoting self-efficacy to achieve optimal performance. Further optimization of the system and determining of cost-effectiveness is needed
How well do Parkinson's disease patients turn in bed? Quantitative analysis of nocturnal hypokinesia using multisite wearable inertial sensors [5]	N = 19, one night at their homes	Multisite inertial sensors to compare nocturnal movements of PD patients	Study showed that PD patients significantly had fewer rolling over, turned with smaller degree, less velocity, and acceleration, but had more episodes of getting out of bed. For effective treatment strategy should be done a comprehensive review of both day- and nighttime symptoms
Analyzing activity behavior and movement in a naturalistic environment using smart home techniques [6]	N = 84, machine learning techniques	Smart home and wearable sensors to collect data about the impact of different medical conditions on daily behavior	Machine learning techniques describes differences between healthy older adults and adults with Parkinson disease. It was confirmed that these differences can be automatically recognized
E-health support in people with Parkinson's disease with smart glasses: a survey of user requirements and expectations in the Netherlands [7]	N = 62, 11 months Survey about the requirements, constraints, and attitudes of people with PD to this new technology	Smart glasses	Study confirmed that smart glasses are new therapeutic and monitoring possibility which is well adopted, especially by younger people with PD
Wearability assessment of a wearable system for Parkinson's disease remote monitoring based on a body area network of sensors [8]	N = 32, the compliance of a telehealth system for the remote monitoring of Parkinson's disease (PD) patients	Telehealth system for the remote monitoring of Parkinson's disease (PD) patients. This system, called PERFORM, is based on a Body Area Network	The test results showed that the acceptance of this system is satisfactory with all the levels of effect on each component scoring in the lowest ranges

*(continued)*

**Table 1.** (continued)

Study	Subjects, method	Technology	Benefits/limitations
		(BAN) of sensors which has already been validated both from the technical and clinical point for view	
A wearable proprioceptive stabilizer (Equistasi®) for rehabilitation of postural instability in Parkinson’s disease: a phase II randomized double-blind, double-dummy, controlled study [9]	N = 40 (two groups 20 and 20), two months	Wearable proprioceptive stabilizer (Equistasi) that emits focal mechanical vibrations in patients with PD	The potential to be more effectiveness to be superior than rehabilitation alone in improving patients’ balance. Small sample
Mobile apps for the treatment of depression [10]	Veterans aged 18 and older, Time Frame: Week 1, Week 4, Week 8	Mood Coach app - Behavioral activation plus mobile app - offer the opportunity for real-time tracking of behavior and have the ability to provide prompt feedback and reminders	Greater adherence to the BA treatment compared to the standard BA condition Greater satisfaction with the app compared to the standard BA protocol that utilizes paper and pencil materials

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