Implementing a Comprehensive Value-based Healthcare System to Improve Pregnancy and Childbirth Outcomes in Urban and Rural Kenya.

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Research

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Abstract

Background: Maternal and neonatal mortality rates in many low- and middle-income countries (LMICs) are still far above the targets of Sustainable Development Goal (SDG) 3. Value-based healthcare (VBHC) could potentially surpass traditional input-oriented approaches to create a high-quality health system and to improve maternal, newborn and child health (MNCH) outcomes. This paper describes the implementation of VBHC in urban and rural Kenya with the aim to significantly improve MNCH outcomes.

Methods: We developed a theory of change (ToC) and used an incremental cohort-based implementation approach to create short and long learning cycles along which different components of the VBHC framework were introduced and evaluated. We sought to leverage local resources and used a mobile phone-based platform to support pregnant women and MNCH providers throughout the patient journey, using the system for communication, payment and data collection. We created dashboards and used interviews and focus group discussions to gather feedback and to collect the data to describe the implementation process in this paper.

Results: We implemented all elements of VBHC, starting small and expanding cohort by cohort. Short and long learning cycles between cohorts enabled implementation of the framework in a relatively short time frame. Data on outputs and outcomes show that the VBHC framework had impact on three levels: Mothers’ improved adherence to maternal healthcare, incentivizing providers to improve quality of care, and transparency of outcomes and costs. This paper describes the implementation process and while the evaluation of health outcomes is ongoing, first results show improved adherence to evidence-based care pathways at a low cost per enrolled person.

Conclusion: This study has shown that implementation of the VBHC framework in an LMIC setting is possible with some adaptations to the local context. The incremental, cohort-based approach enabled an iterative learning process, which could support the restructuring of health systems in low resource settings going from a supply-driven model to a value-driven model.

Trial registration: Not applicable

Contributions To The Literature

- Quality improvements in maternal, newborn and child health (MNCH) impact population health by giving individuals a healthy start of their life course
- In low-resource settings, high needs for improvement in MNCH are paired with limited means, which makes leveraging existing resources key for scaling
- This study describes the implementation of a comprehensive value-based health care system for MNCH in Kenya, based on the integration of evidence-based care pathways, provider networks, pay-for-performance, mobile telephony-based services, and learning based on process and outcome data.
- This study shows how a cohort-based approach can be used to gradually increase health impact at low cost through step-by-step scaling up, coupled with iterative learning to improve outcomes.
- Our study findings emphasize that active engagement with clinics is important to achieve process improvements that lead to improved patient outcomes

Background

Over the past decade, investments in improving maternal, neonatal and child health (MNCH) in low- and middle-income countries (LMICs) have largely focused on reducing financial and geographical barriers to access skilled delivery and incentivizing adherence to antenatal guidelines by expanding the supply side of care and stimulating utilization [1, 2]. Despite these investments, maternal mortality rates (MMR) and neonatal mortality rates (NMR) are still high in LMICs. The latest figures show an MMR of 253 [3] and an NMR of 23.8 [4] in LMICs, while the United Nations Sustainable Development Goal 3 (SDG 3) targets specify an MMR of 70 (target 3.1) and an NMR of 12 (target 3.2) in 2030. This raises the question what more is required to meet patients’ needs and to achieve the targets of SDG 3? Research shows that improving accessibility and adherence alone does not guarantee better outcomes and that a broader set of interventions aimed at quality of care is needed [2, 5, 6].

Transforming health systems towards a high-quality health system is a complex and long-term process that requires a multifaceted approach [7–9]. Kruk et al. [1] argues that to achieve better outcomes in LMICs, quality health systems are needed that focus on patient-centeredness, resilience, equity and efficiency. A complicating factor is that in most LMICs, the organization and financing of healthcare is supply driven [10]. To create high-quality health systems, scholars and practitioners argue that health systems should transition from a supply-driven model towards a value-driven model [11–14]. In high-income countries (HICs) this approach is gaining momentum and some
countries are implementing delivery models that embrace a value-driven approach [15, 16]. However, in LMICs, value-driven service delivery models are not common and experiments with value-driven models are scant. This is remarkable as financial resources are limited in LMICs, and models that incentivize high-quality care at lower costs from available resources could be an answer to the question ‘how to do more with less’ to improve MNCH outcomes.

Research on implementation and evaluation of MNCH service models in LMIC focusses mainly on input-driven interventions, addressing single components or subsets of the VBHC framework, such as outcome measurements [17, 18], performance-based payments [19, 20], (data-driven) quality improvements [21–23] or redesigns of referral systems [24, 25]. As an empirical application, in this paper we describe the development and implementation process of an MNCH program called MomCare, developed by the Dutch-Kenyan non-governmental organization (NGO) PharmAccess Foundation (PAF) to close the gap between HICs and LMICs on implementing value-driven delivery. MomCare is based on the VBHC framework [26] and started in Kenya in 2017. As such, it is a prime example of how VBHC can be adapted and implemented to improve MNCH care in low-resource settings. To the best of our knowledge our paper is the first to describe the implementation of VBHC as a holistic system transformation combining all six VBHC components in an LMIC.

**Conceptual Vbhc Framework**

The conceptual framework used in this paper is the concept of VBHC introduced by Porter and Teisberg [11]. Porter [26] advocates that health systems should be focussed on the full cycle of care, rather than single inputs, processes and outputs, and thus move away from supply-driven models. In VBHC there is a strong focus on comprehensive outcome measurements (both clinical outcomes as well as patient-reported outcomes) and reimbursement systems that incentivize providers to maximize value [27]. Importantly, value is created at the level of medical conditions or specific subpopulations, over full care cycles and providers should structure their organizations around patients’ needs [26]. Value is defined as outcomes that matter to patients relative to the total costs of care delivery.

VBHC is becoming a trend in transforming health systems in HICs and the first results of VBHC implementations seem to be positive [28–32]. However, there are methodological and operational challenges to overcome when implementing VBHC in other settings. For example, the VBHC framework does not provide an implementation methodology [33, 34], patient-reported outcome measurements (PROMs) are sensitive to cultural variation and context-specific conditions [35], VBHC requires a cultural change within organizations with physicians becoming accountable for the full cycle of care [36] and a successful implementation requires leadership, clinical and managerial support, as well as substantial investments to enable data collection and analysis [35].

**Research Design And Methods**

**MNCH in the Kenyan context**

In Kenya in 2019 1.5 million babies were born [37]. Of women who are pregnant, 96% attended at least one antenatal care visit, and 58% attended antenatal care at least four times while 62% attended a skilled delivery [38]. The maternal mortality rate (MMR) is 342 per 100,000 live births and the neonatal mortality rate (NMR) is 21 per 1,000 live births [4]. Healthcare services are provided by six levels of facilities, ranging from community services (level 1) to national referral hospitals and large private teaching hospitals (level 6). Antenatal and postnatal care services, including immunizations, are provided by most level 2-6 facilities such as dispensaries, maternity clinics and hospitals. Delivery services, including caesarean sections, are mainly provided by maternity health centres (level 3), (sub)county referral hospitals and medium and large-sized private hospitals (levels 4 and 5) [39].

**Program Setting**

MomCare includes a predefined care pathway for MNCH with predetermined costs and quality standards. First, an ecosystem was created by redefining the care pathway based on internationally agreed standards for MNCH [40] and a network of clinics was put in place. Secondly, PAF enrolled pregnant women in a subsidized health insurance scheme by offering a ‘health wallet’ on their mobile phones, which was used to pay for care provided by clinics within the network. The ‘health wallet’ runs on a digital exchange platform, called M-TIBA (mobile treatment), and has been developed by Carepay and PharmAccess [41].

MomCare was first introduced in an urban area of Nairobi County in November 2017 and expanded to the rural area of West Kenya from May 2019 onwards. MomCare started in Nairobi with three clinics and ultimately expanded to 18 clinics in 2019. Participating clinics vary from level 2 to 4. Providers were selected and contracted by PharmAccess, connected to the digital platform and received support through SafeCare, a care quality improvement methodology [42]. In the time-period of this study (2017-2020), these 18 clinics supported 8,821 women during pregnancy within the program, resulting in 5,085 newborns delivered within the network.

**Vbhc Development Approach**
Since no implementation models existed yet for low-resource settings, the VBHC approach needed to be developed from beginning to end. In the program, multiple activities were implemented sequentially or simultaneously over time. This section describes the three stages of this process: (i) Theory of Change (ToC) development, (ii) VBHC adaptation, and (iii) iterative feedback cycles. We report on our methods following the checklist for reporting ToC (see Additional file 1).

In the first stage, a ToC approach was used to design the program, and monitor and evaluate the implementation process [43, 44]. The ToC describes how MomCare brings about long-term outcomes through a logical sequence of intermediate outcomes [45]. An advantage of this approach is that it allows to create regular feedback cycles to continuously learn and improve during the implementation [46]. The ToC was developed through several iterative rounds in consultation with stakeholders on different levels [45]. Interviews and focus group discussions with the involved stakeholders were held to explore the context, challenges, problems, and solutions in providing high quality maternal care. Combined with an extensive document analysis and literature review the ToC was designed, as shown in Figure 1.

Using a backward mapping approach [47], we first defined the long-term goals as the desired impact of the interventions (right-hand box in Figure 1). The three long-term goals of MomCare are: (1) healthy mothers and babies, (2) sustainable business for providers, and (3) transparency of outcomes and costs throughout the care journey. Second, we identified the changes needed to achieve these goals by specifying causal pathways with specific intermediate outputs and outcomes (boxes three and four). The causal pathways are initiated by the six interdependent components of VBHC shown in the second box of Figure 1.

| 1 | Organize into integrated practice unit (IPU) | 2 | Measure outcomes and costs for every patient | 3 | Move to bundled payments for care cycles | 4 | Integrate care delivery across separate facilities | 5 | Expand excellent services across geography | 6 | Create IT platform |
|---|---|---|---|---|---|---|---|---|---|---|
| a | Redefining of care pathways | a | Collecting patient reported (PROM) and clinician reported outcomes (CROM) | a | Implementation of bundled payments | a | Introducing hub and spoke model | a | Use a cohort-based approach (cohorts 1-7) | a | Implementation of digital payment platform (enabling data collection of CROM) |
| b | Implementation of quality workshops and quality certification (SafeCare) | b | Implementation of outcome measurements by digital tools and use of billing data | b | Offering comprehensive coverage MNCH | b | Implementation of referral system (content package across different facilities) | b | Start of program in urban area (Nairobi) and expansion to rural areas (Kakamega and Kisumu) | b | Implementation of patient journey tracker app (enabling data collection of PROM) |
| c | Investments in medical equipment and quality improvements | c | Implementation of journey score | c | Implementation of outcome-based bonus payments | c | Implementation provider of performance dashboard |
| d | | | | | | | | | | |

The activities address three major issues described in the first box of the model: women have a high risk of bad pregnancy-related outcomes, care providers do not always provide quality care and the health system lacks in transparency and equity. The ToC also reflects that the progress of the program is influenced by factors in the external environment not directly related to the interventions, such as government investments in expanding Universal Health Coverage (UHC) or an external shock like the COVID-19 pandemic.

In the second stage, the six components of the VBHC framework were adapted to the MNCH context in Kenya as listed in Table 1. Adaptation of the VBHC framework is necessary as health systems differ and effects of health system interventions depend on cultural,
financial and social fit. We elaborate on the adaptation of outcome measurements, bundled payments and the digital platform as these components were seen as most impactful to patients and providers.

**Outcome measurements**

Defining outcomes that reflect the total cycle of care is key within any VBHC initiative. Outcomes should be disease (or in some cases subpopulation-) specific and multidimensional [29]. However, designing a valid and reliable outcome set can be complex and time-consuming, especially regarding standardization, which is required to compare between providers and health systems around the world [48]. MomCare used an adapted version of the standard set Pregnancy and Childbirth as developed by the International Consortium for Health Outcome Measurements (ICHOM) [49]. The ICHOM outcome set includes both clinician reported and patient reported outcomes such as maternal morbidity and birth experience. However, as countries differ in health systems, culture and language, exploring the applicability of outcome sets is required [50]. In a previous study in a comparable group of mothers [51], the applicability of the ICHOM set was explored by a two-round feasibility assessment in which pre-selected outcomes were reviewed and finalized by local Kenyan providers and medical experts. In total 14 outcomes were selected as being appropriate in the Kenyan context of which five are patient-reported. The program used these selected outcomes, which were incrementally implemented along the unfolding of each of the cohorts and perfected over different learning cycles.

**Bundled payments**

As shown in Figure 1 Activity 3, the program implemented bundled payments. A bundled payment can be defined as a one-off or periodic lump-sum payment for a range of services delivered by one or more providers based on best practices or by following clinical pathways with an increasing emphasis on outcomes [52]. A bundled payment suggests that financial risks of care delivery are shifted from payer to provider. As a result, providers are incentivized to coordinate care across settings, deliver appropriate care and reduce costs over the full care cycle [53]. As Kenyan providers are inexperienced using other payment models than fee-for-service and capitation, the program chose an iterative approach by implementing sub-bundles that resemble each phase of the care pathway instead of one bundle that covers the whole pregnancy episode. In total 130 activities, that were separately billed before, were grouped into 32 sub-bundles. The bundled payment model also included a pay-for-performance scheme that is derived from a patient journey score. The patient journey score is a standardized risk adjusted metric that resembles the adherence to the maternity pathway and the care delivered in accordance with the guidelines [10]. The score ranges from a minimum of 0 (no care received) to a maximum of 5 (well attended and managed journey). In order to maintain provider involvement and maximize effects, bonus payments were made available based on the patient journey score and providers received feedback on their performance.

**Digital platform (M-TIBA)**

The digital exchange platform connects patients, providers and payers by directly channelling ring-fenced healthcare funds into mobile ‘health wallets’. Each time the wallet is used at a healthcare facility, medical and financial data is collected. This data provides critical insights into the costs, utilization and quality of care, enabling more effective allocation of resources. At enrolment, pregnant women were asked questions through a digital enrolment app on socio-economic status, demographics and obstetric history including pre-existing medical conditions. Healthcare providers submit their (invoice) data following the International Statistical Classification of Diseases and Health Related Problems, ICD-10 [54]. The digital exchange platform enriched the collected data, applying business rules to calculate the patient journey score and concomitant quality bonus for each clinic. Enrolled women received a text message at three moments during the patient journey to capture PROMs and in addition received an ‘end-of-journey-call’. As use of mobile phones is widespread in Kenya, text messages via SMS services are an efficient and reliable way to capture patient reported outcomes [55, 56].

**Feedback loop**

In the third stage, a feedback loop was created between outcomes, outputs and activities to implement improvements every time a new group of mothers (a cohort) was onboarded in the program. Learnings from earlier cohorts were used to adjust activities to improve outputs and outcomes for later cohorts. A total of seven cohorts, enrolled in the period from 2017 to 2020, were included in this study. An overview of program roll-out and the learnings from the iterative feedback cycles are described in the Results section.

**Results**

First, we provide an overview of the program and the data, after which we shortly describe the changes made with each cohort. In Table 2, the uptake of and roll-out of the model is shown over time. Separated by 3-month intervals (except for cohort 1-2), groups of pregnant women (a cohort) are invited to enrol (≤ 16 weeks of gestation) in the program at a contracted health facility. At enrolment, information about the program and care pathway is given as well as access to the ‘health wallet’. As the total patient journey takes 45 weeks on
average, two cohorts have already started once the final outcomes of the first cohort are known. Table 2 shows for each cohort the number of enrolled women and the number of participating facilities. Facilities having a hub status provide level 4 and 5 health services when referred, e.g., in case of a complicated delivery or C-section. Spoke clinics offer basic MNCH care services, including normal skilled deliveries. Clinics having a hub and spoke status offer both basic and more complex health services. From cohort 5 onwards, the program was expanded to the rural areas of Kakamega and Kisumu (cohorts 5b to 7b).

Table 2
Uptake data of MomCare program

| Cohort | Urban | Rural |
|--------|-------|-------|
| Indicator | 1 | 2 | 3 | 4 | 5a | 6a | 7a | 5b | 6b | 7b |
| Enrolled Mothers | 217 | 172 | 517 | 481 | 282 | 901 | 1,240 | 824 | 1,978 | 2,209 |
| # Hubs | 0 | 1 | 1 | 1 | 1 | 1 | - | - | - |
| # Spokes | 2 | 1 | 2 | 3 | 3 | 4 | 6 | - | - | - |
| # Hub and spoke in the same clinic | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 4 | 10 | 14 |

Table 3 shows adherence and delivery outputs. Table 4 shows clinical reported outcomes on survival, maternal and neonatal morbidity. As mothers and their new-borns often get out of the clinic’s sight after delivery, data on maternal and neonatal mortality is not registered consistently and is therefore sometimes missing. Hence, caution is needed when interpreting these numbers and comparing these to a baseline. Table 5 shows patient reported outcomes on health responsiveness, breastfeeding, birth experience, patient satisfaction and mental health. Results on the implementation of bundled payments are shown in Table 6. Figure 3 displays the timing of the introduction of each additional VBHC component and key lessons learned per cohort.

Table 3
Output indicators of the MomCare program

| Cohort | Urban | Rural |
|--------|-------|-------|
| Indicator | 1 | 2 | 3 | 4 | 5a | 6a | 7a | 5b | 6b | 7b |
| Adherence | | | | | | | | |
| % Skilled Delivery | 43% | 56% | 64% | 62% | 59% | 70% | 74% | 49% | 47% | 57% |
| Avg ANC | 3.17 | 3 | 2.27 | 3.25 | 3.22 | 3.03 | 3.1 | 3.69 | 3.17 | 3.25 |
| Avg PNC | 0.39 | 0 | 0.68 | 0.73 | 0.97 | 0.96 | 1.05 | 0.78 | 0.9 | 0.9 |
| % PNC <= 48 hours | 8% | 2% | 4% | 3% | 3% | 40% | 39% | 45% | 78% | 81% |
| % PNC 3-7 days | 15% | 7% | 11% | 8% | 11% | 6% | 4% | 0% | 2% | 1% |
| Avg Patient Journey Score | 2.23 | 2.9 | 1.97 | 2.92 | 2.53 | 2.84 | 2.94 | 2.98 | 2.76 | 2.94 |
| Deliveries | | | | | | | | |
| % Deliveries | 40% | 58% | 66% | 64% | 60% | 71% | 72% | 50% | 47% | 56% |
| % Normal deliveries | 52% | 69% | 78% | 72% | 69% | 70% | 65% | 69% | 70% | 63% |
| % Normal deliveries - with complication(s) | 45% | 11% | 8% | 6% | 7% | 10% | 14% | 10% | 14% | 22% |
| % C-section | 0% | 16% | 12% | 20% | 23% | 19% | 21% | 19% | 15% | 14% |
| Clinical outcomes | Urban | Rural |
|-------------------|-------|-------|
| Mortality         |       |       |
| % Still births    | -     | -     | 0.59  | 0.78  | 0.33  | 0.72  | 0.97  | 0.64  |
| % Newborn death   | -     | -     | -     | 0.78  | 0.22  | 0.24  | -     | 0.32  |
| % Maternal death  | -     | -     | -     | 0.36  | -     | -     | -     | 0.05  | 0.09  |
| Neonatal Morbidity|       |       |
| % Iatrogenic pre-term birth | - | - | - | - | 0.16 | 0.89 | - | - | - |
| % Spontaneous pre-term birth | - | - | 0.29 | 0.65 | 2.37 | 0.47 | 0.33 | 0.24 | 0.11 | 0.24 |
| % Oxygen          | 1.18  | 2.02  | 1.18  | 5.50  | 7.10  | 8.39  | 6.45  | 2.17  | 1.83  | 1.68  |
| % Birth injuries  | -     | -     | -     | -     | -     | -     | -     | 0.48  | 0.11  | 0.24  |
| % Birth asphyxia  | -     | -     | 0.59  | -     | 0.59  | 1.24  | 1.33  | 0.48  | 0.22  | 0.56  |
| Maternal Morbidity|       |       |
| Avg bed charge    | 1.00  | 1.88  | 4.77  | 4.49  | 3.84  | 3.02  | 2.08  | 2.31  | 2.87  | 3.05  |
| % Blood transfusion| - | 4.04  | 0.29  | 0.97  | -     | 1.24  | 0.44  | 1.69  | 1.29  | 2.00  |
Table 5
Patient Reported Outcomes

| Patient Reported Outcomes | Cohort (urban and rural) |
|---------------------------|--------------------------|
| # mothers participated in the survey | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Health responsiveness (End of Journey Call) | | | | | | | |
| % Informed about danger signs | - | - | 96% | 86% | 82% | 87% | 93% |
| % Informed about labor signs | - | - | 86% | 93% | 88% | 89% | 95% |
| % Informed about postpartum danger signs | - | - | 93% | 91% | 82% | 81% | 88% |
| Breastfeeding (End of Journey Call) | | | | | | | |
| % Informed about breastfeeding | - | - | 96% | 92% | 85% | 81% | 87% |
| % Challenges breastfeeding | 10% | 8% | - | 5% | 8% | 13% | 19% |
| Birth experience (End of Journey Call) | | | | | | | |
| % Treated with dignity and respect | - | - | 99% | 97% | 89% | 90% | 94% |
| % Supported by care professional during the care journey | 96% | 95% | 86% | 68% | 66% | 88% | 90% |
| % Satisfaction with delivery experience | - | - | 96% | 96% | 84% | 90% | 95% |
| Patient satisfaction (SMS) | | | | | | | |
| Response rate | - | - | - | - | - | - | 49% |
| % Were you satisfied with the service? | - | - | - | - | - | - | 97% |
| Breastfeeding (SMS) | | | | | | | |
| Response rate | - | - | - | - | - | - | 18% |
| Breastfeeding: Are you planning to do? | | | | | | | |
| Exclusive | - | - | - | - | - | - | 86% |
| Partly | - | - | - | - | - | - | 10% |
| Not at all | - | - | - | - | - | - | 4% |
| Mental Health PHQ-2 (SMS) | Over the last 2 weeks, how often have you been bothered by little interest or pleasure in doing things? | | | | | | | |
| Response rate | - | - | - | - | - | - | 16% |
| Never | - | - | - | - | - | - | 12% |
| Sometimes | - | - | - | - | - | - | 53% |
| Nearly every day | - | - | - | - | - | - | 20% |
| Too often | - | - | - | - | - | - | 14% |
| Over the last 2 weeks, how often have you been bothered by feeling down, depressed, or hopeless? | | | | | | | |
| Response rate | - | - | - | - | - | - | 15% |
| Never | - | - | - | - | - | - | 22% |
| Sometimes | - | - | - | - | - | - | 53% |
| Nearly every day | - | - | - | - | - | - | 21% |
| Too often | - | - | - | - | - | - | 5% |
Cohort 1

The first cohort of the program started in Nairobi in November 2017 (Table 2). As shown in Figure 3, two VBHC components were implemented in cohort 1. Two clinics were contracted to act as an integrated practice unit (IPU) offering basic MNCH care, including four antenatal care (ANC) visits, skilled (normal) delivery service, two PNC visits and three immunization visits. In cohort 1, 217 women were enrolled, and they attended 3.00 ANC and 0.39 PNC visits on average (Table 3), which is lower than the prescribed basic MNCH care bundle criteria. Table 2 shows 43% of enrolled women attended skilled delivery at the contracted facility. As the basic MNCH care bundle did not cover for complications and a data registry protocol was missing, clinics did not register data consistently to determine clinical outcomes. This made it difficult to paint a clear picture of the quality of care for this first cohort.

Cohort 2

To address the lack of complications coverage, a hub-and-spoke network was organized in cohort 2 to cover for C-sections and basic complications across facilities (see Figure 3). A level 4 clinic was contracted to act as hub and together with the spoke clinic a triage and referral process was defined. Secondly, as clinics did not consistently register outcome data, a digital platform was created to capture outcomes. Finally, the inclusion criteria were updated from 16 to 18 weeks of pregnancy (WoP) to increase the enrolment of pregnant women. Cohort 2 started in July 2018, enrolling 172 pregnant women in the program. This lower number was caused by a spoke clinic leaving the program and limited funding to enrol more women. The end-of-journey calls reached 63 women to capture PROMs (Table 4). In total 8% of them indicated having challenges with breastfeeding and 95% of them felt supported by facility staff during their pregnancy and delivery. In response to the low adherence to ANC visits seen in cohort 1, cohort 2 introduced bonus payments for reaching a minimal level of attendance. The effect of including complicated deliveries and C-sections in the care bundle resulted in 11% deliveries with complications and 16% C-sections and increased the average bundle costs to 124 USD per delivery (Table 5). In total 5% of the total number of bundles received an additional bonus.

Cohort 3

In cohort 3 the bundle composition did not change relative to cohort 2. However, a second spoke clinic was added to attract pregnant women and to strengthen the hub and spoke network. The cut-off point to enrol in the program changed to a maximum of 26 weeks of gestation. As a result, 517 women enrolled into the program. Despite an increase of the percentage skilled deliveries in the network, the average ANC visits dropped to 2.27 visits, but the average PNC visits increased slightly to 0.68, resulting in a lower average patient journey score of 1.97. In cohort 3, no maternal and neonatal deaths were registered. The clinics did report first-time cases of spontaneous pre-term birth and birth asphyxia as a part of neonatal morbidity (Table 5). The bed charge representing maternal morbidity increased noticeably to 4.77%. On the outcome level health responsiveness and birth experience were added to the PROMs. In total 72 women responded to the end-of journey call of which 86% indicated they received sufficient information about labor signs and 99% indicated that they were treated with dignity and respect. The percentage of finished bundles with a bonus payment increased to 9%.

Cohort 4

As the referral process in cohort 3 did not result in a better patient flow, the hub and spoke network organized a series of workshops to optimize the referral process and synchronize their cooperation. Secondly, the content of the data workshops were better aligned with the needs of the end-users at the clinics. In the data workshop more attention was paid to creating commitment at clinics to use data in their day-to-day operations. Thirdly, since adherence output indicators were weak in cohort 3, investments were put in strengthening the hub and spoke network by adding an extra spoke clinic to shorten travel time for enrolled women. In total 481 pregnant women enrolled in the program. In cohort 4, output indicators were stable or even improved; as a result, the average patient journey score improved to 2.93.
Spontaneous pre-term birth increased to 0.65% and oxygen use increased to 5.50%. Most PROMs were stable, except the percentage of women that were informed about danger signs decreased to 86% and the percentage of women who felt supported by care professional during the care journey declined to 68%. As a result of the improved output indicators, 49% of finished bundles received a bonus payment.

**Cohort 5**

In May 2019, the program implemented VBHC component 5 by expanding the model to the rural areas of Kakamega and Kisumu. In cohort 5, all VBHC components were implemented. Other changes in the program were the use of standardized pricelists, further improvement of the referral process, providing free maternity goods incentivizing women to enrol into the program, and integration of multiple digital platforms to simplify data capturing. From cohort 5 onwards, a distinction is made between the women enrolled in the urban area (cohort 5a) and women enrolled in rural areas (cohort 5b). In cohort 5b, three clinics were contracted to offer the basic bundle including C-sections and treatment of complications. In total 824 women enrolled in cohort 5b. The outputs of cohort 5b, on both adherence and delivery, showed a better performance than the urban cohort 5a. The average numbers of ANC and PNC visits are 3.69 and 0.78, with 49% skilled deliveries, and representing a patient journey score of 2.98. The outcomes of cohort 5b are similar to the outcomes of cohort 5a. PROMs were not measured separately for 5a and 5b. As Table 4 shows, the indicator for measuring the percentage of women who felt supported by the care professional during the care journey continues to be lower than most outcome indicators and shows a level of 66%. The actual average costs of a bundle in cohort 5a amount 172 USD which is higher than cohort 5b at an average of 55 USD. This difference is caused by the absence of level 4 clinics to treat complications and perform C-sections in the rural cohort. Due to its better patient score, cohort 5b has relatively more finished bundles with a bonus.

**Cohort 6**

Cohort 6 started in September 2019. Based on the short-cycle learnings of cohort 5, several improvements were made. First, ambulance services were added to the bundle. Secondly, access to data on outputs and outcomes was made easier and dashboards were improved to be used on a daily basis by clinics and monitoring staff. Thirdly, control of billing processes was tightened to prevent irregularities. Finally, the bonus payment was improved by adding adherence elements. In cohort 6, nine additional clinics were contracted and 2,879 women enrolled in the program. In the urban cohort 6a, 70% of enrolled women gave birth in a MomCare clinic. This is the highest number of skilled delivery in all seven cohorts. Neonatal death and iatrogenic pre-term birth were reported by clinics for the first time, at a level of 0.78% and 0.16% respectively. Noticeably, oxygen use increased to 8.39%. The percentage of finished bundles with a bonus in cohort 6a increased to 47%. In the rural cohort 6b, still births increased to 0.97 and for the first time, maternal deaths were reported, at a level of 0.05%. The other clinical outcome measurements painted a similar picture as in cohort 5b. In cohort 6, 608 women were reached by the end of journey call and PROMs did not show any noticeable changes. However, the percentage of women that felt supported by care professional during the care journey improved to 88%.

**Cohort 7**

In cohort 7, which started in January 2020 and coincided with COVID-19 lockdowns, a fully digital patient engagement platform was introduced including digital enrolment, SMS-based reminders and outcome measurements. Second, a digital support network was introduced to help clinics improve their health services. The digital platform also enabled a patient journey tracker app, which can be used by clinics to follow each patient in their pregnancy journey. Six additional clinics were contracted and 3,449 women enrolled into the program, making this the largest cohort in the program. Outputs and outcomes showed good progress especially in cohort 7a. For example, skilled deliveries increased to 74%, which is the highest score of all cohorts, and as a result the patient journey score increased again to 2.94. Except for iatrogenic pre-term birth all other clinical outcomes showed strong progress in cohort 7a. Outputs and outcomes of cohort 7b painted a stable picture. Interestingly to notice is that PROMs, captured through end-of-journey calls, reached the highest scores of all cohorts. In cohort 7, the SMS-based survey questions on mental health were introduced, and the results show that 79% of the women reached have been bothered by depressed or hopeless feelings over the last two weeks. This might be explained due the COVID-19 lockdown.

**Patient journey score: provider level**

The output and outcome scores per cohort (e.g., average Patient Journey Scores in Table 3) are impacted by new clinics being added to the network, and mask developments at the level of individual clinics. Table 6 shows the patient journey scores of individual clinics that participated in three or more cohorts. This data shows the effects of the short and long cycle learnings for each clinic. Clinics with lower baseline scores are clearly improving, and the differences between clinics become smaller. A less strong improvement is shown for the clinics operating in rural areas, but their baseline scores were already high.

**Discussion**
The objective of MomCare is to improve outcomes of MNCH care through access to high quality care based on the VBHC framework. In LMICs, value-driven health systems could be a game changer, as they are characterized by generating maximum value for patients by cost-effectively achieving the best possible outcomes. In HICs, volume-driven transitions aimed at high quality care have shown that unwanted cost increases can occur [52, 57], something health systems in LMICs cannot afford. A volume-driven focus on access alone threatens health equity and the roll-out of universal health coverage [58]. It is imperative that health transitions in LMICs leapfrog a volume-driven system and move straight to the creation of a value-driven system [1, 9].

As the VBHC framework does not provide an implementation methodology and implementing a grand design for LMIC settings was considered inappropriate as the healthcare landscape is too fragmented, our study was the first to develop and implement an incremental cohort-based implementation approach of the VBHC framework in an LMIC context. The four main contributions of our study are the following: the application of the ToC approach for implementing VBHC in an LMIC setting, the adaptation of the six VBHC components to MNCH care, the iterative, cohort-based, implementation process to foster short and long learning cycles, and a first evaluation of the outcomes of this approach, yielding lessons learned as input for a broader implementation of the VBHC framework for other patient groups/diseases and in other LMIC settings. An advantage of the incremental cohort-based approach is that it increases accessibility of care across geographies, while simultaneously improving quality of care, in a relatively short time. In addition, a value-based healthcare ecosystem around MNCH was created: a referral system was implemented within a hub-and-spoke network of providers, a system was built to measure clinical and patient reported outcome measurements, a digital mobile phone based platform was created to enable payments, data capturing and benchmarking, and bundled payments and outcome-based bonus payments were introduced.

During roll-out we identified several challenges to overcome. First, it remains paramount to improve quality of data registries and consistency of data capturing by providers, especially data that is not captured automatically through billing processes such as mortality rates. Additional training of providers proved key to improve data collection and usage. Second, as the providers are normally paid on a fee-for-service basis or via capitation, shifting financial risk from payer to provider by introducing full bundled payments was considered a bridge too far. The program started with grouping billable services into (sub)bundled payments, but was not yet able to shift financial risks to providers completely by introducing one bundled payment that covered the total patient journey. Although the bundled payments were calculated based on main cost drivers, time-driven activity-based costing was not part of the provider workshops and providers were not trained on financial risks related to bundled payments. A third challenge concerns the validation of patient-reported outcome measures. A limited number of PROMs were included in the current outcome set. This was a result of limited validation of the ICHOM set in the Kenyan context. This outcome set can only be expanded if outcome measures are adapted to what matters to pregnant women with different cultural backgrounds living in urban and rural areas. Adapted questionnaires and outcomes measurements should be further validated to provide reliable results on women's views of high quality MNCH care.

Data-driven learning for PAF and healthcare providers took place at two different speeds: through short learning cycles versus long learning cycles. Short learning cycles refer to improvements implemented from one cohort to the next and are typically related to care utilization and adherence to care. An example of a short learning cycle is that the model started with a very basic care pathway, but it was soon realized that there were women who needed care for more complicated pregnancies, hence the approach to expand the care pathway to include complicated services and include in the IPU health facilities that provide those services. Long learning cycles refer to improvements based on data that is available only at the end of the full care cycle continuum that takes into account the antenatal, delivery and post-natal period of pregnancy estimated at a total of 60 weeks. An example of long cycle learning is the additional training offered to providers around breastfeeding: train providers to inform women about its importance and how to deal with challenges experienced by mothers. This improvement was based on outcomes that could only be measured at the end of the care cycle.

Progress of the program was tracked using various indicators. The overall impact of the program is reflected in the reach (number of enrolees), the patient journey score, and the variety of outcome measures tracked per enrolee. The reach of the program increased ten-fold, from 217 enrolees in cohort 1 to 3,449 enrolees in cohort 7a and 7b combined. The patient journey score and outcome indicators per cohort are averages across all enrolees and all clinics in one cohort. With the addition of new, inexperienced clinics in each new cohort, the average performance is bound to be impacted downwards. However, when looking at the performance of individual clinics over time, the results paint a more stable picture of the positive effects of the VBHC framework on outcomes. Especially clinics that started at a relatively low baseline show clear improvements of the patient journey score, reflecting better adherence to the care pathway. Important to note is that the implementing team and the health facilities must have a strong learning culture [59] that allows for course correction whenever necessary and is aided by the data driven approach that PAF takes.

The success of implementing VBHC in LMIC settings, such as Kenya, depends on several enabling factors. These include having an IT infrastructure in place to enable digital communication and data collection, the uptake of mobile phones in the community, the availability of mobile money, and management buy-in at facility level to improve care. More specific enablers are the deployment of a provider support
team to train and support facilities with VBHC interventions and digital skills [60]. Another enabling factor relates to the position of a trusted third party like PAF to connect payers to providers and to create a high-trust environment in which clinics are willing to participate in a program. Finally, the scalability of the program is key. By using existing platforms for mobile money and SMS communications, the program managed to increase the sophistication of services provided while keeping transaction costs low [60]. With increasing numbers of enrollees in each cohort, transaction costs decreased from 4 USD for each enrolled woman in cohort 1 to about 1 USD in cohort 7.

Conclusion

This study shows that implementation of the VBHC framework in an LMIC setting is possible with some adaptations to the local context. The integration of the digital platform with SMS-based services was key to the success of the program. Participating clinics showed progress in improving MNCH outcomes. The first results are positive, but more research is needed to provide more clarity on its impact on costs and quality. We recommend using this cohort-based approach for other conditions and patient groups, such as ischaemic heart diseases and diabetes mellitus type 2, in order to incrementally build and adapt a customized VBHC strategic framework for addressing multiple diseases and conditions with high disease burden in LMICs.

Abbreviations

ANC: Antenatal Care; CROM: Clinician Reported Outcome Measure; HIC: High Income Countries; ICD-10: International Statistical Classification of Diseases and Health Related Problems; ICHOM: International Consortium for Health Outcome Measurements; IPU: Integrated Practice Unit; LMIC: Low- and Middle-Income Country; MMR: Maternal Mortality Rate (per 100,000 live births); MNCH: Maternal, Newborn and Child Health; NMR: Neonatal Mortality Rate (per 1,000 live births); PAF: PharmAccess Foundation; PNC: Postnatal Care; PROM: Patient Reported Outcome Measure; ToC: Theory of Change; UHC: Universal Health Coverage; VBHC: Value Based Healthcare; WoP: weeks of pregnancy

Declarations

Ethics approval and consent to participate

The ethical clearance for the research is obtained from the Amref Health Africa Ethics and Scientific Review Committee 8 August 2019 with approval number: P679-2019. All the participants gave prior consent to participate in the program and could withdraw from the study at any time. All data have been anonymized.

Consent for publication

Not applicable.

Availability of data and materials

The data that support the findings of this study are available from PharmAccess Foundation, but restrictions apply to the availability of these data, and thus are not publicly available. Data are however available from the corresponding author upon reasonable request and with permission of PharmAccess Foundation.

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Competing interests

Peter Dohmen worked for PharmAccess Foundation in the past.
Teresa De Sanctis, Emma Waiyaiya, Tobias Rinke de Wit, Nicole Spiker, and Mark van der Graaf are employed by PharmAccess Foundation.
Wendy Janssens declares no competing interests.
Erik van Raaij declares no competing interests.

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Contributions

PD, TdS and EW are the principal researchers. PD, TdS, EW, WJ, TRdW and EvR all contributed to the design of the study and conceptualization. Literature research was conducted by PD and EvR. The ToC was designed by PD, TdS, EW, MvdG and NS. TdS extracted the quantitative data and EW collected qualitative data (interviews and focus group discussions). PD, TdS and EW conducted the data analyses. The first version of the manuscript was written by PD and edited by TdS and EW. All authors edited further versions of the manuscript. All authors read and approved the final manuscript.

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**Figures**

**Figure 1**

Theory of Change for MomCare
Figure 2

Patient Journey Score per clinic. Each color represents a different clinic.

Figure 3

Implementation of VBHC components, learnings and adaptations (learnings are shown in bold, adaptations of components are shown in italic)
Supplementary Files

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