BMJ Global Health

Mobile health messaging service and helpdesk for South African mothers (MomConnect): history, successes and challenges

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To cite: Barron P, Peter J, LeFevre AE, *et al*. Mobile health messaging service and helpdesk for South African mothers (MomConnect): history, successes and challenges. *BMJ Glob Health* 2018;**3**:e000559. doi:10.1136/bmjgh-2017-000559

Handling editor Seye Abimbola

Received 9 September 2017
Revised 30 November 2017
Accepted 9 December 2017

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ABSTRACT

MomConnect is a flagship programme of the South African National Department of Health that has reached over 1.5 million pregnant women. Using mobile technology, MomConnect provides pregnant and postpartum women with twice-weekly health information text messages as well as access to a helpdesk for patient queries and feedback. In just 3 years, MomConnect has been taken to scale to reach over 95% of public health facilities and has reached 63% of all pregnant women attending their first antenatal appointment. The helpdesk has received over 300 000 queries at an average of 250 per day from 6% of MomConnect users. The service is entirely free to its users. The rapid deployment of MomConnect has been facilitated by strong government leadership, and an ecosystem of mobile health implementers who had experience of much of the content and technology required. An early decision to design MomConnect for universal coverage has required the use of text-based technologies (short messaging service and Unstructured Supplementary Service Data) that are accessible via even the most basic mobile phones, but cumbersome to use and costly at scale. Unlike previous mobile messaging services in South Africa, MomConnect collects the user's identification number and facility code during registration, enabling future linkages with other health and population databases and geolocated feedback. MomConnect has catalysed additional efforts to strengthen South Africa's digital health architecture. The rapid growth in smartphone penetration presents new opportunities to reduce costs, increase real-time data collection and expand the reach and scope of MomConnect to serve health workers and other patient groups.

Key questions

What is already known?

- MomConnect was launched in August 2014 as a flagship South African National Department of Health initiative to strengthen the quality of maternal and infant health services and improve mortality outcomes.
- It is universally accessible through all mobile phones and aims to register all pregnant women, provide them with vital health information and create channels for their feedback.

What are the new findings?

- MomConnect has been scaled rapidly through strong government stewardship and leverage of existing technology, content and partnerships.
- With a cumulative total of over 1 700 000 registered mothers, MomConnect now represents a powerful platform for real-time data collection and linkage to additional services to improve patient care.

What do the new findings imply?

- The demonstration of a nationally scaled model of mobile health messaging to pregnant women may encourage other counties with similar maternal and child health problems to replicate this programme.
- Using mobile data services instead of short messaging service and Unstructured Supplementary Service Data will enable MomConnect to reach users more affordably, without being limited to short messages.
- Cheaper mobile data costs will facilitate an extension of MomConnect to the partners and families of pregnant women, as well as similar programmes targeting health behaviours such as HIV antiretroviral therapy adherence.

BACKGROUND

Public health is a sector where mobile phones offer great potential to improve linkages between patients and health systems. Throughout the last decade, over 600 mobile health (mHealth) programmes have been piloted in low-income and middle-income countries.[2] Most remained small in size, though the Text4Baby initiative in the USA was one of the first projects to post large numbers.[3] This programme sparked interest in the role of mobile messaging to drive behaviour change among pregnant women and new mothers in lower income settings

with limited access to traditional channels for health information.

South Africa's disease burden and the characteristics of its mobile phone market made it a prime candidate for mHealth generally, but particularly for services targeting pregnant women.[4] By 2010, South Africa had universal mobile phone penetration[5] and unlike South Asia and much of sub-Saharan Africa, gender parity in mobile phone ownership[6] and high (91.7%) female literacy rates.[7]

By 2012 it was clear that South Africa was unlikely to achieve its Millennium Development Goal targets related to maternal and child survival.[8] In response, the Minister of Health, Dr Aaron Motsoaledi, proposed a number of health system interventions including an mHealth initiative later named *MomConnect*. The vision of MomConnect was to use widely accessible mobile technology to empower all pregnant women accessing services in the public sector with information to improve their own health as well as that of their babies. In addition, MomConnect would provide the means for pregnant women to give unsolicited feedback to the health system on the quality of antenatal and postnatal care received. The Minister of Health officially launched MomConnect on 24 August 2014.

Although several papers and case studies[9–12] have described different aspects of MomConnect, this is the first paper to detail the origins of MomConnect and the ingredients (leadership, partnerships, service design and financing) that enabled the programme to function. In addition, this paper highlights several key health system innovations and the interconnected components that were required for MomConnect to be introduced at scale. Finally, it outlines challenges and mitigation strategies, and provides a vision for the future.

HISTORY OF MHEALTH MESSAGING SERVICES IN SOUTH AFRICA

By 2013 South Africa had a range of mHealth interventions and a robust ecosystem of mHealth implementers. These included Mobile Alliance for Maternal Action (*MAMA*) *South Africa*,[13] a messaging service aimed at pregnant women, which was one of the building blocks in the development of MomConnect.

Most mHealth initiatives were led by non-governmental organisations (NGO) and funded by donors. They typically had no formal relationship with the South African public health system and focused on behaviour change communication and demand generation for maternal and child health (MCH) services. Messaging services pushed out one-way scheduled messages with no opportunity for user feedback. As most services relied upon self-subscription, pregnancies were not verified prior to registration, and there was no way to ensure that users were expectant or new mothers or even women of reproductive age (P Benjamin, personal communication, 2017).

LEADERSHIP AND PARTNERSHIPS

MomConnect's success has been enabled by governance and oversight by the South African National Department of Health (NDOH), the technical expertise, agility and flexibility of the NGO sector and generous donor funding. MomConnect was adopted as a ministerial key project from its inception,[14] and the Minister of Health's political support has been critical.[15] Prior to MomConnect's launch, he personally conducted roadshows in each of the nine provinces in South Africa, bringing together the senior provincial management as well as representatives of MCH services from each health district to explain in detail how MomConnect would work and request the support of all health workers. He has actively supported MomConnect at events to mark its first anniversary and reaching the milestone of 1 million users.

In May 2013 the NDOH established a task team of people working on mHealth maternal health messaging projects, under the authority of a senior member of the NDOH, to develop an effective programme plan. This laid the foundation for implementation support and oversight across a range of diverse stakeholders, while providing a forum for routine information sharing and troubleshooting. The task team had NDOH authority and political support to ensure that its suggestions and recommendations would be mainstreamed.

Task team members were selected to complement the clinical expertise of the NDOH, and included individuals with experience running mHealth projects, expertise in the flow, transfer and storage of data, mobile network industry experience and funders. The task team met every 2 months through 2013 and the first quarter of 2014 and has thereafter met monthly.

DESIGNING THE MOMCONNECT SERVICE

The most important components of the design of MomConnect were the technology and service architecture, registration and linkages with the public health system, messaging and scheduling, user feedback to the helpdesk, responses from the helpdesk, and monitoring and evaluation. A detailed description of the MomConnect technology and service architecture is included in this series.[16] All remaining components are described below.

Registration and linkages to the health system

MomConnect was designed to promote universal coverage, including women in the lowest socioeconomic bracket. Practically this meant that MomConnect needed to reach women with even the most basic mobile phones and be free of charge to the user. This restricted options to the text-based modalities of short messaging service (SMS) for sending of messages and Unstructured Supplementary Service Data (USSD) for registration of users. SMS can be sent to any phone, while USSD is available on all mobile phones and familiar to most South Africans

through the process of buying and loading mobile airtime.

Formal registration for MomConnect occurs at the first antenatal appointment when pregnancy is confirmed. The limitations of USSD, which is expensive and prone to timeouts, required keeping data elements collected at registration to a minimum. These were the gestational age (to send stage-based messages), the age of the pregnant woman (a key demographic variable), the South African national identification number of the woman (to serve as a unique identifier, enabling linkage with other electronic records including that of patients on HIV antiretroviral drugs), the identification code of the facility (to link to the service received) and the language of choice (so that messages were sent in the preferred language).

Registrations took place either on the woman's own phone or via a health provider's phone, in which case the woman's mobile phone number was required as an additional variable. The costs of USSD were reverse-billed (ie, billed directly to the MomConnect service providers, rather than to end-users) so that women could register or be registered free of charge. Some exploratory work has been done on health workers' concerns around the use of their private phones for registration, with more research required.[17]

To integrate the registration process with antenatal service delivery, 30 000 nurses in nearly 4000 facilities were trained within 6 months. Each MCH coordinator in the 52 health districts was asked to be the champion of MomConnect. District support partners (DSP) provided training in individual facilities and delivered posters and other training materials. These DSPs were already actively working in the districts with established relationships at facility level to support efforts to combat HIV, funded by the US Government through its President's Emergency Fund for AIDS Relief (PEPFAR) programme.

Messaging

Messages were based on those developed for MAMA South Africa, which had demonstrated improved health-seeking behaviour.[18] These messages were reviewed and adapted by an NDOH task team. The messages addressed important behaviours associated with improved maternal and infant health outcomes, such as uptake of antenatal care, nutrition, HIV in pregnancy, exclusive breast feeding and immunisation. Messages also included information on fetal and child development to encourage bonding between mother and child. The content was carefully targeted by gestational age to closely align with a woman's individual experience, forging a connection between the user and the service as a foundation for subsequent behaviour change communication. Messages were sent twice weekly through a tested SMS system previously used by MAMA South Africa.

Helpdesk

The helpdesk allows women to ask individual questions and serves as a social accountability mechanism by accepting user feedback on the quality of health services. The helpdesk is based in the NDOH and is staffed by a small team of nurses who answer questions and follow-up on complaints. They also have easy access to relevant programme managers in the NDOH. Each question to the helpdesk receives either a standard response to an identified frequently asked question (FAQ), or a more personalised response from the helpdesk supervisor via a message or direct telephone call if the question does not fit into FAQ format.

Each complaint sent to the helpdesk is associated with the facility code included in the pregnant woman's registration so that specific feedback is easily linked back to facilities. Helpdesk personnel forward the complaint to the relevant facility managers, who have 10 days to respond. Unresolved complaints are escalated within the health system and provincial heads of health receive a manual weekly and monthly summary of unresolved complaints from the helpdesk. Relevant managers are also made aware of compliments to individual facilities or health workers.

Monitoring and evaluation

MomConnect is routinely monitored through the NDOH's information system, the national District Health Information System (DHIS). Each registered pregnant woman is linked to a facility, allowing the calculation of coverage rates through the comparison of registration data with total antenatal attendance data for facilities, districts and provinces. These are monitored monthly and reports sent to provincial and district MCH coordinators (table 1). Although the vision of MomConnect was universal registration, targets were set at 40% in the first year (2014), increasing to 60% in 2015, 80% in 2016 and 100% in 2017.

Several pieces of operational research have been carried out, including a study of how to improve the registration process.[19] The University of Stellenbosch was contracted to carry out a formal evaluation of MomConnect. This involved quantitative linkage of MomConnect with indicators collected through routine data in the DHIS, as well as a qualitative assessment of pregnant women's views on MomConnect and self-reported changes in attitude and behaviour, included in this supplement.[20]

FUNDING

Donor funding allowed speed and agility in the start-up phase of MomConnect. The catalyst for the national roll-out of MomConnect came via funding from the Office of the US Global AIDS Coordinator through PEPFAR, which agreed to provide bilateral support. Johnson & Johnson (a founding funder of MAMA South Africa) and ELMA Philanthropies chose to continue funding local NGO partners to support the implementation

Table 1 Example of a MomConnect monitoring report. (Limpopo province, Capricorn district: overall MomConnect registrations number and % August 2014 to June 2015 and for 1 month June 2015)

Province	District	Subdistrict	MomConnect registrations August 2014 to June 2015 (n)	Targets for August 2014 to June 2015 (n)	Achievement against target (%)	MomConnect registrations June 2015 (n)	Target for June 2015 (n)	Achievement against target (%)
Limpopo	Capricorn	Aganang	512	1016	50.4	53	113	46.7
		Blouberg	1030	1635	63.0	112	182	61.6
		Lepelle-Nkumpi	1971	2184	90.2	163	218	74.8
		Molemole	594	975	60.9	47	114	41.2
		Polokwane	4361	5980	72.9	276	655	42.2
	Subtotal Capricorn		8468	11 790	71.8	651	1282	50.8

of MomConnect. Unicef, which had started a similar pilot project in two districts in KwaZulu-Natal province, allowed the NDOH to use the name MomConnect and funded aspects of the helpdesk.

The costs of USSD and SMS, when taken to scale, are expensive. Though each of the four largest mobile network operators in South Africa (Cell C, MTN, Telkom and Vodacom) gave substantial discounts to MomConnect on SMS costs after extensive negotiations, the monthly mobile inventory costs of around US$60 000 per month still account for about three quarters of the total running costs of MomConnect. This is a key issue to address in the expansion and long-term sustainability of the programme. The annual cost of sustaining MomConnect (approximately US$1 million) at its current level of activity is not large in relation to the total South African public health sector budget of around US$10 billion, but represents an opportunity cost in a time of economic constraint.

MOMCONNECT PROGRAMME SUCCESSES

MomConnect grew to national scale strikingly fast. The Minister of Health and the US Ambassador launched MomConnect together,[21] receiving considerable media coverage that led to registrations at clinics all over the country. During the first month, nearly 50 000 pregnant women were registered on to the system. The programme celebrated its 1 000 000th user in 2016 and by August 2017 had cumulatively reached over 1.7 million pregnant women, representing 63% of all women attending their first antenatal care appointment.[1]. Ways to increase registration to achieve universal coverage with MomConnect are being explored, including offline registration, batch registration and embedded messages downloaded in the form of a mobile application.

The MomConnect helpdesk has handled over 300 000 questions, with an average of 500–700 daily questions requiring a response. More than 9700 compliments have been received, and about 1300 complaints lodged, with a resolution rate above 80%.[1] The complaints to the helpdesk have resulted in both local (facility) and general (health system) improvements in the quality of care such as addressing stock-outs of essential medicines at all clinics.[22]

MomConnect users report high levels of satisfaction with the messaging service and its role in supporting pregnancy, their health and that of their children. A high value is placed on the system and the content of the messages.[19] Informal feedback from a wide range of stakeholders shows that most are enthusiastic about it and many health managers in the NDOH have expressed interest in using this platform for other health programmes.

MomConnect has resulted in several innovative developments. Although South Africa already had a supportive policy framework for digital health at the time of MomConnect's inception, many policies were not yet implemented and MomConnect served as the first real-world test case.[23] For example, all facilities in the country required a unique code to identify the site of each user registration. Although six-digit facility codes were in place, they had never been used, and were only institutionalised in response to the needs of MomConnect. The privacy, data security and confidentiality aspects of holding individual patient information in a national system in South Africa also came to the fore for the first time in MomConnect. Rules and operating procedures were established for hosting and accessing such data, which are held on secure NDOH-controlled servers and subject to the same rules as other routine data systems.

MOMCONNECT'S LIMITATIONS AND IMPLEMENTATION CHALLENGES

Despite the impressive growth in MomConnect registrations, there are still challenges.[24] The USSD process, while text based and simple to operate from any phone, is prone to both network and user timeouts. Networks place lower priority on USSD transactions, so where services are limited a higher value voice call may displace a USSD session. For the user, completing a session may rely on either the ability to read fluently or familiarity with the options to permit quick navigation through the menus. Repeat sessions for MomConnect registrations are costly in terms of user time and network charges, and significant numbers of potential registrations are

lost because the USSD session is never completed.[21] A case study at clinic level found that some facility staff described MomConnect as an added burden—it requires completion of a new and time-consuming task within an already time-pressured patient interaction without directly assisting other clinical or administrative work.[25]

Sending messages via SMS has its own drawbacks, including cost and limitation of length to 160 characters. There are no economies of scale with SMS costs (it costs as much per SMS to send 100 SMS as it does to send 100 000). Consequently, SMS mobile inventory charges are a significant cost driver as the MomConnect service has scaled to national coverage. SMS systems are good at sending one-way messages from the centre to the patient, but are ill designed to allow interaction, including between women who are in the same geographic area and could potentially provide face-to-face support to each other. There is no functionality to permit direct communication between the facility and the woman, and MomConnect also does not yet link to any patient record system to support the continuum of care. As a result, it has yet to demonstrate the potential of a truly connected health system.

Currently, MomConnect does not support mobile phone number changes. An in-depth pilot study using MomConnect to support early childhood development found substantial changes of SIM cards and mobile phones with messages not delivered to approximately 10% of all women for 5 consecutive weeks.[21] This contributes to the number of women who drop out or opt out of the MomConnect service. As any dropout from the system for technical reasons (eg, lost phone) is a measure of inefficiency, plans are in place to allow for changing of phones and numbers.

VISION FOR THE FUTURE

The use of mobile phones and related applications is increasing exponentially and a few examples illustrate how MomConnect will tap into this in the future. Smartphones make up more than 40% of all mobile phones in South Africa and it is estimated that over the next 5 years there will be virtual universal use of these phones.[26] Using data services instead of SMS and USSD will enable MomConnect to reduce the cost of sending information to users and permit longer messages. Mothers will be able to access graphical and pictorial content, which will improve understanding, especially for illiterate mothers.

Cheaper data costs, estimated at less than 10% of SMS costs, will facilitate the introduction of many similar programmes to MomConnect that can easily extend support to the partners and family of pregnant women. The current messaging of MomConnect stops when the baby reaches age 1, but could extend to age 5 and include in-depth messaging around early childhood development and maternal mental health. HIV-positive pregnant and lactating mothers could be specifically supported around their needs with additional messaging and links to a dedicated helpdesk and community-based services. Further, chronic disease management such as HIV, tuberculosis, diabetes and mental health could benefit from adherence support in the way of MomConnect-type messaging.

Machine learning and artificial intelligence will allow further automation of helpdesk responses, enabling a limited number of dedicated helpdesk staff to efficiently manage a growing number of helpdesk enquiries and comments.

By moving to use of a unique patient identifier, MomConnect can link with South Africa's national laboratory service and relevant electronic medical records. Future opportunities include linkage to the vital statistics database for birth registration and Department of Social Development to facilitate application for a child support grant. This grant is available to parents/caregivers of children under the age of 18 with a current income of less than US$2700 per year for single parents.

The current use of USSD-based surveys to engage with MomConnect users will in future be replaced by a more conversational messaging interface that captures real-time patient information on services received and on knowledge, attitudes and practices. This will strengthen the use of MomConnect for obtaining feedback on quality of care, and enable more rapid adjustment of the platform and individualised content to increase user engagement and reported behaviour change.

Overall, MomConnect has been well received by beneficiaries (pregnant women) as well as health workers. This sets a sound platform on which to base further developments as technologies advance and usage increases. MomConnect can be seen as the catalyst of a growing effort to transform South Africa's public health system through the use of digital health technologies.

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Acknowledgements The support provided by John Snow, Inc. (JSI) in the President's Emergency Plan for AIDS Relief (PEPFAR) and United States Agency for International Development (USAID)-funded MEASURE Evaluation Strategic

Information for South Africa (MEval-SIFSA) project to enable this publication is acknowledged with gratitude.

Contributors PB wrote the first draft, which was further redrafted by AEL and JP. PBe, JS, RA, MB and ANP contributed to the content. The penultimate draft was reviewed by YP. All authors read the final manuscript.

Competing interests JP is employed by Johnson & Johnson, one of the primary funders of MomConnect.

Provenance and peer review Not commissioned; externally peer reviewed.

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