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Investigating caregiver mental health and user engagement during a digital parenting intervention (ParentApp) in Tanzania with caregivers of adolescents

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Abstract

Introduction

Mental health conditions pose a significant global health challenge, disproportionately affecting low- and middle-income countries (LMICs) where access to care is limited. Caregivers of adolescents face unique pressures, balancing their own psychological well-being with the demands of parenting during a crucial developmental phase. ParentApp, a culturally adapted, offline digital parenting intervention designed to promote positive parenting and support caregiver mental health, offers a preventive approach to reach underserved populations. This study aimed to: (1) evaluate changes in caregiver mental health symptoms following ParentApp use; (2) identify psychosocial and user engagement factors associated with caregiver mental health at follow-up; and (3) explore whether baseline caregiver mental health, demographics, and psychosocial variables predict user engagement with the intervention.

Methods

Secondary data were analysed from a cluster randomised controlled trial involving 1200 Tanzanian caregivers of adolescents. Participants completed baseline and follow-up assessments measuring depression, anxiety, social support, and parenting stress. Automated app engagement metrics were also collected. Descriptive statistics summarised sample characteristics. Changes in caregiver mental health between baseline and follow-up were assessed using Wilcoxon Signed Rank Tests. Multiple linear regression identified psychosocial and engagement factors associated with mental health outcomes at follow-up. A logistic regression explored baseline predictors of app engagement, considering social support, parenting stress, and sociodemographic factors.

Results

Caregivers showed significant improvements in mental health symptoms post-intervention ($Z = -12.39$, $p < 0.001$). Regression analyses indicated that better self-reported health predicted greater mental health improvement, while higher parental stress was linked to poorer outcomes. Social support and engagement metrics were not independently associated with changes in mental health symptoms. No baseline factors significantly predicted user engagement, suggesting that initial characteristics did not differentiate those who completed the intervention from those who did not.

Discussion

Findings suggest that digital parenting interventions like ParentApp, with offline functionality and local cultural adaptation, may effectively support caregiver mental health in LMIC settings. Addressing infrastructural barriers and tailoring content to local needs remain crucial to maximise reach and intervention impact. However, limitations in the measurement of engagement highlight the need for improved metrics in future research.

Conclusion

This study demonstrates the feasibility and potential benefits of the ParentApp intervention in improving caregiver mental health in Tanzania. Leveraging technology adapted to local contexts offers a scalable approach to enhancing family well-being in LMICs. Future research should focus on larger trials, integration with health systems, and strategies to improve digital access, cultural relevance, and engagement measurement to optimise outcomes.

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List of Terms and Abbreviations

Adolescent – A young person between the ages of 10 and 19.

App – Mobile Application (as in ParentApp)

Caregiver – Someone who takes on a parenting role, providing care, support, and guidance to a child. This includes not only biological or adoptive parents but also relatives or community members who fulfil essential parenting duties.

CMHCs – Common Mental Health Conditions

DALY – Disability-Adjusted Life Year

HIC – High-Income Country

LMIC – Low- and Middle-Income Country

MOS - Medical Outcomes Study Social Support Survey

PLH – Parenting for Lifelong Health

PHQ-4 – Patient Health Questionnaire-4

PSS – Parental Stress Scale

RCT – Randomised Controlled Trial

SSA – Sub-Saharan Africa

YLD – Years Lived with Disability

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Chapter 1: Introduction

The global prevalence of common mental health conditions (CMHCs) has been reported to be high in recent years, with an estimated 970 million individuals affected worldwide and limited support available (Fan et al., 2025). Among these, depression is estimated to impact over 279 million people, while anxiety conditions affect approximately 301 million individuals (GBD 2019 Mental Disorders Collaborators, 2022). Studies have shown that vulnerable groups, such as children, minority groups, and individuals and families in low-income and low social support settings are more likely to have CMHCs (Nam et al., 2021). Although adolescents have been shown to be a vulnerable group (Gordon, 2020), there is evidence to suggest that caregivers of adolescents may also be at increased risk for CMHCs, particularly when the household experiences adversities such as the COVID-19 pandemic (Sherr et al., 2022). Caregivers had to deal not only with their own fears, loss of income, and increased health concerns, but also support their children through lockdown restrictions and remote learning (Lachman et al., 2024).

Despite mental health challenges being prevalent, the care and treatment gap in mental health support is a notable concern. In many settings, varying levels and types of mental health assistance and care do exist, although scarce, yet awareness and access to available support are frequently constrained (McGinty & Eisenberg, 2022). Several factors, including stigma surrounding mental health, lack of mental health literacy, limited availability of services, financial constraints, cultural beliefs, and fear of discrimination, play a significant role in individuals not accessing support (Bila & Carbonatto, 2022; Grant et al., 2024; Muhorakeye & Biracyaza, 2021; Reupert et al., 2021). The consequences of unidentified and untreated CMHCs are profound, impacting both individuals and families.

Prioritising parental mental health is essential for fostering both healthy child development and strong family bonds (Backhaus et al., 2023; DeVore & Ginsburg, 2005; Marceau et al., 2015; Sandler et al., 2015). A caregiver's mental health significantly influences the parent-child relationship, as it affects the parent's ability to provide emotional support, care, and overall involvement (DeVore & Ginsburg, 2005; Tăut et al., 2021; Wamoyi & Wight, 2014). Parents who are experiencing CMHCs may struggle to offer consistent attention, leading to communication issues and strained attachment (Havighurst et al., 2020).

Access to general resources like healthcare, education, employment, childcare and parenting support can play a vital role in promoting positive mental health for caregivers (Norman et al., 2012). Although more parenting programmes are available in high-income settings, substantial progress has also been made in lower-income contexts where community resources are scarce (Devlin et al., 2018; Jeong et al., 2021; Nowak & Heinrichs, 2008; Sandler et al., 2015; Spencer et al., 2020). However, the availability and accessibility of parenting programmes is limited in sub-Saharan Africa, even more so for caregivers of adolescents (Backhaus et al., 2023; Mikton & Butchart, 2009).

Parenting interventions improve caregiver mental health primarily by reducing stress, boosting parenting confidence, and fostering stronger caregiver-child bonds (Borghouts et al., 2021). Meta-analytic evidence from multiple RCTs reveals that the Triple P-Positive Parenting Program yields small to moderate improvements in parental wellbeing, with larger effects in families with higher distress (Nowak & Heinrichs, 2008). Further research highlighted complex interactions between parental trauma, mental health, and parenting behaviours, emphasising the need for psychosocial support to enhance caregiving (Christie et al., 2020). Another RCT conducted with low-income families found that a brief strength-based video coaching intervention improved caregivers' parenting self-efficacy, with the greatest benefits observed among caregivers who experienced high levels of early adversity (Liu et al., 2025). A recent global mapping study highlights the universal presence of these psychosocial pathways leading to improved mental health and underscores the effectiveness of parenting

programmes worldwide (van Tuyll van Serooskereken Rakotomalala et al., 2023). One of the parenting interventions which has contributed to the body of evidence in the LMIC region is the Parenting for Lifelong Health (PLH) programme.

PLH is an evidence-based parenting programme that has been tested in 15 randomised controlled trials (RCT) in 29 different countries, including South Africa and Tanzania, and has proven to be effective in improving positive parenting techniques as well as reducing parental mental health issues as a secondary outcome (Cluver et al., 2016, 2020; Cluver et al., 2018; Redfern et al., 2019; Shenderovich et al., 2020). All versions of the PLH programme incorporate mindfulness, breathing, and grounding exercises for parents in each session, providing users with a variety of tools to effectively reduce stress, anxiety, and anger (Awah et al., 2022; Havighurst et al., 2020; Sherr et al., 2022). A recent study in Tanzania involving 40,000 families found the Furaha Teens adaptation of PLH positively impacted child maltreatment, family relationships, adolescent development and reduced both caregiver and adolescent depression symptoms (Lachman et al., 2020, 2024; Martin et al., 2021). PLH in-person programmes have successfully served over 180,000 families; yet, despite the expansion, physical limits to wider use remain (Cluver et al., 2016; Cluver et al., 2018; Lachman et al., 2024; Martin et al., 2021; Redfern et al., 2019; Shenderovich et al., 2020; Ward et al., 2020).

Similarly to PLH, accessibility remains a significant challenge for the delivery of parenting interventions, as in-person sessions are still the most common method of delivery for available programmes (van Tuyll van Serooskereken Rakotomalala et al., 2023). In-person participation requires caregivers to have physical access to the programme's site, which can be especially difficult in regions with limited community centres and outreach opportunities (Holst et al., 2020). Additional constraints such as childcare, work responsibilities, travel difficulties, and geographical location further hinder participation (Weisenmuller & Hilton, 2021).

Despite growing interest in digital interventions as a means to support parenting and improve mental health, there remain significant gaps in the literature, particularly in LMICs. While digital interventions have been shown to be feasible to deliver and effective in high-income settings, less is known about their impact in resource-constrained environments, where access to technology, cultural differences, and the unique stressors faced by caregivers may influence both the effectiveness of the interventions and the degree of user engagement (Du Toit et al., 2022).

Given the shift towards the potential use of digital interventions for mental health and parenting programmes to address barriers to access, the in-person delivery approach of PLH has been adapted into a digital app-based intervention called ParentApp for Teens (ParentApp) (Awah et al., 2022; Baerecke et al., 2024; Janowski et al., 2023). ParentApp is a smartphone application that is designed to be used completely offline in areas where participants do not have access to regular internet connection and can be easily adapted to diverse contexts. Working closely with partners who are experienced in delivering parenting support to caregivers in Tanzania, ParentApp was redesigned and localised to suit the language, culture and context of caregivers and their teens living in Tanzania. ParentApp was the first of its kind to be piloted in Tanzania in a feasibility study (n=204) in 2022 (Klapwijk et al., 2024). The pilot study mimicked a planned RCT in order to determine the feasibility of delivering a digital parenting intervention in the setting in preparation for the upcoming RCT (Whitehead et al., 2014). Another key gap in the literature is the understanding of the relationship between caregiver mental health and user engagement in digital interventions.

This study seeks to address these gaps by investigating a possible bidirectional relationship between caregiver mental health and user engagement during a digital parenting intervention in Tanzania. By focusing on a specific LMIC context, this research will contribute to the growing body of knowledge on the effectiveness and applicability of digital interventions in diverse settings. It will also provide valuable insights into how caregivers' baseline mental health status influences their engagement with digital interventions, an area that remains under-researched.

1.1 Aim and Objectives

The aim of this research is to investigate caregiver mental health and user engagement during a digital parenting intervention.

The objectives of the study are to:

- Investigate the change in caregiver mental health symptoms after using the ParentApp digital parenting intervention.
- Determine the psychosocial and user engagement factors associated with change in caregiver mental health symptoms between baseline and follow-up.
- Investigate whether caregiver mental health, demographics and psychosocial factors at baseline predict levels of engagement in the ParentApp intervention.

1.2 Summary of Chapters

This dissertation contains five chapters which are summarised below.

Chapter 1 introduces the importance of supporting caregiver mental health in LMICs, especially for parents navigating unique socio-economic challenges. Chapter 2 explores the prevalence and impact of caregiver mental health issues like depression and anxiety, evaluating evidence on digital interventions in parenting and examining their potential in LMIC contexts. Chapter 3 provides an overview of the study's research design, outlining participant recruitment, data collection methods on caregiver mental health and engagement, and analysis strategies for assessing intervention impacts. Findings are presented on changes in caregiver mental health and predictors of engagement with the intervention are then presented in Chapter 4. Finally, the study's findings are interpreted in Chapter 5, where the potential of digital parenting interventions in strengthening caregiver well-being and parenting is discussed, while considering barriers like engagement challenges and cultural adaptation needs. Concluding with a summary of key findings, this chapter emphasises the role of accessible, scalable digital resources for caregivers, suggesting areas for future research to refine digital support in LMIC settings.

Chapter 2: Literature Review

This chapter examines caregiver mental health and digital parenting interventions in low- and middle-income countries (LMICs). The literature review begins by outlining the significance and global burden of caregiver mental health, with specific attention to the LMIC context. It then explores parenting interventions, particularly those delivered digitally and the factors influencing user engagement.

2.1 Burden and Prevalence of CMHCs

CMHCs represent a major contributor to the global burden of disease, which is measured primarily through Disability-Adjusted Life Years (DALYs), which combine years of life lost (YLLs) due to premature mortality with years lived with disability (YLDs) (GBD 2019 Mental Disorders Collaborators, 2022; Santomauro et al., 2021). Importantly, for mental conditions, the burden is overwhelmingly driven by YLDs because these conditions rarely cause early death but often have a chronic or relapsing course. Globally, depressive disorders rank as the second leading cause of YLDs across all ages, while anxiety disorders rank eighth (GBD 2019 Mental Disorders Collaborators, 2022). Collectively, both disorders account for a notable proportion of the non-fatal disease burden worldwide and lead to significantly reduced quality of life (GBD 2019 Mental Disorders Collaborators, 2022). Globally, the mental health condition burden increased from 80.8 million DALYs in 1990 to 125.3 million DALYs in 2019, accounting for approximately 4.9% of all global DALYs in 2019, with depressive and anxiety conditions among the leading contributors (GBD 2019 Mental Disorders Collaborators, 2022).

In Tanzania, CMHCs contribute a substantial burden, with total mental health-related DALYs estimated just under 1,722 per 100,000 population in 2020 (GBD 2019 Mental Disorders Collaborators, 2022). Depressive conditions rank as the second leading cause of years lived with disability (YLDs) in the country, while anxiety conditions rank eighth among all causes of YLDs (GBD 2019 Mental Disorders Collaborators, 2022). Despite a robust evidence base

supporting effective mental health interventions across various populations, the global burden of CMHCs has shown little decline since 1990 (GBD 2019 Mental Disorders Collaborators, 2022). This persistent burden highlights the pressing need for scaling up mental health services and addressing the substantial non-fatal disability that these conditions impose on individuals and societies.

CMHCs, particularly in LMICs, represent a significant public health concern due to their high prevalence globally (Patel et al., 2018). In 2021, approximately 970 million people worldwide were affected by CMHCs, including 301 million with anxiety conditions and over 279 million with depression (GBD 2019 Mental Disorders Collaborators, 2022). Globally, stress-related conditions affect 35.1% of adults, with a slightly greater prevalence in females (36.1%) than in males (33.6%) (Smith & Wesselbaum, 2025). The prevalence of depression in adults within LMICs ranges widely from 0.5% to 62.7% and anxiety symptoms range between 0.2% to 32.2% (Edwards et al., 2023; Huang et al., 2017).

CMHCs represent a substantial burden in sub-Saharan Africa (SSA), with a prevalence that often exceed global averages (Atewologun et al., 2025). In Africa, CMHCs among adults include anxiety conditions, with a prevalence of around 14% (Edwards et al., 2023), and depressive conditions, ranging from 11% to as high as 46% (Huang et al., 2017). According to a systematic review conducted with data from 25 unique studies including 58,887 participants across 10 SSA countries, posttraumatic stress conditions has a prevalence of 22%, with stress-related conditions affecting up to 36% of the population (Ng et al., 2020). Atewologun (2025) interestingly reports that depression affects 26.9% of the population in SSA, which is markedly higher than the global prevalence range of 10-20%. Additionally, a cross-sectional web-based survey conducted among 3,221 participants across four sub-Saharan African countries (Ghana, Nigeria, Malawi, and Mozambique) showed that the co-occurrence of depression, anxiety, and stress was frequent, with 51.3% of participants experiencing two of these conditions and more than a quarter affected by all three

simultaneously (Ike et al., 2025). In Tanzania, one-third of adults experience CMHCs such as depression and anxiety (Mainland et al., 2023).

The prevalence of CMHCs among parents and caregivers is notably high, especially in low- and middle-income countries, due to the added psychological burdens of caregiving. This unique vulnerability stems from chronic stressors related to raising children, resource constraints, and multiple household roles (Pedersen et al., 2019). A World Health Survey analysis across 47 LMICs found that 19.1% of caregivers reported anxiety symptoms and 10% reported symptoms of depression, both substantially higher than the prevalence reported among non-caregivers (Smith et al., 2022). A cross-sectional study conducted in Uganda with 2,315 parents and their primary school children found that approximately 28% of parents exhibited depressive symptoms, highlighting the significant mental health burden among caregivers in low-resource settings (Huang et al., 2017). In another cross-sectional study involving 170 parents in Malawi, 41.2% reported experiencing psychological distress (Masulani-Mwale et al., 2018). In Tanzania, a cross-sectional study of 212 caregivers of children and adolescents found that 42% exhibited symptoms of anxiety and 38% showed symptoms of depression, indicating a substantial mental health burden in this population (Swai et al., 2024). A qualitative study with male caregivers in Tanzania further emphasised that fathers experienced various mental health challenges, including symptoms of depression, anxiety, and stress, largely linked to socioeconomic pressures and caregiving responsibilities (Jeong et al., 2024). Caregivers of children and adolescents with mental health or neurodevelopmental conditions are more at risk than others, according to a scoping review synthesising evidence from 35 studies across 15 LMICs, predominantly in Africa and South-East Asia (Ademosu et al., 2021). Indeed, findings indicate a high prevalence of caregiver psychological distress, with depression rates ranging from 28% to 79% (Ademosu et al., 2021).

2.2 Defining Caregiver of Adolescents

A caregiver of an adolescent is an individual, such as a parent, guardian, aunt, grandmother, or other family member, who is primarily responsible for the care, guidance, and support of a young person transitioning through the developmental stage of adolescence. Although the definition of adolescence varies, the most commonly accepted age range is 10 to 19 years (World Health Organization and the United Nations Children's Fund, 2024). This study specifically focuses on adolescents aged 10 to 17 years, while adolescents are still school-going and living with the caregivers. Caregivers in this role not only provide physical and emotional care but also support the adolescent's growing need for autonomy, identity exploration, and social development. This period often involves unique challenges, as adolescents experience rapid physical, emotional, and cognitive changes, and caregivers are crucial in helping them navigate issues such as peer relationships, academic pressures, and risk-taking behaviours.

2.3 Importance of Caregiver Mental Health

Caregiver mental health refers to the psychological and emotional well-being of individuals responsible for raising children and plays a critical role in shaping the well-being of children and adolescents (Crnic & Low, 2002; DesRoches et al., 2023). Poor caregiver mental health can hinder parent-child engagement, increase parenting stress, strain family relationships, and ultimately lead to adverse child development outcomes (Bonsu et al., 2020; Doherty & Gaughran, 2014; Patel et al., 2018; Venta et al., 2016; Ward & Lee, 2020).

Caregiver CMHCs may have profound and lasting effects on children's attachment with caregivers and on family relationships (Kamis, 2021; Risi et al., 2021). Such conditions affect caregivers' ability to form secure attachments and provide consistent emotional support to their children (Tăut et al., 2021; van Tuyll van Serooskereken Rakotomalala et al., 2023). Impaired parenting behaviours, such as harshness or emotional disengagement, contribute to

children's feelings of insecurity and distress during critical developmental periods (Risi et al., 2021). These difficulties may also increase family dysfunction, including marital conflict and inconsistent caregiving, further undermining children's wellbeing (Behere et al., 2017; Lagdon et al., 2021). Exposure to caregiver mental health conditions in childhood predicts increased distress that persists into adulthood, highlighting the enduring impact on the parent-child relationship and family dynamics (Kamis, 2021).

Caregiver mental health has a significant impact on multiple domains of child development, including mental wellbeing, social-emotional and cognitive development, and physical health (Sager et al., 2024). Children of caregivers with CMHCs are at a higher risk of developing mental health conditions themselves, with exposure to parental psychological conditions linked to behavioural issues and poorer emotional regulation (Featherston et al., 2024; Kamis, 2021). Maternal depression and anxiety, in particular, have been associated with disruptions in parenting behaviours such as reduced sensitivity and increased harshness, which negatively affect children's social-emotional development and cognitive outcomes (Lovejoy et al., 2000; Wang et al., 2022; Wang et al., 2024). Furthermore, children of caregivers with CMHCs are more likely to experience attachment difficulties, and impaired academic achievement (Kamis, 2021).

Interventions targeting both caregiver mental health and parenting practices have demonstrated positive effects on child cognitive and social-emotional outcomes (Christie et al., 2020; Cluver et al., 2020; Lachman et al., 2014; Meinck et al., 2017; Risi et al., 2021; Sandler et al., 2015; Sandler et al., 2011). Therefore, exploring and addressing factors affecting caregiver mental health is essential for improving family well-being and promoting positive developmental outcomes for children (Bhutta et al., 2023; Gardner et al., 2019; Hansen et al., 2019; Keijser et al., 2020).

2.4 Factors Influencing Caregiver Mental Health

Caregiver mental health is influenced by a complex interaction between factors operating at multiple levels of the ecological model (Crawford, 2020; Eriksson et al., 2018). While these factors affect the mental health of any individual, caregivers may be at heightened risk due to their added responsibilities and the burden of caregiving. These include individual factors, household factors and broader community-level factors. Understanding these factors is crucial for designing effective interventions and support systems for caregivers, particularly in low-income settings (Crawford, 2020; Eriksson et al., 2018). In Tanzania, cultural, societal, and religious traditions heavily shape caregivers' experiences with mental health conditions (Hovland et al., 2025), therefore any guidance must respect and incorporate family and community culture due to their strong influence on healthcare decisions.

2.4.1 Individual Factors

At the individual level, factors such as sociodemographic characteristics, trauma, adversity, health, and lifestyle factors account for 60%-90% of CMHCs (Bala et al., 2024). Gender differences emerge, with women more frequently assuming caregiving roles, correlating with higher rates of anxiety and depression compared to men (Bhan et al., 2020; Cherewick et al., 2021). Gendered social norms also play a role, with girls and women disproportionately affected due to greater unpaid care responsibilities and social expectations, which contribute to increased mental health risks (Leon-Himmelstine et al., 2021).

Age is a significant factor influencing caregiver mental health. In Tanzania, studies show that a large proportion of caregivers are women aged between 35 and 44 years, with many being young mothers (aged 18-35) (Lyela et al., 2024), who often face heightened psychological distress due to limited experience and resources. Young mothers, in particular, are vulnerable to anxiety and depression, as they navigate the challenges of early parenting (Hassan et al., 2025). Both younger and elderly caregivers report higher stress levels, the former due to

inexperience and the latter due to physical strain and health challenges (Kirkbride et al., 2024; Mwanyangala et al., 2010; Stieglitz et al., 2023).

Individual sociodemographic characteristics, including relationship status, education level, and literacy, play a crucial role in shaping caregivers' mental health. Being in a relationship is generally associated with a reduced risk of developing mental health conditions compared to being single, divorced, or widowed (Grundström et al., 2021; Rapp & Stauder, 2020; Scott et al., 2010; Wadsworth, 2016). Higher levels of education and literacy are linked to better mental health, as they provide individuals with greater knowledge, coping skills, and access to resources, while lower literacy is consistently associated with increased rates of anxiety and depression (Nguyen et al., 2017). Digital literacy further contributes to mental wellbeing by enabling individuals to access information, maintain social connections, and manage stress more effectively. Indeed, those with higher digital skills tend to report better psychological outcomes and reduced stress levels (Chen et al., 2024; Yeo et al., 2024). Other individual factors influencing mental health include recent household death, alcohol use and child gender, each variably linked to mental health outcomes (Alves et al., 2021; Borghouts et al., 2021; Lunansky et al., 2021; Lund et al., 2010; Marlow et al., 2022).

Parenting challenges related to caring for adolescents significantly influence caregiver mental health outcomes. Adolescence is a developmental stage characterised by increased autonomy-seeking, emotional volatility, and experimentation, which can lead to challenging behaviours such as defiance, mood swings, and risk-taking (Du Toit et al., 2022; Kobak et al., 2017; Marceau et al., 2015). Caregivers often struggle to manage these behaviours effectively, especially when lacking confidence in their parenting abilities. Caregivers with lower self-efficacy, who feel less capable of responding to adolescent behaviours, are more likely to experience elevated stress, anxiety, and depressive symptoms (Wamoyi & Wight, 2014). This stress is compounded in settings with limited resources, where access to parenting support and mental health services is scarce (Versluis et al., 2018).

2.4.2 Household and Social Factors

Household factors, such as the number of children or dependents under a caregiver's responsibility, play a critical role in influencing caregiver mental health outcomes. Caregivers managing larger households or multiple dependents often experience increased caregiving burden, which exacerbates stress and risk of mental distress (Scherer et al., 2019).

Socioeconomic status critically shapes mental health by influencing the support individuals receive and their overall quality of life. Poverty and low household income are major stressors contributing to anxiety and depression, with caregivers living in poverty often facing chronic stressors such as food insecurity, inadequate housing, and limited access to education and healthcare (Embleton et al., 2023; Marlow et al., 2022). Food insecurity is particularly detrimental, as it not only increases psychological distress in caregivers but is also linked to higher anxiety and depression (Abeldt, 2024; Ejiohuo et al., 2024). Poor housing quality and instability, such as overcrowding, frequent moves, or substandard living conditions, are associated with greater depressive symptoms, and elevated stress, while stable, affordable housing supports improved mental health outcomes (Alidoust & Huang, 2023; Rolfe et al., 2020).

Social support from family and friends plays a vital role in protecting caregiver mental health (Bauer et al., 2021). Caregivers with strong emotional and practical support systems tend to experience lower stress levels and better overall mental well-being (Acoba, 2024). Higher social support is linked to better mental well-being and highlights the value of incorporating strong social networks into caregiver health interventions to improve their effectiveness (Casale et al., 2014; Na et al., 2019). A comparative study conducted in South Africa and India highlights that greater perceived social support among LMIC caregivers is associated with improved mental health outcomes, as it helps reduce psychological distress and enhances their capacity to manage caregiving challenges effectively (Dada et al., 2020). In Tanzania, factors such as lack of social support, family dysfunction, stigma, and discrimination place

significant strain on the access to mental health support underscoring the need for accessible community-based support to prevent mental health conditions (Iseselo & Ambikile, 2020).

2.4.3 Community Factors

Exposure to violence significantly impacts caregiver mental health, especially in environments with high levels of family and community violence (Mersky et al., 2013; Pereda & Díaz-Faes, 2020). In Tanzania, witnessing violence in the community increases stress, affecting caregivers' mental health and their ability to care for children effectively (Ward et al., 2020).

Community violence is a global public health issue closely linked to mental health challenges, particularly among children, adolescents, and marginalised communities (Gehris et al., 2023, 2023). Direct victimisation has a more severe impact on mental well-being than witnessing violence (Miliauskas et al., 2022). Broader societal instability and unsafe living conditions exacerbate caregiver mental health challenges by heightening feelings of insecurity and anxiety (Cluver et al., 2020; Southern & Sullivan, 2021).

Caregivers' mental health conditions, often associated with individual, household, and community hardships, highlight the urgent need for accessible interventions that address both symptoms and the broader contextual factors affecting them. However, few evidence-based programmes specifically targeting caregivers' mental health needs address both basic household needs and psychological wellbeing (Patel et al., 2018).

2.5 Parenting Interventions

There is a growing acknowledgment that one of the most impactful approaches to improve the health, well-being, and development of children lies in implementing strategies to support their caregivers (Bloomfield & Kendall, 2012). Parenting programmes provide evidence-based strategies and techniques to help parents create supportive and nurturing environments for their children (Breitenstein et al., 2014; Hill et al., 2021; Nowak & Heinrichs, 2008; Smith et

al., 2020).These programmes address various aspects of parenting, equipping parents with essential skills, knowledge, and support to confidently navigate the challenges of raising children (Marcus, Rachel et al., 2019).

In addition to enhancing parenting practices, parenting programmes often take a comprehensive approach, addressing both external stressors and internal coping mechanisms that influence caregiver mental health, by equipping parents with stress management tools and strategies (Keijser et al., 2020). Many interventions address external stressors such as financial constraints, trauma, and lack of social support, which often undermine caregivers' ability to provide a stable environment (Bloomfield & Kendall, 2012; Featherston et al., 2024; Lachman et al., 2021; Marcus, Rachel et al., 2019). In addition to targeting external stressors, many parenting programmes strengthen caregivers' internal coping mechanisms by teaching skills such as emotional regulation, problem-solving, and mindfulness, which enable caregivers to manage their own stress responses and maintain psychological resilience. By addressing both internal and external factors, these holistic programmes ensure that caregivers receive the comprehensive support needed to foster their well-being and create healthier family dynamics (Colizzi et al., 2020). Effective interventions consider the interplay of these factors, tailoring delivery methods and content, whether in-person, hybrid, or digital, to caregivers' unique contexts.

Positive parenting refers to a caregiving approach that combines warmth, responsiveness, and emotional support with clear boundaries, consistent monitoring, and appropriate discipline (DeVore & Ginsburg, 2005). This style fosters a secure and nurturing environment in which adolescents feel valued and understood, while also learning to respect limits and develop self-regulation skills (DeVore & Ginsburg, 2005). Effective parent-child communication is a central component of positive parenting, enabling caregivers and adolescents to share thoughts, feelings, and expectations openly and constructively and parenting interventions have been shown to enhance these communication skills, promoting healthier interactions and stronger relationships between caregivers and their children (Janowski et al., 2023; Lachman et al.,

2017; Marcus, Rachel et al., 2019; Martin et al., 2021; Nowak & Heinrichs, 2008; Sandler et al., 2015). Improving parenting skills can have a substantial and long-term impact on adolescents' mental health and well-being, laying the groundwork for their future success and happiness (Norman et al., 2012; Wessels & Ward, 2015).

2.5.1 Overview of Parenting Programmes

Recent peer-reviewed evaluations demonstrate that parenting programmes around the world that focus on positive parenting, including but not limited to the Strengthening Families Programme, Nurturing Parenting Programmes, Parenting Wisely, Active Parenting of Teens and the Parenting for Lifelong Health (PLH) programme, can lead to improvements in parenting skills, child behaviour, and family relationships. However, evidence on their impact on parental mental health varies depending on context and specific programme characteristics.

The Strengthening Families Programme (SFP 10-14) teaches parents effective parenting techniques, strengthens parent-teen communication, and supports adolescents in developing healthy behaviours and resisting peer pressure (Stefanek et al., 2022). Evidence from high-income countries (HICs), such as the United States and the United Kingdom, shows that participation in SFP 10-14 can reduce family conflict and increase parental confidence, while also decreasing youth substance use and behavioural problems, and improving family communication and parent-child bonds (Spoth et al., 2012; Weybright et al., 2025). However, these studies lack long-term mental health follow-up and the use of clinically validated mental health measures, limiting confirmation of the sustained benefits of the programme.

The Nurturing Parenting Programmes focus on building parenting skills, enhancing knowledge of child development, and fostering self-worth, empathy, and self-awareness among young and often teen parents. This programme is designed to address the specific challenges faced by teen parents. Evidence primarily from HICs and some middle-income country contexts

suggests improvements in parenting attitudes, skills, and self-worth, along with indications of reduced parental stress and better emotional wellbeing (Gross et al., 2023). Nevertheless, these findings often rely on self-reported data and small, less diverse samples, limiting the generalisability of the results and the strength of conclusions regarding mental health outcomes (Beck Aguilera et al., 2023; Gross et al., 2023).

Parenting Wisely delivers skills aimed at reducing child behaviour problems and enhancing parental confidence and satisfaction. While short-term reductions in perceived stress and family conflict have been reported, these findings mainly come from small-scale studies with limited follow-up duration (Cefai et al., 2010; Cotter et al., 2013; Kacir & Gordon, 2000; Stalker et al., 2018). The programme's effectiveness depends on active parental engagement, but barriers such as motivation and contextual relevance impact participation and outcomes (Becker et al., 2017).

Active Parenting of Teens is a video-based programme designed to help parents understand and meet the challenges of raising adolescents. This programme has been linked to better parent-teen communication, fewer adolescent behavioural problems, and improved family relationships (Jespersen et al., 2021). Despite qualitative reports of benefits to parental wellbeing, few studies directly measure parental mental health with standardised tools, revealing an important gap in the literature on the programme's impact on caregiver mental health.

When examining interventions across different contexts, including SSA and other LMICs, most programmes improve child and adolescent mental health, parenting behaviours, and family functioning (Lachman et al., 2020; Pedersen et al., 2019). However, fewer studies assess parental mental health as a primary outcome, and where measured, the positive effects tend to be modest. For instance, a cluster RCT in rural Tanzania combining parenting and economic strengthening interventions resulted in reduced child maltreatment and increased parenting confidence but provided limited evidence on direct improvements in parental mental

health or long-term resilience (Lachman et al., 2020). Moreover, implementation challenges are notable in LMICs, as programmes often require cultural adaptation and face issues with recruitment, retention, and resource constraints. Many studies in these settings use small samples or lack control groups, which increases the risk of bias and limits the applicability of findings (Weber et al., 2021).

There is a scarcity of comparative research between high-income and low-resource settings, but current evidence suggests that while positive parenting skills are universally beneficial, the extent and durability of effects on parental mental health depend greatly on local context, delivery quality, and available support systems (Kingsbury et al., 2019; Kjøbli et al., 2023).

Finally, significant gaps remain in the evidence base, including the frequent absence of standardised, validated mental health measures for parents in many studies, limited long-term follow-up data, and underreporting of null or adverse results. Small sample sizes and limited power are common, particularly in SSA and other LMICs, restricting the conclusiveness of findings.

Overall, while parenting programmes show promise for enhancing both child and parent outcomes, including mental health, there is a pressing need for more robust, culturally sensitive research that employs standardised assessment tools. This need is especially urgent in SSA and other LMICs, where larger, well-powered studies with longer follow-up periods and a clear focus on parental mental health outcomes are required to inform adaptation and scaling of effective interventions.

2.5.2 Parenting for Lifelong Health

The Parenting for Lifelong Health (PLH) programme has been widely recognised for its evidence-based approach to supporting healthy child development, strengthening family relationships, and reducing violence within families (Cluver et al., 2018). Unlike some earlier programmes, PLH explicitly addresses challenges across diverse cultural settings by offering

adaptable, context-specific resources that help caregivers create nurturing environments (Shenderovich et al., 2020). Importantly, PLH incorporates validated mental health measures and includes follow-up assessments to evaluate sustained improvements, thereby addressing limitations related to generalisability, cultural relevance, and long-term mental health outcomes identified in other parenting interventions (Janowski et al., 2025; Martin et al., 2021; Ward et al., 2020).

Using Bronfenbrenner's socio-ecological model, PLH acknowledges the multiple levels of influence on caregivers and children, including individual, household and community factors. At the individual level, PLH equips caregivers with essential skills and strategies that promote positive parenting, while at the household level, the programme works to strengthen family relationships by enhancing communication and reducing conflict, fostering a healthier home environment (Ward et al., 2020). At the community level, the programme is adapted to local cultures and parenting practices. In Tanzania, PLH focuses on positive communication, effective discipline, and emotional bonding (Awah et al., 2022; Janowski et al., 2023). Its flexible delivery, through in-person sessions, digital tools, and workshops, makes parenting support accessible in different settings and helps address specific local challenges (Ambrosio et al., 2024; Baerecke et al., 2024; Cooper et al., 2024; Martin et al., 2021). Research using mixed methods has shown that PLH is feasible, acceptable, and scalable in Tanzania, with early results indicating it boosts caregiver confidence, lowers stress, and improves parenting (Lachman et al., 2024; Martin et al., 2021).

While parenting interventions like PLH show promise in LMICs, both in-person and digitally, further research is needed to understand how caregiver engagement affects outcomes and to determine the best ways to adapt these programmes for different settings. Understanding these dynamics will enable more targeted adaptations of PLH to maximise its impact in diverse LMIC contexts.

2.6 Digital Interventions for Parenting Support

2.6.1 Overview of Digital Parenting Interventions

Digital mental health interventions for parents have rapidly emerged as promising and scalable tools to support caregiver wellbeing and effective parenting, particularly in LMICs. Much like in person interventions, digital interventions often include components such as stress management techniques, relaxation exercises, psychoeducation on mental health, and strategies for improving caregiver-child interactions (Economides et al., 2018; MacKinnon et al., 2022). Delivered through mobile applications, SMS messaging, and web platforms, these programmes provide flexible access to evidence-based parenting guidance, mental health information, and educational resources. Digital solutions are especially advantageous for caregivers facing barriers such as geographic distance, transportation challenges, and limited availability of traditional in-person services, making them highly relevant in resource-constrained settings (Baumel & Faber, 2018; Emezue, 2020).

Research indicates that digital parenting interventions can improve parental knowledge, enhance parenting skills, reduce parenting stress, and decrease symptoms of depression and anxiety (Novianti et al., 2023; Ramaekers & Hodgson, 2020; Virani et al., 2019). These interventions often incorporate interactive components, such as multimedia content, quizzes, reminders, and online communities – elements which boost user engagement and sustain participation (Breitenstein et al., 2014). Importantly, studies conducted in various African contexts have demonstrated that mobile-based interventions positively impact both child and caregiver outcomes, underscoring their potential suitability for settings like Tanzania (Kabongo et al., 2021; Seif et al., 2017; Till et al., 2023).

One notable example is ParentText, developed under the WHO Parenting for Lifelong Health initiative. This mobile-based programme sends SMS and WhatsApp messages containing parenting tips, guidance on positive behaviour, and self-care strategies. Pilot studies in

countries such as South Africa and the Philippines have demonstrated improvements in parenting confidence, parent-child interactions, and reductions in harsh disciplinary practices, with ongoing research assessing impacts on parental stress and mental health (Ambrosio et al., 2024; Cooper et al., 2024)

In Tanzania, a mobile phone intervention delivering educational messages and psychoeducation modules to new mothers showed improvements in maternal knowledge, increased help-seeking behaviour, and reductions in symptoms of postpartum depression and anxiety (Seif et al., 2017). Similar text-based programmes in other African countries have demonstrated benefits for maternal mental health and hold promise as models for caregiver-focused digital support across the region (Kabongo et al., 2021; Till et al., 2023). Moreover, several studies have shown impact on caregiver mental health, with reductions in depression and anxiety among caregivers who participated in mobile or online parenting programmes (Fagan et al., 2019; Opie et al., 2024).

Generally, the literature indicates that digital parenting interventions are generally acceptable and show promise in improving parental knowledge, behaviours, and mental health outcomes, particularly when they include interactive and personalised content tailored to users' needs and contexts (Yap et al., 2018). Evidence suggests that interventions combining digital delivery with some in-person or social interaction components tend to achieve better engagement and outcomes than purely digital interventions alone. For example, a study in Kenya comparing a purely digital intervention with one that included a minimal in-person component found both effective in improving maternal and child outcomes, with only marginal gains from the added in-person aspect, highlighting the potential for well-designed digital programmes to be impactful on their own (Jäggi et al., 2025).

Despite their potential, the success of digital parenting interventions depends heavily on users' engagement levels, sustained access to technology, and cultural adaptation of content (Smith et al., 2025). Evaluations highlight the importance of tailoring programmes to local contexts,

supporting digital literacy, and ensuring accessibility to encourage ongoing participation and maximise impact (Baumel & Faber, 2018; Ramaekers & Hodgson, 2020). Indeed, experts widely advocate for contextual adaptation of digital parenting interventions to ensure cultural relevance, appropriateness, and responsiveness to specific challenges faced by caregivers, such as poverty, violence, and limited resources, which are particularly salient in settings like Tanzania (Borghouts et al., 2021; Bur et al., 2022; Embleton et al., 2023). Despite this consensus, there is a notable lack of rigorous comparative studies directly examining outcomes of contextually adapted interventions versus those implemented without adaptation. This gap underscores a critical need for more research assessing how cultural tailoring influences engagement, effectiveness, and sustainability of digital mental health interventions in diverse low-resource environments.

2.6.2 User Engagement with Digital Interventions

User engagement is vital for effective digital interventions. It refers to the extent to which users interact with the content, complete the programme, and integrate the strategies into their daily lives (Yardley et al., 2016). High levels of engagement are associated with better outcomes, as they indicate that users are more likely to absorb and apply the information and techniques offered by the intervention (Christensen et al., 2009).

User characteristics, such as age, education, and prior experience with digital technologies, can affect how easily caregivers navigate and use the platforms (Andrews et al., 2019). For example, caregivers who are less familiar with technology may find it challenging to engage with digital content, leading to lower levels of participation and adherence (Borghouts et al., 2021).

Psychosocial factors also play a key role in user engagement. Caregivers experiencing high stress or poor mental health may struggle to engage consistently, even if they recognise the potential benefits (Beatty & Binnion, 2016). On the other hand, those who perceive strong

social support or have higher self-efficacy are more likely to persist in using the intervention, as they feel more capable of overcoming challenges and incorporating new parenting strategies (Mohr et al., 2011). Support from family and community can encourage caregivers to complete the programme and seek help when needed, which is especially important in settings like Tanzania where social networks are a key source of resilience (Lin-Lewry et al., 2024).

Contextual factors, such as the availability of time and resources, can further impact engagement. In LMICs, caregivers often juggle multiple responsibilities, including work, childcare, and household duties, which can limit the time they have available to participate in digital interventions (Borghouts et al., 2021; Hansen et al., 2019; Perski et al., 2017; Shenderovich et al., 2018). Moreover, inconsistent access to reliable internet or mobile data can pose additional barriers to sustained engagement (Rotheram-Borus, 2021).

Despite these challenges, strategies such as tailoring content to the local context, providing reminders, and offering incentives have been shown to enhance engagement in digital interventions (Perski et al., 2017). Involving users in programme design and providing practical support are also linked to higher engagement (Aldridge et al., 2024). Features such as personalisation, user control, and interactive elements can make digital tools more appealing and easier to use (Janowski et al., 2025; Toves, 2023). Understanding the factors that drive or inhibit user engagement is essential for designing effective digital interventions that meet the needs of caregivers in settings like Tanzania (van Tuyll van Serooskereken Rakotomalala et al., 2025).

In Tanzania, where digital literacy varies, it is important to consider these factors when developing and implementing digital parenting interventions. There is a notable gap in the literature on how digital literacy and other contextual factors influence engagement and effectiveness of such programmes in Tanzanian settings. Understanding what helps or hinders

engagement can guide the creation of more effective, user-centred programmes that support both caregiver well-being and parenting practices.

2.7 Summary of Literature Review

This study addresses gaps in the literature by examining caregiver mental health and user engagement within a digital parenting intervention for caregivers of adolescents in Tanzania, using the socio-ecological framework to guide the structure and objectives.

While this chapter draws on international literature, there is relatively limited LMIC-specific evidence, and even fewer studies that consider features typical of non-Western family systems, such as distributed caregiving and extended households. These gaps highlight the importance of examining caregiver mental health and digital engagement in Tanzanian families, where caregiving responsibilities are often shared across multiple relatives.

Furthermore, this study is unique in its focus on caregivers of adolescents, a population that is often overlooked in parenting interventions. By examining the mental health needs and user engagement patterns of this group, the research will offer important contributions to the development of targeted interventions that address the specific challenges faced by caregivers of adolescents in resource-limited settings.

Ultimately, this research will contribute to the broader goal of improving caregiver mental health and family functioning in LMICs, where the need for scalable and accessible interventions is particularly acute. By addressing the key gaps in the literature, this study aims to inform future policies and programmes that support caregiver well-being and, by extension, the well-being of their children.

Chapter 3: Methodology

3.1 Study Design

For this study, secondary data collected during baseline and one-month post intervention follow-up interviews were used for caregivers included in the intervention arm (n=1198) of a cluster randomised controlled trial (Baerecke et al., 2024). The trial aimed to assess the impact of the ParentApp intervention on child maltreatment and sexual risk prevention and victimisation, compared to the control intervention, a Water Sanitation and Hygiene (WASH) App.

3.2 Setting

The intervention was implemented in urban and peri-urban areas of Mwanza (see Figure 1), which are characterised by high levels of poverty, informal employment, and constrained access to health and social services; yet within this context, the trial recruited caregivers who met minimum literacy criteria. This study setting was chosen using criteria from the Tanzania Social Action Fund programme, which identifies and supports households that are particularly vulnerable, impoverished, and food insecure (TASAF, 2017). This approach allowed the study to prioritise communities most likely to benefit from a digital parenting intervention. In the current sample, approximately 90% of caregivers reported that they could read easily and 85% reported employment outside the home, suggesting that participants were relatively advantaged compared with national averages for adult literacy and formal employment in Tanzania, and that more marginalised caregivers with limited literacy were likely under-represented. This pattern indicates that the requirement for ease of reading and smartphone access may have inadvertently selected higher-educated and higher-SES caregivers, which has important implications for the external validity and equity of digital parenting interventions in this setting. Data from the Global System for Mobile Communications indicated anticipated growth in smartphone ownership in Tanzania over the study period, highlighting a relevant

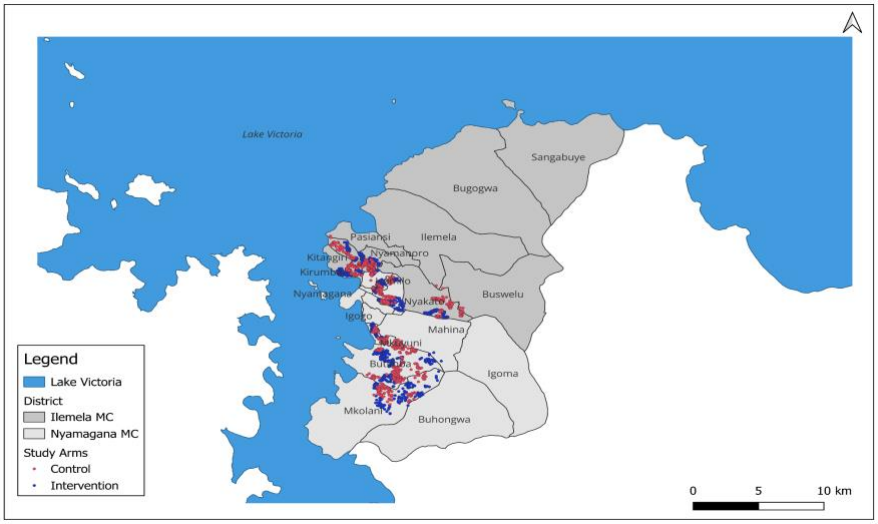
opportunity for digital health interventions (GSMA, 2022). Further, the study targeted households without smartphone ownership, and provided phones and data bundles to users, to ensure all participants had access to the intervention. This may have mitigated the bias toward higher socioeconomic households, particularly given the selection of these communities as described above.

Figure 1

Map of Mwanza, Tanzania

Figure 2

Map of RCT clusters in Mwanza, Tanzania



3.3 Participants

A total of 2400 dyads of caregivers and adolescents were recruited, making a total of 4800 participants for the RCT, with 1200 dyads in the intervention group and 1200 in the control group. The number of participants was decided after power calculations were conducted in the pilot study prior to the RCT (Klapwijk et al, 2025, in progress). These findings indicated that to achieve 80% power and considering the dropouts in both the trial and programme, a minimum of 80 clusters, each comprising 30 families, was needed (Klapwijk et al., 2024). Clusters were selected with consideration of their geographical locations within the Mwanza region (see Figure 2), and the research team received guidance from statistical experts indicating that the risk of contamination was deemed negligible due to the technology-driven nature of the intervention (Baerecke et al., 2024).

The main eligibility requirements for caregivers was that they (1) were 18 years or older, (2) were taking care of an adolescent between the ages of 10 and 17 years who lived in the same household, and who had assented to be part of the study, (3) possessed basic literacy skills, (4) were willing to take part in the intervention programme ParentApp or the control programme Water Sanitation and Hygiene (WASH) App, and (5) gave their consent to take part in the research (Baerecke et al., 2024). The present study used data from caregivers enrolled in the ParentApp arm only.

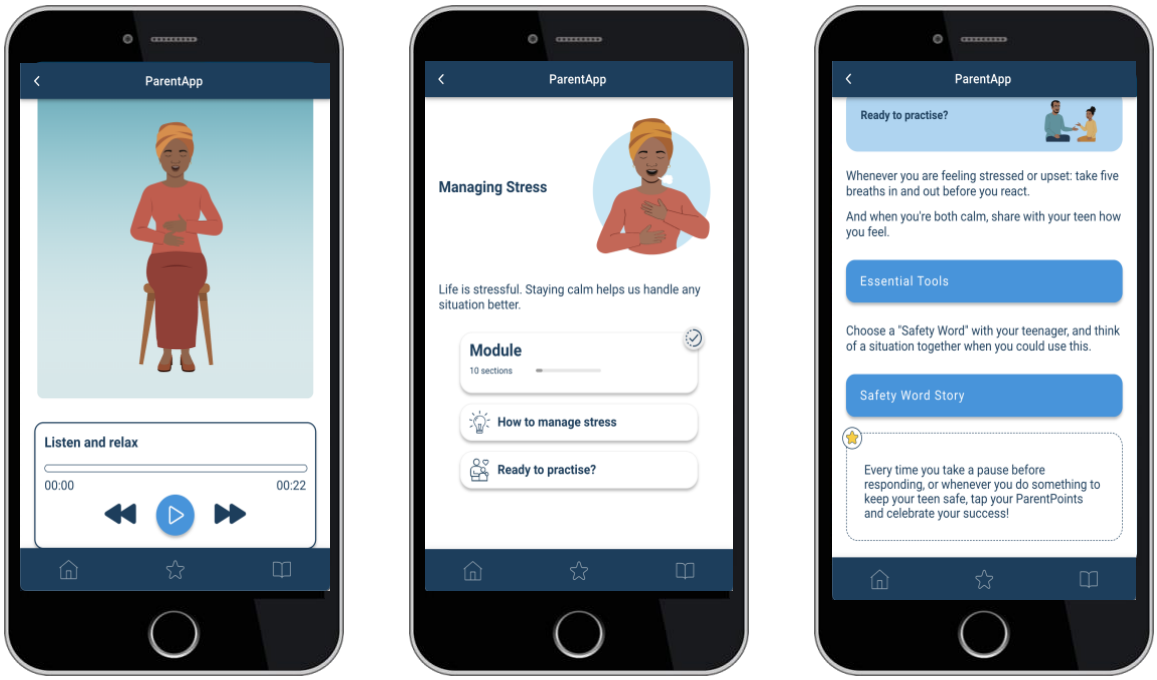
3.4 Intervention

PLH ParentApp for teens (ParentApp) (https://plh-teens-tz.web.app/) is a free, mobile application (see Figure 3) that supports parents of teenagers aged between 10-17 years old. It can be downloaded and used without an internet connection, making it ideal for areas where internet access is limited. The 12-week programme consists of weekly asynchronous modules that offer a variety of parenting tools and techniques to help improve positive parenting skills. These modules contain a mix of text, audio, and images to make the learning experience engaging and informative. Modules cover the following content: (1) self-care; (2) one-on-one

time with your teen; (3) praising each other; (4) positive instructions; (5) managing stress; (6) family budgeting; (7) establishing rules and routines; (8) calm consequences; (9) problem-solving; (10) teen safety; (11) dealing with crisis; and (12) reflection and next steps.

Figure 3

Screenshots from the ParentApp intervention



ParentApp offers caregivers more than just access to content, with additional support in Parent Library, which covers various aspects like dealing with grief and offering a list of support contacts. ParentApp also includes a habit-tracking feature that rewards users with ParentPoints when they complete home activities, giving them a chance to celebrate and reinforce the skills they have learned.

ParentApp contains a range of 24 mindfulness exercises that caregivers can work through as they go through the modules. These activities were developed using evidence-based theory examining how body, mind and emotions work together to reduce depressive symptoms (Williams et al., 2007). The exercises are audio recorded and range between 30-60 seconds

each. These audios are available in the module as caregivers work through the content, and in the Parent Library for easy access from outside the module.

Participants in the control arm of the study received the WASHApp, a water and sanitation-focused digital intervention designed to promote hygiene and handwashing practices. WASHApp contains 12 modules that participants can access in any order and at any time, providing flexible, user-driven learning. The WASHApp delivered culturally relevant content aimed at improving knowledge and behaviours related to water, sanitation, and hygiene (WASH), supporting healthy practices in everyday life.

3.5 Procedure

Before the recruitment phase, the research team undertook a phase of community mobilisation, during which community leaders were invited to engage in discussions about the study, with the aim of identifying potential eligible participants within their respective communities. Subsequently, community leaders invited potential participants to a meeting introducing the study. In this introductory session, participants went through consent forms, and then the screening process took place.

Data were collected digitally using tablets equipped with ODK (Open Data Kit) forms. Participants were handed the tablet devices to self-complete sensitive questionnaire sections, ensuring privacy and accurate reporting. The ODK platform enabled structured data capture with offline functionality, which was ideal for the study's low-resource setting. Research assistants conducted home visits to eligible participants and went through consent forms and baseline questionnaires. Following this phase, community leaders came together for the randomisation ceremony, during which a random number between 1 and 100 was selected. The team statistician used that number to determine the allocation of clusters into either the control or intervention group based on this random selection.

Following this, participants were provided with smartphones, accompanied by guidance from the research team in downloading the applications required for the study. The control group received the WASHApp application and WhatsApp, while the intervention group received ParentApp and WhatsApp. Caregivers allocated to intervention groups were added to WhatsApp groups with others in their cluster. These WhatsApp groups were used to facilitate participants' engagement with the weekly content across the 12 modules.

Following the completion of the fourth module, an in-person gathering was planned, where all participants were invited from control and intervention groups. This gathering was a monitoring and evaluation touchpoint, allowing the team to address any technical issues and to ensure the synchronisation of engagement and app-usage data. Participants completed follow-up questionnaires one month after completion of the 12-week intervention period. This study uses data from the baseline and one-month follow-up questionnaire. Another follow-up questionnaire was conducted at the 14-month mark, which was completed in May 2025.

Safeguarding procedures were put in place to prevent and address various forms of harm, including sexual exploitation, abuse, harassment, bullying, psychological abuse, and physical violence, to ensure the safety and well-being of research participants, communities and staff. Participants were encouraged to notify the research team of any social harm events at baseline and during the follow-up survey. The research assistant inquired about any such events, and participants experiencing them received appropriate evaluation and support from a local counsellor, with cases of abuse reported to the study manager for further guidance. All social harm events were reported, and comprehensive records of these events, including details, referrals, and outcomes, were meticulously maintained.

3.6 Measures

3.6.1 Socio-demographics

Various socio-demographic characteristics were captured through the baseline questionnaire (see Appendix C1), including age, gender, literacy level, employment, self-reported health, and digital literacy. Literacy level was determined by asking participants whether they could read easily; only those who reported reading easily or with little difficulty were included in the study. Employment status was initially categorised into several options for participants to select from: stay-at-home caregivers managing children and household tasks; domestic work for others (including house, field, or garden work); retail (such as shops, markets, or street vending); hospitality industry roles (e.g., restaurants or hotels); trades (such as tailoring or carpentry); other (with specification); not currently working; and preferring not to say. For analysis purposes, these categories were simplified into either employed out of home, or unemployed. Self-reported health was assessed using the question, “How would you describe your overall health today on a scale from 0 (poor health) to 100 (excellent health)?”. The digital literacy assessment explored multiple facets of internet use, such as searching for information, downloading apps, connecting with others, and sharing photos on social media. Based on responses, digital literacy was categorised into high, medium, or low levels. The high rate of missing data for digital literacy resulted from skip logic: participants who answered “no” to owning a smartphone were not asked these questions. Socio-demographic factors were also assessed by gender.

3.6.2 Depression and Anxiety

The patient health questionnaire 4 (PHQ-4) (Kroenke et al., 2009) was used to screen for symptoms of depression and anxiety among caregivers of teens in the study. The PHQ-4 was included in both baseline and post-test questionnaires (see Appendix C1 and C2). The four items of the PHQ-4 scale were analysed for internal consistency within this study’s dataset,

yielding a Cronbach's alpha of α=0.797, indicating acceptable reliability. The PHQ-4 has been rigorously tested to measure the validity and reliability in Tanzania - the internal reliability was good (α>0.80) and it has been observed to be a psychometrically sound tool that can be used to measure depression and anxiety symptoms rapidly and effectively in the context of the study (Basaraba et al., 2023; Materu et al., 2020). A recent systematic review of the psychometric properties of the PHQ-4 revealed that the content validity of has been consistently explored, with results indicating its relevance for measuring symptoms of anxiety and depression (Caro-Fuentes & Sanabria-Mazo, 2023). PHQ-4 scores range from normal (0-2) to mild (3-5) to moderate (6-8) to severe (9-12) and the optimal cutoff for anxiety was ≥ 3, and ≥ 2 for depression (Basaraba et al., 2023). A notable limitation of using the PHQ-4 in this study is that, although it effectively screens for core symptoms of depression and anxiety, it does not measure the severity of these symptoms. This means that while it can identify probable cases, it provides limited insight into symptom intensity or clinical diagnosis. Furthermore, despite the PHQ-4 having been previously tested in Tanzania (Sequeira et al., 2022), further validation within diverse Tanzanian populations and contexts would strengthen confidence in its psychometric properties and cultural appropriateness. Such additional testing is warranted given the complex socio-cultural factors influencing mental health expression and reporting in the region. Safeguarding measures were put in place to refer any participant scoring 7 or more for any of these questions for further counselling.

3.6.3 Parenting Stress

Parental stress was measured using seven items adapted from the Parental Stress Scale (PSS), each question was rated on a scale of 0-10 (Berry & Jones, 1995). Items were adapted to shorten the questionnaires, and to make it simpler for parents to answer. The PSS was included in both baseline and post-test questionnaires. The PSS is commonly used to measure parenting stress, including in LMICs (Pedersen et al., 2019; Side & Kumar, 2022). An example of a question a caregiver was asked is, "Based on the past month, tell me how

much you agree or disagree with the statement by giving me a number from 0 - 10 where 0 means strongly disagree, and 10 means strongly agree. Caring for my children leaves little time and flexibility in my life." Items 3, 4, 5, 6 & 7 were reverse scored, with total scores ranging from 0 to 70 - lower scores indicating lower levels of parental stress. The items of the PSS demonstrated a Cronbach's alpha of α=0.672, indicating moderate internal consistency within the data subset used for this study. Other studies showed the overall internal consistency reliability for the PSS to be α=0.85 (Dol et al., 2022). Convergent validity of the PSS was demonstrated with significant medium-sized correlations with family functioning, parental anxiety and parental depression (Zelman & Ferro, 2018).

3.6.4 Social Support

Using seven items adapted from the Medical Outcomes Study Social Support Survey (MOS) (Gjesfjeld et al., 2008). Participants were asked to provide responses on a Likert scale ranging from 1-4 of how many times (none, some, most, all) in the past 4 weeks they had: 1) Someone to confide in or talk to about yourself or your problems? 2) Someone to turn to for advice about how to deal with a personal problem? 3) Someone who understands your problems? 4) Someone to help you if you were ill in bed? 5) Someone to have a good time with? 6) Someone to get together with for relaxation? 7) Someone to do things with to help you get your mind off things? Scores range between 4-28, with lower scores indicating lower levels of social support. The data in this study yielded a Cronbach's alpha of α=0.863, indicating high internal consistency. Other studies showed the internal consistency of this adapted scale resulted in an acceptable Cronbach α=0.73, the scale indicated sufficient content validity (CVI>0.70) and sufficient cross-cultural validity was observed (Dao-Tran et al., 2023).

3.6.5 In-app Engagement

Engagement was assessed through automated monitoring of participants' app usage. Usage data were stored locally on the app and uploaded to a secure server once a stable internet connection was available. The total number of modules completed by the participant were

extracted from the dashboard. A completed module is 100% completed, anything below 100% complete is categorised as incomplete. Preliminary tests indicated that the data were heavily skewed towards higher module completion rates, with most participants completing more modules than not. Therefore, for the purpose of this analysis, engagement was operationalised as the number of modules completed out of a total of 12. Completion was then categorised into two levels:

- Complete: participants who completed 100% of all 12 modules
- Incomplete: participants who completed less than 12 modules

A limitation to note on data collected is the inconsistency of engagement data stored. This specific usage data is only stored and backed up when participants have an active connection to the internet while using the app. This means that if participants used the app without an active connection to the internet, engagement data may not have been backed up.

3.7 Analysis

The primary researcher extracted the caregiver baseline and one-month follow-up intervention group data needed for the present study from the main dataset and cleaned the extracted data. The data were loaded into Statistical Product and Service Solution (SPSS) version 30. Engagement data from the app were extracted from the overall dashboard by the development team and shared with the primary researcher for further analysis. The engagement data, baseline and one-month follow-up data were combined into a single merged wide dataset. The reliability of the screening tools mentioned above was examined by testing Cronbach's alpha on the data before proceeding with further analysis. Statistical significance for all analyses was set at $p=0.05$.

Descriptive statistical analyses were conducted for socio-demographic and psychosocial variables. As appropriate, measures of central tendency including the mean or median, alongside indicators of variability, such as standard deviation, were calculated. Frequencies

were reported for categorical variables. All variables were visually displayed using a summary table.

This analysis drew on variables such as change in caregiver mental health symptoms, intervention completion status (complete vs. incomplete), and a range of sociodemographic factors. Due to inconsistencies in identifier variables used across engagement and questionnaire datasets, only 1031 participants could be matched for analysis. Missing data resulted from various factors, including participants deleting the app or losing their phone.

Objective 1:

First, change in PHQ-4 score between baseline and post intervention assessment were compared. Some participants did not complete the PHQ assessment at both baseline and post-test, and only completed one, making them ineligible for the tests, which required paired observations. This reduced the total sample size from 1104 to 1099 due to missing data, which was further reduced to 1031 participants data that could be merged with engagement data. The difference in PHQ-4 scores between time points was not normally distributed and contained outliers, as assessed using histograms, Q-Q plots, and the Shapiro-Wilk test. Since the assumptions of the paired t-test were violated, a non-parametric Related-Samples Wilcoxon Signed Rank Test was conducted. Additionally, analyses were stratified by gender to assess potential differences in mental health changes between male and female caregivers.

Objectives 2 & 3:

Correlation analyses were first conducted to explore the relationships between caregiver mental health symptoms (PHQ-4 scores) at follow-up, user engagement, and social support. As the data were not normally distributed Spearman's rank-order correlation was employed for continuous variables, including caregiver mental health (PHQ-4), social support (MOS), perceived parenting stress (PSS), self-reported health and intervention completion.

To address the second objective, to determine the psychosocial and user engagement factors associated with change in mental health symptoms, unadjusted and adjusted multiple linear regressions were performed with the change in caregiver mental health (PHQ-4) scores from baseline to follow-up as the dependant variable. Independent variables included parenting stress, social support, and intervention completion at follow-up. Regression results are presented as unstandardised coefficients (B) with corresponding 95% confidence intervals (CI). Statistical significance was determined at the $p<0.05$ level. Age, gender, and variables that showed significant associations in unadjusted analyses were included in the adjusted regression model to control for potential confounding effects and better isolate the unique contributions of psychosocial and engagement factors to changes in caregiver mental health. Including these covariates ensures that observed relationships are not driven by demographic differences or other correlated factors, thereby increasing the robustness and validity of the findings.

For the third objective, investigating whether factors at baseline predict levels of engagement, a binary logistic regression was conducted to examine factors associated with intervention completion, using caregiver baseline mental health along with psychosocial and sociodemographic variables as predictors. For this objective, results are reported as odds ratios (OR) with corresponding 95% confidence intervals (CI). Statistical significance was determined at the $p<0.05$ level. Frequencies for engagement status are reported, which includes the number of participants who completed the intervention and those who did not. Given that no variables were significant in the unadjusted model, only age and gender were included as independent variables in the adjusted model.

This thesis focused on the intervention arm of a larger cluster RCT and used change scores (follow-up minus baseline) as the primary outcome metric for caregiver mental health. Although this approach allowed an initial exploration of associations between psychosocial factors, engagement, and within-person change, it does not account for potential regression to the mean or baseline imbalances, and current trial statistics guidance generally

recommends modelling post-intervention outcomes while adjusting for baseline scores instead. Access to the full RCT dataset, including the control arm, and re-specifying models using baseline-adjusted post-test outcomes would provide a more rigorous basis for causal inference and strengthen the suitability of these findings for publication.

3.8 Ethical Considerations

3.8.1 Data Management

The trial was registered on the Open Science Framework on 14 March 2023 (https://osf.io/t9fxz). Ethical approval has been obtained for the RCT study from both Oxford University (R84601/RE002) and the Tanzanian MRCC (NIMR/HQ/R.8a/Vol.IX/4218) and has been formally endorsed by UCT (CSSR 2023/03) (Appendix A)

In my capacity as a research coordinator on this study, my responsibilities have been primarily oriented towards implementation and project management duties. My involvement encompassed facets such as facilitating HR procedures pertinent to team recruitment, contributing to the formulation of project documentation, including but not limited to Standard Operating Procedures, guidelines, and various supportive tools. I coordinated the process by which insights learned from earlier phases of the study informed and guided adaptations made to the RCT. Additionally, I played a role in assisting with monitoring and evaluation activities and assumed a coordinating role in content creation and app development. I provided oversight of the administration and project management tasks as well as preparing comprehensive reports for our project's funders and stakeholders.

The study team ensured that research data were securely stored, backed up, managed, and curated in accordance with GDPR and/or national data protection legislation (e.g., Tanzanian Research Integrity Framework, 2020), as well as the local institution's data protection policy. Data management prioritised data confidentiality, security, and safety, which was especially crucial for protecting participants identities.

Electronic records from data collection were exported from the respective platforms to secure servers at the Tanzanian National Institute for Health Research, University of Cape Town, and University of Oxford. This included electronic records of surveys and participant tracking lists. Non-electronic data, such as consent forms and registers, were stored in locked filing cabinets at the National Institute for Medical Research in Mwanza, Tanzania.

Data cleaning occurred after each data collection phase. Baseline and post-intervention datasets were kept separate from the merged dataset to aid data validation. All electronic data, were stored on two password-protected servers accessible only to the research team, ensuring protection against server failure and confidentiality breaches.

Engagement and usage data were collected automatically through the app, which was managed by the software developers IDEMS International. Participants were required to accept ParentApp's Terms and Conditions (Appendix B3) and Privacy Policy (Appendix B4) prior to using ParentApp, providing consent for the collection of engagement data.

All collected data were securely stored in the study team's research data repository on SharePoint. Before requesting access to this data, I needed to obtain permission from the RCT management team. An email was sent to the research team's management outlining the aims and objectives of this study, as well as detailing the specific data required. Once approval was obtained, I applied for an internal hub email address with restricted access to only the necessary folders for this study. These login credentials had a set time limit and expired once the designated period ended. After submitting the application, it was reviewed by the research team's data manager. The application met the necessary requirements and access was granted. This process helped maintain the dataset's integrity and security by ensuring only authorised individuals could access it. Once the email address was allocated, I was able to log in and view the data.

3.8.2 Informed Consent

At each data collection point, a trained research assistant described the study to participants. They explained what the study entailed, what would be required from participants, how their information would be kept safe, and that they could withdraw at any time. If adolescents agreed to participate in the study, their caregivers needed to provide approval first. The research team ensured that all participants understood the study by sharing a simplified version of the information sheet (Appendix B1) and by using simple language and speaking slowly for those with limited literacy (Appendix B2).

Confidentiality

The research team was trained on all data confidentiality procedures, including transporting paper data in sealed envelopes or locked boxes and storing it in locked cabinets. Consent forms and questionnaires were administered using password-protected Android devices in the field, with data automatically uploaded to a secure server via the open-source software platform Open Data Kit (ODK; www.opendatakit.org). To maintain participant confidentiality, data was de-identified before analysis, with identifiers stored separately from the research data and linked only through unique codes.

Risks and benefits of participation

Participation in this study should not have posed any significant risks to caregivers or adolescents. Participants may choose not to answer any survey questions they find uncomfortable and may withdraw from the study at any time without consequence. Should any participant experience distress, referrals for professional support services were provided.

All participants received a smartphone, along with data bundles for ParentApp and WhatsApp usage. This smartphone was provided at no cost, and participants were not required to return it upon study completion. Participants benefit directly from being part of the intervention, which aims to improve their parenting skills and psychosocial wellbeing, with the potential to

positively impact their relationships with their children and reduce stress. Additionally, a small token of appreciation was provided for completing study-related surveys.

Chapter 4: Results

The results of tests examining changes in caregiver mental health symptoms are presented first, followed by correlation and regression analyses of factors associated with mental health outcomes and intervention engagement. Each section provides a detailed account of the descriptive statistics, the statistical models applied, and the key results.

4.1 Socio-demographic and Psychosocial Characteristics of the Participants

As shown in Table 1, a total of 1031 caregivers were included in the sample, 263 males and 768 females. The average age was significantly higher for males (m=49.62 years, SD=12.88) compared to females (m=42.32 years, SD=10.60, p<0.001). Most participants were employed out of the home (n=869, 84.3%), followed by those unemployed or working at home (n=160, 15.5%). The majority described good self-reported health (m=87.69, SD=17.61), with males (m=83.06, SD=23.24) reporting slightly better health than females (m=89.29, SD=14.89) (p<0.001). High literacy levels were observed, with 89.3% (n=921) reading easily, as high literacy was one of the inclusion criteria, the remaining 10.6% (n=109) could read, but with some difficulty. Of the 524 participants with digital literacy data, 44.7% (n=461) had low literacy, 5.6% (n=58) fell within the medium digital literacy category and very few had high digital skills (n=5, 0.5%).

The overall mean PHQ-4 score, measuring depression and anxiety symptoms, was 11.25 (SD=9.78). Significant gender differences were observed: males had a lower mean PHQ-4 score of 9.07 (SD=8.83), while females scored higher at 12.00 (SD=10.60; p<0.001). The mean MOS social support score for the full sample was 17.00 (SD=5.96). Males reported significantly greater social support with a mean of 18.81 (SD=5.78) compared to females who had a mean of 16.38 (SD=5.91; p<0.001). Perceived stress levels (PSS) showed a mean of 34.77 (SD=14.18) for all participants, with no statistically significant gender difference (males: 33.73, SD=14.71; females: 35.13, SD=13.98; p=0.08). Participants completed an average of

9.83 modules (SD=3.96), and module completion did not differ significantly by gender (males: 9.60, SD=4.03; females: 9.90, SD=3.94; p=0.165). Of the total 1031 participants, 733 (71.1%) completed all 12 modules and were classified as fully engaged, while 298 (28.9%) completed fewer than the full programme and were classified as not engaged. This engagement distinction is important when examining intervention effects and interpreting null findings.

Table 1

Socio-demographic and psychosocial characteristics of the sample at baseline (n=1031)

Variables	n (%) / (M;SD)	Male	Female	p-value
Age	1031 (44.18; 11.66)	263 (49.62; 12.88)	768 (42.32; 10.60)	<0.001
Employment (2 missing)	1029	263	766	
Employed out of home	869 (84.3)	247 (93.9)	622 (81.0)	
Unemployed	160 (15.5)	16 (6.1)	144 (18.8)	
Self-reported health (5 missing)	1026 (87.69; 17.61)	263 (83.06; 23.24)	763 (89.29; 14.89)	<0.001
Literacy (1 missing)	1030	263	767	
Read easily	921 (89.3)	244 (92.8)	677 (88.2)	
Read with difficulty	109 (10.6)	19 (7.2)	90 (11.7)	
Digital Literacy (507 missing)	524	143	381	
Low	461 (44.7)	120 (45.6)	341 (44.4)	
Medium	58 (5.6)	20 (7.6)	38 (4.9)	
High	5 (0.5)	3 (1.1)	2 (0.5)	
PHQ total score (5 missing)	1026 (11.25; 9.78)	263 (9.07; 8.83)	763(12.00; 10.60)	<0.001

MOS total score (6 missing)	1025 (17.00; 5.96)	262 (18.81; 5.78)	763 (16.38; 5.91)	<0.001
PSS total score (5 missing)	1026 (34.77; 14.18)	263 (33.73; 14.71)	763 (35.13; 13.98)	0,08
Modules complete	1031 (9.83; 3.96)	263 (9.60; 4.03)	768 (9.90; 3.94)	0,165

4.2 Caregiver Mental Health

Figure 4

PHQ4 Scores of Female Participants at Baseline

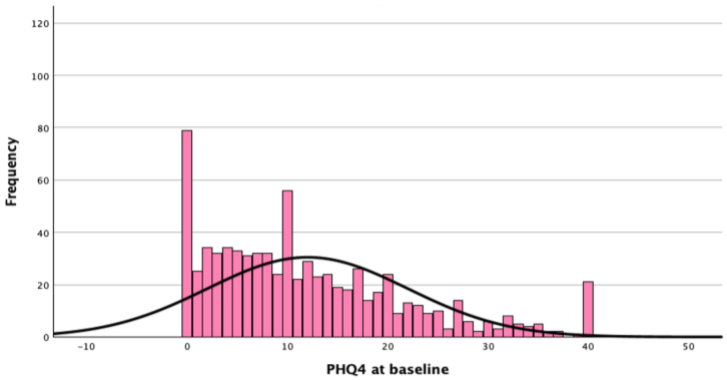


Figure 5

PHQ4 Scores of Female Participants at Post-Test

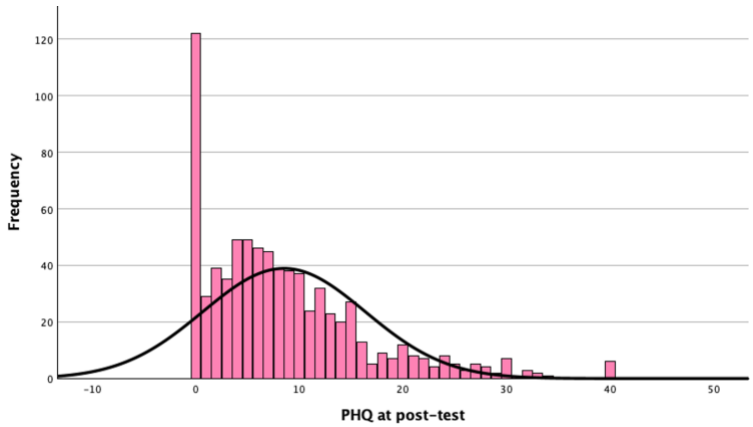


Figure 6

PHQ4 Scores of Male Participants at Baseline

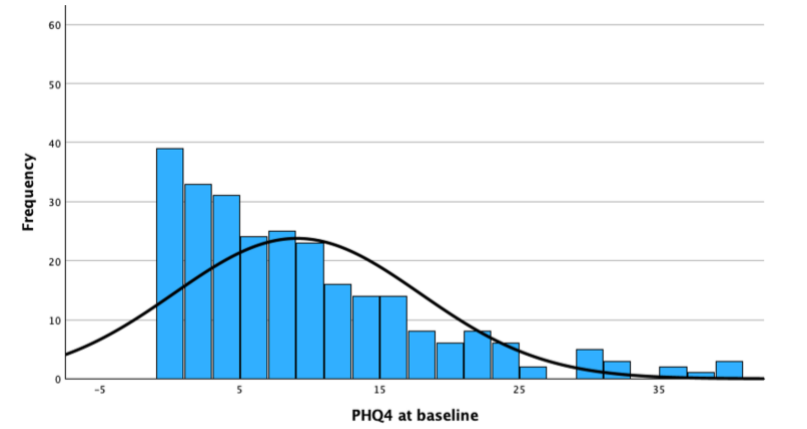
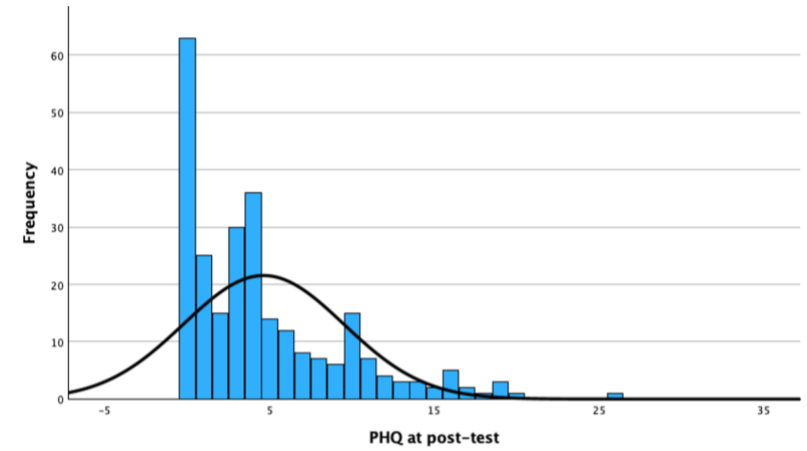


Figure 7

PHQ4 Scores of Male Participants at Post-Test



The histograms above (Figures 4 - 7), overlaid with normal distribution curves, show the spread of PHQ-4 total scores at baseline and post-test, separated by gender. At baseline, both female and male participants displayed a right-skewed distribution, with a greater number of low scores. At post-test, the distributions remained positively skewed, but the clustering of lower scores became more noticeable.

A Wilcoxon Signed-Rank Test was conducted to compare PHQ scores at baseline and post-test. In this analysis, a positive change corresponds to a decrease in PHQ scores, indicating

an improvement in mental health symptoms, while a negative change would indicate symptom increasing over time. The results indicated a significant reduction in PHQ scores from baseline (median=12, IQR=10.6) to post-test (median=9.1, IQR=8.8) ($Z=-12.39$, $p<0.001$). This pattern indicates a general decrease in reported symptoms of anxiety and depression after the intervention.

As shown in Table 2, the analysis revealed no significant correlations between engagement and any of the other variables (Social Support, Perceived Stress, and Mental Health) at 1-month follow-up, with correlation coefficients of -0.024 (p=0.447), 0.022 (p=0.474), and -0.027 (p=0.387), respectively. However, social support showed significant negative correlations with both perceived stress (rho=0.126, p<0.001) and mental health (rho=-0.172, p<0.001), indicating that higher social support was associated with lower levels of stress and mental health symptoms. Additionally, a significant positive correlation was found between perceived stress and mental health (rho=0.253, p<0.001), suggesting that higher levels of perceived stress were associated with higher levels of mental health conditions.

Table 2

Spearman's Correlation Results for Caregiver Mental Health, Perceived Parenting Stress, Social Support, and Modules Complete at Follow-up

	Social support	**Mental health**	**Parenting stress**
Modules Complete	-0.024	-0.027	0.022
Social support		-0.172*	-0.126*
Mental health			0.253*

* Significant at <0.001 level

Individual unadjusted linear regression models were conducted to identify predictors of a change in caregiver depression and anxiety (PHQ-4) scores (Table 3). The mean difference between baseline and follow-up scores was the dependent variable. The independent

variables were psychosocial factors (MOS & PSS), user engagement (modules completed), and socio demographics (age, gender, literacy, employment, self-reported health) at baseline.

Table 3

Linear regression output examining psychosocial predictors of change in PHQ-4 scores

Variable	m (sd)	Unadjusted	Adjusted
		B (CI)	B (CI)
Age	44.17 (11.67)	-0.02 (-0.07 to 0.03)	-0.03 (0.11 to 0.06)
Gender (n,%)			
Female	(768, 74.5)	1.00	1.00
Male	(263, 25.5)	-0.97 (-2.35 to 0.41)	-0.807 (-2.30 to 1.38)
Literacy (n,%)			
Easily Reads	(921, 89.3)	1.00	
Difficulty Reading	(109, 10.6)	0.026 (-1.70 to 2.22)	
Employment (n, %)			
Unemployed	(160, 15.5)	1.00	
Employed	(869, 84.3)	0.52 (-1.14 to 2.18)	
Health	87.60 (17.62)	0.08 (0.04 to 0.11)*	0.14 (0.08 to 0.19)*
Social Support	17.01 (5.97)	-0.01 (-0.11 to 0.09)	
Perceived Stress	34.77 (14.17)	-0.10 (-0.15 to -0.06)*	-0.09 (-0.15 to -0.02)*

* Significant at <0.05 level

In the adjusted linear regression model examining predictors of change in mental health symptoms (Table 3), only self-reported health and perceived stress were significant. Better self-rated health at baseline was associated with greater improvements (bigger score change) in mental health symptoms (B=0.14, 95% CI: 0.08 to 0.19, p<0.001), while higher levels of perceived stress at baseline were associated with less change in mental health

symptoms (B=-0.09, 95% CI: -0.15 to -0.02, p=0.009). Employment status (B=1.52, 95% CI: -1.05 to 4.09, p=0.246), age, gender, literacy, and social support were not significantly associated with changes in mental health symptoms after adjusting for other covariates.

4.3 Engagement with ParentApp

Table 4

Logistic regression output examining baseline predictors of engagement with ParentApp

Variable	Participants who completed (n, %) / m(sd)	Participants who did not complete (n, %) / m(sd)	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
Age m(sd)	43.9 (11.2)	44.8 (12.7)	1.00 (add 95% CI)	0.99 (0.98 - 1.01)
Gender (n, %)				
Female	(556, 75.9)	(212, 71.1)	1.00	1.00
Male	(177, 24.1)	(86, 28.9)	0.79 (0.58 - 1.06)	0.86 (0.62 - 1.20)
Literacy (n, %)				
Easily Reads	(648, 88.4)	(273, 91.6)		
Difficulty Reading	(84, 11.5)	(25, 8.4)	1.42 (0.89 - 2.26)	
Employment (n, %)				
Unemployed	(117, 16.0)	(43, 14.4)	1.00	
Employed	(614, 83.8)	(255, 85.6)	0.88 (0.60 - 1.27)	
Health m(sd)	87.9 (17.1)	87.1 (18.7)	1.00 (0.10 - 1.01)	
Social Support m(sd)	16.9 (5.9)	17.2 (6.0)	0.99 (0.97 - 1.01)	
Parental Stress m(sd)	34.9 (13.9)	34.6 (14.9)	1.00 (0.99 - 1.01)	
Mental Health m(sd)	11.1 (9.7)	11.6 (9.9)	0.99 (0.98 - 1.01)	

Logistic regression analyses (Table 4) were conducted to examine the associations between sociodemographic, psychosocial, and mental health variables at baseline and intervention

completion. In both unadjusted and adjusted models, none of the predictors investigated were associated with intervention completion.

Chapter 5: Discussion

This chapter interprets the study's main findings, explores their implications for policy and practice, and outlines its limitations. The discussion begins by presenting the key results related to each objective, followed by an integrated interpretation contextualised within the broader literature. Finally, implications for policy and practice are considered, the study's strengths and limitations are discussed, and future research directions are proposed.

5.1 Main Findings

The first objective of this study was to investigate the change in caregiver mental health after completing the digital parenting intervention. Findings suggest that caregiver's scores on the PHQ-9 decreased significantly from baseline to one-month post intervention. This effect was evident for both mal e and female participants.

The inclusion of stress management, mindfulness, and self-care content alongside parenting skills likely contributed to these outcomes, consistent with previous RCTs using mobile apps (Bakker et al., 2018; Cox et al., 2019; Versluis et al., 2018); although given that this study did not include control group data, this may have been due to other reasons. The structured, strengths-based content and opportunities for positive caregiver-child interactions may have fostered a sense of control and competence which are known protective factors for mental wellbeing (Hurley et al., 2020; Jiang et al., 2022).

The second objective of this study was to explore psychosocial and engagement factors linked to the changes in caregiver mental health outcomes between baseline and one-month post-intervention. The adjusted linear regression model showed that among the variables considered, only self-reported health and baseline levels of perceived stress were significant predictors of changes in mental health symptoms. Specifically, caregivers with better self-rated health at baseline experienced greater improvements, whereas higher perceived stress at baseline was associated with less favourable changes. In contrast, measures of social support

and user engagement (operationalised as intervention complete/incomplete) did not show a significant independent association with mental health changes at follow-up. This was supported by findings from Spearman's correlation analyses indicating weak associations between engagement and mental health symptoms at follow-up.

These findings echo broader evidence that good baseline health facilitates engagement and responsiveness, whereas elevated stress represents a barrier to benefiting from interventions (Cooper et al., 2022; Jukes et al., 2024; Linardon et al., 2019). In this study, social support was positively associated with mental health status at follow-up, reflecting its protective role in reducing stress and enhancing psychological wellbeing. However, social support was not significantly linked to change in mental health over time, suggesting that while it may buffer distress and contribute to better overall mental health, it does not necessarily drive the magnitude of improvement during the intervention period.

Similarly, engagement, very simply operationalised as module completion, was not associated with mental health outcomes. In a pre-post analysis without a control group, this implies that changes in mental health scores cannot be conclusively attributed to the intervention or differentiated from natural fluctuations over time. The lack of a direct link between completion and outcomes underlines the complexity of engagement; mere adherence does not capture the quality or depth of interaction with programme content, nor does it reflect individual differences in how users internalise and apply intervention skills. These findings highlight the need for more nuanced measures of engagement and analytic approaches that can distinguish intervention effects from natural progression or extraneous influences.

The third objective investigated whether caregiver mental health, demographics and psychosocial factors at baseline predicts levels of engagement in ParentApp. A logistic regression analysis was conducted to identify baseline predictors of intervention completion, defined as completing all 12 modules. The model included caregiver mental health (PHQ-4 scores), social support, perceived health, perceived parenting stress, gender, literacy, age,

and employment. None of the variables emerged as significant predictors of completion status in either the unadjusted or adjusted models. Odds ratios for all predictors were close to 1, indicating minimal influence.

The high overall completion rates observed in this study may have limited variability, complicating the detection of baseline or demographic predictors of engagement. This unusually strong engagement contrasts with common challenges faced by adults in digital interventions, especially in low-resource settings characterised by low literacy, limited internet access, and socio-economic constraints. The intervention's offline design, provision of phones, WhatsApp reminders, and digital literacy training among participants likely contributed to overcoming these typical barriers, resulting in notably good adherence. This suggests that when structural and contextual barriers are removed or mitigated, through culturally adapted content, technological support, and proactive engagement strategies, caregiver engagement can be significantly improved. Nonetheless, other contextual factors, such as community norms around parenting and prior experience with digital tools, though likely influential, were not captured in baseline measures and warrant further exploration in future research.

5.2 Interpretation of Findings

The absence of significant baseline predictors for completion of the digital parenting programme indicates that initial mental health, socio-demographic, and psychosocial factors did not substantially influence caregiver engagement. This aligns with international RCTs reporting no significant relationship between baseline mental health symptoms and intervention duration or completion (Elkes et al., 2024; Gan et al., 2021), suggesting that within the study context, caregivers broadly engaged irrespective of initial characteristics. This pattern is consistent with digital parenting and health intervention research where user engagement arises from complex, multifaceted processes rather than simple demographic or baseline health indicators (Cai et al., 2024; Jäggi et al., 2025; Sim et al., 2005).

One possible explanation, as suggested in a systematic review looking at 29 different smartphone apps targeting symptoms of depression and anxiety, is that the offline, locally adapted design of the intervention may have effectively reduced typical barriers faced by caregivers (Wu et al., 2021). For example, limited digital literacy, unstable internet connectivity, or socio-economic constraints that often impede digital intervention uptake may have been mitigated by tailoring content to the cultural context and enabling offline access (Krukowski et al., 2024). Such design features improve accessibility and accommodate diverse users, thereby promoting equitable engagement across different settings (Awah et al., 2022). Alternatively, the high overall completion rate may have created a ceiling effect, reducing variability in engagement outcomes and limiting statistical power to detect meaningful predictors. When the vast majority of participants complete the programme, differences between completers and non-completers become less distinct, potentially obscuring subtle influences of baseline factors (Lintula et al., 2025).

Moreover, the social and contextual environment, such as supportive family members, community norms around parenting, and prior experiences with digital tools, may critically shape engagement behaviours but remain difficult to quantify in typical baseline datasets (Shenderovich et al., 2023). These contextual and psychosocial elements can fluctuate over time, impacting motivation and adherence variably during intervention participation.

The improvements in mental health observed in this study align with international evidence from RCTs of in-person parenting interventions, including those from the Parenting for Lifelong Health (PLH) suite, which have consistently reported secondary mental health benefits (Cluver, Shenderovich, et al., 2020; Massarwi et al., 2023; Shenderovich et al., 2020). For example, a pragmatic cluster RCT assessing the impact of PLH in South Africa found significant improvements in caregivers' mental health, including reductions in depression (effect size d=-0.33), parenting stress (d=-0.37), and increased social support (d=0.31) (Cluver et al., 2018). Another RCT with 296 caregivers reported a 20% decrease in caregiver depression 4 to 5 months post-intervention, indicating improved mental health after

participation (Ward et al., 2020). This study extends these findings by demonstrating similar outcomes via a digital, offline programme in a low-resource setting.

This study aligns with systematic reviews identifying baseline health and perceived stress as key moderators of intervention effects (Borghouts et al., 2021; Cooper et al., 2022; Jukes et al., 2024; Mytton et al., 2014). Participants' initial perceived health status strongly influences responsiveness (Park et al., 2022) and despite digital interventions improving accessibility and standardising content, individual factors such as stress remain crucial for engagement and benefit (Shenderovich et al., 2018). Findings from this study demonstrated that caregivers who reported better self-rated health experienced greater improvements in mental health, whereas higher baseline perceived stress predicted poorer outcomes. This echoes results from RCTs of worry-reduction (Versluis et al., 2018) and mindfulness apps (Economides et al., 2018), emphasising the need to integrate stress management with parenting content.

Predictors of mental health outcomes should be prioritised. While baseline perceived stress was not associated with engagement in the present study, evidence suggests that caregivers experiencing elevated stress face competing demands, reduced cognitive and emotional resources, and impaired motivation, which can limit behaviour change even when access barriers are minimal (Mohr et al., 2017). This may result in superficial engagement and diminished benefits (Bonsu et al., 2020). Digital programmes that provide privacy and reduce stigma may better support caregivers experiencing moderate stress (Chen et al., 2024), whereas those with severe stress are likely to require more tailored assistance (Naslund et al., 2017). Baseline stress thus acts both as an outcome moderator and a dynamic influence on engagement. Importantly, the lack of association between baseline symptom severity and engagement observed in this study aligns with prior research, suggesting that flexible, low-demand digital programmes may enable participation even among highly distressed caregivers, unlike rigid face-to-face formats where distress may negatively impact adherence (Mohr et al., 2017).

When it comes to predictors of engagement, the broader literature indicates that baseline demographics, mental health, and psychosocial factors are generally poor predictors of engagement in digital interventions (Baños et al., 2022; Borghouts et al., 2021; Günther et al., 2023; Hazra-Ganju et al., 2023; Nahum-Shani & Yoon, 2024; Perski et al., 2017). Rather, intervention design features exert stronger influences; for example, in the ParentApp trial, cultural tailoring, usability, appealing visuals, flexible pacing, and social support via peer groups were key to sustaining engagement (Cai et al., 2024; Janowski et al., 2025; Mytton et al., 2014; Yeo et al., 2025). Privacy and confidentiality assurances remain vital in reducing stigma and promoting participation in low-resource settings (Hazra-Ganju et al., 2023; L. K. Yap et al., 2025).

Engagement is a multifaceted and dynamic construct encompassing behavioural, cognitive, and emotional involvement with digital interventions, shaped by interactions among individual traits, intervention design, and environment (Lipschitz et al., 2022; Milne-Ives et al., 2024; Short et al., 2018; Smith et al., 2025). Despite its centrality in mediating mental health benefits, pathways linking engagement to outcomes remain unclear, partly due to inconsistencies in how engagement is measured and conceptualised. This study's use of module completion, a simplistic behavioural metric, does not necessarily equate to meaningful or sustained engagement, as users might reduce use after deriving early benefits (Cross & Alvarez-Jimenez, 2024). Key factors influencing engagement quality, including motivation, attention, perceived relevance, and user experience, are often missed by purely quantitative usage metrics (Borghouts et al., 2021; Fleming et al., 2023). The lack of association between module completion and baseline mental health and other variables in this and other studies underscores the need for further research that captures the complexity of engagement (Gan et al., 2021; Granja et al., 2018; Molloy & Anderson, 2021).

For interventions in resource-limited settings, user-centred design addressing psychosocial and contextual needs is vital (Cai et al., 2024). Additionally, developing and validating diverse engagement measures that integrate quantitative usage data with qualitative insights will

provide richer and more nuanced assessments of engagement, enabling iterative programme improvements to maximise reach, adherence, and impact (Yap et al., 2025). Emerging scholarship advocates mixed-method approaches combining self-report scales, qualitative interviews, and behavioural analytics to capture engagement complexity (Löchner et al., 2025; O'Connor et al., 2016; Opie et al., 2024). Without such comprehensive assessment, quantitative metrics risk overlooking pivotal drivers of intervention outcomes and engagement.

This study contributes important evidence on the impact of digital parenting interventions on caregiver mental health and engagement in a low-resource setting. The findings suggest that digital, offline parenting programmes can yield meaningful mental health improvements even when delivered as secondary intervention outcomes. While significant short-term reductions in depression and anxiety symptoms were observed across genders, causal inferences are limited by the absence of a control group. Although baseline distress levels were heterogeneous, the focus on change scores helps account for this, as participants with higher baseline symptoms are more likely to show greater change over time. Importantly, these findings form part of a larger, ongoing RCT of ParentApp for Teens in Tanzania, which includes a control group and longer-term follow-up; results from this full trial will provide more definitive evidence on effectiveness and identify subpopulations who benefit most (Baerecke et al., 2024).

5.3 Implications for Policy and Practice

Digital parenting interventions have demonstrated potential to improve mental health outcomes in low-resource settings when effectively implemented. This study shows that delivering these programmes via mobile phones, supplemented by social support features such as WhatsApp groups, may enhance caregiver engagement and (van Tuyll van Serooskereken Rakotomalala et al., 2025). However, to maximise these benefits, community organisations may need to provide ongoing support to facilitate the management of WhatsApp groups, including appointing and training facilitators (Janowski et al., 2025). Additionally,

offering digital literacy training for caregivers can be critical to overcoming technological barriers and promoting sustained participation (O'Connor et al., 2016). Given their broad benefits, parenting programmes can positively influence mental health and other public health priorities, underscoring the need for coordinated intersectoral collaboration among the Departments of Health, Social Development, Education, and other relevant sectors. Such collaboration is vital to maximise reach and effectiveness across diverse populations.

Strategic investment in digital infrastructure and facilitation is critical to scaling up these interventions successfully. Evidence from the ParentApp trial demonstrates promising improvements not only in mental health but also in violence prevention and parenting outcomes, highlighting the value of strengthening digital delivery systems (Cluver, et al., 2025 In progress). Alongside infrastructure, policymakers must prioritise funding for ongoing research to understand the motivational and contextual factors that drive engagement and to optimise intervention design and delivery for maximum impact. For example, the Parent Positive app trial showed that a smartphone parenting support intervention, developed with extensive parent and expert input, can reduce child emotional problems cost-effectively when implemented at scale in a real-world pandemic context, illustrating the public health potential of universal digital parenting programmes (Palmer et al., 2023). Furthermore, a recent review of government funding parenting interventions emphasises the need for integration with existing services backed by ongoing funding to ensure sustained engagement and effectiveness (Havighurst et al., 2022).

Ideal implementation requires close collaboration among practitioners across mental health, child health, and community services. By working together, professionals can identify families with varying needs and tailor interventions accordingly, including providing more specialised mental health support when necessary. Programmes must be culturally adaptable and designed with flexibility, reflecting the target population's cultural contexts, health beliefs,

technology usage patterns, and psychosocial realities to ensure accessibility and relevance (Clough et al., 2022; Spanhel et al., 2021).

Supporting features such as peer interaction, privacy safeguards, and user-friendly interfaces play a crucial role in promoting sustained participation and adherence (Mohr et al., 2011). In contexts with limited face-to-face services, digital parenting programmes offer scalable, innovative solutions to close critical gaps in mental health and parenting support (Breitenstein et al., 2014). Integrating these programmes into broader health and social service frameworks, leveraging mobile technology and community networks, is essential to widen reach and enhance outcomes.

Sustained monitoring, evaluation, and research are necessary to uphold intervention effectiveness and support iterative improvements at scale. Policymakers should focus on incentivising rigorous evaluation and fostering cross-sectoral collaboration to ensure digital parenting interventions deliver lasting mental health and child development benefits for diverse populations. This aligns with Tanzania's Health Sector Strategic Plan V (2021-2026) prioritises embedding mental health services within primary healthcare and calls for multisectoral collaboration to address social determinants and improve access and quality of mental health care, particularly for children and adolescents, through coordinated, evidence-based interventions across health, education, and social protection sectors (Ministry of Health, Community Development, Gender, Elderly and Children, 2021; World Health Organization and the United Nations Children's Fund, 2024).

5.4 Strengths of the Study

The use of a validated tool (PHQ-4) to assess caregiver mental health symptoms provided a reliable and standardised outcome measurement, supporting the credibility of the findings and allowing comparisons with other studies.

The main study evaluated a digital parenting intervention in a real-world Tanzanian context, thus maximising external validity, addressing gaps in parenting support in low-resource settings. Although mental health was a secondary outcome, the intervention, which primarily focused on reducing violence against children, still led to improvements in caregiver mental health. This highlights the broader psychosocial benefits of the intervention, its external validity, and its potential for scalable impact across similar low- and middle-income country contexts.

5.5 Limitations of the Study

Digital parenting interventions such as ParentApp offer important advantages for caregivers in low-resource settings. These include scalability and offline access, but they are also constrained by structural barriers such as variable connectivity, device access, and differences in digital literacy, all of which can undermine sustained use and depth of engagement (Janowski et al., 2025). These considerations also have implications for scale up in other low-resourced settings. In this study these broader challenges shaped how caregivers engaged with ParentApp and provided the rationale for focusing on user engagement as a key variable of interest among the multiple limitations inherent to digital delivery.

Measuring user engagement was challenging due to unstable internet connectivity, which affected the consistency of data capturing. Engagement could only be recorded when participants had a stable connection, limiting the accuracy and completeness of the data. As a result, engagement was operationalised as the number of modules completed, rather than more nuanced metrics such as time spent on the app, duration the app remained open, or number of pages accessed. While this may not fully reflect the depth or quality of user engagement, a consistent and objective measure of module completion was used across all participants to ensure comparability.

Because engagement in WhatsApp support groups was captured at the cluster level, we were unable to link this data to individual participants. As a result, we could not assess the specific

influence of individual-level WhatsApp engagement on module completion or mental health outcomes, which may have limited our understanding of how facilitated group support contributed to overall engagement.

The findings are based on a specific population in Mwanza, Tanzania, which might limit how applicable the results are to other LMIC contexts or caregiver populations. However, since the study focused on a clearly defined demographic of caregivers of adolescents in low-resource settings, the findings may offer valuable insights for similar populations.

A further methodological limitation is the use of change scores in the intervention arm only, instead of using the full RCT dataset with control data. While this analytic choice was pragmatic within the scope of an MPhil project, more robust approaches, such as modelling post-test outcomes with baseline adjustment and incorporating both arms, would better address concerns about regression to the mean and baseline imbalance and are recommended for future publications arising from this trial.

Threats to the study's internal validity were another limitation. First, although the main study employed a RCT design to reduce bias, this study only made use of subsets of the main dataset, excluding the control group. This absence of a control group limits causal attribution of changes in caregiver mental health and allows for alternative explanations such as natural symptom variation or external influences. Second, the recruitment of participants without requiring mental health screening cut-offs introduced heterogeneity in baseline distress, potentially reducing precision in detecting intervention effects. Third, the use of brief self-report measures like the PHQ-4 constrained clinical insight and other symptoms of depression or anxiety may have been missed, while the short one-month follow-up period limited assessment of long-term outcomes. Fourth, statistical models explained only a small portion of variance in mental health changes, likely due to unmeasured confounders and limited psychosocial variables. Fifth, as described above, engagement measurement was limited by reliance on simplified completion data and the absence of qualitative insights, which restricted

the understanding of how participants engaged with the content in depth. Additionally, the study may not have fully captured the experiences of individuals who used the app without completing all modules, leading to possible under-representation of partial or selective users. Furthermore, offline use of content may have been under-recorded, potentially missing important aspects of engagement occurring outside of tracked digital interactions. Together, these factors pose significant threats to internal validity, warranting cautious interpretation of effects and mechanisms of change.

5.6 Future Directions

With only baseline and one-month follow-up data, assessing the longer-term effects of the digital intervention on caregiver mental health and sustained engagement is challenging. However, this short follow-up allowed observation of early changes in mental health outcomes, providing promising preliminary evidence of the intervention's impact. These findings are part of a larger ongoing randomised controlled trial (RCT) of ParentApp for Teens in Tanzania, which includes longer-term follow-ups and a control group to more rigorously evaluate sustained effects and causal impact (Baerecke et al., 2024; Cluver et al., in progress). The full RCT will help clarify the durability of mental health improvements and engagement patterns over time.

Improving the measurement of engagement is also important. Future research should incorporate more detailed and automated metrics, such as time spent on each module, page views, and in-app interactions, ideally recorded without requiring a stable internet connection - particularly in rural areas. Collecting more granular engagement data will help clarify how specific behaviours relate to intervention outcomes.

These sample characteristics also reinforce the importance of contextual adaptation and equity-focused design for future digital parenting interventions. To reach caregivers with lower literacy and fewer economic resources, adaptations such as audio-based content, simplified interfaces, and integration with community-based delivery platforms may be needed to reduce

access barriers and ensure that benefits extend beyond relatively advantaged subgroups. This suggests that further research on adapting and testing the intervention is required for these populations.

Further studies are needed to evaluate digital parenting interventions across diverse geographic, cultural, and socio-economic settings to determine their generalisability and adaptability. This will ensure that interventions remain culturally relevant and effective for a wider range of caregivers. Additionally, investigating the role of WhatsApp group engagement at the individual level could provide valuable insights into how facilitated peer support influences intervention use and outcomes. Linking data on group participation with individual engagement and mental health measures may reveal the benefits of integrated support channels.

5.7 Conclusion

This study explored the impact of a digital parenting intervention on caregiver mental health within the context of an RCT in Tanzania. Despite mental health not being the primary outcome, the intervention findings revealed improved caregiver mental health, with reductions in symptoms of depression and anxiety observed across both male and female participants. These findings provide promising evidence that digital parenting programmes can deliver meaningful mental health benefits alongside their core aims, especially in low-resource settings where access to support is limited. While improvements in mental health were found, the analysis revealed that few factors measured in the study predicted this change, with only self-reported health and perceived stress emerging as a significant, very small, predictor. Further, this study contributes to understanding user engagement and the measurement of engagement in digital interventions. In this study, psychosocial factors, self-reported health, perceived parental stress and perceived social support, socio-demographic characteristics and internet use/digital literacy did not seem to influence participation. These findings suggest that the mechanisms driving both outcomes and engagement may be more complex than

currently understood, and that additional, unmeasured influences, such as motivation or external stressors, may play an important role.

Together, these findings highlight the multi-dimensional value of digital parenting interventions in improving caregiver well-being and point to critical areas for future research. Understanding the underlying drivers of engagement and mental health change is essential for refining and scaling these programmes. In doing so, we can better support caregivers and families in low-resource settings, ultimately contributing to improved outcomes for both parents and children. The findings add to the literature on the design of culturally relevant, user-centred digital parenting programmes and support the development of policies that improve caregiver well-being and family outcomes in LMICs.

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Appendix A1: UCT Ethics

CENTRE FOR SOCIAL SCIENCE RESEARCH

University of Cape Town ▪ Private Bag Rondebosch 7701 ▪ South Africa
Tel: 021 650 4656 ▪ Fax: 021 650 4657 ▪ Web: www.cssr.uct.ac.za

TO: Nicole Chetty
FROM: Jane Kelly
Research Officer, Centre for Social Science Research, UCT
SUBJECT: Research Ethics Review – Endorsement letter
RESEARCH: A hybrid digital parenting programme to prevent abuse of adolescents in Tanzania: A randomised controlled trial
REFERENCE: CSSR 2023/03

Dear Ms Chetty and colleagues,
We have reviewed the amendments to your research proposal and note that they have already been approved by Oxford University. We hereby endorse their approval of the amendments.

We expect that you will continue to deliberate as necessary over ethical issues that arise in the course of the research, both within the team and with scholars outside of the team as appropriate.

Best wishes for your research and we look forward to learning about your findings.

Jane Kelly
Research Officer
Adolescent Accelerators Research Hub
Centre for Social Science Research
Jane.Kelly@uct.ac.za

CENTRE FOR SOCIAL SCIENCE RESEARCH

University of Cape Town ▪ Private Bag Rondebosch 7701 ▪ South Africa
Tel: 021 650 4656 ▪ Fax: 021 650 4657 ▪ Web: www.cssr.uct.ac.za

TO: Lauren Baerecke

FROM: Jeremy Seekings
Director, Centre for Social Science Research, UCT

SUBJECT: Research Ethics Review

RESEARCH: A hybrid digital parenting programme to prevent abuse of adolescents in Tanzania: A randomised controlled trial

REFERENCE: CSSR 2023/03

3rd April 2023

Dear Ms Baerecke and colleagues

We have reviewed your proposed research. Your submission was very thorough and professional. We note that it has already been approved by the relevant institutions at both Oxford University and in Tanzania, where the research will be conducted. We endorse their approval of your research.

We expect that you will continue to deliberate as necessary over ethical issues that arise in the course of the research, both within the team and with scholars outside of the team as appropriate.

Best wishes for your research and we look forward to learning about your findings.

Centre for Social Science Research
University of Cape Town

Appendix A2: Oxford University Ethics

SOCIAL SCIENCES & HUMANITIES
INTERDIVISIONAL RESEARCH ETHICS COMMITTEE

Research Governance, Ethics & Assurance Team, Research Services, University of Oxford,
Boundary Brook House, Churchill Drive, Headington, Oxford OX3 7GB, UK
Tel: +44(0)1865 289881 Email: ethics@socsci.ox.ac.uk

Professor Lucie Cluver & Jenny Chen-Charles
Department of Social Policy & Intervention
University of Oxford

16 February 2023

Dear Lucie and Jenny,

Research ethics approval

Research title: "A hybrid digital parenting programme to prevent abuse of adolescents in Tanzania: A randomised controlled trial"

Research ethics reference: R84601/RE001

The above application has been considered by the Social Sciences and Humanities Interdivisional Research Ethics Committee (SSH IDREC) in accordance with the University's procedures for ethical approval of all research involving human participants.

I am pleased to confirm that, on the basis of the information provided to the IDREC, ethics approval has now been granted for this study for the period 15 February 2023 to 31 December 2025.

Please note the following:
Personal data: It is the responsibility of the PI to ensure that all personal data collected during the project is managed in accordance with the University's guidance and legal requirements.
In-person activities: Any data collection involving in-person interactions with participants must have an up-to-date fieldwork risk assessment in place; further guidance is available from the Safety Office's website.
Amendments: Please notify the committee if you intend to make any amendments to the information in your ethics application as submitted at date of this approval, as all changes must receive ethical approval prior to implementation. The amendment form is available on the SSH IDREC webpage.
Adverse events: The SSH IDRECs must be notified within seven days of any unexpected adverse consequences to the research participants, researchers or other people involved in this research project.
Audit: The SSH IDREC audits a sample of projects each year to enable the Committee to monitor the ethical aspects of research in progress.

We welcome feedback on your experience of the ethical review process and suggestions for improvement. Please email any comments to ethics@socsci.ox.ac.uk.

Yours sincerely:

Miss Sue Sparke
Research Ethics Administrator
for
Jennifer Blaikie
Research Ethics Manager (SSH IDREC)

cc: ethics@spi.ox.ac.uk

Jenny Chen-Charles

From: Elizabeth Sparke on behalf of Social Sciences & Humanities IDREC
Sent: 21 February 2023 13:24
To: Jenny Chen-Charles
Cc: Ethics
Subject: R84601/RE002: Amendment to CUREC 2: "A hybrid digital parenting programme to prevent abuse of adolescents in Tanzania: A randomised controlled trial" (DREC ref SPI_C2_22_002)

Dear Jenny,

Thank you for submitting a request for amendments to project **R84601**, which has been reviewed on behalf of the Social Sciences and Humanities Interdivisional Research Ethics Committee (SSH IDREC).

On the basis of the information provided to the IDREC your amendments have been approved, under reference **R84601/RE002**.

Best wishes,
Bess

Bess Sparke
Research Ethics Administrator

Research Services | Research Governance, Ethics & Assurance Team
University of Oxford, Boundary Brook House, Churchill Drive, Headington, Oxford OX3 7GB

E: ethics@socsci.ox.ac.uk

researchsupport.admin.ox.ac.uk

From: Ethics <ethics@spi.ox.ac.uk>
Sent: 16 February 2023 09:52
To: Social Sciences & Humanities IDREC <ethics@socsci.ox.ac.uk>
Cc: Jenny Chen-Charles <jenny.chen@spi.ox.ac.uk>
Subject: Amendment to CUREC 2: "A hybrid digital parenting programme to prevent abuse of adolescents in Tanzania: A randomised controlled trial", Lucie Cluver, ref R84601/RE002 (DREC ref SPI_C2_22_002)
Importance: High

Dear Jennifer and Jenny,
Please find attached Jenny's minor amendments.
Best wishes,

Olivia Thornton - **Research & Finance Officer**
Department of Social Policy and Intervention, 32 Wellington Square, Oxford OX1 2ER

https://www.spi.ox.ac.uk/people/olivia-thornton

From: Jenny Chen-Charles <jenny.chen@spi.ox.ac.uk>
Sent: 14 February 2023 12:04

From: Social Sciences & Humanities IDREC <ethics@socsci.ox.ac.uk>
Sent: Tuesday, September 12, 2023 9:47 AM
To: Jenny Chen-Charles <jenny.chen@spi.ox.ac.uk>
Cc: Ethics <ethics@spi.ox.ac.uk>
Subject: Amendment to CUREC 2: "A hybrid digital parenting programme to prevent abuse of adolescents in Tanzania", Lucie Cluver - ethics approval, ref R84601/RE004

Dear Jenny

Thank you for submitting a request for an amendment to project R84601, "A hybrid digital parenting programme to prevent abuse of adolescents in Tanzania: A randomised controlled trial", to make the following changes:

- Expanding data collection to include potential exploratory surveys with additional adolescent siblings/co-residents in RCT households.
- The addition of bereavement content to the app.
- Updated consent forms.

The amendment has now been reviewed on behalf of the Social Sciences and Humanities Interdivisional Research Ethics Committee (SSH IDREC). On the basis of the information provided to the IDREC, the amendment has been approved. The new ethics reference is **R84601/RE004**.

Best wishes
Jennifer

UNIVERSITY OF OXFORD RESEARCH SERVICES

Jennifer Blaikie
Research Ethics Manager

Research Services | Research Governance, Ethics & Assurance Team
University of Oxford, Boundary Brook House, Churchill Drive, Headington, Oxford
OX3 7GB

T: 01865 616578 **E:** jennifer.blaikie@admin.ox.ac.uk

Appendix A3: Tanzania IRB Ethics

THE UNITED REPUBLIC OF TANZANIA

National Institute for Medical Research
3 Barack Obama Drive
P.O. Box 9653
11101 Dar es Salaam
Tel: 255 22 2121400
Fax: 255 22 2121360
E-mail: ethics@nimr.or.tz

Permanent Secretary
Ministry of Health
Government City Mtumba,
Health Road
P.O. Box 743
40478 Dodoma

NIMR/HQ/R.8a/Vol.IX/4218

02 March 2023

Dr. Joyce Wamoyi
NIMR-Mwanza Medical Research Centre
P O Box 1462
Mwanza

RE: ETHICAL CLEARANCE CERTIFICATE FOR CONDUCTING MEDICAL RESEARCH IN TANZANIA

This is to certify that the research entitled: **A hybrid digital parenting programme to prevent abuse of adolescents in Tanzania: study protocol for a pragmatic cluster randomised controlled trial (Wamoyi J. et al.),** has been granted ethical clearance to be conducted in Tanzania.

The Principal Investigator of the study must ensure that the following conditions are fulfilled:

1. Progress report is submitted to the Ministry of Health and the National Institute for Medical Research, Regional and District Medical Officers after every six months.
2. Permission to publish the results is obtained from National Institute for Medical Research.
3. Copies of final publications are made available to the Ministry of Health and the National Institute for Medical Research.
4. Any researcher, who contravenes or fails to comply with these conditions, shall be guilty of an offence and shall be liable on conviction to a fine as per NIMR Act No. 23 of 1979, PART III Section 10(2).
5. Sites: Mwanza region.

Approval is valid for one year: 02 March 2023 to 01 March 2024

Name: Prof. Said S. Aboud

CHAIRPERSON
MEDICAL RESEARCH
COORDINATING COMMITTEE

Name: Prof. Tumaini I. Nagu

Signature
CHIEF MEDICAL OFFICER
MINISTRY OF HEALTH

CC:Director, Health Services-TAMISEMI, Dodoma.
RMO of Mwanza region.
DMO/DED of Nyamagana and Ilemela districts.

THE UNITED REPUBLIC OF TANZANIA

National Institute for Medical Research
3 Barack Obama Drive
P.O. Box 9653
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Tel: 255 22 2121400
Fax: 255 22 2121360
E-mail: ethics@nimr.or.tz

NIMR/HQ/R.8b/Vol.I/1205

Permanent Secretary
Ministry of Health
Government City Mtumba
Health Road
P.O. Box 743
40478 Dodoma

25 January 2024

Dr. Joyce Wamoyi
National Institute for Medical Research
Mwanza Medical Research Centre
P.O. Box 1462
Mwanza

RE: ETHICAL APPROVAL FOR PROTOCOL AMENDMENT

This letter is to confirm that your application for amendment of a research protocol entitled "**A hybrid digital parenting programme to prevent abuse of adolescents in Tanzania: A randomised controlled trial**" **(Wamoyi, J. *et al.*)**, with ref. NIMR/HQ/R.8a/Vol.IX/4218, dated 2 March 2023 has been granted ethical clearance to be conducted in Tanzania.

Approval is for the following amendments:

1. Expanding data collection to include potential exploratory surveys with approximately 2,000 additional adolescent siblings/co-residents in participating households
2. Changes have been made to Question 1, Question 5, Question 7 and Question 17 to reflect the inclusion of exploratory surveys of adolescent siblings and/or co-residents in participating households
3. Updated consent forms to reflect changes made in the protocol

Approval of the listed amendments is valid from 25 January 2024.

Name: Prof. Said S. Aboud

CHAIRPERSON
MEDICAL RESEARCH
COORDINATING COMMITTEE

Name: Prof. Tumaini J. Nagu

Signature
CHIEF MEDICAL OFFICER
MINISTRY OF HEALTH

c.c: Director, Health Services-TAMISEMI, Dodoma.
RMO of Mwanza region.
DMOs/DEDs of Nyamagana and Ilemela districts.

Caregiver Informed Consent for the PLH ParentApp for Teens Study

Thank you for taking the time to speak with us. We are conducting research on our parenting app, PLH ParentApp for Teens. We would like to invite you to be part of the research study.

Why are you asking me?

We want to learn about families' experiences with ParentApp. We think this research could help us understand how the app might improve the lives of parents and teens such as yourself.

Do I have to take part?

Your participation is completely voluntary. This means that you do not have to participate if you do not want to.

Even if you do agree to take part, you can change your mind at any time without any penalty. If you want to stop taking part in the study, please let one of the research team members know; you do not need to give any reason.

What happens if I agree to join the study?

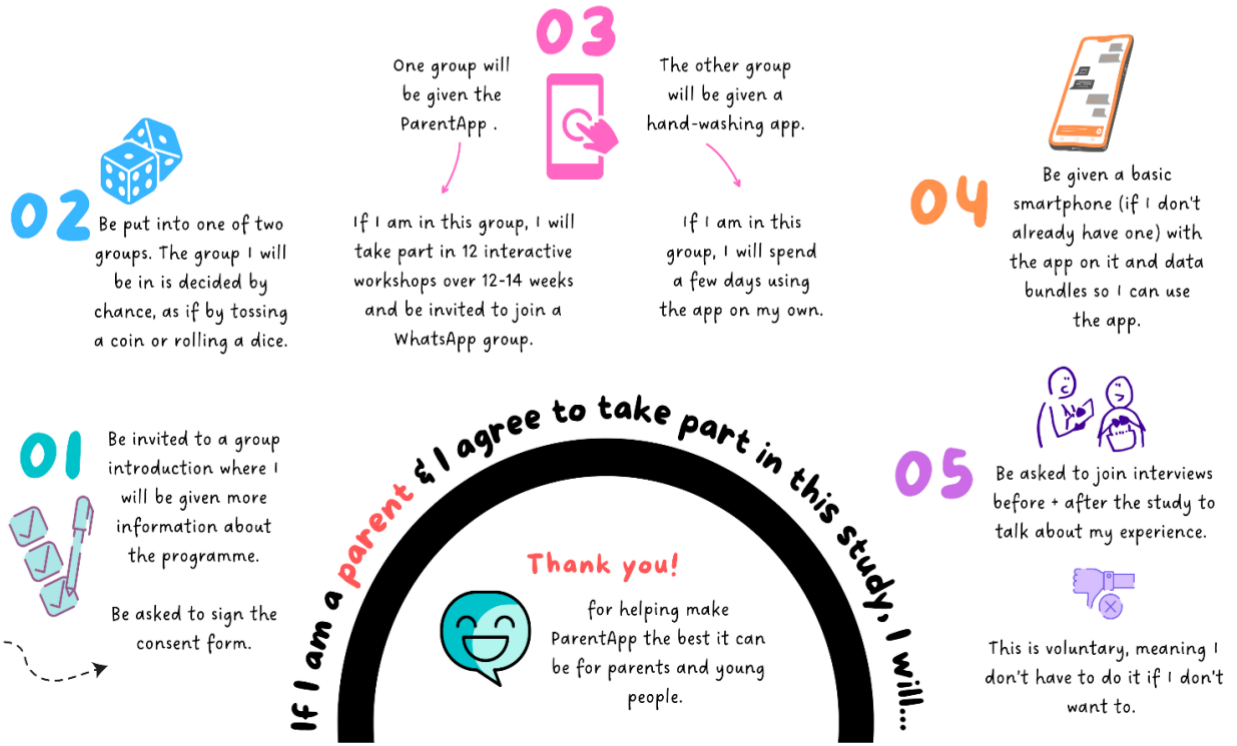
This picture explains what taking part in this study will mean for you. We will also give you an information sheet to take home with you.

Do I have to answer all the questions?

If any questions make you feel uncomfortable, you don't have to answer them. If you find anything that we talk about upsetting, and would like to talk to someone afterwards, we can help to provide you with contact details where you can get support services.

What will happen to my information?

All information you give us will be kept confidential and secure. The results from the study will be presented to people working in the field of parenting programmes. In all these presentations and reports, it will not be possible to identify people who took part.



Appendix B2: Caregiver and Teen Full Information Sheet and Consent/Assent Form for Participation in the Study

Date:[DD MM YYYY]

CAREGIVER AND TEEN PARTICIPANT INFORMATION SHEET FOR PARTICIPATION IN THE PLH PARENTAPP FOR TEENS STUDY.

You are invited to take part in a collaborative study conducted by researchers from the National Institute for Medical Research, University of Cape Town in South Africa and the University of Oxford in the United Kingdom. Before you decide whether you would like to be part of this study, it is important for you to understand why the research is being done and what it will involve.

Why is this research being conducted?

We are conducting research on our parenting app, PLH ParentApp for Teens. We want to know about families' experiences with ParentApp, including the in-app workshops, activities and the WhatsApp-based support group. We are also interested in changes in your family, your relationships, and parenting before and after participating in the programme. We think this research could help us understand how the app might improve the lives of caregivers and teens.

Why have we been invited to take part?

You have been invited to take part in this study because you are a caregiver of an adolescent aged 10-17. In order to participate, you and your teen will need to provide consent to confirm you are both willing to participate in the study.

Do we have to take part?

No, your participation is completely voluntary. This means that you do not have to participate if you do not want to. You and your teen should only take part if you both want to volunteer.

If you say yes to taking part in the study, you can always change your mind. If at any stage of this study you decide that you want to stop participating, please let one of the research team members know; you do not need to give any reason, and there will be no penalty. Once you have let the research team know that you would like to withdraw, we will stop processing and delete your personal information from the study.

What will happen to me and my teen if we take part in the research?

- If you agree to take part in this study, you and your teen will be given a chance to ask any questions that you have about the study and be asked to sign the consent form.
- You will be invited for a group introduction and onboarding session where you will be given more information about the programme.
- Because we want to know more about the use of a smartphone app for this programme, we need to compare ParentApp with a different kind of app. To do this, we will put people taking part in this research into two groups. The groups are selected by chance, as if by tossing a coin.
- Caregivers in one group will be given the ParentApp. Caregivers in the other group will be given an app on hand washing and hygiene.
- If you are in the ParentApp group, your participation will last over a 12-14 week period, where you as the caregiver will participate in 12 interactive workshops/modules. This will include home-based activities with your teen. If you are in the WashApp group, your participation will only be a few days.
- There will also be a WhatsApp support group for caregivers. The support groups will have a maximum of 50 participants in a group. Each group will have one lead facilitator and one co-facilitator. Observers may join the group to experience the WhatsApp support group process so that they may lead their own groups in the future.
- It is important that neither you nor we know which of the two apps you are given. This information will be recorded for safekeeping, but we will not look at these files until

after the research is finished. This is the best way we have for understanding the use and value of the parenting programme as an app.

- You and your teen will be asked to do an interview before and then two times after you use the app where we will ask you questions about yourself, your household, and your caregiver-teen relationship and experiences. This will take about 30 - 45 minutes each time and will be done individually so that your answers are kept confidential.
- Some personal information about you and your family (like your name/nickname and age) and how you use the app (like how many times you open it and what you look at when you're using the app) will be directly collected through the app you use. This will be shared with us for research purposes like understanding how the app functions and your experience with the app.

Expenses and payments

You will be provided with a smartphone with ParentApp on it to use while you take part in this study. This phone is free of charge and you are not required to return the phone once the study is completed or if you decide you no longer want to participate in the study later on. You will be provided with data bundles so you can use the app. In addition, we will also provide a small token of appreciation for your participation in study surveys.

Are there any benefits in taking part?

The information you provide will help us to make ParentApp the best it can be for parents and young people such as yourself, both in your community and other communities across Africa.

Is it bad or dangerous for my teen and I to take part in the study?

We do not expect anything bad to happen if you and your teen take part in this study. Remember, everything you talk about in your interview/survey is kept private and only shared

with the research team. If there are any questions that you don't like, you don't have to answer them and you can skip any questions. If you are asked questions together with your teen or in a group with other caregivers/teens, we will make sure there are rules about not sharing what people say with anyone outside of the group.

If you feel upset or confused by anything we talk about during the study, we are here to answer any questions and we can also give you or your teen the telephone number of someone safe you can talk to who is not part of the study and who will keep everything you say private. Remember, you can always change your mind about taking part in the study and say that you want to stop without telling us why.

What will happen to the information my teen and I provide?

The personal information that we collect only includes what is necessary for the study. The information you share with us (e.g., your consent form and your answers to the survey) will be kept safe on a secure server at NIMR and backed up on servers at the University of Oxford and/or at the University of Cape Town. It may be transferred to other countries so that we can share it with our research partners involved in similar research. Our research partners include the National Institute of Medical Research Tanzania, the University of Cape Town, the University of Oxford, IDEMS International, INNODEMS, Investing in Children and their Societies, the World Health Organisation, and UNICEF, but over time more research partners will join this research team and may have access to the data. All our research has the goal of supporting children and families, and is non-profit.

We will keep your identifying details separately and only restricted study staff will have access. The rest of the information will be entered into another database, identified only by your study number, and we will only use this database to find the answers to our study questions. This means all information will remain confidential and private. Your information will not be kept longer than necessary. All the data will be stored for five years after the study, but the data that allows you to be identified (e.g., your name) will be destroyed at the end of the study

unless you give us permission to contact you in the future to ask whether you would like to be part of longer-term research about this programme. If you give us permission to record your interview, the recording will be deleted once we've written down what you said.

Study information may be reviewed by ethics committees, and independent monitors, to check that the study procedures were done correctly, and the information is correct. Your information will remain confidential unless we are required by law to release information.

When the study is finished, we will make information from the study available to be shared with other researchers. This will only be done after all the information which identifies people who took part has been removed, so the identities of the people who took part will remain confidential. You have the right to request access to your personal information at any time or request that we correct or destroy any information that you have provided before it is fully anonymised.

What will happen to the results of the research?

The results from the study will be presented to people working in the field of parenting programmes, to other researchers and to governments and other agencies in the form of presentations, publications in academic journals and policy briefs. In all these presentations and reports, it will not be possible to identify people who took part.

Data protection

The National Institute for Medical Research, the University of Oxford and University of Cape Town are responsible for ensuring the safe and proper use of any personal information you provide. We will only process data for research purposes. Research is a task that is performed in the public interest.

Who has reviewed this study?

This study will be approved by the National Institute for Medical Research (ref number), the University of Cape Town Department of Psychology's Research Ethics Committee (ref number), and the University of Oxford Ethics Committee (ref number).

The National Health Research Ethics Sub-Committee (NatHREC), National Institute for Medical Research has reviewed this study. If you have any questions or concerns about your rights as a person taking part in a research study, or if you wish to make a complaint about the study, you may contact:

Secretary of the National Institute for Medical Research Ethics Committee
National Institute for Medical Research, 3 Barack Obama Drive, 11101 Dar es salaam, Tanzania. Landline: +255 22 2121400. Mobile: +255 758 587885. Email: ethics@nimr.or.tz/ nimrethics@gmail.com.

Who do I contact if I have a question, a concern, or a complaint about the study?

Please let us know if you have any questions about this study before providing consent. Should you have any questions, concerns, or would like to lodge a complaint about the study, you may raise this with the research team who gave you this form or the lead facilitator of your WhatsApp support group. You can also contact Dr Joyce Wamoyi at the National Institute for Medical Research. The number is 0282500399.

If you have any further questions or concerns about your rights as a study participant, you can contact: Dr. Safari Kinunghi, director at the National Institute for Medical Research. He can be contacted by telephone on 0282500399 and by email at kinunghi_csm@hotmail.com.

Thank you for helping us make ParentApp the best it can be for parents and teens :)

Caregiver Informed Assent:

Before you sign the consent, there may have been some parts you don't understand or things that you want me to explain more about because you are interested or concerned. Do you have any questions for me about the study?

	Please mark
1. I confirm that I have read and understand the information sheet for the above study. I have had the opportunity to think about the information, ask questions and have had these answered to my satisfaction.	
2. I understand I can stop at any time, without giving any reason.	
3. I understand that by signing this form I am agreeing to my information being collected.	
4. I understand that all information gathered from this study will be strictly confidential unless required by law.	
5. I understand that sections of data collected during the study may be looked at by responsible individuals from the research partners listed on the information sheet.	
6. I understand who will have access to my data and how it will be stored, shared and published.	
7. I understand how to make a complaint or raise any concerns about my participation.	
8. I am aware that I can request my data be updated or removed at any time before it has been anonymised.	
9. I agree to take part in this study.	
10. I agree to the researcher(s) contacting me after the study has been completed, to ask if I would like to be part of longer-term research about this programme.	

11. I freely give my consent for my adolescent child/ward to take part in this study.	

_____ _____

Signature of Parent Taking Part in Study Date

_____

Printed Name of Parent Taking Part in Study

_____ _____

Signature of Parent Providing Consent to Approach Their Child/Ward to Participate Date

Adolescent Informed Assent:

Before you sign the consent, there may have been some words you don't understand or things that you want us to explain more about because you are interested or concerned. Do you have any questions about the study?

I have read this information (or had the information read to me). I have had my questions answered and know that I can ask questions later if I have them.

I agree to take part in the research.

OR

I do not wish to take part in the research and I have not signed the assent below

_____ (initialled by child/minor)

Only if child assents:

_____ _____

Signature of Child Date

_____

Printed Name of Child

Statement of Person Obtaining Informed Consent

I have carefully explained to the person taking part in the study what he or she can expect from their participation. I confirm that this research subject speaks the language that was used to explain this research and is receiving an informed consent form in their primary language. This research subject has provided legally effective informed consent.

_____ _____

Signature of Person Obtaining Informed Consent Date

_____

Printed Name of Person Obtaining Informed Consent

Appendix B3: ParentApp Privacy Policy

Privacy Policy

IDEMS International built the international.idems.plh_teens app as a Free app. This SERVICE is provided by IDEMS International at no cost and is intended for use as is.

This page is used to inform visitors regarding our policies with the collection, use, and disclosure of Personal Information if anyone decided to use our Service.

If you choose to use our Service, then you agree to the collection and use of information in relation to this policy. We will not use or share your information with anyone except as described in this Privacy Policy.

The terms used in this Privacy Policy have the same meanings as in our Terms and Conditions, which is accessible at international.idems.plh_teens unless otherwise defined in this Privacy Policy.

1. **What Information does the app collect about you and how do we use it?**

Personal Data

For the purpose of this Privacy Policy, “personal data” means any information that enables us to identify an individual, directly or indirectly, by reference to an identifier such as name, identification number, location data, online identifier or one or more factors specific to the individual. While using our Service, we may require you to provide us with certain personally identifiable information. Specifically, this is data regarding chosen username, age, gender, household composition and relationship statuses, and (if applicable) the recruiting organisation. All data collected is linked to your unique user ID, which you can choose to share with trusted parties so that they can support you.

Log Data

We want to inform you that whenever you use our Service, we collect data and information (through third party products) on your phone called Log Data. This Log Data includes information such as your device Internet Protocol (“IP”) address, device name, operating system version, the configuration of the app when utilising our Service, the time, date and nature of your use of the Service.

Cookies

Cookies are files with a small amount of data that are commonly used as anonymous unique identifiers. These are sent to your browser from the websites that you visit and are stored on your device's internal memory.

This Service does not use these “cookies” explicitly. However, the app may use third party code and libraries that use “cookies” to collect information and improve their services. In particular, the app integrates Matomo analytics and Firebase authentication software.

Legal

The information that we request will be retained by us and used as described in this Privacy Policy.

2. Information Sharing

You agree that your personal information may be shared with third parties such as researchers, including those outside your country. We ensure that the researchers will keep your personal information confidential and all data will be made anonymous to the extent possible and where appropriate. If we publish the results of this research, you will not be identified by name.

No personal information will be made available to a third party unless that third party has agreed to abide by strict confidentiality protocols that we require. If a third party asks us for any of your personal information we will only share it with them if: (1) you have given your

consent for the disclosure of the information to that third party; or (2) we have a legal or contractual duty to give the information to that third party.

You agree that we may transfer your personal information outside your country, for example, to administer cloud services. We will ensure that any country, company or person that we pass your personal information to agrees to treat your information with the same level of protection as we are obliged to.

3. Third Party Service Providers

The app does use third party services that may collect information used to identify you. We do so for the following reasons:

- To facilitate our Service
- To provide the Service on our behalf
- To perform Service-related services; or
- To assist us in analysing how our Service is used.

We want to inform users of this Service that these third parties have access to your Personal Information. The reason is to perform the tasks assigned to them on our behalf. However, they are obligated not to disclose or use the information for any other purpose.

Links to the privacy policies of third-party service providers used by the app:

- Google Play Services
- Google Analytics for Firebase
- Sentry

4. How do we keep your data secure

We value your trust in providing us your Personal Information, thus we are striving to use commercially acceptable means of protecting it. But remember that no method of transmission

over the internet, or method of electronic storage is 100% secure and reliable, and we cannot guarantee its absolute security.

5. Third-Party Websites

This Service may contain links to other sites that are not covered by this Privacy Policy. If you click on a third-party link, you will be directed to that site. This Privacy Policy applies only to the processing of your information by this Service. It does not address, and we are not responsible for, the privacy, information, or other practices of any third parties, including any third party operating any site or service to which this Service links to.

6. Children’s Privacy

These Services do not address anyone under the age of 18. We do not knowingly collect personally identifiable information from individuals under 18. We do collect information about children under 18, as the Service is targeted at caregivers of children aged 10 - 17 years who may be asked questions about their children's behaviour. In the case we discover that an individual under 18 has provided us with personal information, we immediately delete this from our servers. If you are a parent or guardian and you are aware that your child has provided us with personal information, please contact us so that we will be able to do necessary actions.

7. Retaining your Personal Information

We will only retain your personal information for as long as we need it to fulfil our purposes, including any relating to app services and legal, accounting, or reporting requirements.

8. Your rights

Under certain circumstances, by law you have the right to:

- Request access to your data (commonly known as a "subject access request"). This enables you to receive a copy of your data and to check that we are lawfully processing it.

- Request correction of your data. This enables you to ask us to correct any incomplete or inaccurate information we hold about you.
- Request erasure of your data. This enables you to ask us to delete or remove your data under certain circumstances, for example, if you consider that there is no good reason for us continuing to process it. You also have the right to ask us to delete or remove your data where you have exercised your right to object to processing (see below).
- Object to processing of your data where we are relying on our legitimate interests (or those of a third party) and there is something about your particular situation which makes you want to object to processing on this ground.
- Request the restriction of processing of your data. This enables you to ask us to suspend the processing of your data, for example if you want us to establish its accuracy or the reason for processing it.
- Request the transfer of your data to another party.

Depending on the circumstances and the nature of your request it may not be possible for us to do what you have asked, for example, where there is a statutory or contractual requirement for us to process your data and it would not be possible to fulfil our legal obligations if we were to stop. Further information on your rights is available from the Information Commissioner's Office (ICO).

9. Notifications of changes to the Privacy Policy

We may update our Privacy Policy from time to time, with such changes being effective immediately upon posting them to the Service. We thus advise you to review this page periodically for any changes. We will notify you of any changes by posting the new Privacy Policy on this page. The "Last Updated" date at the bottom of this sub-section indicates when this Privacy policy was last revised.

Last Updated: 7 February 2022.

10. Contact Us

If you have any questions or suggestions about our Privacy Policy, do not hesitate to contact us at apps@idems.international.

This Privacy Policy page was based on a draft created at privacypolicytemplate.net and modified/generated by App Privacy Policy Generator.

Appendix B4: ParentApp Terms and Conditions

Terms & Conditions

1. **User Agreement**

These Terms of Use are an agreement between you and [APP NAME] that set the rules for your interactions with the [APP NAME]. Please read these Terms of Use carefully. By downloading or using the app, you agree that you have read, understood, and accepted the terms and conditions contained below.

Your privacy is important to us – please also read our Privacy policy, which will walk you through how we collect, store and use the information that you provide to us. By using the [APP NAME], you are confirming to us that you are agreeing to our privacy policy.

2. **Rules of Usage**

You're not allowed to copy, or modify the app, any part of the app, or our trademarks in any way. You're not allowed to attempt to extract the source code of the app, and you also shouldn't try to translate the app into other languages, or make derivative versions. The app itself, and all the trade marks, copyright, database rights and other intellectual property rights related to it, still belong to IDEMS International.

3. **Content**

IDEMS International is committed to ensuring that the app is as useful and efficient as possible. For that reason, we reserve the right to make changes to the app or to charge for its services, at any time and for any reason. We will never charge you for the app or its services without making it very clear to you exactly what you're paying for.

4. **Security**

The international.idems.plh_teens app stores and processes personal data that you have provided to us, in order to provide our Service. It's your responsibility to keep your phone and

access to the app secure. We therefore recommend that you do not jailbreak or root your phone, which is the process of removing software restrictions and limitations imposed by the official operating system of your device. It could make your phone vulnerable to malware/viruses/malicious programs, compromise your phone's security features and it could mean that the international.idems.plh_teens app won't work properly or at all. To see how we handle your personal information, please see our Privacy policy.

5. **External links and resources**

The app does use third party services that declare their own Terms and Conditions. Link to Terms and Conditions of third party service providers used by the app

- Google Play Services
- Google Analytics for Firebase
- Sentry

6. **Disclaimer**

You should be aware that there are certain things that IDEMS International will not take responsibility for. Certain functions of the app will require the app to have an active internet connection. The connection can be Wi-Fi, or provided by your mobile network provider, but IDEMS International cannot take responsibility for the app not working at full functionality if you don't have access to Wi-Fi, and you don't have any of your data allowance left.

If you're using the app outside of an area with Wi-Fi, you should remember that your terms of the agreement with your mobile network provider will still apply. As a result, you may be charged by your mobile provider for the cost of data for the duration of the connection while accessing the app, or other third party charges. In using the app, you're accepting responsibility for any such charges, including roaming data charges if you use the app outside of your home territory (i.e. region or country) without turning off data roaming. If you are not

the bill payer for the device on which you're using the app, please be aware that we assume that you have received permission from the bill payer for using the app.

With respect to IDEMS International's responsibility for your use of the app, when you're using the app, it's important to bear in mind that although we endeavour to ensure that it is updated and correct at all times, we do rely on third parties to provide information to us so that we can make it available to you.

IDEMS International accepts no liability for any damage or loss, direct or indirect, you experience as a result of using the app, or arising from any reliance you may place on advice or information provided from the app. You should always exercise your own discretion and judgement appropriate to your own circumstances in relation to any advice or information provided from the app.

At some point, we may wish to update the app. The app is available on Android & iOS – the requirements for both systems (and for any additional systems we decide to extend the availability of the app to) may change, and you'll need to download the updates if you want to keep using the app. IDEMS International does not promise that it will always update the app so that it is relevant to you and/or works with the Android & iOS version that you have installed on your device. However, you promise to always accept updates to the application when offered to you. We may also wish to stop providing the app, and may terminate use of it at any time without giving notice of termination to you. Unless we tell you otherwise, upon any termination, (a) the rights and licences granted to you in these terms will end; (b) you must stop using the app, and (if needed) delete it from your device.

7. Changes to This Terms and Conditions

We may update our Terms and Conditions from time to time. Thus, you are advised to review this page periodically for any changes. We will notify you of any changes by posting the new Terms and Conditions on this page. Last updated: 7 February 2022.

8. **Contact Us**

If you have any questions or suggestions about our Terms and Conditions, do not hesitate to contact us at apps@idems.international.

This Terms and Conditions page was based on a draft generated by App Privacy Policy Generator.

Appendix C1: Baseline Questionnaire (extracted from main RCT questionnaire)

SECTION 1.2: About You
1.2.1. How old are you?
1.2.2. Do you identify yourself as male or female?
1.2.3. We think Caregivers are amazing! Tell us one thing that best describes you
1.2.4. What is the main language you speak at home?
1.2.5. If other, Please tell me what language this is
1.2.6. Many people find reading difficult. How do you find reading?
1.2.7. What kind of work do you do? Stay at home and take care of the children and house Domestic work for someone else (house, field or garden work) Retail (shop, market, street vendor) Hospitality industry (in bar, hotel) Trade (tailor, carpenter) Other, specify Do not work Prefer not to say
1.2.7a. What other work do you do?
1.2.8. How would you describe your overall health today on a scale from 0 (poor health) to 100 (excellent health)?
1.2.9. Smartphones are becoming more common these days. Do you or someone in your household have a smartphone? Yes, I own a smartphone Yes, someone in my household has a smartphone No Prefer not to say
1.2.10. How much experience do you have using a smartphone?
How many times have you done these activities in the past 4 weeks?
1.2.11. Used the internet to find information or read or watch the news
1.2.12. Downloaded an app onto a mobile phone
1.2.13. Used the internet to connect with friends and family on WhatsApp or other chat apps
1.2.14. Shared a photo on social media
SECTION 4: HOW I THINK AND FEEL
There are days in our lives when we feel sad and down, and days we feel really happy. We will ask you about the past 4 weeks
4.1 Please say how many days in the past 4 weeks you have felt this way.
4.1a. How often have you been feeling nervous, anxious or on edge?
4.1b. How often have you been not able to stop or control worrying?

4.1c. How often have you been having little interest or pleasure in doing things?
4.1d. How often have you been feeling down, depressed, irritable, or hopeless?
SECTION 12: Being a caregiver
Sometimes parenting our children can be stressful. I will read to you a number of statements. Please tell me how much you agree or disagree with each statement based on the past 4 weeks. Tell me how much you agree or disagree by giving me a number from 0 - 10 where 0 means strongly disagree and 10 means strongly agree
12.1. I enjoy spending time with my children
12.2. I feel close to my children
12.3. Caring for my children leaves little time and flexibility in my life
12.4. It is difficult to balance different responsibilities because of my children
12.5. My children are a major source of stress in my life
12.6. Caring for my children has been a financial difficulty for me
12.7. Having children has meant having too few choices and too little control over my life.
12.8. Physical punishment helps to raise, or educate a child properly
12.9 As a parent, can you tell me one time when you felt very proud of your children?
SECTION 13: MY SOCIAL SUPPORT NETWORKS
We all need people in our lives who listen to us and help us, but sometimes it can be hard to find the right person. Thinking about you, how many times in the past 4 weeks have you had if you needed …
13.1. Someone to confide in or talk to about yourself or your problems?
13.2. Someone to turn to for advice about how to deal with a personal problem?
13.3. Someone who understands your problems?
13.4. Someone to help you if you were ill in bed?
13.5. Someone to have a good time with?
13.6. Someone to get together with for relaxation?
13.7. Someone to do things with to help you get your mind off things?
13.8. Thanks for talking to me about the types of things you talk to others about. What else do you like to do for fun?

Appendix C2: Post-test Questionnaire (extracted from main RCT questionnaire)

SECTION 1.2: About You
1.2.1. How old are you?
1.2.2. Do you identify yourself as male or female?
1.2.3. We think Caregivers are amazing! Tell us one thing that best describes you
1.2.4. What kind of work do you do? Stay at home and take care of the children and house Domestic work for someone else (house, field or garden work) Retail (shop, market, street vendor) Hospitality industry (in bar, hotel) Trade (tailor, carpenter) Other, specify Do not work Prefer not to say
1.2.5. What other work do you do?
1.2.6. How would you describe your overall health today on a scale from 0 (poor health) to 100 (excellent health)?
How many times have you done these activities in the past 4 weeks?
1.2.7. Used the internet to find information or read or watch the news
1.2.8. Downloaded an app onto a mobile phone
1.2.9. Used the internet to connect with friends and family on WhatsApp or other chat apps
1.2.10. Shared a photo on social media
SECTION 4: HOW I THINK AND FEEL
There are days in our lives when we feel sad and down, and days we feel really happy. We will ask you about the past 4 weeks.
4.1 Please say how many days in the past 4 weeks you have felt this way.
4.1a. How often have you been feeling nervous, anxious or on edge?
4.1b. How often have you been not able to stop or control worrying?
4.1c. How often have you been having little interest or pleasure in doing things?
4.1d. How often have you been feeling down, depressed, irritable, or hopeless?
SECTION 12: Being a caregiver
Sometimes parenting our children can be stressful. I will read to you a number of statements. Please tell me how much you agree or disagree with each statement based on the past 4 weeks. Tell me how much you agree or disagree by giving me a number from 0 - 10 where 0 means strongly disagree and 10 means strongly agree
12.1. I enjoy spending time with my children
12.2. I feel close to my children
12.3. Caring for my children leaves little time and flexibility in my life
12.4. It is difficult to balance different responsibilities because of my children

12.5. My children are a major source of stress in my life
12.6. Caring for my children has been a financial difficulty for me
12.7. Having children has meant having too few choices and too little control over my life.
12.8. Physical punishment helps to raise, or educate a child properly
12.9 As a parent, can you tell me one time when you felt very proud of your children?
SECTION 13: MY SOCIAL SUPPORT NETWORKS
We all need people in our lives who listen to us and help us, but sometimes it can be hard to find the right person. Thinking about you, how many times in the past 4 weeks have you had if you needed …
13.1. Someone to confide in or talk to about yourself or your problems?
13.2. Someone to turn to for advice about how to deal with a personal problem?
13.3. Someone who understands your problems?
13.4. Someone to help you if you were ill in bed?
13.5. Someone to have a good time with?
13.6. Someone to get together with for relaxation?
13.7. Someone to do things with to help you get your mind off things?
13.8. Thanks for talking to me about the types of things you talk to others about. What else do you like to do for fun?