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mHealth for community-based growth monitoring and promotion: Three case studies from South African settings

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ABSTRACT

Optimal nutrition and growth of vulnerable children requires appropriate growth monitoring and promotion (GMP) through regular measurement and follow up, to detect nutritional problems early and prevent malnutrition. Routine surveillance of children's growth, especially their height, is not currently taking place reliably in primary healthcare (PHC) facilities. Community-based GMP responds to this gap, which could benefit from integration with mHealth tools. Three non-profit organisations in South Africa using mHealth for community-based GMP at the community level are compared. Recommendations for the use of mHealth for community-based GMP in similar settings are proposed. All three cases recognise that mHealth is a useful approach to digitising growth data on children. Collaboration with PHC for GMP referral and treatment is important to treat at-risk children. mHealth can be beneficial to GMP activities, when data are accessible and analysis is timeous. Ongoing costs related to data access remain a barrier to scaling up mHealth.

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1. Introduction

Child growth monitoring and promotion (GMP) is a cornerstone of public health interventions aimed at addressing undernutrition and improving child survival, particularly in low- and middle-income countries. In Sub-Saharan Africa, where child malnutrition remains a significant contributor to morbidity and mortality, community-based growth monitoring programmes continue to play a vital role in early detection of growth faltering and timely referral to health services. However, these programmes often face challenges such as inconsistent data quality, delays in reporting, and limited access to real-time information to guide decision-making.

Child growth in South Africa is suboptimal, with approximately one in four children under five years old suffering from stunting (low height-for-age) (Hall et al., 2024). Poor growth outcomes are associated with poor individual health, developmental and socio-economic outcomes, some with life-long effects (Black et al., 2008). Early identification of nutritional problems can help in preventing malnutrition and improving children's

growth and development. Interventions such as nutrition counselling, provision of nutrition supplements and referral to primary health care (PHC) have formed part of GMP since the approach was adopted by the United Nations Children's Fund (UNICEF) in the 1980s and have since been implemented worldwide (Claeson & Waldman, 2000). Evidence of acceptability of community-based GMP in South Africa exists from at least the early 2000s (Faber et al., 2003).

Routine surveillance of children's growth and development, especially their height, is not currently taking place in South Africa (Koetaan et al., 2018; Legoale & Manafe, 2024). This is evident from low completion rates of height charts in the Road to Health Booklets across geographies in the country (Naidoo et al., 2018; Mabesa et al., 2023; McLaren et al., 2024). Children visit primary health care settings infrequently, and despite decades of community-based programmes and the 2017-adopted Ward-based Primary Health Care Outreach Team (WBPHCOT) Strategy, community-based growth monitoring is not practised universally (Schneider et al., 2018; Mhlongo & Lutge, 2019). Even when at-risk or under-nourished children are identified during outreach events or by community health workers (CHWs), referral pathways are poorly developed, which can result in high severe acute malnutrition admission rates in hospitals (Muzigaba et al., 2018). Community-based GMP is not curative but can open up conversation between community-based para-professionals or clinicians and parents about children's growth trends, by making such trends visible (Mangasaryan et al., 2011; Fink et al., 2017). At facilities, growth faltering can be missed by poor clinician proficiency in interpretation of growth curves (Nel et al., 2022). By strengthening the capacity for GMP in communities, and ensuring that interventions are taking place timeously, earlier response to chronic and acute malnutrition cases can improve outcomes for children (Mangasaryan et al., 2011). The evidence is particularly compelling for activities that promote appropriate infant and young child feeding practices like exclusive breastfeeding, as part of GMP (Keats et al., 2021).

In recent years, the rapid expansion of mobile health (mHealth) technologies has offered promising opportunities to strengthen the delivery and management of community health services (Steinhubl et al., 2015). The World Health Organisation (WHO) defines mHealth as the use of mobile devices like smartphones or tablets to support healthcare practices, including data collection, communication, and health information dissemination (WHO, 2011). We recognise that there is significant debate in academic literature over the success of mHealth, but limit our background and discussion to its application in the context of growth monitoring. Over the past decade, the integration of mHealth tools into community-based growth monitoring programmes has garnered increasing attention as a strategy to enhance the efficiency, accuracy, and coverage of these essential services.

The WHO supports the strategic and innovative use of information and communication technologies as an essential component in improving access to universal health coverage and enhancing health and well-being (WHO, 2021). However, digital applications alone are not sufficient to bring about these improvements. Success depends on several enabling factors, including leadership and governance, investment, interoperability, infrastructure, and workforce capacity (WHO, 2019).

The WHO classifies digital Health services and applications into five main categories as seen below in [Figure 1](#) (WHO, 2023:41). Digital community-based GMP, along with

SERVICES AND APPLICATION TYPES

The digital services and application types represent the types of software, information and communications technology (ICT) systems and services or communication channels that deliver or execute the digital health intervention(s) and health content. The classification categorizes them into 5 representations within the Digital Health Architecture. Definitions and additional descriptors are included to support the appropriate mapping and categorizing of digital solutions.



Figure 1. Classification of digital health interventions (WHO, 2023:41).

related digital record-keeping and case registration, occurs at the *point of service* and can be classified under any of the application types labelled 'A' in [Figure 1](#). The WHO supports digital decision support for health workers when it aligns with their existing duties

(WHO, 2019). These activities can also support *geographic information systems* synthesising and mapping of growth and malnutrition data (WHO, 2019).

mHealth is part of the National Department of Health's strategy to improve delivery of healthcare services, most recently in the National Digital Health Strategy for South Africa, 2019–24 (National Department of Health, 2019). The National Department of Health announced in 2020 that it was working with Dimagi, an India-based 'global tech for good social enterprise' to develop a universal mHealth tool for CHWs under the WBPHCOT strategy called CommCare. According to Dimagi's website, they deployed CommCare in five districts within the first year (Dimagi, 2020). CHWs have been described as para-professionals, who receive training prior to implementing either generalist or specific functions in communities where they possess significant knowledge of the local culture and language (Olaniran et al., 2017).

A systematic review on the use of digital solutions aiming to improve primary healthcare outcomes has yielded mixed results with some small improvements seen in patient record-keeping and healthcare workers following guidelines (Agarwal et al., 2025). Yet a qualitative systematic review found health workers appreciated mHealth when it aided their work and most preferred it to paper-based systems, but still faced challenges like poor network connection, mobile data access and electricity cost (Odendaal et al., 2020).

A growing body of literature highlights the potential of mHealth interventions to improve growth monitoring practices across Sub-Saharan Africa. These studies report on a range of applications, from mobile applications used by CHWs for anthropometric data capture and automated growth charting, to SMS-based reminders and decision-support tools for follow-up care. By digitising growth monitoring, mHealth tools aim to reduce human error in measurement interpretation and ensure that growth faltering is identified correctly and promptly. By handling calculations and charting electronically, the technology allows health workers to focus more on counselling caregivers and taking action on detected issues, rather than on time-consuming record-keeping. Furthermore, mHealth can enable real-time data transmission to centralised databases, which can strengthen nutrition surveillance and oversight. Health managers can receive up-to-date growth data from remote communities, helping to inform rapid responses to emerging malnutrition hotspots. A key motivation behind many mHealth initiatives in Africa has been to overcome the delays and data quality problems of paper systems (Aboye et al., 2023).

Evidence from South Africa and other contexts like Rwanda, Kenya, and Malawi, demonstrates that mHealth can improve data quality, reduce reporting delays, enhance caregiver engagement, and support timely identification and management of growth-related health risks. South African research has focused on the public sector MomConnect platform, designed to improve maternal and child health outcomes, which was rolled out in 2014 (Christofides et al., 2022; Sibuyi et al., 2022).

Several recent studies have focused on mobile applications used by CHWs for anthropometric data collection and digital growth charting. For instance, a quasi-experimental study in Rwanda evaluated an mHealth tool designed to assist health providers in conducting growth and nutritional assessments of infants under six months. The tool automated the calculation of z-scores, plotted growth charts, and provided decision-support messages, leading to improved early identification of growth failure and enhanced provider decision-making (Nemerimana et al., 2021).

In Kenya, a feasibility study by Jensen et al., 2023 assessed the use of a smartphone application by CHWs to collect high-frequency health and nutrition data from hard-to-reach populations. The study found that caregivers collected and submitted anthropometric measurements, such as mid-upper arm circumference (MUAC), of an equal quality to enumerators in other studies, indicating the potential of mHealth tools in supporting community-based growth monitoring.

SMS-based interventions have also shown promise in improving follow-up and caregiver engagement. A retrospective cohort study across multiple sub-Saharan African countries examined the effectiveness of SMS technology on timely CHW follow-up for childhood malnutrition. The study demonstrated that SMS reminders significantly improved the timeliness of CHW visits, enhancing the management of acute malnutrition cases (Sarma et al., 2018).

In Malawi, the implementation of the YendaNafe mHealth platform provided CHWs with an integrated smartphone-based tool to support longitudinal patient care, data storage, clinical decision support, and routine monitoring. A qualitative study exploring CHWs' experiences with YendaNafe revealed high levels of acceptability and perceived improvements in service delivery, particularly in maternal and child health services (Kachimanga et al., 2024).

Despite these promising outcomes, gaps remain in the consistent implementation, scalability, and long-term sustainability of mHealth-supported growth monitoring initiatives. Furthermore, while many interventions show localised success, there is limited synthesis of lessons learned and best practices across different contexts within the region.

This article seeks to build on the current state of evidence on the use of mHealth in community-based growth monitoring programmes, by adding three case studies from South Africa. We also provide a brief overview of key trends, challenges, and opportunities for leveraging mobile technologies to improve child nutrition outcomes in resource-limited settings.

2. Materials and methods

We followed a collective case study or multiple-case study approach for this investigation (Yin, 2014). This study design compared different approaches to the same process, namely the use of mHealth for community-based GMP. We defined the case study boundaries as follows: use of mHealth for GMP activities, at the community level, in South African settings, rural or urban, by three non-profit organisations (the Zero2Five Trust, Grow Great and One-to-One Children's Fund). These cases were selected based on their collective emphasis on the reduction of malnutrition among children (including stunting) as an ultimate outcome of their programmes and their interest in contributing to research.

Each organisation's representative(s) developed the case study content, wearing two hats, namely as practitioner and as contributing author. All authors are public health practitioners and/or mHealth specialists within their respective organisations. Their contribution was based on their knowledge of the mHealth tool used in their organisation, as well as their experience with programmatic design and implementation, and access to internal data. This included an inherent strength as well as a weakness, as the author

of the case study has detailed knowledge and understanding, but may also have biases and blind spots. Attempts to counter this included consistent structure for describing each case. Each case was described individually before comparison across approaches to draw out general patterns.

Similarities and contrasts were identified and inductive thematic analysis was used to create key insights. This allowed the authors to develop a cross-case synthesis. The aims were firstly to illustrate the application of mHealth for community-based GMP and secondly to derive recommendations for the use of mHealth for community-based GMP in similar settings.

3. Results

3.1. Case study 1: Zero2Five Trust – community-based GMP in the context of early childhood development programmes

3.1.1. Description of the tool and development process

Zero2Five Trust aims to advance rural early childhood development (ECD) by promoting the socio-emotional and physical development of children, so they can thrive by age five. The Khula Nathi project, one of Zero2Five's flagship projects, aims to establish ECD centres, also known as Early Learning Programmes (ELPs), as nutrition hubs in rural communities. ECD practitioners are upskilled in nutrition and WASH (water, sanitation and hygiene) practices, and equipped to conduct GMP screening and refer at-risk children to the local primary healthcare (PHC) facility.

One of the key challenges encountered in implementing GMP at the ECD level is the difficulty of interpreting anthropometric data – particularly for non-health cadres (Marume et al., 2022). In response, Zero2Five partnered with Impande in 2023 to develop a mHealth GMP application for ECD practitioners and NPO fieldworkers. Impande had been using the customisable no-code app called CommCare from Dimagi, for their grassroots ECD work in KwaZulu-Natal and the Eastern Cape. Drawing from Impande's experience, this partnership produced three forms on CommCare: a GMP form and two complementary forms to track referrals and outcomes. Zero2Five led the development of the form content, while Impande managed technical implementation and backend systems. The form underwent iterative testing and refinement based on field feedback. Integration with Microsoft PowerBI further enhanced the system by enabling data visualisation on interactive reports and dashboards in real-time and facilitating access to actionable insights.

Fieldworkers employed by Zero2Five and partner ECD practitioners can create individual child profiles on CommCare that link key demographic information and anthropometric measurements – weight, height and MUAC. The app automatically interprets growth measurements by calculating a Z-score for weight-, height-for-age, weight-for-height and mid-upper arm circumference (MUAC) which then flags at-risk children for referral to the PHC facility for full assessment and, if indicated, counselling and treatment. Caregiver information is also captured and linked to the child's profile to streamline referral and follow-up.

The two complementary forms track the post-measurement care pathway. Firstly, the referral form tracks whether a flagged child was referred and whether the referral was

successfully communicated to the caregiver. The intention was for the ECD practitioner to complete this form, but the delicate trust-based caregiver-practitioner relationship has suffered on occasion with the referral responsibility resting on the practitioner. Some families have opted to remove children from ELPs, which can be detrimental to the child's development and nutrition, as Zero2Five provide nutrition support to all partner ECD centres.

The second form is captured by Zero2Five's clinic liaison. She collects data on assessment outcomes and any interventions provided at the clinic. Together, these digital tools enhance the accuracy and timeliness of growth monitoring, and support the continuum of care from screening to intervention.

3.1.2. Location of implementation

Khula Nathi was implemented in the Winnie Madikizela-Mandela (WMM) Local Municipality in the Alfred Nzo District of the Eastern Cape. This predominantly rural area grapples with widespread poverty, with 3 out of 4 households dependent on social grants and subsistence farming (Alfred Nzo District Municipality, 2020). Zero2Five selected this area as malnutrition rates in this district are expected to be high. Although no formal survey exists at the sub-district level, we assumed similar stunting rates to Mqanduli, which has similar socio-economic conditions to WMM (Matlwa Mabaso et al., 2022). Stunting is in part due to chronic undernutrition, most likely linked to the high levels of food insecurity in WMM (Hall et al., 2024).

At the time of writing, Khula Nathi was in its third and final year of implementation. Over two years, 5995 children were screened on CommCare at 137 ECD centres. Fifty ECD practitioners were onboarded on CommCare, with fieldworkers providing remote or in-person support for anthropometric measuring techniques, app usage and troubleshooting. CHWs were capacitated with knowledge, skills and resources to widen their GMP activities and collaborate and facilitate bi-directional communication between PHC staff and ECD practitioners for follow-up of referred children.

3.1.3. Key insights

- **Real-Time Growth Interpretation enhances accuracy:** The introduction of digital tools significantly improved the accuracy of interpreting anthropometric measurements. By eliminating manual interpretation, the system provided immediate and reliable results, which enabled more timely and appropriate referrals. While measurement errors were not entirely removed, the digital system reduced them substantially compared to paper-based GMP by eliminating some errors during digitised data entry by NPO data capturers. This is in part due to data validations on numerical fields.
- **ECD Practitioners as a Capable Cadre:** ECD practitioners can conduct GMP using mHealth technologies. The majority of ECD practitioners can use these tools effectively, provided training is tailored and highly specific.
- **Data Integrity Features:** Built-in validation (e.g. restricting input to numerical values or mandatory fields) helps reduce data entry errors.
- **Numeracy support integrated in training:** Many ECD practitioners had limited formal schooling. Integrating brief numeracy refreshers into anthropometric training improves their ability and confidence to measure and record data accurately.

- **Ongoing support for sustainability:** Ongoing training, supervision, and incentives are necessary for sustaining engagement and enthusiasm for GMP. GMP is an additional task within already busy ECD routines, without ongoing support it is vulnerable to being deprioritised.

3.1.4. Challenges and lessons learned

- **Connectivity limitations restrict timely data syncing:** In remote, low-income areas, mobile data access remains unreliable. Although CommCare can function offline, the process of syncing data requires an internet connection. Providing data bundles was not effective, as devices frequently consumed the data for background processes before CommCare could sync. A more sustainable solution is needed, such as establishing community WiFi hubs or identifying low-cost mobile data packages tailored to CommCare users.
- **Shared licensing is more affordable but demands clear partnership agreements:** A clear partnership agreement is vital for managing licenses and operational logistics, including data requirements for field updates. Zero2Five's shared CommCare license hosts multiple forms with various functions and restricted user profiles. Coordinating updates and data requirements for field updates and data syncing ensures smooth working. If not carefully planned, expenditure is significantly impacted.
- **Referral Systems Integration:** Ideally, PHC services should be integrated with the mHealth app, but without universally used and aligned mHealth tools, this is limited. Furthermore, ECD practitioners often prioritised caregiver trust over formal referrals, contributing to referral attrition in the second year of the project. Some caregivers felt ECD practitioners overstepped by suggesting PHC referrals after GMP screening, despite using scripted messages that avoided nutritional diagnoses from the project's outset.

In summary, the GMP form on CommCare significantly improved the efficiency and accuracy of measurements, eliminated data capture challenges and offered timely referrals for children at risk of malnutrition. However, some challenges remain which are critical for this project to have sustainable impact.

3.2. Case study 2: Grow great campaign – mHealth for state-employed CHWs

3.2.1. Description of the tool and development process

Grow Great Champions (GGC) is a project of the Grow Great campaign. The project aims to train 50% of all CHWs in South Africa in maternal and child health and nutrition, including GMP, to monitor the growth of 1.1 million children under two, annually. Since 2018, over 3900 CHWs have been trained across four provinces (Limpopo, Mpumalanga, Gauteng and the Western Cape), who record their clients' data on paper folders. From 2024, CHWs have been systematically transitioned to a digital tool, namely a custom-built app called 'CHW Connect'. CHW Connect was designed to ensure that child-level growth and development data are obtained in real time to provide high quality and targeted services to local communities, identify gaps and enable early referral for at risk children. In the sites where CHW Connect is used, the

digital system replaced the paper-based client management approach in place before 2024, which provided GGC with monthly data aggregated at the level of the CHW. The development and implementation of the app had two primary goals: firstly, to improve the client management system for CHWs, who would no longer need to carry paper folders with them from house to house, and secondly to provide evidence of the quality of data collection and screening activities completed by CHWs. CHWs provide an important but largely invisible and underrecognised service in the South African public health system (Mhlongo et al., 2020; Malatji et al., 2023, 2024).

In the user-friendly app, CHWs can create digital client folders, register new clients, track and schedule home visits and log attendance at team meetings. CHWs can view their caseload and progress to reaching targets via a dashboard. In addition, home visiting tools and resources are embedded in the app, making it easy for CHWs to share relevant information with parents and caregivers during home visits. Outreach Team Leaders, to whom the CHWs report, also have access to the CHWs' activity data through a purpose-built dashboard. They can track indicators like the number of children screened for malnutrition in the community, and compare with in-facility malnutrition registers to close the feedback loop between referral from the community and presentation at the facility.

CHWs can also access specially adapted training and short courses on topics related to the First Thousand Days in the app through an integrated resource hub with other health, nutrition and psychosocial support and information needed by CHWs. This was developed in part to respond to the need for capacity-building and skills development among CHWs, as documented by Malatji and colleagues in 2024.

The app is part of a Global Innovation Fund and Department of Science and Innovation co-funded initiative called ECD Connect.

3.2.2. Location of implementation

Ehlanzeni and Cape Winelands districts were selected as the initial roll-out sites. These districts are part of Grow Great Champions' footprint or areas of operation prior to the introduction of the mHealth tool. Ehlanzeni is a predominantly rural district in Mpumalanga, of which approximately a 20% of the population is under the age of 9 and a third to half is unemployed (Ehlanzeni District Municipality, 2024; Stats SA, 2024a). Cape Winelands, located in the Western Cape, is also largely rural, but has a significantly lower unemployment rate of 15%, and 15% of the population is under the age of 9 (Western Cape Government, 2022; Stats SA, 2024b).

Onboarding of outreach team leaders (OTLs) and CHWs was mainly facilitated by the GGC Development Facilitator with support from the Grow Great campaign's IT manager. CHWs were issued with an android mobile phone preloaded with the CHW Connect app, a major cost contributor to the project. Data use is reverse-billed in the absence of zero-rated content. The cost of implementation of the app is fully borne by the Grow Great campaign, which is donor-funded.

3.2.3. Key insights

- **Improved accuracy** – clients' growth data was accurately captured and interpreted, as the app calculates the child's Z-score for height, weight and MUAC, accurately

classifying the child's growth. Prompts are given for referrals or reminders about missed immunisation or supplement doses. Although CHWs conduct growth monitoring as a screening activity, they are able to take accurate measurements and refer at-risk children.

- **Better time management** – CHWs reported that the app improved the quality of their work and that they were able to manage their daily tasks more efficiently.
- **Greater confidence** – Replacing printed job aids with videos and digital infographics improves the quality of the information shared.

3.2.4. Challenges and lessons learned

At the time of writing, the app was not yet fully functional in offline mode, which poses challenges in areas where network connectivity issues persist. High data costs remain a barrier, as the only alternative is connecting to WIFI at the nearest clinic, which may be a far distance to someone travelling on foot.

Providing more regular in-field support is needed, especially in areas where there is high turnover of CHWs. Training cannot be once-off, as digital literacy is not guaranteed and user confidence takes time to develop. Due to differences in education and digital literacy levels among CHWs, remote troubleshooting and support is a challenge, and GGC is exploring the use of local 'app champions' to support their peers in managing issues with app usage.

The feedback loop between CHWs, the OTLs who supervise their activities, and the clinics that they refer clients to is vital. Regular sharing of data is needed to increase buy-in and accountability of all parties. Downloading data has been an ongoing challenge, which means the app has not yet achieved its overall goal of improving visibility of the scope and quality of CHWs' contribution to service delivery.

In summary, CHW Connect is a promising tool to improve the client management process for CHWs, as well as offering more interactive material for health promotion in the home. However, the first year of implementation has surfaced many areas requiring further improvement.

3.3. Case study 3: One-to-one Africa's enable programme

3.3.1. Description of the tool and development process

The Enable Programme is a transformative initiative of the One-to-One Children's Fund aimed at improving maternal and child survival outcomes in the OR Tambo district in the Eastern Cape. This rural area, characterised by widespread poverty and limited access to healthcare, faces significant maternal and child health challenges. To address these, the programme employs and empowers Mentor Mothers – trained community-based health workers – who deliver tailored health services to children under five and their caregivers, ensuring no child is left behind in achieving optimal health and development.

Central to the programme's success is the Enable App, a user-friendly, android-based application designed to streamline health interventions. Developed by One-To-One Africa in collaboration with Dimagi, the app was built on CommCareHQ, a no-code platform. Its development process involved converting manual forms to digital ones,

defining objectives, conducting user needs assessments, and refining data requirements through iterative feedback.

The app comprises intuitive menus and forms that support multiple workflows, including the Underweight-for-age (UWFA) module, which tracks children under five who are faltering in their weight. Mentor Mothers use the app during routine home visits and community outreach sessions to collect data, deliver interventions, and monitor progress. The App has offline functionality allowing for data collection in areas with limited connectivity.

The app's case management feature allows Mentor Mothers to track critical child growth indicators, including height, weight, mid-upper arm circumference (MUAC), and immunisation status. These metrics are automatically plotted on digital growth charts, providing real-time insights into a child's nutritional status. Alerts for malnutrition or developmental delays prompt timely actions, such as counselling caregivers, referring children to healthcare facilities, or engaging families in community-based nutrition programmes.

Additionally, the app screens pregnant women, tracks newborns and under-fives, monitors home-based care clients, and records data from follow-up visits. Data collected is saved in case properties, enabling long-term tracking of growth, immunisation, and health concerns.

3.3.2. Location of implementation

The Enable Programme operates across 38 villages in the OR Tambo district, many of which are in rural, remote areas with limited infrastructure. Only 15% of the district's population is employed. The population of children under the age of 9 is 25% (COGTA, 2020; Stats SA, 2024c). A team of 30 Mentor Mothers, 2 Supervisors, and 1 Community Nurse uses the Enable App to support over 2400 children under five. While Mentor Mothers focus on data collection and intervention, Supervisors and the Community Nurse provide oversight, and facilitate advanced care when necessary.

3.3.3. Key insights

The Enable App has greatly enhanced the efficiency and effectiveness of the programme by addressing several critical areas:

- **Improved data accuracy** has been a significant benefit, as digital plotting and tracking of growth charts have reduced errors in growth measurement and record-keeping.
- This improvement has, in turn, allowed for **more precise detection** of growth faltering among children.
- Additionally, the App's ability to flag potential concerns such as malnutrition or developmental delays **empowers Mentor Mothers** to take timely and appropriate action.
- The availability of real-time data further **supports early intervention** efforts, helping to reduce the risk of malnutrition and associated complications.
- Moreover, the **inclusion of interactive educational videos** in isiXhosa has strengthened caregiver education, fostering better understanding and engagement in the growth monitoring process.

3.3.4. Challenges and lessons learned

Despite these advantages, there are key considerations that must be addressed to optimise the App's implementation. Access to reliable electricity for charging devices remains essential, particularly in remote areas where power supply may be inconsistent. Network connectivity also poses a challenge, necessitating offline functionality to save data temporarily and sync when a connection becomes available. Additionally, the safety of health workers must be prioritised, as carrying devices could make them targets in high-crime areas. Data protection is equally crucial; the App should be password-protected, and all information must be securely stored on a server rather than on the device itself to ensure confidentiality.

The co-development of mHealth solutions with end users is crucial for success. Mentor Mothers, who are thoroughly trained, specialist CHWs or para-professionals, remain central to the programme's success. It is essential to recognise that the App serves as a tool to complement their expertise and efforts, rather than replace them.

Additionally, flexibility in design ensures the app remains user-friendly and culturally sensitive. Allowing users to skip questions or sections enables healthcare workers to adapt their approach based on the situation, ensuring they can 'read the room' and collect data in a manner that is both appropriate and sensitive to the needs of the individuals they are supporting. This adaptability enhances the App's utility in diverse settings.

3.4. Comparison across cases

3.4.1. Accurate interpretation

Each organisation's use of mHealth recognises the importance of accurate interpretation of child growth data in order to identify and refer at-risk children appropriately. Due to the varying education levels of the workforce implementing GMP (CHWs and ECD practitioners), using a tool that calculates a child's height-for-age Z-score or weight-for-age Z-score accurately or even automatically gains accuracy and reliability of referrals. This can improve the relationship with the primary healthcare system which receives referred clients into a system that is under pressure, as well as improving trust between the CHW or ECD practitioner and the caregiver of the at-risk child.

3.4.2. Custom-built or customise?

Two organisations (Zero2Five and One-to-One Africa) describe the use of CommCare, a tool developed by Dimagi and is used globally. The forms used by CHWs, ECD practitioners or other data capturers were built for purpose by either in-house or externally contracted skilled professionals, although the tool is marketed as a no-code platform. We refer to this type of development as the customisation of existing tools. These organisations pay a licence for its use, either directly or facilitated through another organisation. In contrast, CHW Connect, developed for the Grow Great Champions project, is a licence-free app, the development of which was funded through a combination of philanthropic and public financing. It is a custom-built app. However, there are ongoing costs related to usage, including procurement and maintenance of the devices used in the field. The complexity of the forms used in the app dictate the level of sophistication required in

terms of phone or tablet specifications, which can drive up costs. Customising an existing platform could lead to faster implementation or roll-out, while custom-built allows for a greater level of control over features.

3.4.3. *Offline functionality*

A common theme that emerged across the three cases is that data costs and incomplete network coverage pose ongoing challenges to implementing mHealth tools. For feedback to a central database, a user must sync their data when internet access is available, otherwise the results of their measurements remain stored on the device. Without a low-cost solution for uploading data, the feedback and surveillance benefits of a digital tool are undermined. Using the mHealth tool for more than data extraction through client case management is also dependent on data access to additional features like learning content or communication between users as part of peer learning through a community of practice.

4. Recommendations

Based on the case studies included in this article, we propose three key requirements for scaling up the use of mHealth in community-based GMP. Firstly, users must be adequately capacitated to conduct anthropometric measurements through regular training opportunities. Community-based growth monitoring is primarily a screening mechanism, which should lead to referrals of at-risk children for appropriate intervention in the healthcare system. When the quality of the data is high, caregivers and clinicians alike can trust that referrals are relevant and interventions are necessary, which strengthens service demand and accountability. Conversely, if the primary healthcare system grows to distrust the influx of mis-identified clients at their facilities, goodwill between non-profit organisations and local government stakeholders can erode quickly. This can have negative ripple effects for health-seeking behaviour.

Secondly, the digital tool (app or form) must be accessible in an offline mode for day-to-day use. The relationship between the app user and the client (child or caregiver) should not be adversely affected by challenges in digital client management. Creating a new profile or moving through a flow of data collection and information sharing should be smooth. The follow up step of sharing the data with the central database and implementing organisation should likewise be as easy as possible. Organisations have implemented different mechanisms for uploading data or 'syncing' with the system, including encouraging users to connect to WIFI at clinics during team meetings, sending mobile network data bundles to users, or taking mobile data access points like dongles to training or community-based events. However, in most of these cases, the organisation is carrying the data costs and the volume of data needed can be difficult to predict and include accurately in budgets. High data costs remain a serious barrier to rural and informal urban communities, as well as low-income cadres of community-based workers, be it ECD practitioners or CHWs. Non-profit organisations who implement innovative solutions like mHealth as part of their data collection and malnutrition programmes experience data costs as a barrier to scaling and fundraising. Network coverage further complicates internet access, which is more often a rural challenge.

The final recommendation is about sustainability at the system level. Due to the proportionally high cost of development, ongoing maintenance and refinement of mHealth tools such as apps, especially for small non-profit organisations, it is important to review plans for expanding use, content and coverage. This is especially relevant for cost-per-user models and where devices must be procured to run the mHealth tool. Economies of scale are more likely to be successful in driving down cost when procurement is for example for a provincial CHW workforce rather than at a sub-district level. We recommend that there is greater integration and collaboration at the outset with national and provincial health information systems, like the District Health Information System, and alignment with the National Digital Health Strategy for South Africa. This would avoid these case studies remaining as standalone donor-driven pilots.

5. Discussion

To move beyond the current scope of these case studies, mHealth initiatives in child growth monitoring must align with Department of Health priorities and secure stakeholder buy-in at all levels, as already identified by Leon and colleagues in a [2012](#) publication. Engaging national decision-makers and planning units early, adapting the tools to interoperate with routine health data systems, and building local technical capacity (for troubleshooting, updates, and data management) are all recommended as part of scaling up. When these conditions are met, mHealth has the potential to transform community-based nutrition programmes; however, without them, there is a risk that digital tools will be abandoned after initial enthusiasm.

The recent Food and Agriculture Organization (FAO) for the United Nations' Nutrition for Growth (N4G) Summit held in Paris in March 2025, underscored the importance of integrating nutrition into broader development agendas beyond health, such as agriculture, education and climate action. This multisectoral approach is essential to achieving sustainable improvements in nutritional outcomes (Nutrition for Growth, [2024](#)). In this context, the integration of mHealth technologies into existing systems offers a promising pathway to catalyse intersectoral collaboration, as recommended by the WHO (WHO, [2019](#)). The Department of Education provides daily meals at quantile 1–3 primary and high schools through the National School Nutrition Programme; however, expanding to ELP has been unrealised (Droomer et al., [2023](#)). The Zero2Five Trust's case study illustrates how early childhood education can serve as an effective entry point for nutrition interventions and daily meal provision, demonstrating the potential for early childhood education and nutrition to be mutually reinforcing in efforts to combat malnutrition.

Furthermore, the rapid advancement of artificial intelligence (AI), particularly Large Language Models (LLMs) and machine learning, presents emerging opportunities to enhance mHealth platforms, especially in areas such as data analysis, communication, and decision support (Nel et al., [2022](#)). However, persistent inequities in digital access – particularly related to internet connectivity and the affordability of mobile data – pose a risk of exacerbating disparities. Without deliberate strategies to bridge these digital divides, there is a danger that the most vulnerable communities will be excluded from these technological advancements, further widening existing inequalities.

In summary, the literature suggests that while mHealth can augment growth monitoring by improving data collection and use, careful attention must be paid to training, infrastructure, community engagement, and health system integration to overcome implementation barriers. Many interventions are still in pilot phases, and evidence on long-term impact and cost-effectiveness is evolving.

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