

Review

Delivery of Allied Health Therapies to People with Parkinson's Disease in Africa

Roberto Cilia^{a,*}, Marieke C.J. Dekker^b, Esther Cubo^c and Mary W. Agoriwo^{d,e}

^a*Fondazione IRCCS Istituto Neurologico Carlo Besta, Department of Clinical Neurosciences, Parkinson and Movement Disorders Unit, Milan, Italy*

^b*Department of Medicine and Pediatrics, Kilimanjaro Christian Medical Centre, Moshi, Tanzania*

^c*Neurology Department, Hospital Universitario Burgos, Burgos, Spain*

^d*Department of Physiotherapy and Rehabilitation Sciences, University of Health and Allied Sciences, Ho, Ghana*

^e*Division of Physiotherapy, Stellenbosch University, Cape Town, South Africa*

Accepted 30 October 2023

Abstract. Allied health therapies refer to a range of healthcare professionals, including physiotherapists, occupational and speech-language therapists, who aim to optimize daily function and quality of life in conjunction with medical care. In this narrative review of literature on allied health therapies in people with Parkinson's disease (PD), we focused on the diversity in healthcare access, state of the art, current challenges in the African continent, and proposed solutions and future perspectives. Despite the increasing prevalence and awareness of PD in Africa, numerous challenges persist in its management. These include resource limitations, geographical barriers, sociocultural beliefs, and economic constraints. Nevertheless, innovative solutions, including telerehabilitation and community-based rehabilitation, offer hope. Collaborative efforts within the continent and internationally have shown potential in bridging training and resource gaps. Significant strides can be made with tailored interventions, technological advancements, and multifaceted collaborations. This review offers practical insights for healthcare professionals, policymakers, and caregivers to navigate and optimize PD care in the African context.

Keywords: Parkinson's disease, Africa, allied health therapies, rehabilitation, telemedicine

ALLIED HEALTH THERAPIES IN THE MANAGEMENT OF PARKINSON'S DISEASE

Parkinson's disease (PD) is a progressive neurodegenerative disorder characterized by motor and non-motor symptoms, ranking as the second most widespread neurodegenerative condition and stands out as the fastest escalating neurological disorder worldwide in terms of prevalence [1, 2]. This surge is

driven by a combination of factors, including a rise in life expectancy, the impact of industrialization, environmental influences (such as exposure to pesticides, air pollution, and solvents), and genetic predispositions [1]. Hallmark motor symptoms include rest tremor, rigidity, and bradykinesia; as PD progresses, additional motor symptoms and signs increase patient disability due to limited improvement with pharmacological therapy, such as speech and swallowing difficulties, freezing of gait, postural stability, and falls. Concerning non-motor symptoms, patients may develop cognitive impairment, mood and behavioral disorders, sleep disturbances, and autonomic system dysregulation [1]. The complexity of the disease,

*Correspondence to: Roberto Cilia, Fondazione IRCCS Istituto Neurologico Carlo Besta, Parkinson and Movement Disorders Unit, via Celoria 11, 20133, Milan, Italy. Tel.: +39 0223942552; E-mail: roberto.cilia@istituto-besta.it.

combined with limited treatment options, constitutes an enormous challenge in the management of patients and heightens the burden on caregivers [3], and this is greatly magnified in low-to-middle-income countries. Therefore, managing PD necessitates a holistic multidisciplinary approach that extends beyond pharmacotherapy to encompass a range of allied health therapies, including cultural understanding between patient and caregiver [4].

The trio of physiotherapy (PT), occupational therapy (OT), and speech-language therapy (SLT) is essential for tackling the diverse and intricate symptoms presented by PD [4]. Nutritionists, PD nurse specialists, social workers, and recreational therapists play an essential role and are valuable members of the allied health team. Their integration is not just about managing symptoms but about enhancing overall well-being and functionality.

These allied health therapies target various aspects of PD:

Physiotherapy focuses on movement strategies, balance training, and muscle strengthening to address bradykinesia, rigidity, and postural instability [5, 6]. Regular physiotherapy can enhance mobility, strength, and balance in people with PD. Professionals specializing in PT who employ treadmill training, stationary bicycle training, or multimodal exercises can minimize the hazards associated with PD complications and expenses compared to treatment by more general therapists [5, 6]. Initiating PT proactively at an early stage enhances the quality of life and alleviates the burden on caregivers [7, 8]. Higher baseline levels of physical activity improve outcomes in various neurological disorders, including PD [9].

Emerging evidence suggests that well-coordinated, multidisciplinary teams that offer comprehensive symptom management could best meet the newly established quality outcome indicators by the American Academy of Neurology for individuals with PD [10]. Over recent years, several guidelines and clinical consensus documents related to PD care have been published, outlining instructions for rehabilitation assessment, treatment, outcome measurement, and recommendations for forming multidisciplinary care teams [11–13]. The development of easily accessible education, training, and needs assessment tools is becoming increasingly vital. These tools might enhance rehabilitation literacy among family members and people with PD, particularly in the current healthcare landscape, where fast-paced policy and funding changes enable direct access to rehabilitation services [8].

The use of devices assisting clinicians and physiotherapists has been increasingly adopted in clinical settings in Africa [14]. In a recent study conducted in an outpatient physiotherapy department in Ghana, a device was used to measure muscle rigidity by calculating various parameters simultaneously (including non-neural tone, stiffness, and elasticity) of three muscles (biceps brachii, flexor carpi radialis, and tibialis anterior) in 30 patients with PD, demonstrating the feasibility of using technology in a clinical setting in Sub-Saharan Africa (SSA) [14].

Occupational therapy helps individuals maintain their daily living activities and independence despite their motor limitations. Occupational therapists play a pivotal role in PD care by tailoring interventions to enhance patients' daily activities. The efficacy of occupational therapy for PD has been convincingly demonstrated in a randomized controlled trial [15]. Specialized OT professionals evaluate safety within the home and workplace for individuals with PD [6, 15]. They also offer internal and external cueing methods to enhance postural stability and movement, enabling better self-management and independence in performing daily household tasks. This, in turn, contributes to improved motor skills, daily living activities, and overall quality of life for those with PD. Specialized OT paired with specialized PT has been recently demonstrated to be linked to a reduced incidence of PD-related complications, suggesting a possible synergistic effect between these two expert disciplines [6]. No specific studies on OT care in PD in SSA are available and OT availability is severely limited [16].

Speech and language therapy assists with speech and swallowing difficulties commonly seen in PD [1, 4]. Dysarthria and dysphagia often show limited improvement with pharmacotherapy but may benefit from specialized SLT interventions, including focused training on voice and swallowing [4]. Dysphagia greatly increases the risk of aspiration pneumonia. A Consensus panel recently reviewed the evidence and supported a multidisciplinary treatment of dysphagia in PD, involving speech-language therapists, neurologists, otorhinolaryngologists, gastroenterologists, phoniaticians, and clinical nutritionists [17]. Talebi and colleagues uncovered substantial evidence supporting the effectiveness of specialized SLT in reducing the incidence of pneumonia [6]. Eleven randomized clinical trials have been published in PD complicated by dysphagia, demonstrating the effectiveness of standard SLT, expiratory muscle strength training, sensorimo-

tor training for airway protection, and video-assisted swallowing therapy [18, 19]. No specific studies on SLT in PD in SSA are available but a survey confirms severely limited availability [16].

Nutritional counseling addresses weight loss and malnutrition in PD, providing dietary recommendations for symptom management. Adjusting the diet can help manage PD symptoms and medication side effects. Taking care of the dietary habits and nutrient intake in PD improves the pharmacokinetics of levodopa. It significantly reduces the need for daily levodopa in subjects following a protein-redistribution diet, improving the management of motor and non-motor symptoms, especially at advanced PD stages [20, 21].

A significant portion of the current literature draws on data gathered before the latest quality standards set by the American Academy of Neurology and the National Institute for Health and Care Excellence guidelines, which endorse yearly evaluations of rehabilitation necessities for those with PD [13]. Notably, there is supporting evidence for integrated allied health strategies in PD care [4]. These treatments are pivotal in mitigating symptom progression, preserving autonomy in daily functions, and elevating the patient's overall quality of life [4]. Several studies suggest the potential under use of these services in PD, even in high-income countries [3, 8, 22]. A holistic approach ensures that people with PD receive comprehensive care, addressing both motor and non-motor disabilities of PD. As the disease progresses, the need for allied health interventions becomes more and more pronounced, making them an indispensable part of global PD management.

OVERVIEW OF PARKINSON'S DISEASE IN AFRICA

Africa's population is not only expanding but also ageing at a rate faster than any other region in the world [23]. In addition, infectious diseases that used to rampage SSA countries, such as malaria and respiratory and gastrointestinal infections, have been increasingly better controlled due to improved nutrition, sanitation, and childhood vaccination programs. This dual growth trend and ageing has an indirect consequence: an escalating burden of non-communicable, age-related neurological disorders, such as PD [24]. It is important to emphasize that resources for healthcare and access to specialized neurological care and treatments vary widely

across Africa; these health disparities can adversely affect individual disability. Northern African countries (such as Egypt, Tunisia, and Morocco) and the Republic of South Africa have more health insurance coverage and access to quality healthcare for their citizens than the SSA countries, which comprise most of the continent (46 of the 55 African countries). Information regarding the diagnosis, pharmacological and non-pharmacological treatment, economic burden, and personal experiences of people with PD is noticeably lacking from an African standpoint [25]. Based on community prevalence studies, the PD treatment gap in SSA is estimated to be greater than 75% [26]. Therefore, the challenge in Africa is exacerbated by a dearth of appropriate neurological workforces, rehabilitation, and treatment, making daily life difficult for people with PD [27]. This is further compounded by a low coverage of healthcare insurance, which in many SSA countries is below 10%. The reality of sustainable medication is grim, as it remains largely out of reach and unaffordable across the continent [27]. The economics of scarcity with few suppliers monopolizing the market further adds to unaffordable prices for patients in SSA, who may earn up to a few US dollars a day only, than for patients in the Global North whose incomes may be manifold higher. However, there is a silver lining: research into alternative sources of levodopa in low-to-middle-income countries, such as *Mucuna Pruriens*, has produced promising outcomes [28, 29].

With its unique sociocultural and economic landscape, PD management presents distinctive challenges in Africa. Within the African continent, non-pharmacological allied health therapy delivery faces numerous challenges, from resource constraints to cultural factors. The role of allied health therapies in this management cannot be underestimated. This review takes an in-depth look into the state, challenges, and innovative solutions concerning the delivery of allied health therapies for PD in Africa.

CURRENT STATE OF ALLIED HEALTH THERAPIES FOR PD IN AFRICA

PD care and access to allied health therapies

The observed lower prevalence of PD in SSA could be attributed to inconsistencies in study methodologies and to the smaller percentage of individuals over 65 in the SSA demographic compared to wealthier

countries. A substantial role is still played by the low social recognition of the condition and the limited access to healthcare leading to the under-diagnosis of PD, especially if typical symptoms of the disease are misidentified as normal signs of ageing [26, 30]. Most patients in SSA with PD do not have access to PD medication due to unavailability or, where available, financial constraints [26, 27, 30]. Even when a diagnosis of PD is made, patients frequently face significant obstacles. A recent international survey involving neurologists and physicians with a special interest in PD throughout Africa examined various facets of PD treatment, such as availability, affordability, usage frequency, and insurance coverage of therapies (including pharmacological, surgical, physiotherapy, and speech therapy) and services like specialized clinics, specialists, and nursing care [27]. This survey confirmed that the accessibility and affordability of PD therapies and services are largely lacking across most regions of Africa, with noticeable regional differences in access (most accessible in Northern and Southern Africa, less so in the rest of SSA) and variations even within individual countries, as previously reported [27]. This observed trend corresponds with findings from recent Global Burden of Disease studies that show a strong relationship between development status and health outcomes, with more developed health systems in middle-to-high-income countries providing better access [2]. This research was consistent with the World Health Organization's (WHO) report, which noted that the availability of antiparkinsonian drugs in primary health care was lowest in Africa at 12.5%, in stark contrast to the Americas (57.1%), Eastern Mediterranean (73.7%), Europe (79.1%), Southeast Asia (33.3%), and the Western Pacific (44.4%). A subsequent report in 2017 indicated an improvement to 22% in Africa, although this figure still trails other regions [31].

Healthcare providers

Another major concern is the severe shortage of medical specialists, including neurologists, neurosurgeons, PD nurses, and other healthcare providers, such as physiotherapists, speech therapists, and occupational therapists, who are integral to caring for patients with PD [27, 32].

Neurologists The scarcity of neurologists and specialists in movement disorders has created challenges in accurately diagnosing and treating patients with

PD in SSA [27, 30, 32]. Data documented in the WHO Atlas of Country Resources for neurological disorders revealed a marked disparity in the availability of neurologists, with only 0.03 neurologists per 100,000 population in SSA, compared to 0.07 in Southeast Asia and 4.84 per 100,000 population in Europe [31, 33]. A recent survey showed that specialized PD and movement disorders clinics were absent in 77% of the African countries examined [27]. In terms of medical care, neurologists were the primary treating physicians for PD in 75% of the countries, followed by general practitioners in 14%, internists in 4%, and traditional healers in 7% [27].

PD nurse specialists (PDNS) PDNS are crucial in the shifting and sharing of tasks in managing PD, contributing significantly to easing the care burden of clinicians. Besides providing emotional and psychological support to patients and their caregivers, the PDNS may assess and monitor motor and non-motor symptoms. In several regions, including both low- and high-income countries, nurses are granted the authority to prescribe medications and play a pivotal role in maintaining continuity of care for chronic diseases by coordinating care between patients, primary and secondary care providers [34]. In Africa, PDNS may function as independent prescribers, filling the gap left by the shortage of neurologists. Therefore, we advocate for adequate training for nurses in Africa by movement disorders specialists, aiming to promote task shifting between neurologists and PDNS: once the diagnosis is made and appropriate pharmacological therapy is set, trained PDNS may facilitate adherence to complex drug regimens, provide long-term management, and make therapy adjustments [34]. Unfortunately, Africa suffers from a scarcity of neurology nurses, including PD nurses. Data from WHO in 2006 revealed that SSA had no neurology nurses, a stark contrast to the figures in other regions (0.005 in Southeast Asia, 0.13 in the Eastern Mediterranean, 0.14 in the Americas, 0.32 in the Western Pacific, and 2.43 in Europe per 100,000 population), according to the WHO Atlas [31]. Since then, there have been positive developments, but the dearth remains. The survey conducted by Hamid and colleagues emphasized the disparity, indicating that specialized clinics and nurses were consistently available in 7/28 (25%) and 2/28 (1%) of African countries, respectively, and completely unavailable in 82% of countries [27].

Physiotherapists No studies have focused on PT and OT's regional availability or benefits for individuals with PD in Africa. Physical exercise improves functional outcomes in PD, irrespective of the disease stage [9]. The overall level of physical activity for African individuals living in the country is high, given that most rural dwelling Africans are subsistence farmers who rely on their agricultural activities for food. Due to a lack of resources, such activities are rarely aided by motorized equipment. Urbanization in various parts of Africa is soaring, rendering increasingly large parts of the population physically less active. The largely rural setting of SSA favors physical exercise in people with PD but may be overtaken by increasing wealth and a sedentary lifestyle due to urbanization, ironically approximating needs and goals for PD physiotherapy across the globe.

General physiotherapy (not specific to PD) is consistently available in most African countries (82%) and sometimes prescribed in 52% of countries where the service exists. However, specific PD physiotherapy programs are completely lacking in about 61% of African countries [27]. These data are consistent with the WHO data, reporting that neuro-rehabilitation services could be found in 81% of African countries [32]. The comparison between the recent survey by Hamid and colleagues [27] and previous WHO data [33] highlights that there has been little progress over the past 15 years.

Occupational therapists Recent estimates show that general and PD-specific occupational therapy are available in 25% and 3.6% of countries, respectively [27]. Active OT services are registered in several African countries, including Botswana, Kenya, Malawi, Mauritius, Namibia, Nigeria, Rwanda, South Africa, Tanzania, Uganda, and Zimbabwe [32].

Speech-language therapists General speech therapy is consistently available in approximately half of African countries, whereas it is completely not available in 11% of countries; on the other hand, specific PD speech programs are available only in 4% of countries [27]. This is in line with a previous search for SLT services in SAA performed in 2016 [32], reporting that SLT services were available in Kenya, Rwanda, Tanzania, and Uganda in East Africa and in Cote d'Ivoire, Ghana, Nigeria, Senegal, and Togo in West Africa. In contrast, no SLT services had been registered in the following countries: Burundi,

Burkina Faso, Cape Verde, Gambia, Guinea, Guinea Bissau, Liberia, Mali, Niger, and Sierra Leone.

Cognitive behavioral therapists Neuropsychiatric symptoms in PD are frequently treated with medications such as benzodiazepines, antidepressants, and neuroleptics. However, these drugs are frequently associated with undesirable side effects adding to the neuropsychiatric burden. Examples are reduced cognitive function, balance problems, and sedation, which may increase the risk of falls [35]. On the other hand, the availability and affordability of such medications is limited in Africa [27]. Cognitive behavioral therapy (CBT) is the most commonly used psychotherapy for anxiety in the general population [36]. In PD, CBT has been proven effective for the treatment of depression, anxiety, as well as impulse control disorders [37]. In Africa, there are few reports about the use of CBT in the context of ongoing violence, nurse-delivered CBT intervention for adherence and depression in HIV [38, 39]. To our knowledge, the feasibility and efficacy of mental health interventions have not been formally tested in PD in Africa so far. Although CBT has a lower priority as compared to physiotherapy, occupational therapy, and speech and language therapy, it is a promising non-pharmacological approach that deserves *ad hoc* randomized clinical trials that need to address several challenges, such as the sustainability of long-term providers and specific culturally tailored interventions.

Telemedicine

Considering the limited availability of health-care professionals, telemedicine may stand out as a promising avenue for improving specialized management of PD in Africa [40]. Telemedicine presents numerous potential advantages, such as expanding the reach of medical practice and reducing travel time and costs for both patients and clinicians. Furthermore, tele-education can decrease academic isolation, time, costs, and visa and other legal requirements for traveling, facilitating the improvement and updating of professional skills and networking. In this regard, a Grade B evidence-based recommendation supports healthcare tele-education [41]. In addition to traditional peer-reviewed journals, meetings, and congresses, most of them offer hybrid access (in-person and online). Social media represents a growing tool for reaching medical information and collaboration worldwide. For example, in a sur-

vey exploring the use of technology in healthcare in South Africa, nursing students showed positive attitudes towards eHealth and technology, especially social media [42]. It also enhances educational and continuous medical training opportunities for healthcare providers and provides both individual and group education about neurological diseases. Telemedicine has proven to be effective in bridging the urban-rural divide in access to specialized neurology services and delivering healthcare to people with PD, particularly in areas lacking adequate services. Typical methods for delivering telemedicine include real-time video conferencing systems (synchronous) or store-and-forward systems (asynchronous). This model could be adapted, refined, and culturally tailored to meet the unique needs of Africa. Telemedicine is a promising tool for improving PD management in SSA due to the incredible growth in telecommunication infrastructure over the past twenty years. Indeed, internet services and mobile phone usage have reportedly reached around 75% of adults, with approximately 35% owning smartphones [40]. In a recent survey conducted in 28 African countries, asynchronous telemedicine was unavailable in 50% and always or intermittently available in 25% and 21% of the countries, respectively [27]. Synchronous telemedicine was consistently available in just two countries, while 17 countries (61%) had no access to it [27]. Telemedicine aiming to manage PD is a promising tool still underutilized in Africa. Concomitant caveats are the issues of patient privacy and confidentiality as well as a sociocultural taboo on movement disorders, which may stop a patient or their caregiver (often a junior in the household with an inherent respect for elders) from video recording symptoms and sharing them.

Telemedicine may also be applied to implement specialized education and training for clinicians and allied health professionals in low-to-middle-income countries, as demonstrated by the successful tele-education PD program for healthcare providers developed by Cubo and colleagues in Cameroon [43].

CHALLENGES FACED IN DELIVERING ALLIED HEALTH THERAPIES ACROSS THE AFRICAN CONTINENT

The delivery and state of allied health therapies for PD in Africa are impacted by a combination of factors, including the absence of insurance coverage for health services in many African countries, infras-

structural limitations, sociocultural dynamics, and the sheer geographical vastness of the continent.

Resource limitations

There is a shortage of trained allied health professionals across the African continent [27, 32]. There may be fewer than one neurologist per one million people in some regions, making access to multidisciplinary care a luxury for many. Despite the global recognition of the importance of allied health therapies in Africa, SSA struggles with a shortage of specialists [26, 27, 30, 32]. The limited numbers of physiotherapists, occupational therapists, and speech therapists means many patients with PD cannot access the multidisciplinary care they require [27, 32].

Training and workforce development

The scarcity of training programs and continuing professional development opportunities limit Africa's allied health workforce's growth. The shortage is not just in numbers but also in specialized training. Moreover, the rapid advancements in PD care mean that continuous professional development is paramount—a rare amenity in many African countries. To fill this gap, the International Parkinson and Movement Disorders Society (MDS) promoted educational courses for nurses and allied health professionals for PD in Africa [44]. The first ever PD nurse training program in SSA was held in Tanzania in December 2012. Subsequent courses have been held in Anglophone West Africa (in conjunction with a neurology training course for non-neurologists, Ghana in 2013) [45, 46], Southern Africa (South Africa in 2014), Eastern Africa (Ethiopia in 2016 and Tanzania in 2021) [44]. The primary purpose of these courses was to improve the nursing and allied health management of PD. These courses featured relevant topics, including local availability and sustainability of pharmacological and non-pharmacological therapies, and setting up PD patient support groups in SSA. The role of PD Nurses and the multidisciplinary team approach in managing PD and related conditions were emphasized, making these courses ideal for nurses in the field of neurology, physiotherapists, and occupational therapists. The most recent allied health professional training by the MDS is the *Train the Trainer Pilot Program* (MDS-TTP), which provided training for selected allied health professionals who offered training to allied health professionals in

their various countries in their local languages [47]. In the MDS African section, six allied health professionals and two neurologists from Cameroon, Egypt, Ghana, Kenya, Nigeria, South Africa, and Tanzania were offered training in rehabilitation for PD over eleven months via virtual meetings and 2-days in-person hands-on sessions in Tunisia, December 2022. Trainers were equipped with theoretical and practical skills in PT, OT, SLT, and nursing strategies for PD management and were tasked to provide local training for their colleague professionals at their local institutions. Such training opportunities are needed to facilitate peer training and skills transfer among health professionals [47].

Geographical barriers and infrastructure

Africa's health infrastructure is heavily centralized in urban areas. This urban focus leaves rural patients with PD underserved and often reliant on makeshift solutions. Vast distances and poor infrastructure can prevent individuals from accessing therapy centers. Though urban centers might have specialized clinics, the vast terrains and remote living conditions in rural regions often mean that many patients must travel long distances, sometimes for days, to receive adequate care [26, 30]. The disparity in medical technology further exacerbates the treatment gap. An acute lack of well-equipped rehabilitation centers leads to service delivery challenges. Beyond human resources, physical infrastructure is equally wanting. Modern equipment and technologies suitable for PD care, such as robotics, virtual reality, body weight-supported treadmill systems, or speech labs, are scarce [27] but will become increasingly available and affordable for SSA individuals.

Economic challenges, healthcare policies, and funding

Limited government funding for neurological conditions means the bulk of the financial responsibility falls on patients and their families. High out-of-pocket costs can make therapies inaccessible, even when they are available. Even when therapies are available, the cost remains prohibitive for many. With most of the population relying on out-of-pocket health expenditures, many forego essential treatments due to financial constraints. The cost of allied health therapies, especially in private settings, can be prohibitive for many African families. Coupled with limited public healthcare funding for

non-communicable diseases, this has resulted in a sizeable patient population missing essential therapies. Moreover, health policies often prioritize infectious diseases over non-communicable diseases, leaving conditions like PD on the back burner [26, 27, 30].

Research

There is a significant gap in context-specific research on the efficacy of various therapies for PD in Africa. For the various reasons mentioned above, inevitably Africa is still grossly under-represented in global health research although positive developments are taking place with more appreciation and awareness for the huge body of evidence awaiting research in African populations. Without local research, interventions may not be tailored to local needs, making them less effective [25].

Sociocultural factors

Cultural beliefs about disease etiology and healing practices may impact the acceptance of modern medical and therapeutic interventions. In many African cultures, diseases like PD might be attributed to the normal ageing process, spiritual or ancestral causes [48]. As a result, traditional healers may be the first or sole point of call rather than medical professionals. This deeply-rooted belief system in some SSA countries can delay or stop the pathway towards the correct diagnosis and thus impact the acceptance and consistency of therapeutic interventions, including medical and allied health therapies.

INNOVATIVE SOLUTIONS AND INITIATIVES

Research and clinical advancement

To address these challenges, collaborative studies with uniform methodologies and staff having analogous training could pave the way for data collection. Such data can facilitate comparisons of PD prevalence rates across diverse populations. Furthermore, creating minimum consensus management guidelines could enhance care consistency and quality. International support is urgently needed to foster public awareness of neurological diseases, train healthcare workers, provide affordable medications, and develop facilities for PD treatment and monitoring in the affected region. This assistance could be

a critical step in improving the overall management and well-being of patients with PD in these areas.

Context-specific research can inform best practices for therapy delivery tailored to the African context [24]. Further research is needed to explore the economic viability of specialized allied health therapies in low-to-middle-income nations where pharmacological treatment resources are restricted. This research should focus on the potential advantages of allied health therapies, specifically, specialized PT and OT, on functional outcome indicators like non-medical aids or institutionalization. Such investigation could reveal further preventative effects on complications that are more effectively addressed through allied health interventions. Another essential step will be investigating multidisciplinary programs, including specialized allied health therapies delivered by multiple disciplines, with greater integration across therapists. This will promote the establishment of specialized centers of excellence to act as hubs for comprehensive multidisciplinary care in the territory. Taken it as a whole, these data would increase specialized training programs and awareness on non-pharmacological approaches, including specialized allied health therapies for a wide PD population in Africa. Additionally, a focus on PD-specific training at both the undergraduate and postgraduate levels is vital in equipping professionals with basic and advanced knowledge, respectively, in managing persons with PD. While the authors acknowledge the scarcity of experts to teach on such courses in Africa, training institutions and various allied health professional associations are encouraged to take advantage of online and in-person course opportunities such as the MDS outreach education programs. The program includes the developing world education program (DWEP), train the trainer, visiting and virtual professor, and ambassador programs, providing financial, technical, and human resources for training.

Lifestyle interventions

Lifestyle interventions and non-pharmacological therapies offer a promising avenue for preventing the progression from prodromal to manifest PD [49]. In low socioeconomic regions, home-based lifestyle trials can be effective without the need for expensive exercise equipment for physiotherapy. In one recent randomized clinical trial, the authors administered a physical activity and dietary intervention using goal setting and education about healthy lifestyles while remotely available therapists provided support

and applied motivational interviewing to improve motivation and adherence. With only one baseline and one follow-up center visit at six months, this improved cardiovascular risk factors in rural adults [50]. For optimal health benefit, it is recommended for adults to accumulate at least 150 min of moderate-intensity physical activity per week [51]. However, within the Middle East and North Africa region, it is estimated that about 49% of adults and 75% of the youth population are not sufficiently active to meet the recommended international guidelines for physical activity [52]. Due to skyrocketing urbanization, the current living environment in several low-to-middle-income countries is characterized by increased availability of unhealthy food combined with a lifestyle requiring low levels of physical activity, promoting high energy intake, and low energy expenditure, all of which are major risk factors for non-communicable diseases, including PD [53]. The main limitations for physical activity reported in North Africa included the lack of suitable sports facilities, time, social support and motivation, gender and cultural norms, and harsh weather and hot climate. On the contrary, specific socio-demographic factors, such as advanced age, less education, being female, and being married, were found to be negatively associated with physical activity. Physical activity facilitators were identified as gaining health benefits, being male, losing/maintaining weight, dietary habits, recreation, and increased body mass index [52].

SSA countries are faced with the challenge of educating a critical mass of OTs and PTs to meet the growing demand for health and rehabilitation services. A few years ago, a survey conducted in Anglophone SSA countries concluded that there were limited OT and PT training programs and that these training programs in Anglophone SSA countries are offered at or below the bachelor's level. More than half of the countries do not have OT or PT training programs. The number of qualified OTs and PTs appears insufficient to meet the demand for rehabilitation services. Nigeria and South Africa are the only countries offering post-entry-level master's and doctoral-level training programs in PT and OT [54]. For this reason, international partnership with allied health organizations is crucial in non-pharmacological interventions and education. International collaborations are also important for obtaining resources (e.g., books, equipment) particularly through foreign non-government organizations. These allied health professionals can benefit from

professional support from foreigners, either as mentors or through volunteer groups running professional development workshops. However, technology was crucial for maintaining these collaborations (e.g., email, WhatsApp, and YouTube). Providers should be aware of not always explicit cultural norms and expectations and the sustainability of these programs when designing non-pharmacological interventions [55].

Efforts needed to overcome the shortage of allied health therapies

The challenges are monumental, but so are the efforts to overcome them (Fig. 1):

Public awareness campaigns Raising awareness among the public and policymakers and advocating for attention towards PD is vital. Increasing the number of individuals with varying expertise in PD diagnosis and care involves attracting and educating a broader and more diverse range of healthcare providers, extending beyond traditional neurologist-led care. Such integration would facilitate quicker dissemination and serve as a foundation for educational offerings from the MDS Africa.

Partnering with local community leaders and media can increase awareness about PD and allied health therapies. Using local influencers and community radio, grassroots campaigns have started dispelling myths and promoting awareness about PD and its management.

Increasing public awareness of the importance of lifestyle interventions will further improve PD-related disability and quality of life. Establishing local PD support groups is another avenue for awareness creation and knowledge sharing.

Local and global collaborations Addressing the monumental challenge of enhancing access to PD therapies and services necessitates a multifaceted approach. This should encompass both PD-specific improvements and broader healthcare system enhancements, with national, regional, and global interventions staged in both the short and long term.

Collaboration within the continent and with international partners is essential. The partnership between global health agencies, NGOs, and local governments is pivotal. International collaborations, such as the project “*Transforming Parkinson’s Care in Africa*” (TraPCAf; ISRCTN77014546) are work-

ing towards improving the state of PD care in the African continent [56]. Initiatives sponsored by international organizations, such as the World Health Organization, aim to boost local capacities. Collaborations between local and international PD support groups must be encouraged and promoted to serve as a platform for shared experiences and learning.

Training partnerships Collaborations with international bodies can help bolster training opportunities for African professionals. Several international bodies, NGOs, and universities have collaborated with African institutions to enhance training opportunities. The MDS offers many courses on assessing and managing varying movement disorders, including PD, for its members, and the majority are free. African allied health professionals are encouraged to join the MDS, with no fee membership, to gain access to these training opportunities.

Community-based rehabilitation Engaging community health workers to provide basic rehabilitation services can enhance accessibility and acceptance and provide basic rehabilitation services, especially given the trust they command within communities. A model where community health workers, after basic training, provide fundamental rehabilitation services. Given the trust they command within local communities, their engagement can also bridge cultural barriers.

Tele-rehabilitation Leveraging technology to provide remote therapy sessions can help overcome geographical barriers. Mobile penetration in Africa is impressive. Leveraging this, tele-rehabilitation promises to reach remote areas, providing therapies via virtual platforms. With increasing mobile penetration and internet connectivity, virtual platforms can help bridge the care gap.

Digital interventions Despite these challenges, there are beacons of hope. Mobile clinics and community-based rehabilitation initiatives are emerging, attempting to bridge the care gap. Training in the use of digital interventions accessed via smartphones and computers, such as virtual reality, gait analysis software, and exergaming is warranted in assessing and providing advanced technology-based therapies for PD patients.



Fig. 1. Multiple efforts are needed to overcome the shortage of allied health therapies in Africa.

Focus on research and data With Africa being under-represented in global health research, prioritizing local studies is crucial. Understanding the unique genetic, environmental, and social factors influencing African patients with PD (especially unanticipated pitfalls in continuity of care) can significantly impact treatment outcomes. Alternative treatment strategies derived from subtropical natural resources such as *Mucuna pruriens* elsewhere regarded as an ‘add-on’ solution at most, might be the only option for a patient with PD who lacks access to costly medication but has a vegetable patch, cooking fire, pestle and mortar meaning they can farm and process *Mucuna pruriens*. Randomized controlled trials on treatment strategies regarded unconventional from a high-resource perspective may provide solutions for the aging African continent and its oncoming surge of patients with PD [28, 29].

FUTURE PERSPECTIVES

Future initiatives must be multi-pronged. Enhancing the quality and reach of educational programs can elevate the awareness landscape. Research grants specific to African challenges can stimulate more localized research, ensuring that interventions are contextually relevant. The essence lies in collaborations—be it international partnerships, local community engagements, or interdisciplinary collaborations within the medical community. The African patient with PD deserves a holistic, multi-disciplinary, and tailored approach, and every step taken in this direction will bring significant positive change.

As the African continent continues to evolve and adapt to its ever-changing healthcare landscape, the approach to PD management will undoubtedly

Table 1
Take-home messages

-
- Access to specialized PD care, including allied health therapies in Africa, exhibits significant variability. This inequality is further exacerbated by the low rates of healthcare insurance coverage.
 - The expected surge in the number of people with PD in Africa, attributable to the increased life expectancy and better control of infectious diseases, coupled with limited drug accessibility, will increase the demand for allied health therapies in the management of PD.
 - The integration of physiotherapy, occupational therapy, speech and language therapy, and the additional involvement of PD nurse specialists is not just about managing symptoms but also enhancing overall PD well-being and functionality.
 - Multidisciplinary treatment approaches improve survival and quality of life in people with PD, regardless of their geographical or economic setting. Principles of multidisciplinary treatment arise from cultural and socioeconomic values and assumptions that are not always applicable internationally, requiring targeted research.
 - Given the limited healthcare resources available for PD management in Africa, ongoing research collaborations across the continent are studying interventions and therapeutic strategies tailored to the unique needs and environmental factors of the region.
-

edly witness transformative shifts. Technological advancements, globalization, and heightened international collaborations offer a promising outlook. We anticipate a greater integration of digital health platforms in PD management, allowing for more consistent patient monitoring and timely interventions. Moreover, as local research efforts amplify, there is potential for developing region-specific therapeutic protocols that consider genetic, environmental, and sociocultural factors unique to Africa. Community-driven health initiatives centered around PD awareness and education are poised to break barriers of stigma and misunderstanding. The future of PD care in Africa will not only hinge upon medical innovations but will be deeply rooted in community engagement, interdisciplinary collaborations, and a steadfast commitment to prioritizing the needs and well-being of individuals with PD.

CONCLUSIONS

Delivery of allied health therapies to people with PD in Africa presents unique challenges. However, with concerted efforts, collaborations, and innovations, there is hope that the continent can provide holistic and effective care for all its patients with PD (Table 1). The management of PD in Africa is a pressing concern that demands concerted efforts from governments, international bodies, and local communities. Despite the challenges, there are viable opportunities for innovation and collaboration. Enhancing the accessibility and quality of these non-pharmacological therapies and adequate pharmacological therapies can play a pivotal role in improving the lives of millions of patients with PD across the African continent.

ACKNOWLEDGMENTS

The authors have no acknowledgment to report.

FUNDING

The authors have no funding to report.

CONFLICT OF INTEREST

The authors have no conflict of interest to report.

REFERENCES

- [1] Bloem BR, Okun MS, Klein C (2021) Parkinson's disease. *Lancet* **397**, 2284-2303.
- [2] GBD 2016 Neurology Collaborators (2019) Global, regional, and national burden of neurological disorders, 1990-2016: A systematic analysis for the Global Burden of Disease Study 2016. *Lancet Neurol* **18**, 459-480.
- [3] Chou KL, Martello J, Atem J, Elrod M, Foster ER, Freshwater K, Gunzler SA, Kim H, Mahajan A, Sarva H, Stebbins GT, Lee E, Yang L (2021) Quality improvement in neurology: 2020 Parkinson disease quality measurement set update. *Neurology* **97**, 239-245.
- [4] Bloem BR, de Vries NM, Ebersbach G (2015) Nonpharmacological treatments for patients with Parkinson's disease. *Mov Disord* **30**, 1504-1520.
- [5] Ypinga JHL, de Vries NM, Boonen LHHM, Koolman X, Munneke M, Zwiderman AH, Bloem BR (2018) Effectiveness and costs of specialised physiotherapy given via ParkinsonNet: A retrospective analysis of medical claims data. *Lancet Neurol* **17**, 153-161.
- [6] Talebi AH, Ypinga JHL, De Vries NM, Nonnekes J, Munneke M, Bloem BR, Heskes T, Ben-Shlomo Y, Darweesh SKL (2023) Specialized versus generic allied health therapy and the risk of Parkinson's disease complications. *Mov Disord* **38**, 223-231.
- [7] Gage H, Grainger L, Ting S, Williams P, Chorley C, Carey G, Borg N, Bryan K, Castleton B, Trend P, Kaye J, Jordan J, Wade D (2014) Specialist rehabilitation for people with Parkinson's disease in the community: A randomised controlled trial. *NIHR Journals Library*, Southampton (UK).
- [8] Roberts AC, Rafferty MR, Wu SS, Miao G, Cubillos F, Simuni T; Parkinson's Foundation Quality Improvement

- Initiative Investigators Steering Committee Members; PF QII Principal Investigators (2021) Patterns and predictors of referrals to allied health services for individuals with Parkinson's disease: A Parkinson's foundation (PF) QII study. *Parkinsonism Relat Disord* **83**, 115-122.
- [9] Zhen K, Zhang S, Tao X, Li G, Lv Y, Yu L (2022) A systematic review and meta-analysis on effects of aerobic exercise in people with Parkinson's disease. *NPJ Parkinsons Dis* **8**, 146.
- [10] Vaughan CP, Prizer LP, Vandenberg AE, Goldstein FC, Trotti LM, Hermida AP, Factor SA (2017) A comprehensive approach to care in Parkinson's disease adds quality to the current gold standard. *Mov Disord Clin Pract* **4**, 743-749.
- [11] Academy of Neurologic Physical Therapy, Parkinson's Disease Evaluation Database to Guide Effectiveness (PD-EDGE) (2014) <http://www.neuropt.org/professional-resources/neurology-section-outcome-measures-recommendations/parkinson-disease>. Accessed July 22, 2023.
- [12] Radder DLM, Nonnekes J, van Nimwegen M, Eggers C, Abbruzzese G, Alves G, Browner N, Chaudhuri KR, Ebersbach G, Ferreira JJ, Fleisher JE, Fletcher P, Frazzitta G, Giladi N, Guttman M, Inasek R, Khandhar S, Klucken J, Lafontaine AL, Marras C, Nutt J, Okun MS, Parashos SA, Munneke M, Bloem BR (2020) Recommendations for the organization of multidisciplinary clinical care teams in Parkinson's disease. *J Parkinsons Dis* **10**, 1087-1098.
- [13] Institute for Health and Care Excellence (2017) Non-pharmacological management of motor and non-motor symptoms. NICE Guideline: Parkinson's Disease in Adults, National Institute for Health and Care Excellence. <https://www.nice.org.uk/guidance/ng71/chapter/Recommendations#non-pharmacological-management-of-motor-and-non-motor-symptoms>. Accessed on August 22, 2023.
- [14] Agoriwo MW, Muckelt PE, Yeboah CO, Sankah BEA, Agyapong-Badu S, Akpalu A, Stokes M (2022) Feasibility and reliability of measuring muscle stiffness in Parkinson's disease using MyotonPRO device in a clinical setting in Ghana. *Ghana Med J* **56**, 78-85.
- [15] Sturkenboom IH, Graff MJ, Hendriks JC, Veenhuizen Y, Munneke M, Bloem BR, Nijhuis-van der Sanden MW, OTIP study group (2014) Efficacy of occupational therapy for patients with Parkinson's disease: A randomised controlled trial. *Lancet Neurol* **13**, 557-566.
- [16] Cubo E, Gabriel-Galan JM, Martinez JS, Alcubilla CR, Yang C, Arconada OF, Pérez NM (2012) Comparison of office-based versus home Web-based clinical assessments for Parkinson's disease. *Mov Disord* **27**, 308-311.
- [17] Schindler A, Pizzorni N, Cereda E, Cosentino G, Avenali M, Montomoli C, Abbruzzese G, Antonini A, Barbiera F, Benazzo M, Benarroch E, Bertino G, Clavé P, Cortelli P, Eleopra R, Ferrari C, Hamdy S, Huckabee ML, Lopiano L, Marchese-Ragona R, Masiero S, Michou E, Occhini A, Paccetti C, Pfeiffer RF, Restivo DA, Rondanelli M, Ruoppolo G, Sandrini G, Schapira A, Stocchi F, Tolosa E, Valentino F, Zamboni M, Zangaglia R, Zappia M, Tassorelli C, Alfonsi E (2021) Consensus on the treatment of dysphagia in Parkinson's disease. *J Neurol Sci* **430**, 120008.
- [18] Wen X, Liu Z, Liu X, Peng Y, Liu H (2022) The effects of physiotherapy treatments on dysphagia in Parkinson's disease: A systematic review of randomized controlled trials. *Brain Res Bull* **188**, 59-66.
- [19] Troche MS, Curtis JA, Sevitz JS, Dakin AE, Perry SE, Borders JC, Grande AA, Mou Y, Vanegas-Arroyave N, Hegland KW (2023) Rehabilitating cough dysfunction in Parkinson's disease: A randomized controlled trial. *Mov Disord* **38**, 201-211.
- [20] Barichella M, Cereda E, Pezzoli G (2016) Major nutritional issues in the management of Parkinson's disease. *Mov Disord* **24**, 1881-1892.
- [21] Burgos R, Bretón I, Cereda E, Desport JC, Dziewas R, Genton L, Gomes F, Jesús P, Leischker A, Muscaritoli M, Poulia KA, Preiser JC, Van der Marck M, Wirth R, Singer P, Bischoff SC (2018) ESPEN guideline clinical nutrition in neurology. *Clin Nutr* **37**, 354-396.
- [22] Fullard ME, Thibault DP, Hill A, Fox J, Bhatti DE, Burack MA, Dahodwala N, Haberfeld E, Kern DS, Klepitkava OS, Urrea-Mendoza E, Myers P, Nutt J, Rafferty MR, Schwab JM, Shulman LM, Willis AW; Parkinson Study Group Healthcare Outcomes and Disparities Working Group (2017) Utilization of rehabilitation therapy services in Parkinson disease in the United States. *Neurology* **89**, 1162-1169.
- [23] World Population Prospects 2022 <https://population.un.org/wpp/Download/Standard/Population/>. Accessed on August 22, 2023.
- [24] World Health Organization (2021) Web-based consultation on the first draft of the Intersectoral Global Action Plan on epilepsy and other neurological disorders 2022-2031. World Health Organization, Geneva.
- [25] Dekker MCJ, Coulibaly T, Bardien S, Ross OA, Carr J, Komolafe M (2020) Parkinson's Disease research on the African continent: Obstacles and opportunities. *Front Neurol* **11**, 512.
- [26] Dotchin C, Msuya O, Kissima J, Massawe J, Mhina A, Moshy A, Aris E, Jusabani A, Whiting D, Masuki G, Walker R (2008) The prevalence of Parkinson's disease in rural Tanzania. *Mov Disord* **23**, 1567-672.
- [27] Hamid E, Ayele BA, Massi DG, Ben Sassi S, Tibar H, Djonga EE, El-Sadig SM, Amer El Khedoud W, Razafimaha J, Kouame-Assouan AE, Ben-Adji D, Lengané YTM, Musubire AK, Mohamed MH, Phiri TE, Nestor N, Alwahchi WA, Neshuku SN, Ocampo C, Sakadi F, Moidal MA, Ngwende GW, Hooker J, Okeng'o K, Charway-Felli A, Atadzhanov M, Carr J, Okubadejo NU, Shalash A (2021) Availability of therapies and services for Parkinson's disease in Africa: A continent-wide survey. *Mov Disord* **36**, 2393-2407.
- [28] Cilia R, Laguna J, Cassani E, Cereda E, Pozzi NG, Isaias IU, Contin M, Barichella M, Pezzoli G (2017) Mucuna pruriens in Parkinson disease: A double-blind, randomized, controlled, crossover study. *Neurology* **89**, 432-438.
- [29] Fothergill-Misbah N, Maroo H, Cham M, Pezzoli G, Walker R, Cilia R (2020) Could Mucuna pruriens be the answer to Parkinson's disease management in sub-Saharan Africa and other low-income countries worldwide? *Parkinsonism Relat Disord* **73**, 3-7.
- [30] Cilia R, Akpalu A, Cham M, Bonetti A, Amboni M, Faceli E, Pezzoli G (2011) Parkinson's disease in sub-Saharan Africa: Step-by-step into the challenge. *Neurodegener Dis Manag* **1**, doi: 10.2217/nmt.11.28.
- [31] World Health Organization. Atlas - Country resources for neurological disorders 2017. https://www.who.int/mental_health/neurology/atlas_second_edition/en/. Accessed August 22, 2023.
- [32] Williams U, Bandmann O, Walker R (2018) Parkinson's disease in Sub-Saharan Africa: A review of epidemiology, genetics and access to care. *J Mov Disord* **11**, 53-64.

- [33] World Health Organization (2006) *Neurological Disorders: Public Health Challenges*. World Health Organization, Geneva.
- [34] Tenison E, James A, Ebenezer L, Henderson EJ (2022) A narrative review of specialist Parkinson's nurses: Evolution, evidence and expectation. *Geriatrics (Basel)* **7**, 46.
- [35] Brandmeir NJ, Brandmeir CL, Kuzma K, McInerney J (2016) A prospective evaluation of an outpatient assessment of postural instability to predict risk of falls in patients with Parkinson's disease presenting for deep brain stimulation. *Mov Disord Clin Pract* **3**, 151-155.
- [36] Cuijpers P, Sijbrandij M, Koole S, Huibers M, Berking M, Andersson G (2014) Psychological treatment of generalized anxiety disorder: A meta-analysis. *Clin Psychol Rev* **34**, 130-40.
- [37] Moonen AJH, Mulders AEP, Defebvre L, Duits A, Flinois B, Köhler S, Kuijff ML, Leterme AC, Servant D, de Vugt M, Dujardin K, Leentjens AFG (2021) Cognitive behavioral therapy for anxiety in Parkinson's disease: A randomized controlled trial. *Mov Disord* **36**, 2539-2548
- [38] Andersen LS, Magidson JF, O'Cleirigh C, Remmert JE, Kagee A, Leaver M, Stein DJ, Safren SA, Joska J (2018) A pilot study of a nurse-delivered cognitive behavioral therapy intervention (Ziphamandla) for adherence and depression in HIV in South Africa. *J Health Psychol* **23**, 776-787.
- [39] Hinsberger M, Holtzhausen L, Sommer J, Kaminer D, Elbert T, Seedat S, Wilker S, Crombach A, Weierstall R (2017) Feasibility and effectiveness of narrative exposure therapy and cognitive behavioral therapy in a context of ongoing violence in South Africa. *Psychol Trauma* **9**, 282-291.
- [40] Sarfo FS, Adamu S, Awuah D, Ovbiagele B (2017) Tele-neurology in sub-Saharan Africa: A systematic review of the literature. *J Neurol Sci* **380**, 196-199.
- [41] Chipps J, Brysiewicz P, Mars M (2012) A systematic review of the effectiveness of videoconference-based tele-education for medical and nursing education. *Worldviews on evidence-based nursing*/Sigma Theta Tau International. *Honor Soc Nurs* **9**, 78-87.
- [42] Lekalakala-Mokgele E, Lowane MP, Mogale NM (2023) Knowledge, perceptions and attitudes of eHealth and health technology among nursing students from Gauteng Province, South Africa. *Healthcare (Basel)* **11**, 1672.
- [43] Cubo E, Doumbe J, Njiengwe E, Onana P, Garofia R, Alcalde J, Seco J, Mariscal N, Epundugu BM, Cubo Sixto, Coma MJ (2015) A Parkinson's disease tele-education program for health care providers in Cameroon. *J Neurol Sci* **357**, 285-287.
- [44] MDS Education. <https://education.movementdisorders.org/Detail/455/MDS-Africa-Nurse-and-Allied-Health-Professionals-Course-for-Parkinson's-Disease>. Accessed August 22, 2023.
- [45] Movement Disorder, <https://www.movementdisorders.org/MDS/Regional-Sections/Sub-SaharanAfrica/Neurology-Training-for-Non-Neurologists-in-West-Africa.htm>. Accessed August 22, 2023.
- [46] World Federation of Neurology. <https://worldneurologyonline.com/article/neurology-training-for-non-neurologists-in-west-africa-sept-15-18-2013/>. Accessed August 22, 2023.
- [47] MDS Train the Trainer Pilot Program. <https://www.movementdisorders.org/MDS/About/MDS-Programs/Train-the-Trainer-AS.htm>. Accessed August 27, 2023.
- [48] Mshana G, Dotchin CL, Walker RW (2011) 'We call it the shaking illness': Perceptions and experiences of Parkinson's disease in rural northern Tanzania. *BMC Public Health* **11**, 219.
- [49] Janssen Daalen JM, Schootemeijer S, Richard E, Darweesh SKL, Bloem BR (2022) Lifestyle interventions for the prevention of Parkinson disease: A recipe for action. *Neurology* **99**, 42-51.
- [50] Blackford K, Jancey J, Lee AH, James AP, Waddell T, Howat P (2016) Home-based lifestyle intervention for rural adults improves metabolic syndrome parameters and cardiovascular risk factors: A randomised controlled trial. *Prev Med* **89**, 15-22.
- [51] Bull FC, Al-Ansari SS, Biddle S, Borodulin K, Buman MP, Cardon G, Carty C, Chaput JP, Chastin S, Chou R, Dempsey PC, DiPietro L, Ekelund U, Firth J, Friedenreich CM, Garcia L, Gichu M, Jago R, Katzmarzyk PT, Lambert E, Leitzmann M, Milton K, Ortega FB, Ranasinghe C, Stamatakis E, Tiedemann A, Troiano RP, van der Ploeg HP, Wari V, Willumsen JF (2020) World Health Organization 2020 guidelines on physical activity and sedentary behaviour. *Br J Sports Med* **54**, 1451-1462.
- [52] Chaabane S, Chaabna K, Abraham A, Mamtani R, Cheema S (2020) Physical activity and sedentary behaviour in the Middle East and North Africa: An overview of systematic reviews and meta-analysis. *Sci Rep* **10**, 9363.
- [53] Musaiger AO, Al-Mannai M, Tayyem R, Al-Lalla O, Ali EY, Kalam F, Benhamed MM, Saghir S, Halahleh I, Djoudi Z, Chirane M (2013) Perceived barriers to healthy eating and physical activity among adolescents in seven Arab countries: A cross-cultural study. *Scientific World Journal* **2013**, 232164.
- [54] Agho AO, John EB (2017) Occupational therapy and physiotherapy education and workforce in Anglophone sub-Saharan Africa countries. *Hum Resour Health* **15**, 37.
- [55] Jansen-van Vuuren J, Aldersey HM, Lysaght R (2001) The role and scope of occupational therapy in Africa. *Disabil Rehabil* **43**, 3639-3651.
- [56] Walker R, Fothergill-Misbah N, Kariuki S, Ojo O, Cilia R, Dekker MCJ, Agabi O, Akpalu A, Amod F, Breckons M, Cham M, Del Din S, Dotchin C, Guggsa S, Kwasa J, Mushi D, Nwaokorie FO, Park T, Rochester L, Rogathi J, Sarfo FS, Shalash A, Ternent L, Urasa S, Okubadejo N (2023) Transforming Parkinson's Care in Africa (TraPCAf): Protocol for a multimethodology national institute for health and care research global health research group project. *BMC Neurol* **23**, 373.