Research Article

A Scaffolded Culturo-Techno-Contextual-Approach Theoretical Framework for Recommended Exercise Adherence in African Settings

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Exercise adherence is a critical issue in health promotion, rehabilitation, and chronic disease management, particularly in Africa and other low-resource settings, where culture, socioeconomic factors, environmental factors, and health system resources play important roles in adherence to recommended exercise programmes. The Scaffolded Culturo-Techno-Contextual-Approach (S-CTCA) Framework is presented here as a multi-dimensional and culturally responsive model for understanding and encouraging sustained exercise adherence. The framework brings together the cultural context, technological support systems, contextual realities, and scaffolded behavioural strategies into a coherent framework that identifies behaviour adherence as a developmental process, not just a behavioural choice. The model is grounded in Social Cognitive Theory and ecological health models, Self-Determination Theory, and culturally responsive principles of health promotion and emphasises the linkages between behaviour, community support, institutional arrangements, and technological interventions. The framework is structured into a series of progressive stages: initiation support, behaviour stabilisation, and long-term maintenance and internalisation. The importance of culturally responsive interventions, community outreach, cost-effective digital health interventions, and an inter-professional approach to improving adherence outcomes is highlighted. The framework may be applied clinically to rehabilitation, education, public health promotion, and sports and exercise science research. The S-CTCA framework is a context-based approach to optimise exercise uptake, enhance preventative health care and exercise rehabilitation, and develop enduring public health solutions.

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Introduction

Guided physical activity or structured exercise is beneficial to human health. There is a wealth of scientific evidence worldwide on the role of exercise in preventing and managing non-communicable diseases, improving functional capacity and psychological well-being, healthy ageing, reducing healthcare costs and improving quality of life. As such, organisations such as the World Health Organisation (WHO) continue to endorse regular physical activity through global recommendations on physical activity and sedentary behaviour[1][2]. While the health benefits of exercise are becoming increasingly well known, adherence to recommended exercise remains a major global challenge. Many people find it difficult to meet the recommendations for physical activity, such as the WHO recommendations for regular moderate-to-vigorous physical activity. This inability to sustain regular exercise engagement over time has been a major contributor to the continued preponderance of preventable non-communicable diseases such as hypertension, diabetes mellitus, obesity, cardiovascular diseases, musculoskeletal disorders, and mental health disorders[3].

This challenge is even more pronounced in African settings where exercise, as defined in formal health promotion literature, is often not culturally seen as a distinct health-enhancing behavioural practice[4]. In many African societies, physical activity is traditionally embedded in occupational labour, farming, transportation, communal engagements, domestic work, traditional dances, religious activities and other culturally meaningful forms of movement rather than structured exercise programmes[5]. Moreover, African societies are mainly communal, filial, intergenerational and religious. Homes, churches, schools, villages and community spaces where children, youths, adults and older persons interact closely within strong social and cultural networks are common. Yarker[6] notes that these communal structures present unique opportunities for adherence interventions that are rarely well captured in dominant Western-derived behavioural models.

Crucially, the younger generations in Africa are more comfortable with modern technology such as smartphones, wearable devices, social media platforms, mobile applications, internet-based communication systems and digital health technologies. In contrast, many older people may have low technological literacy. They may thus not derive the full benefit from exercise interventions using these technologies to prevent and manage chronic diseases[7]. Therefore, the present framework posits that

technologically literate youths and children can serve as scaffolding for elderly individuals to improve exercise adherence in the African cultural setting. Filial relationships, community interaction, family structures, school-community linkages, and religious associations could help younger individuals assist older adults in accessing technological tools that support participation in the recommended exercise. This support may include assisting older adults with mobile app use, interpreting exercise reminders, participating in virtual exercise communities, tracking physical activity, accessing telehealth support or engaging in culturally tailored digital exercise programmes.

This intergenerational scaffolding mechanism provides a central logical basis for the proposed Scaffolded CTCA (S-CTCA) Theoretical Framework for Recommended Exercise Adherence in African Settings. The framework adapts Okebukola's Culturo-Techno-Contextual Approach (CTCA) for exercise adherence, recognising that effective behavioural maintenance in African societies is not merely a matter of individual motivation but also the interplay of cultural realities, technological accessibility, contextual conditions, communal relationships, and scaffolded social support systems[8]. Therefore, the S-CTCA Theoretical Framework for Recommended Exercise Adherence in African Settings is proposed as a multidimensional, culturally grounded, technologically adaptable, communally supported, and context-sensitive framework to enhance long-term exercise adherence across African populations. The framework integrates behavioural, social, cultural, environmental, institutional and technological factors in a progressive scaffolded structure that supports individuals from exercise initiation to long-term adherence.

In this framework, the acronym CTCA is adapted from Okebukola's[8] Culturo-Techno-Contextual Approach (CTCA), which emphasises the integration of culture, technology and contextual realities to promote meaningful learning and behavioural transformation. The current framework, S-CTCA, extends Okebukola's CTCA to recommended exercise adherence in African contexts by acknowledging the complex interplay of culture, technology, context and intervention strategies that shape sustained participation in exercise programmes.

Conceptual Foundation of the S-CTCA Framework

Conceptually, the S-CTCA Theoretical Framework is based on the premise that adherence to exercise is not an individual behavioural issue, but rather a process that is socially mediated, culturally shaped, technologically influenced, and contextually constrained. The framework acknowledges that, as MacDonald, Bennekou, Midtgaard, Langberg and Lieberman[9] state, many people are already familiar

with the benefits of physical activity. However, this awareness has not led to long-term adherence to recommended physical activity. Consequently, preventable non-communicable diseases continue to rise despite global public health campaigns promoting physical activity. The framework, therefore, undermines the notion that knowledge alone necessarily leads to behaviour changes. Rather, it suggests that in African contexts, adherence to exercise behaviour relies heavily on the dynamic interplay among cultural elements, technological access, community social support, environmental factors and mediated interpersonal dynamics.

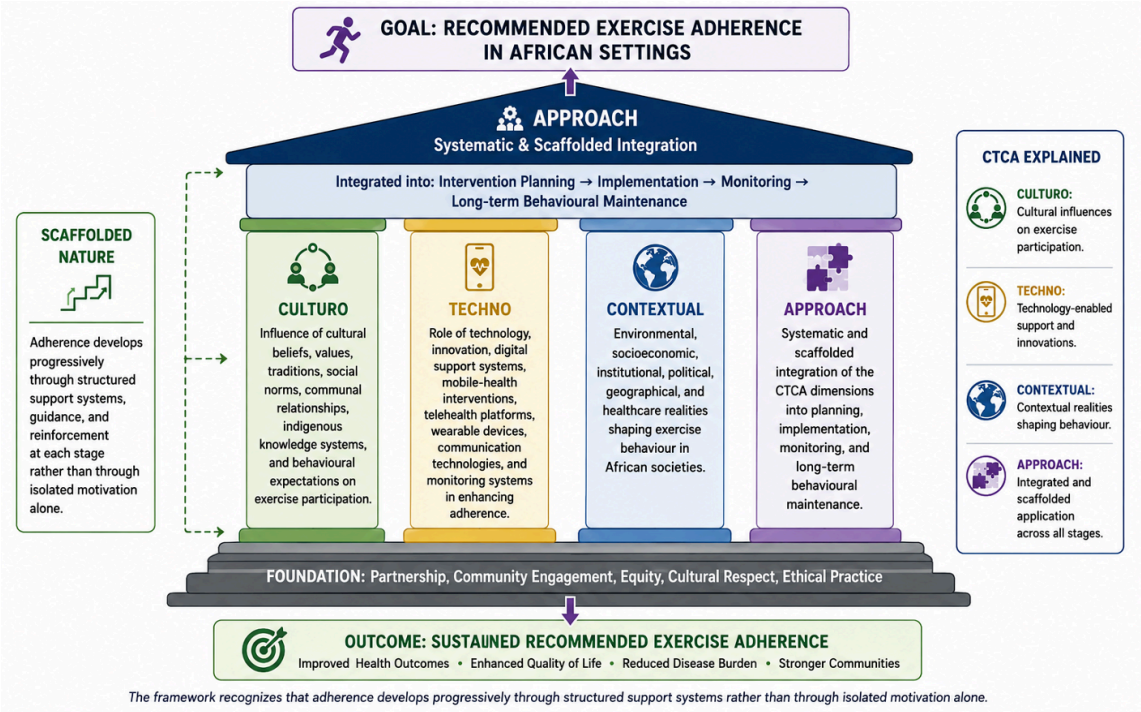
The theoretical underpinning of the framework is Okebukola's Culturo-Techno-Contextual Approach (CTCA), which holds that integrating culture, technology, and contextual realities can create meaningful teaching, learning, and behavioural transformation in multicultural environments[8]. Within the current framework, the S-CTCA framework is extended to the field of exercise adherence and preventive health behaviour. The cultural dimension of the framework acknowledges that African societies are highly community-oriented, with strict obligations to parents and family members, and are deeply religious with strong intergenerational ties. The socio-cultural context, family structures, social norms, and community perceptions should not be separated from exercise behaviour. Formal exercise is not typically conceptualised as a stand-alone daily activity in many African contexts, as it is in many Western contexts[10]. Instead, movement is part of culturally relevant activities, such as farming, market activities, traditional dances, domestic labour, transportation, festivals, and religious gatherings.

The techno dimension recognises the rising influence of contemporary technologies within African societies, particularly amongst youths and children who have been exposed to smartphones, digital communication systems, social media platforms, wearable devices, and mobile applications[11]. However, elderly populations who are often at greater risk of non-communicable diseases may experience technological limitations[12]. The framework, therefore, proposes the concept of intergenerational technological scaffolding, in which technologically literate youths and children help the elderly use digital tools to facilitate adherence to recommended exercise. The contextual dimension focuses on the socio-economic, environmental, institutional, and infrastructural contexts relevant to behavioural possibilities in African societies. Adherence to recommended exercise can be influenced by poverty, transportation difficulties, insecurity, lack of recreational facilities, occupational demands, a poor health care system, and lack of a public health system[13]. Thus, the framework posits that adherence to exercise is not comprehensible apart from the lived context.

All of these dimensions work together dynamically within a scaffolded behavioural support system (BSS) that offers a step-by-step framework for moving individuals from initiation through stabilisation and onto maintenance of their exercise behaviours. The framework's scaffolded structure draws on the educational scaffolding principles discussed by Maftuna[14], who conceptualised scaffolding as a gradual, supportive, step-by-step process that leads learners to independent competence. In the proposed framework, scaffolding is transformed into a gradual behavioural support process to help people achieve long-term exercise adherence. In the beginning, a significant amount of support and guidance is provided externally through family, technology, professional supervision, peer support, and communal reinforcement. The level of external support gradually decreases as people become more confident and behaviourally stable. In contrast, internal support, in the form of self-regulation, exercise competence, and/or behaviour independence, is increased.

The scaffolded nature of the framework is very significant as it acknowledges that sustainable exercise adherence can be achieved over time and requires progressive support, social reinforcement, behaviour modification, and internalisation. The framework thus transcends scaffolding theory from the classroom into the domains of health behaviour change and exercise adherence within the African socio-cultural context.

Structure of the Scaffolded CTCA (S-CTCA) Framework



The framework recognizes that adherence develops progressively through structured support systems rather than through isolated motivation alone.

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The S-CTCA Framework centres on the interrelatedness of cultural context, technology, and cultural realities, which contribute to adherence to recommended exercise in African societies. The main principle is that the individual must regularly engage in recommended exercise programmes despite various social, environmental, economic, and behavioural factors. The framework suggests that adherence behaviour is a process that can be developed step by step through scaffolded adherence support mechanisms within family, religion, education, health care, and community contexts. The current framework acknowledges that communal ties and social interdependence have a profound effect on participation in physical activity in African communities, rather than individual self-discipline alone.

Factors within the culturo domain that affect exercise behaviour include family expectations, religious values, communal interaction, indigenous beliefs, gender norms, and culturally acceptable movement practices. Therefore, cultural acceptance is considered one of the most important factors influencing exercise adherence. Within the techno domain, digital support systems provide reminders, monitoring, education, communication, and reinforcement for recommended exercise participation. When younger participants help the elderly use technology for tracking and exercise, it is most effective. In the contextual domain, behaviour outcomes are influenced by environmental factors such as poverty, accessibility, work demand, safety, health services, transportation, and community infrastructure. These situational factors increase or decrease the likelihood that a person will exercise. The interrelationship between these domains results in adherence outcomes, including exercise consistency, maintenance of behaviour, better health outcomes, a better quality of life, and a reduced burden of non-communicable disease.

The S-CTCA framework is scaffolded over three developmental phases of behaviour: initiation support, behaviour stabilisation, and behaviour maintenance and internalisation. This sequence is based on the recognition that exercise adherence occurs in stages over time, achieved through stages, rather than just through motivation to exercise. The framework is inspired by Social Cognitive Theory, which focuses on self-efficacy, reinforcement, observational learning, and interaction with the environment to induce lasting behaviour change[15]. It is also consistent with the ecological approach to health behaviour, which acknowledges the role of interpersonal, institutional, environmental, and policy factors in shaping health behaviours[16].

Individuals are introduced to recommended exercise at the initiation stage with structured guidance, motivation, education, and social support. In many African settings, physical activity is not viewed as therapeutic unless it is linked to disease or disability. This means the framework is very much focused on

awareness-raising and motivational scaffolding at an early stage of behavioural uptake. This orientation aligns with the health promotion literature, which highlights the importance of health literacy and culturally relevant education to enhance the uptake and maintenance of health-related behaviours[17]. The participants are then encouraged to know what an exercise programme is for, what to expect from it, the risks of not doing it, how to do it safely, and what to expect in terms of progress. Educational materials should be culturally sensitive and, if needed, translated into local languages to enhance understanding, acceptance, and participation. Dickerson et al.[18] hypothesised that the effectiveness of health interventions would increase when grounded in local cultural realities rather than Western biomedical assumptions.

Socio-economic determinants also have a strong impact on adherence behaviours, as acknowledged in the framework. It is important, therefore, to consider transport costs, facility availability, work schedules, work responsibilities, household responsibilities, food security and financial strain when giving exercise recommendations. The S-CTCA framework contends that adherence is unlikely when exercise recommendations conflict with individuals′ and families′ immediate survival priorities. The social determinants of health literature have shown that participation in health behaviours and long-term adherence is significantly affected by poverty, inadequate infrastructure, and inequitable healthcare access[19].

Also, individual goal setting is encouraged to keep exercise goals realistic, incremental, context-sensitive, functionally meaningful, and measurable. This approach aligns with the principles of Self-Determination Theory, which proposes that people are more likely to maintain behaviours that are personally meaningful and congruent with their lived experiences[20][21]. Goals are then linked to real-life achievements, such as walking to and from the market without getting tired, returning to work or farming activities, participating in community sports or minimising joint pain from work. Social reinforcement from family members, peer groups, religious groups, community health workers, and exercise partners is also important for strengthening early adherence and providing encouragement, accountability, and emotional support. This is consistent with the evidence that social support networks are an important determinant of exercise adherence and chronic disease management outcomes[22].

The second phase of the framework is about behaviour stabilisation, where external support for participation slowly transitions to regular, continuous behaviour patterns. The contextual layer of the framework is particularly important at this stage because exercise behaviour occurs in complex and dynamic environmental conditions. Factors in the environment that affect participation include safe

exercise spaces, climate, urban versus rural infrastructure, security, access to health, and transport systems. Adherence behaviours are also influenced by economic factors such as income, healthcare expenses, availability of exercise equipment, employment situations, and the opportunity cost of engaging in exercise. Institutional structures, including but not limited to school systems, work programmes, health and wellness policies, insurance policies, government policies, and community recreational facilities, also impact the sustainability of participation. The framework thus calls for interventions that not only aim to enhance individual motivation but also help lower structural and environmental barriers to participation. This view aligns with ecological frameworks of health promotion, which emphasise the need to create environments that support people's behaviours and to have enabling social systems that promote sustainable behavioural change[23].

The therapeutic and technological support layer includes continuous professional guidance and easily accessible technological systems that support adherence. Professional support can be provided by physiotherapists, exercise physiologists, sports scientists, nurses, medical doctors, community health workers, and physical education specialists who can work together to track progress, reinforce good practice, deliver behavioural counselling, adjust exercise recommendations as needed, manage pain and reduce the risk of exercise. Its focus on interdisciplinary collaboration aligns with patient-centred care strategies, which value integrated care systems for maintaining healthy behaviours over time[24].

The framework recognises the increasing uptake of mobile technologies in African societies and the opportunities they offer to reinforce adherence, alongside professional guidance. Some of the technology-assisted strategies can thus include SMS reminders, WhatsApp support groups, telehealth consultations, mobile fitness apps, wearable activity trackers, radio health education or loudspeaker announcements in the community. There is increasing evidence that appropriately adapted mobile-health interventions can be effective in enhancing adherence to treatment and health monitoring in low-resource settings[25]. The S-CTCA framework, however, stresses that technological interventions should be cost-effective, flexible for limited internet access, compatible with low-end devices, available in local languages, and viable for people with different levels of digital literacy.

The cultural and community engagement layer plays a central role in the S-CTCA framework since health behaviours are deeply embedded in communal and cultural systems in Africa. Thus, traditional beliefs about illness, gender norms, religious practices, body image, age norms, and community attitudes towards physical activity can be significant determinants of exercise adherence. For example, some communities have restrictions on dress codes and gender expectations, and older adults may feel that

structured exercise is unnecessary or inappropriate. In certain contexts, weight gain can also be a sign of good fortune and health. The framework, therefore, advocates culturally sensitive exercise recommendations that acknowledge and respect these realities. This approach aligns with the PEN-3 cultural framework proposed by Opara, Bassendowski and Petrucka[26], which emphasises integrating cultural identity, relationships, and community expectations into health promotion interventions.

Community involvement is also considered critical for building social legitimacy and long-term sustainability. Interventions could include group exercise classes, faith-based wellness programmes, community fitness centres, school-community partnerships, classical dance, community-based involvement in sports and family-centred exercise programmes. Moreover, the framework promotes culturally familiar physical activities, such as traditional dances, farming-related movement patterns, walking groups, indigenous games, and communal labour. This is a cultural way to reduce resistance to participation and increase cultural acceptance and relevance. Community-based physical activity interventions have been widely researched, and it has been found that culturally relevant programmes are successful in enhancing participation and retention, especially in collectivist societies[27].

The last phase of the framework is long-term maintenance and internalisation, where participation in the exercise programme continues after the supervised intervention. Exercise behaviour becomes more personally meaningful, socially normal, and routine at this stage, and more habit-formed and integrated into daily life. There are several interrelated mechanisms involved in long-term adherence, including increased self-efficacy, personal identity, perceived functional improvement, social belonging, enjoyment, satisfaction, community recognition, symptom reduction, and improvements in quality of life. These processes are strongly supported by Self-Determination Theory, which proposes that sustained behaviour is more likely when individuals experience autonomy, competence, and social connectedness[20][21]. The framework also recognises that setbacks and relapse are common aspects of behavioural change. In this way, relapse prevention measures such as booster counselling sessions, peer accountability systems, mobile reminders, seasonal adaptations, flexible schedules, alternative exercise options at home, and family reinforcement systems are integrated to keep people engaged when times get tough or are disrupted. This role aligns with the principles of behavioural maintenance, which emphasise continuous reinforcement, support for adaptation, and relapse prevention[28].

The adherence outcome dimension of the framework emphasises measurable behavioural, health and community outcomes related to long-term adherence to exercise. Primary outcomes are exercise frequency, duration, consistency, programme completion and long-term participation. Secondary

outcomes are increased functional independence, decreased disease burden, mental health benefits, increased quality of life, lower healthcare costs, increased productivity, increased social participation and physical fitness benefits. The framework at the community level expects to see an increase in public health awareness, a decrease in sedentary behaviours, more conducive wellness cultures, better engagement with preventive healthcare practices and better inclusion of physical activity into community patterns of living. These expected outcomes are consistent with evidence from various countries worldwide that long-term physical activity is an important factor in preventing chronic diseases, improving mental health, increasing productivity and better health outcomes for the population[29].

The scaffolding nature of the S-CTCA framework shows how the framework is structured as a progressive series of stages of behavioural development. The first stage of scaffolding includes external support structures, such as professionals to provide structure, family to encourage participation, community systems to support attendance, and technological systems to provide reminders and monitoring. The framework then moves into a phase of co-responsibility, characterised by active participation in planning, shared responsibility for behaviour within peer groups, increased self-monitoring and increased participation in exercise within the context of daily routines. Ultimately, the final scaffold level emphasises independent adherence, where individuals self-regulate their behaviour, exercise becomes habitual, motivation becomes internalised, and participation continues with minimal external supervision. This aligns with Vygotskian principles of scaffolding, which support the use of structured external scaffolding that is gradually faded as competence, confidence and behavioural independence increase over time[14].

Theoretical Integration of the S-CTCA Framework

The S-CTCA Theoretical Framework is interdisciplinary and is informed by a range of complementary behavioural, sociocultural, educational and health promotion theories. While the framework is based on key ideas from Okebukola[8], the Culturo-Techno-Contextual Approach, and the scaffolding principles of Maftuna[14], it also builds conceptually on the theories of behaviour change, social learning, ecological interaction and self-regulation. The framework aligns well with Bandura's[30] Social Cognitive Theory, which acknowledges the reciprocal nature of personal, environmental and behavioural factors in shaping human behaviour. The focus on observational learning, social reinforcement, self-efficacy, and guided exercise-adherence support reflects important aspects of the scaffolded exercise-adherence framework.

The framework also has conceptual parallels with Bronfenbrenner's Ecological Systems Theory, which focuses on how the family system, community relationships, institutions, and macro-sociocultural contexts affect human behaviour[31]. In African contexts, where community interaction and intergenerational living remain central to everyday life, adherence to exercise is more closely tied to environmental and social structures than to individual choice. Likewise, the framework is consistent with the propositions of Self-Determination Theory by Deci and Ryan[20][21], which focus on the roles of competence, relatedness, and autonomy in maintaining sustained behavioural engagement. The sequence of scaffolded exercise participation to independent behavioural maintenance is indicative of shifting from external to internal motivation.

The framework also incorporates components of the Health Belief Model (HBM) proposed by Rosenstock, particularly the perceived susceptibility to illness, perceived advantages of engaging in exercise behaviours, and barriers to engaging in exercise behaviours[32]. The present framework, however, is not only individual-centred, as in the traditional versions, but also situates these perceptions in the context of African social and cultural relationships and communal realities. Furthermore, the framework's contextual aspects align with public health approaches that focus on social determinants of health, environmental factors and health inequities[1][33]. The framework, therefore, acknowledges that adherence to exercise is not independent of poverty, work demands, inadequate infrastructure, transportation difficulties, limited access to healthcare, and other socioeconomic factors.

Emerging literature on digital health behaviour interventions, mobile-health technologies, and technology-assisted health promotion also contributes to the techno-dimension of the framework. The framework also echoes the tenets of the Behaviour Change Wheel. This tool identifies and leverages the roles of capability, opportunity and motivation within supportive intervention systems for sustainable behavioural change[34]. In many African societies, the proliferation of smartphones and digital communication tools opens avenues for people to get their daily dose of exercise, build virtual support networks, receive telehealth guidance, and help provide tech support across generations. Theoretically, these relationships establish the S-CTCA Framework as a culturally inclusive and context-specific, behaviourally integrative framework uniquely suited to understanding and facilitating adherence to recommended physical activity within the African context.

Practical Applications of the Framework

The S-CTCA framework could be applied in a wide range of clinical rehabilitation, education, community health promotion, and sport and exercise science research and practice settings. In the clinical rehabilitation context, the framework can be used to design and implement exercise-adherence programmes for stroke, cardiac, and orthopaedic injuries, as well as other chronic health conditions. It may also facilitate the implementation of culturally responsive strategies, contexts, technology support systems, and scaffolded behavioural guidance in rehabilitation, thereby supporting the delivery of interventions for diabetes management, hypertension control, obesity reduction, and functional recovery. This position aligns with studies that have found that structured physical activity and rehabilitation programmes benefit functional recovery, cardiovascular health and quality of life in patients with chronic diseases and physical impairments[35]. This framework is especially applicable in healthcare contexts in Africa, where socioeconomic factors, access to healthcare and cultural beliefs play a significant role in exercisers' long-term adherence to recommended exercise programmes[36][37].

The framework can be utilised in educational environments to encourage physical activity using structured wellness programmes and culturally appropriate physical education in schools, colleges and universities. It provides a foundation for developing youth fitness campaigns that promote long-term involvement in physical activity, while accounting for environmental, social, and behavioural factors that influence exercise behaviour. This application is supported by research showing that school-based physical activity programmes have a significant impact on physical and mental health and on the development of a healthy lifestyle for children and youth[38]. This approach includes engaging community members, providing technological assistance and employing behavioural strategies, with the potential to encourage positive health habits and minimise sedentary activity amongst students in educational settings.

The framework is also relevant to community health promotion activities. It can be applied to rural health programmes, public health education campaigns, workplace wellness programmes, programmes for the elderly, and women's health promotion programmes, all of which may face cultural norms, financial constraints and facility issues that affect adherence to exercise. The framework highlights the need to involve the community, use activities that resonate with it, and provide accessible resources and support to enhance long-term public health outcomes. This approach is in keeping with the ecological frameworks of health promotion, which suggest that participation in the community, enabling

environments, and supportive social systems are all necessary for sustainable behaviour change[23]. Studies have also shown that community-based physical activity programmes are more effective when interventions are tailored to local cultural and social contexts[39].

In the field of sports and exercise science research, the S-CTCA framework offers a theoretical framework for investigating exercise adherence behaviours in low-resource settings, particularly in Africa. The framework can be used to predict adherence patterns, develop culturally adapted intervention frameworks, test behavioural and health outcomes, test technological support systems, and explore the relationships between cultural, contextual, and behavioural factors and their impact on long-term exercise participation. The behavioural science literature highlights the need for a multidimensional approach to understanding the adoption and maintenance of health behaviour[20][21][30][40]. Moreover, the integration of digital support systems aligns with evidence that mobile health technologies can enhance adherence and health monitoring among underserved populations in ways that are appropriate to local contexts[25]. This framework, therefore, provides an interdisciplinary approach to enhancing research, policy, and evidence-based practice related to exercise adherence and health promotion.

Strengths and Limitations of the Framework

The S-CTCA framework has several strengths, making it relevant to African and other low-resource environments for understanding and promoting recommended exercise adherence. Its multidimensional and holistic approach is one of its key strengths. Unlike other frameworks of exercise adherence, which tend to emphasise individual motivation or biomedical factors, the CTCA framework brings together cultural, technological, contextual, and behavioural factors into a single structure. This integration allows the framework to reflect the multifaceted nature of social relationships, economic conditions, cultural beliefs, environmental constraints, and access to healthcare that can influence health behaviours in African societies. The framework thus offers a broader perspective on adherence behaviour by acknowledging that the decision to engage in exercise is not solely based on personal factors, but also on social and structural factors[41].

Another key asset of the framework is its cultural sensitivity and contextual appropriateness. The framework recognises the importance of health behaviours being interwoven with cultures and group relationships, especially in African societies, where social norms, religious beliefs, indigenous knowledge systems and collective values strongly influence health behaviours. The inclusion of culturally familiar

activities, community involvement, and strategies adaptable to local conditions increases the chances of social acceptance and sustainability. This is consistent with Airhihenbuwa's[36] assertion that culturally based health interventions are more effective than those grounded in biomedical and Western worldviews.

Another strength of the framework is its scaffolding approach. The framework views adherence as a gradual process of development, therefore acknowledging that sustained exercise behaviour builds over time through clear and consistent guidance, reinforcement, social support and internalisation of behaviour. This method is based on the principles of behavioural learning and social cognition theories, which focus on the gradual development of self-efficacy, competence and independent behavioural regulation[30]. The framework, thus, offers practical suggestions for developing interventions to support a transition from external to internal support for participation in exercise. Additionally, the framework is flexible and transferable across contexts, such as clinical rehabilitation, educational programmes, community health promotion programmes and sports and exercise science research. It also adds elements of technological infrastructure, such as mobile health interventions, telehealth, SMS reminders, and digital monitoring, which enhance its relevance in the modern healthcare and public health landscape. This is particularly important in low-resource settings where affordable and accessible technologies may help bridge healthcare gaps and improve adherence monitoring[25].

While the framework has many strong aspects, it also has weaknesses that need to be recognised. One constraint concerns its multidimensional structure. It is important to note that the framework draws on several interacting variables in cultural, technological, contextual, institutional and behavioural areas, which may require significant coordination, interdisciplinary collaboration, and resource availability for implementation. Healthcare systems might not have enough staffing, resources or funding to implement all elements of the framework fully in some low-resource settings. Another constraint concerns differences found among African societies and other cultural settings. The framework was designed with African realities in mind, yet there is significant diversity across Africa regarding language, religion, culture, socio-economic conditions, healthcare systems and infrastructure development. Thus, programmes that work well in one area or setting may not work the same in another. This implies that the framework might need adaptation for implementation before it is put into practice with various populations and across different environments.

Technological access and digital literacy may also be constraints on the framework. Mobile-health technologies and digital support systems have proliferated across Africa. However, in many rural and

less-served communities, significant gaps remain in access to the internet, electricity, and smartphones, as well as in technological competency. Consequently, certain technological aspects of the framework could be challenging to deploy consistently across populations with varying levels of digital infrastructure or tech-savviness. Furthermore, though it is conceptually thorough, there is still a need for further empirical testing. Several of its proposed relationships and mechanisms are yet to be tested longitudinally across a wide range of populations, healthcare contexts, and intervention frameworks to provide evidence of reliability, predictive validity, and practical effectiveness. In light of this, further studies are required to assess the applicability of the framework, identify possible adaptations, and evaluate its capacity to enhance long-term exercise adherence results across diverse socio-cultural and economic settings.

The S-CTCA framework is a culturally responsive, contextually informed, behaviourally based framework for understanding and promoting overall recommended exercise adherence. Although it is complex and has implementation limitations, its multidimensional, scaffolded structure has promise for future use to improve exercise promotion, rehabilitation practice, health education, and the development of public health interventions in African and other low-resource areas in need of exercise intervention development.

Implications for Policy and Practice

The S-CTCA framework has implications for health policy, clinical practice, public health programming, education and exercise promotion in Africa and other low-resource areas. One of the key policy implications of the framework is the need to shift away from solely biomedical interventions in exercise recommendations and acknowledge the wider cultural, social, environmental, and economic context that affects adherence behaviour. The framework underscores that recommended participation in exercise is not simply a function of personal motivation or medical recommendations, but is also influenced by structural factors such as poverty, access to healthcare and services, cultural beliefs, work and employment pressures, and social support networks. This is consistent with ecological and social determinants of health approaches, which propose that interventions to support health should account for both individual and environmental determinants of behaviour[19][41][42].

The framework also emphasises the need for culturally responsive health intervention programmes and policies. Policymakers and practitioners are urged to incorporate locally held beliefs, languages, traditions, gender norms, and community realities when developing strategies to promote physical

activity, rather than relying solely on solutions designed elsewhere that may not be relevant to African sociocultural contexts. This implication is especially relevant because culturally inappropriate interventions have been shown to have poor acceptance and low adherence rates. Airhihenbuwa[36] argued that interventions in African societies must be culturally grounded and socially relevant to achieve sustainable health promotion. As a result, the S-CTCA framework can provide a foundation for policies promoting the incorporation of indigenous physical activities and traditional movement practices, the involvement of community members, and the integration of faith-based wellness programmes into exercise promotion programmes.

One more important implication concerns health care delivery systems and rehabilitation practice. The framework proposes that a multidisciplinary/multi-professional and patient-centred approach to exercise adherence should be encouraged through the collaborative planning and implementation of interventions involving a team of physiotherapists, exercise physiologists, nurses, physicians, sports scientists, community health workers, and physical education specialists. An integrated approach could improve continuity of care, behavioural support, and long-term adherence. The framework also suggests that exercise services are integral to chronic disease management and public health promotion and must be prioritised as key components of the healthcare system. This position is supported by international evidence showing that physical activity is an important factor in reducing the burden of non-communicable diseases, improving functional independence and enhancing quality of life[43][44].

The S-CTCA framework is also relevant to policy and practice in education. Primary, secondary and tertiary educational institutions are encouraged to improve the provision of physical education, school wellness programmes, and community-based fitness programmes to increase physical activity throughout the lifespan. The framework acknowledges that schools and universities are significant social contexts for fostering positive exercise behaviours, health literacy, and behaviours of self-regulation. This implication is consistent with evidence that school-based physical activity programmes have a significant impact on physical health, psychological wellbeing, and the prevention of sedentary lifestyles among children and adolescents[45][46]. This means that educational policymakers are encouraged to promote programmes of physical activity that are inclusive, culturally relevant and context-sensitive, and go beyond participation in competitive sport.

The framework also emphasises the increasing importance of technology as a facilitator for exercise and health behaviour management. Policymakers and practitioners are invited to consider the potential of low-cost, low-tech approaches to digital health interventions, such as SMS reminders, telehealth

consultations, wearable monitoring systems, mobile fitness apps and online support networks to enhance adherence support systems. The framework also highlights the need to tailor technological interventions to local contexts and particularities, including low internet connectivity, low digital literacy, linguistic diversity, and infrastructure issues. This suggestion is consistent with evidence that well-designed mobile health technologies can enhance access to and adherence with health care for underserved populations[25].

This framework also suggests increased investment in community-based physical activity participation, as well as in supporting infrastructure and environments. Health and welfare agencies, local governments, and public health and health care systems are called upon to enhance access to places where people can exercise safely, use recreation facilities, use public transportation to get to and from exercise destinations, and participate in community wellness programmes that promote active living. The framework acknowledges that people are more likely to continue exercising when supportive social and environmental factors are in place. Policies that increase community involvement, work-site wellness programmes, older adult fitness programmes, women's health promotion and rural health promotion can therefore have a substantial impact on exercise adherence and population health.

The framework offers an interdisciplinary basis for exploring adherence to exercise across various sociocultural and economic settings for research and professional practice. Researchers are invited to explore the relationships among cultural attitudes, technologies, context, and behaviours regarding long-term physical activity involvement. The framework, therefore, underpins the development of culturally relevant, socially engaging, and practically viable evidence-based interventions in low-resource settings across Africa and beyond. It also promotes continuous assessment of the effectiveness of the interventions, the implementation of the policy, and behavioural outcomes to enhance exercise promotion strategies and public health practice.

The S-CTCA framework indicates that more holistic, culturally relevant and contextually appropriate policies and practices for exercise adherence should incorporate the tenets of behavioural science, community engagement, technology, and structural support. The framework highlights the mutual influence of cultural, technological, contextual and behavioural factors. It provides valuable insights into enhancing rehabilitation outcomes, advancing preventive health care, building public health systems, and fostering sustainable exercise participation in African societies and beyond.

Conclusion

The S-CTCA Theoretical Framework for Exercise Adherence Recommendation in African Settings provides a multidimensional, culturally grounded and contextually relevant approach to understanding and improving exercise adherence across African populations. The S-CTCA framework does not assume motivation is the only factor influencing behaviour. However, it recognises the influence of socioeconomic realities, community systems, cultural beliefs, health care structures, and access to technology. The adoption of a scaffolded progression from initiation to long-term maintenance acknowledges that adherence develops incrementally through ongoing support, social integration, and behaviour internalisation. The framework therefore has practical value for health care practitioners, researchers, educators, policymakers, physiotherapists, exercise scientists and community development practitioners seeking sustainable exercise participation outcomes in African settings. Overall, the S-CTCA framework contributes to the development of culturally responsive strategies to improve exercise adherence, thereby improving health outcomes, reducing disease burden, enhancing quality of life, and promoting sustainable wellness across African societies.

The S-CTCA Theoretical Framework contributes to the scholarship on exercise adherence by integrating contextual, therapeutic, technological, cultural, and community dimensions into a progressive behavioural support system for African settings. The framework extends beyond traditional frameworks of individual adherence, acknowledging the interrelated influence of structural realities, social relations, and cultural health practices on long-term exercise participation.

Recommendations

The CTCA framework is multidimensional, and therefore multiple recommendations are essential for policy development, professional practice, education, community health promotion, and future research. First, healthcare practitioners and policymakers should embrace a culturally responsive, context-sensitive approach to exercise recommendations and to promote adherence. Exercise interventions need to be designed to reflect the influence of cultural beliefs, socioeconomic realities, community relationships, and environmental restrictions on health behaviour. This entails the development of locally adaptable exercise programmes that include indigenous physical activities, community participation, and communication strategies meaningful to the culture, to enhance acceptance and sustainability.

Furthermore, governments and healthcare institutions should strengthen the provision of preventive healthcare and rehabilitation services through multidisciplinary collaboration. Exercise adherence programmes should be planned, delivered, monitored, and evaluated collaboratively by physiotherapists, exercise physiologists, sports scientists, physicians, nurses, physical education specialists, and community health workers. Such integrated practice may improve continuity of care, patient support, and long-term adherence outcomes. In line with global recommendations on physical activity and health promotion, healthcare systems should focus on promoting exercise as an integral part of chronic disease prevention, rehabilitation, and public health management.

Physical education, school wellness programmes, and youth fitness initiatives should also be enhanced in educational settings to foster lifelong engagement in physical activity. Schools and universities should develop and implement comprehensive physical activity programmes that include health promotion, behaviour development, active living, and competitive sports, in a context-relevant way. Educational policies should encourage health literacy programmes to increase students' knowledge of the benefits of exercise, disease prevention, and healthy lifestyle practices.

The framework also underscores the need to increase investment in community-based health promotion programmes and supportive environments for physical activity. Governments, local authorities, and non-governmental organisations should improve access to safe spaces for exercise, recreational facilities, rural wellness programmes, women's fitness initiatives, elderly physical activity programmes, and workplace wellness interventions. Intervention planning and implementation should focus on community participation, as sustainable exercise adherence is more likely when programmes are socially acceptable, culturally meaningful, and supported by local structures. Therefore, strategies to improve participation and long-term adherence should include community-driven wellness programmes, faith-based initiatives, traditional dance activities, and family-centred exercise interventions.

Another important recommendation is the inclusion of affordable and accessible technology support systems in exercise promotion and rehabilitation practice. Mobile health interventions such as SMS reminders, telehealth visits, wearable activity-tracking systems, mobile fitness apps, and online support platforms need to be adapted to local realities of limited internet connectivity, language diversity, low digital literacy, and infrastructural limitations. Policymakers and practitioners should prioritise low-cost technologies that work well in underserved and low-resource communities.

The CTCA framework also indicates the need for further research and empirical validation. Researchers across sports and exercise science, rehabilitation, behavioural health, and public health should explore

the effectiveness of culturally adapted and scaffolded interventions to enhance exercise adherence in different African populations and healthcare settings. Future studies need to investigate the role of cultural beliefs, technological support systems, contextual barriers, social support, and behavioural outcomes on long-term exercise participation. Longitudinal and community-based research designs are especially crucial for evaluating the real-world efficacy, flexibility, and sustainability of the framework in different sociocultural and economic contexts.

Finally, policymakers, researchers, educators, and healthcare professionals should raise public awareness of the role of physical activity in disease prevention, rehabilitation, mental health, and improved quality of life. Public health campaigns should highlight that the exercise they promote is not just a leisure activity but a vital part of preventative and therapeutic healthcare. Culturally appropriate education, policy development, community engagement, and interdisciplinary cooperation within the CTCA framework can be vital for sustainable exercise adherence, better public health outcomes, and improved quality of life in African and other low-resource settings.

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