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## FINAL REPORT

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# Improving the Quality of Integrated Antenatal Care and Care for Preeclampsia/Eclampsia in Jinja, Uganda

**MAY 2018**

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This report was developed by University Research Co., LLC (URC) for review by the United States Agency for International Development (USAID) and authored by Anjali Chowfla, Connie Namajji, Tamar Chitashvili, Jorge Hermida, Esther Karamagi, and Silvia Holschneider of URC. The intervention to improve the quality of integrated antenatal care and care for preeclampsia/eclampsia in Uganda was carried out under the USAID Applying Science to Strengthen and Improve Systems (ASSIST) Project, which is implemented by URC and made possible by the generous support of the American people through USAID.



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**DISCLAIMER**

The contents of this report are the sole responsibility of University Research Co., LLC (URC) and do not necessarily reflect the views of the United States Agency for International Development or the United States Government.

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For more information on the work of the USAID ASSIST Project, please visit [www.usaidassist.org](http://www.usaidassist.org) or write [assist-info@urc-chs.com](mailto:assist-info@urc-chs.com).

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## Acronyms

ANC	Antenatal care
ARV	Antiretroviral
ASSIST	USAID Applying Science to Strengthen and Improve Systems Project
BP	Blood pressure
CME	Continuous medical education
DHO	District Health Office
Hb	Hemoglobin
HC	Health center
HCI	USAID Health Care Improvement Project
HIV	Human immunodeficiency virus
HMIS	Health management information system
IM	Intramuscular
IPTp	Intermittent preventive treatment in pregnancy
ITN	Insecticide-treated net
IV	Intravenous
MCH	Maternal and child health
MgSO <sub>4</sub>	Magnesium sulfate
MNCH	Maternal, neonatal, and child health
MOH	Ministry of Health
PDSA	Plan-do-study-act
PE/E	Preeclampsia/eclampsia
QI	Quality improvement
RDT	Rapid diagnostic test
RPR	Rapid plasma reagin
RRH	Regional Referral Hospital
URC	University Research Co., LLC
USAID	United States Agency for International Development
VDRL	Venereal Disease Research Laboratory

# EXECUTIVE SUMMARY

## Introduction

There is strong evidence supporting the benefits of antenatal care (ANC) interventions, when effectively administered, on the health of pregnant woman and fetuses and on the prevention of obstetric and neonatal complications. However, significant quality gaps persist in ANC services in low-resource settings, which contribute to a high burden of maternal morbidity and mortality. The USAID Applying Science to Strengthen and Improve Systems (ASSIST) Project, and its predecessor projects, have gained significant experience in improving the quality of ANC services through work in Mali, Afghanistan, Niger, and the Latin America and Caribbean region. However, significant barriers still remain around the effective integration and implementation of high-impact intervention bundles along a continuum of antenatal, intra- and post-partum care and primary to referral level services especially when it comes to early recognition, initial treatment, and referral of preeclampsia/eclampsia cases.

From June 2015 through March 2017 the USAID ASSIST Project implemented an improvement activity in a “slice” of the health care system in Jinja, Uganda to improve the quality of primary ANC services through implementation of an integrated package of antenatal care best practices. These included prevention, early detection, initial management and referral of the most common obstetric conditions with an emphasis on improving screening, diagnosis, treatment and referral of preeclampsia/eclampsia as one of the major causes of preventable maternal death; as well as on early screening, detection, initial management and referral of locally frequent maternal infections such as malaria and syphilis and nutritional deficiencies such as anemia.

## Improvement intervention

The improvement intervention was implemented in 10 high-volume health facilities, which were randomly selected from the catchment area of the Jinja Regional Referral Hospital. Nine additional randomly selected facilities were included to serve as a control group. Baseline and end line assessments were conducted in both the intervention and control groups to measure the impact of the interventions.

ASSIST used a collaborative improvement approach to implement the ANC activity which relied on individual quality improvement (QI) teams simultaneously testing changes focused on the same clinical area (preeclampsia/eclampsia, malaria and syphilis, or anemia), using common indicators to track improvement, and then sharing the results of the most effective changes in “learning sessions”. The ANC improvement activity was organized in three waves, each lasting approximately three months and focusing on a particular clinical area (preeclampsia/eclampsia, malaria and syphilis, and anemia). During both the second and the third waves, QI teams continued to improve care processes initiated during earlier phases so that, by the end of the third wave, teams had developed a comprehensive set of changes to improve antenatal care.

To begin the improvement work, QI teams identified: (1) an improvement aim; (2) the main drivers for improvement towards that aim; and (3) evidence-based interventions and change concepts that could influence those drivers. Individual teams then tested changes in care delivery to address each concept and analyzed results using time-series charts. All ten teams worked on the same aim at the same time, collected data on common indicators, and met periodically in learning sessions to share the changes that they had tested and their results. Learning sessions allowed individual teams to share results and hear about successful changes tested in other facilities and also included refresher clinical training on key components of high quality antenatal care. Throughout the intervention, teams were supported through monthly on-site coaching visits conducted by ASSIST and Ministry of Health staff.

## Results

QI teams achieved statistically significant results in all three major improvement areas covered by the activity. Under preeclampsia/eclampsia care, all 10 intervention facilities saw improvement in the

measurement of blood pressure (BP) for women attending ANC (from 48% during baseline to 98% during end line) and in the percentage of women with BP  $\geq$  140/90 who were assessed for protein in urine (96 percentage point increase), the two main drivers for improving screening of PE/E prioritized by QI teams. A statistically significant increase in the diagnosis of preeclampsia during ANC was also observed. Similar improvements were also seen in provision of malaria prophylaxis (percentage of mothers receiving Isoniazid Preventive Therapy between 28-36 weeks increased by 61 percentage points), malaria diagnosis and treatment (increased from 1% to 4%), syphilis screening (33% at baseline vs. 65% during end line), syphilis treatment (0% at baseline vs. 88% at end line), and anemia prevention (% of women receiving iron-folate increased from 39% to 95%), screening (57 percentage point increase in women whose hemoglobin was assessed during ANC) and diagnosis (7 percentage point increase in diagnosis using laboratory investigations).

## Challenges

The availability of critical inputs for quality antenatal care presented a significant challenge throughout implementation of the improvement intervention. Facilities experienced frequent stock outs of magnesium sulfate for treatment of preeclampsia/eclampsia, as well as of urine dipsticks, hemoglobin estimators, urine containers, and reagents for syphilis testing. In addition, while health workers showed sufficient confidence in diagnosing and treating malaria, anemia, and syphilis there was a perceptible lack of knowledge and confidence surrounding the diagnosis and treatment of preeclampsia/eclampsia. ASSIST implemented refresher clinical trainings in addition to other measures to combat this deficiency.

## Lessons Learned and Recommendations

ASSIST held “harvest meetings” in October 2016 and March 2017 to identify and discuss the successful change ideas that helped improve the quality of antenatal care across the three dimensions that QI teams worked on, synthesize the main lessons learned as a result of the intervention, and come up with recommendations for other facilities trying to improve the quality of antenatal care. Four main lessons emerged as a part of these discussions:

1. Create a managerial environment primed for quality care by strengthening leadership, creating accountability, and recognizing and rewarding staff who prioritize improvement.
2. Ensure basic inputs by strengthening health workers’ knowledge and skills and increase availability of basic supplies.
3. Optimize key care processes by redesigning them and supporting QI teams to test changes and overcome obstacles.
4. Build a mechanism for continuously measuring and improving care through quarterly learning sessions and monthly coaching to facility-based QI teams.

### **Obstacles and successful tested changes to improving screening for PE/E:**

#### **Weak knowledge and skills of personnel:**

- ✓ Frequent periodic hands-on training, job aids on site
- ✓ Peer-to-peer on-site training

#### **Heavy workload for midwives:**

- ✓ Redesign of patient flow
- ✓ Task shifting including nurse students

#### **Scarce blood pressure cuffs:**

- ✓ Establish a sharing schedule among services in the health center
- ✓ Encourage students to bring their own BP cuffs

#### **Long wait times at lab, mothers leave without being tested:**

- ✓ Redesign process: midwives to do the urine testing
- ✓ Escort mothers with high BP to lab

#### **Scarce availability of dipsticks:**

- ✓ Share dipsticks among health centers
- ✓ Divide one dipstick in two and use in two mothers

#### **Lack of urine containers for testing protein in urine:**

- ✓ Use containers provided for sputum samples
- ✓ Sterilize and reuse urine containers



## I. INTRODUCTION

There is strong evidence supporting the benefits of antenatal care (ANC) interventions, when effectively administered, on the health of pregnant woman and fetuses and on the prevention of obstetric and neonatal complications. However, significant quality gaps persist in the provision of ANC services in low- and middle-income countries, which continue to increase women's risk of serious maternal morbidities and mortality as well as the risk of poor outcomes for their newborns. For example, preeclampsia and eclampsia (PE/E) are major causes of maternal death that require integrated care from screening and diagnosis during antenatal care and delivery, through initial management with a loading dose of magnesium sulfate (MgSO<sub>4</sub>) and appropriate referral, to correct management at the hospital level for severe cases of PE/E. While major progress has been made in refining and demonstrating the efficacy of high-impact intervention bundles for PE/E, significant barriers remain around the effective integration and implementation of these intervention bundles along a continuum of antenatal, intra- and post-partum care and primary to referral level services. In particular, early recognition of complications at household and primary care levels and effective referral and counter-referral continue to present major challenges for improving outcomes for mothers with PE/E and their term and premature neonates.

The USAID Applying Sciences to Strengthen and Improve Systems (ASSIST) Project has gained significant experience and results in improving the quality of ANC services through its current work, as well as through its predecessor project, the USAID Health Care Improvement Project. There is a strong need to accelerate and disseminate this learning about effective approaches for improving and sustaining integrated antenatal care in low- and middle-income countries for improved prevention and management of maternal morbidities and obstetric complications.

ASSIST and other partners have started to build substantive experience in improving early detection and case management of PE/E, in several USAID MNCH-priority countries. In particular, ASSIST draws on substantial experience in improving care of PE/E in Mali, Afghanistan, Niger and the Latin American and Caribbean region. In Mali, for example, ASSIST collaborated with the Ministry of Health (MOH) in Mali's Kayes Region to support front-line provider teams to improve PE/E case management in 19 primary and referral maternities in two districts. As a result of project interventions, compliance with PE/E treatment standards in the 17 maternities increased from 0% at baseline (17 sites, October 2012) to 91% in December 2015 (80 sites).

From June 2015 through March 2017 the USAID ASSIST Project implemented an improvement activity in a "slice" of the health care system in Jinja, Uganda to improve the quality of primary antenatal care services through implementation of an integrated package of antenatal care best practices that includes early detection, initial management and referral of the most common obstetric complications. Emphasis was placed on improving screening, diagnosis, treatment and referral of preeclampsia/eclampsia as one of the major causes of preventable maternal death; and on early screening, detection, initial management and referral of locally frequent maternal infections such as malaria and syphilis and nutritional deficiencies such as anemia.

To facilitate learning on how to improve delivery of an integrated package of ANC interventions in Uganda and similar settings, ASSIST implemented quality improvement (QI) interventions in 10 randomly selected facilities within the catchment area of a regional referral hospital (RRH) that included five health centers III, three health centers IV, and one general district hospital, in addition to the RHH. Nine additional randomly selected facilities were included in a baseline and end line assessment to serve as a control group. ASSIST worked closely with MOH in Uganda to select the Jinja District as the location for this activity due to its classification as a high priority district for improvement in maternal and neonatal outcomes, the large volume of deliveries, and the lack of a USAID implementing partner for maternal health at the time of the intervention.

This report describes the baseline assessment that informed the improvement activity and how the improvement activity was conducted and the results obtained. It concludes with a discussion on lessons learned and recommendations for other districts seeking to improve the quality of antenatal care services.

## **II. IMPROVEMENT INTERVENTION**

### **A. Baseline assessment**

The intervention began in June 2015 with ASSIST staff members conducting an initial scoping visit of a health center IV, health center III, and the Jinja Regional Referral Hospital to assess gaps in antenatal care services and prepare for a more comprehensive baseline assessment. Following the scoping visit, quantitative indicators as well as data collection instruments were developed and field-tested by the ASSIST team. The project then worked with the District Health Officer to identify four regional QI coaches to serve as data collectors for the baseline assessment. ASSIST staff trained the coaches on key elements of quality antenatal care, quality improvement methodology, and use of the data collection instruments. The assessment sites were comprised of 10 high-volume facilities, which were randomly selected as intervention sites from three health sub-districts within Jinja and nine control facilities, also randomly selected. A list of the intervention and non-intervention facilities can be found in **Appendix I**. The baseline assessment was conducted in all 19 facilities between September 14-18, 2015. Data was collected from health facility registers on key inputs and processes related to antenatal care and critical maternal and neonatal health outcomes covering the period from March-September 2015. Processes and outcomes of ANC was assessed from the antenatal care registers. Baseline assessment findings indicated:

- *The availability of essential inputs for quality antenatal care across intervention and control sites was varied.* For example, while blood pressure machines, HIV test kits, and anti-retrovirals (ARVs) were available in 100% of intervention facilities and between 88% (blood pressure machines) and 100% (HIV tests and ARVs) of the control facilities, other necessary equipment such as equipment for hemoglobin testing and reagents for syphilis testing were available in less than 50% of the intervention facilities and only slightly more than 50% of control facilities.
- *There was poor screening, diagnosis, and management of common causes of maternal and neonatal morbidity and mortality.* For example, while it was expected that there would be approximately 150 cases of preeclampsia out of the 3,000 pregnant women seen during ANC in the intervention and control facilities per month, the baseline assessment results showed that only 0-4 cases were actually being diagnosed on a monthly basis.

Following the baseline assessment results, ASSIST proposed an activity that built on the project's experience using improvement methods to elevate the quality of primary antenatal care through an integrated package of antenatal care services including: a) early detection, initial management and referral of preeclampsia/eclampsia cases; b) early detection, initial management and referral of locally frequent maternal infections such as malaria and syphilis; and c) prevention, detection, and management of nutritional deficiencies such as anemia.

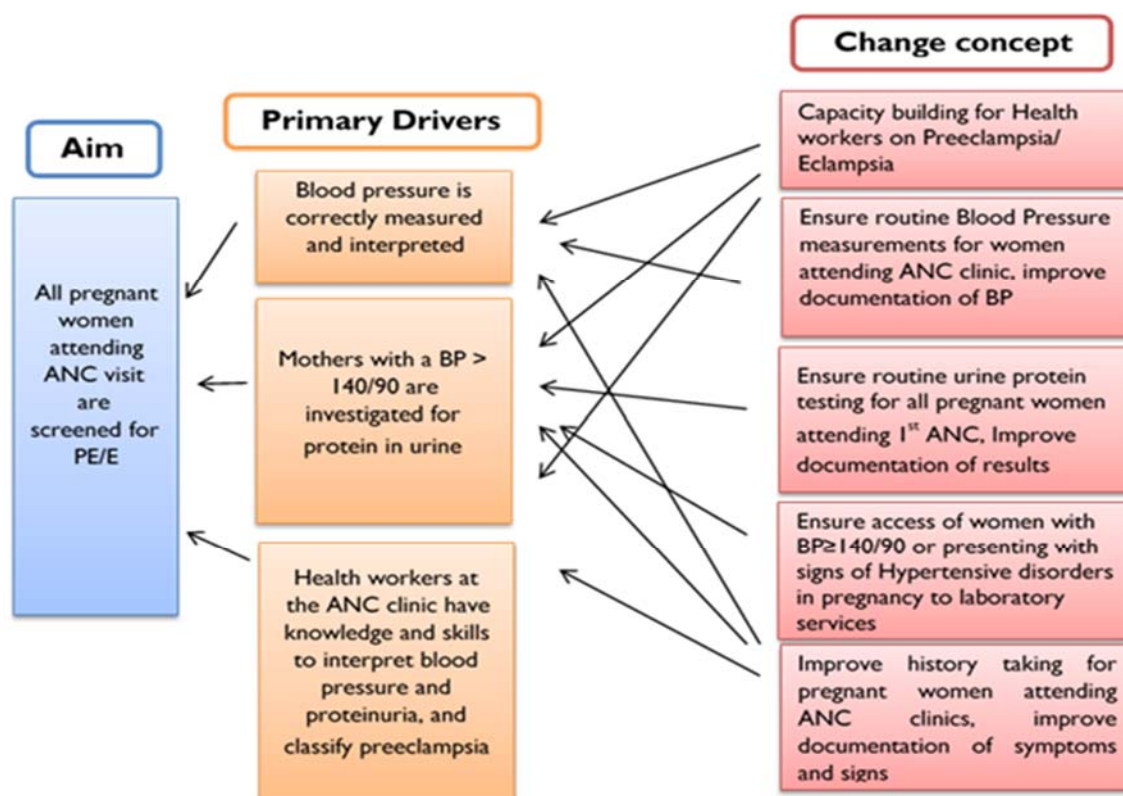
### **B. Using collaborative improvement to improve antenatal care services**

Following the initial planning and baseline assessment stage, the ANC improvement activity was introduced in three waves, each lasting approximately three months. During the first wave (November 2015–February 2016), facilities focused on improving early detection and management of preeclampsia among pregnant women. The second wave (March–May 2016) concentrated on improving screening, diagnosis, and management of malaria and syphilis. In the third and final wave (June–September 2016), facility teams worked to improve screening and management of anemia. During both the second and the third waves, teams continued to improve care processes initiated during earlier phases so that, by the end of the third wave, teams had developed a comprehensive set of changes to improve antenatal care. From the end of the third wave in September 2016 through the conclusion of the activity in March 2017,

ASSIST continued to support monthly on-site coaching visits in addition to conducting a learning session and a harvest meeting designed to synthesize knowledge on key changes that led to improvement.

ASSIST used a collaborative improvement approach to implement the ANC activity which relied on individual QI teams simultaneously testing changes focused on the same clinical area (preeclampsia/eclampsia, malaria and syphilis, or anemia), using common indicators to track improvement, and then sharing the results of the most effective changes in “learning sessions”. To identify and prioritize changes to test, facility teams utilized driver diagrams as a tool for selecting an improvement aim, determining the primary drivers that influence that aim, and focusing on change concepts and evidence-based interventions to improve those drivers. **Figure 1** illustrates the change concepts prioritized by teams as a means for addressing the primary drivers of improved screening for preeclampsia/eclampsia during ANC. A complete list of the improvement aims and indicators that QI teams worked on can be found in **Appendix 2**.

**Figure 1. Driver diagram to improve detection of preeclampsia/eclampsia, Jinja District, Uganda**



### 1. QI team set-up and monthly coaching visits

The improvement collaborative began with ASSIST staff and three regional coaches conducting initial visits to each of the 10 intervention facilities to aid in the formation of QI teams, comprised of maternal and child health (MCH) frontline health workers from antenatal clinics, and maternity and laboratory departments regularly involved in the provision of ANC services. During the first round of facility visits, coaches introduced teams to the ANC improvement activity; improvement tools and methodology; and the “longitudinal ANC register” - a new ANC register piloted by the MOH as a means for allowing better tracking of mothers through consecutive ANC visits. Prior to the introduction of the new register, mothers were entered in the ANC register as they came in with no emphasis on linking current entries with prior ones to ensure continuity of care. As the baseline assessment found poor documentation of ANC visits to be a considerable gap in the provision of quality antenatal services, the longitudinal ANC register served as the basis for allowing health facilities to better document pregnant women throughout the course of

antenatal care and ensure that all essential services were provided. Coaching visits continued throughout the improvement activity and allowed ASSIST and regional MOH staff to support teams in reviewing their improvement aims, improving documentation in the longitudinal ANC register, and conducting rapid tests of changes using Plan-Do-Study-Act (PDSA) cycles. Coaching visits also served as a means for refreshing clinical knowledge on key elements of quality antenatal care and early detection and management of preeclampsia including measuring and interpreting blood pressure results and administering MgSO<sub>4</sub> to women diagnosed with PE/E.

## **2. Learning sessions and clinical trainings**

Learning sessions were held in November-December 2015, April 2016, and October 2016 during each of the three improvement waves as a means for QI teams to gather to share and discuss results and lessons learned; refresh their clinical knowledge on comprehensive antenatal care; review QI concepts as applied to the improvement of ANC; and plan for the next phase in improvement activities. The facilitators of the learning sessions were comprised of ASSIST project staff, as well as staff from the MOH at the national level, the Academy of Obstetrics and Gynecology of Uganda, the MOH at the district level, and the regional coaches. Learning sessions included a mix of didactic, demonstration and return sessions, group work exercises, illustrative case scenarios, and facility level presentations of results. Topics included in the clinical training module of the learning sessions included: components of a complete ANC package with reference to the Focused Antenatal Care Protocol endorsed by the Ugandan MOH; blood pressure measurement; urine testing for protein using a urine dipstick; preeclampsia and eclampsia diagnosis and management; dilution of magnesium sulfate; ; documentation of the primary ANC information in the Health Management Information System (HMIS) tools; diagnosis and management of malaria and syphilis in pregnancy as per the Ugandan National Guidelines; and detection, diagnosis, and management of anemia during pregnancy. Refresher training on using improvement tools and methodology was also provided during learning sessions including using the PDSA cycle to conduct rapid tests of changes and documentation journals to record and track progress against improvement aims. Lastly, learning sessions provided facility staff with a forum for raising issues and constraints to improvement activities such as a lack of critical equipment and supplies to initiate improvements (e.g., urine containers, urine dipsticks, blood pressure machines, etc.); stock-outs of essential medicines for management of preeclampsia/eclampsia, malaria, syphilis, and anemia; lack of a community component to track and link pregnant women to the health facility as early as possible to ensure delivery of a focused ANC care package; and poor communication between laboratory staff and clinicians leading to disagreements on prioritization of tests for the patient and mode of sample collection. The facilitators attempted to address the issues and challenges raised, emphasizing that many of the challenges affecting performance and communication between staff could be addressed within the facility using existing resources through improvement approaches. The District Health Officer was invited to attend parts of the learning sessions to listen to and respond to some of the pertinent issues raised especially concerning the lack of availability of equipment, supplies, and medicines. Other actions taken to address the issues raised by facility teams included: developing action plans for immediate implementation to address identified gaps; having learning session participants conduct continuous medical education (CME) for other health providers upon returning to their health facilities on QI principles and tools and detection and management of obstetric complications; and expanding facility QI teams to include representation from other departments within the facility and facility administration.

## **III. RESULTS**

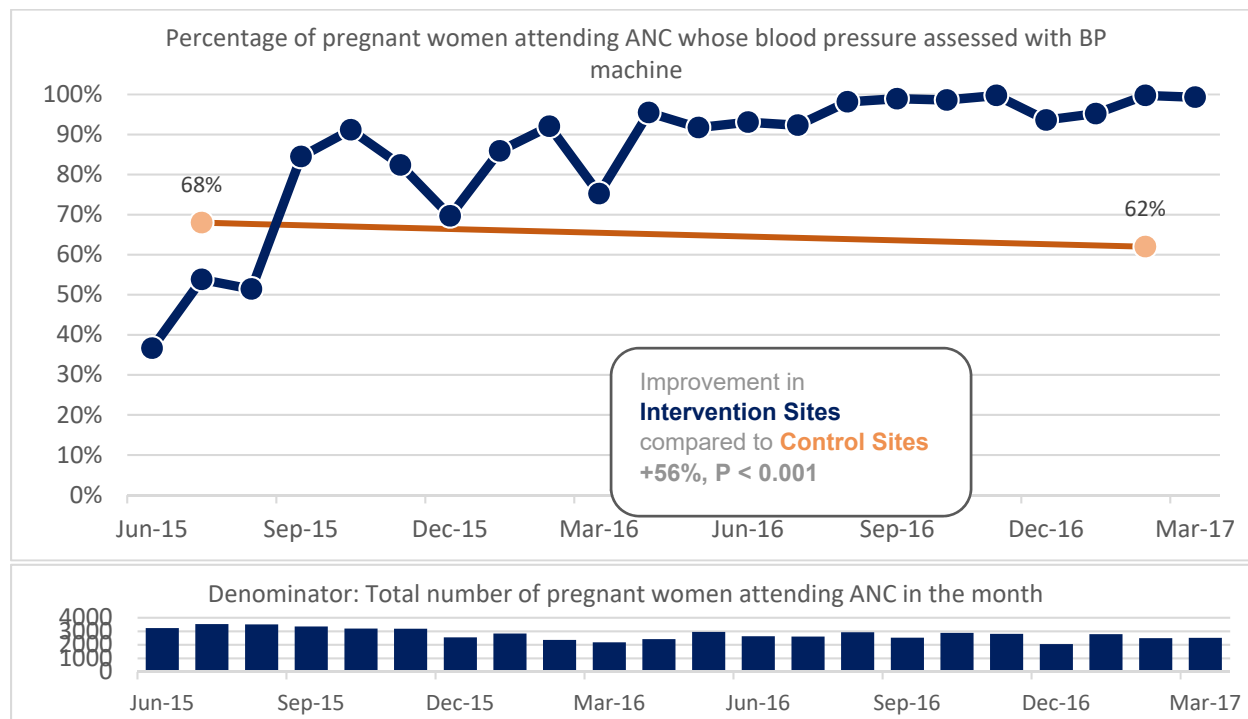
A difference in differences analysis was used to compare the differential effect of improvement activities in the intervention facilities with the control group using baseline and end line data. The analysis showed statistically significant improvement in the performance of the intervention facilities for 12 of the 18 indicators and a decline in performance for one indicator (% of mothers attending first ANC visit who received an insecticide treated net [ITN] and counseling on malaria). Results for the remaining five indicators were not statistically significant.

It is worth noting that there were variations in the initial baseline results from the intervention and control facilities across the 22 indicators that were included in the assessment and as such the two groups did not start off at a similar level of performance. The intervention facilities performed worse than the control facilities across seven of the indicators at baseline and better across six; performance on five additional measures was the same for both groups. For the remaining four indicators, baseline data was missing from either or both the intervention and control facilities and as such conducting the difference in differences analysis was not possible for these indicators. Data from the analysis can be found in **Appendix 3**.

### A. Preeclampsia/Eclampsia

Teams began improvement work by focusing on early detection of preeclampsia. Two primary drivers were identified: blood pressure correctly measured and interpreted for each pregnant woman attending an ANC visit and mothers with a BP  $\geq 140/90$  assessed for protein in urine<sup>1</sup>. The data reveals a statistically significant ( $p < .0001$ ) improvement in both drivers in the intervention facilities as a result of the improvement activity. **Figure 2** highlights the improvement in measurement of blood pressure during ANC visits in the 10 intervention facilities from an average of 48% of pregnant women whose blood pressure was tested during the baseline period (March-September 2015) to 98% during end line (January-March 2017). Using a difference in differences calculation, this represents a 56-percentage point overall increase in performance in blood pressure measurement in intervention sites compared to control sites.

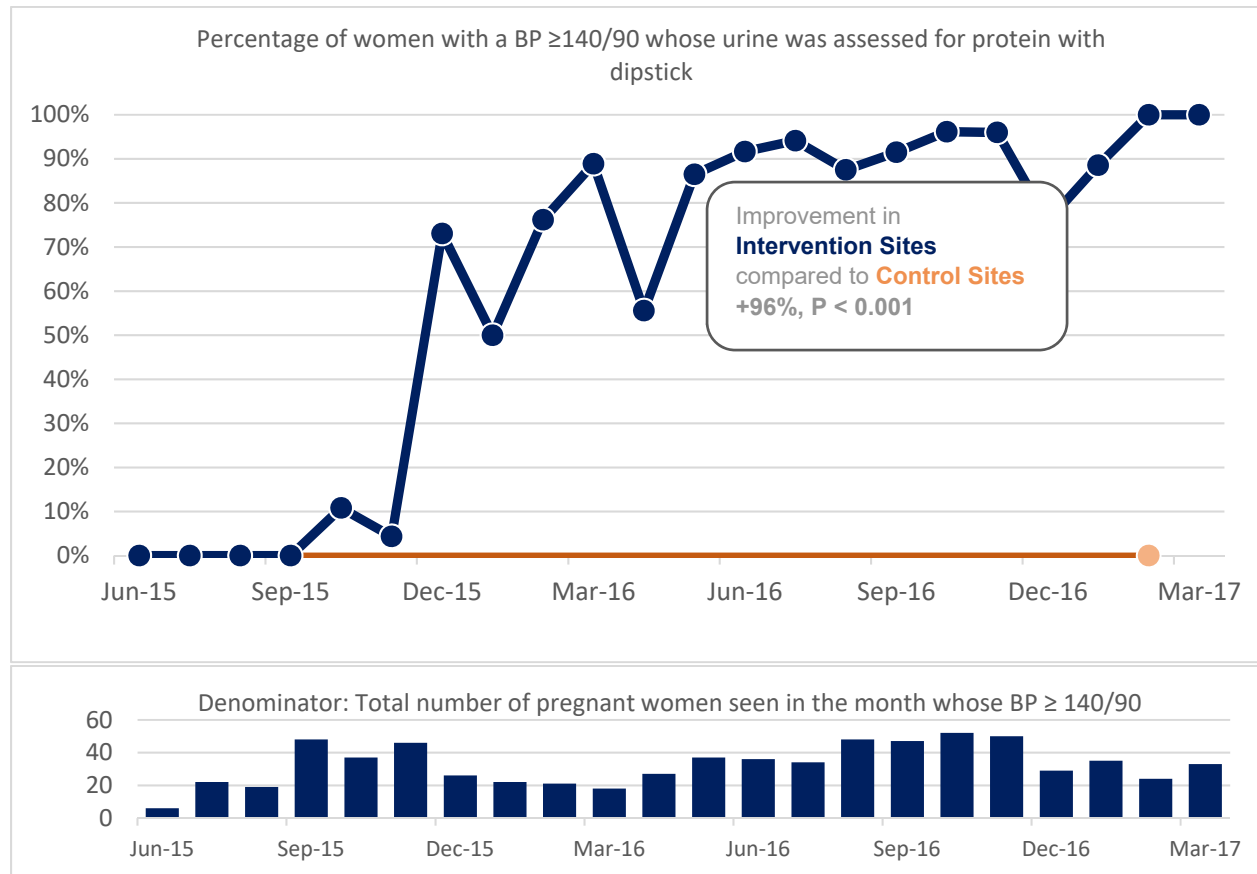
**Figure 2. Improvement in measurement of blood pressure during ANC visits in 10 facilities in Jinja District, Uganda (Jun 2015 – Mar 2017)**



<sup>1</sup> In addition to urine protein testing, teams focused on assessment of signs of neurologic, pulmonary, hepatic, renal and hematologic features (e.g., headache, blurred vision, convulsions or loss of consciousness) to diagnose preeclampsia/eclampsia. However, considering the lack of essential inputs and the fact that relevant signs/symptoms are not documented in the ANC registry, teams only measured progress in blood pressure and urine protein testing.

The percentage of women with a BP  $\geq$  140/90 who were linked to urine protein testing increased from 0% during the baseline (June-Aug 2015) to 96% during end line in the intervention facilities. No improvement was seen in the control facilities (**Figure 3**).

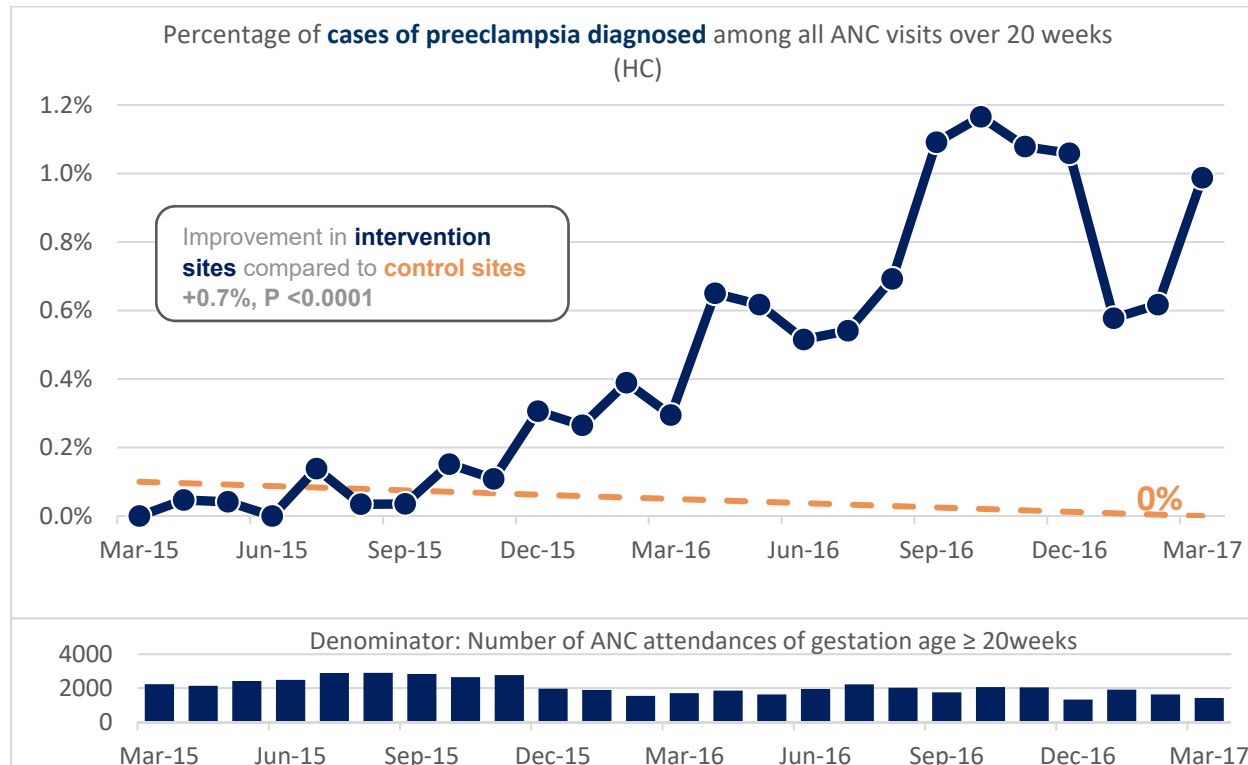
**Figure 3. Improvement in linking women with BP  $\geq$  140/90 to urine protein testing in 10 facilities in Jinja District, Uganda (Jun 2015 – Mar 2017)**



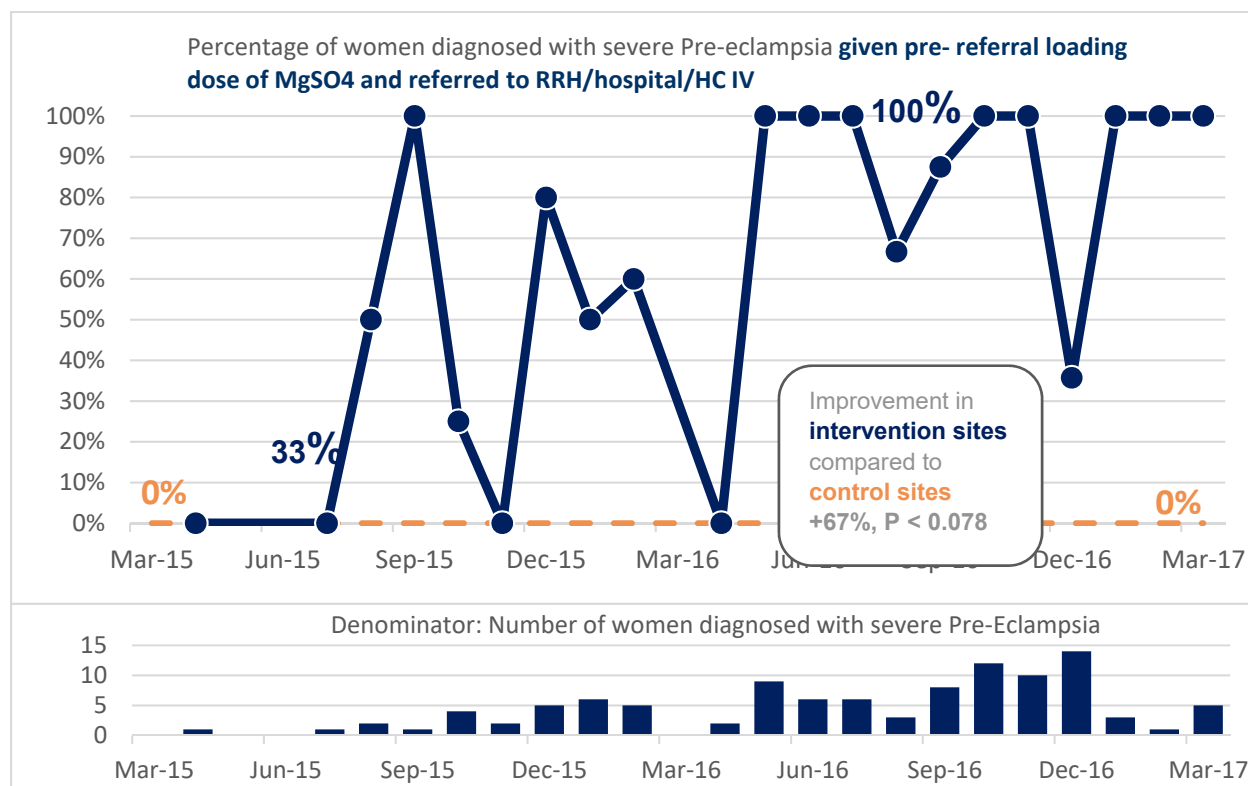
Improvements in screening for preeclampsia resulted in a statistically significant ( $p < .0001$ ) increase in the percentage of preeclampsia cases diagnosed at ANC visits in the intervention facilities, as seen in **Figure 4**, from 0.1% to 0.7%.

However, initial management of women diagnosed with severe preeclampsia through administration of a loading dose of  $MgSO_4$  and referral to a higher-level facility (RRH, general hospital, or health center IV) did not result in significant improvement. Routine monitoring results of initial treatment and referral of severe preeclampsia shows improvement – though due to a small number in the denominator – the indicator is fluctuating (**Figure 5**). Similarly, baseline and end line assessment revealed that baseline performance in intervention facilities has improved from 33% (at baseline) to 100% (March 2017) while it remained unchanged (0%) in control facilities. But due to the same reason (small number in denominator), attributable improvement in intervention facilities compared to control facilities (67%) was not statistically significant ( $p=0.078$ ).

**Figure 4. Improvement in the cases of preeclampsia diagnosed among all ANC visits in 10 facilities in Jinja District, Uganda (Mar 2015 - Mar 2017)**



**Figure 5. Initial treatment and referral of women with severe pre-eclampsia in 10 facilities in Jinja District, Uganda (Mar 2015 - Mar 2017)**



At the Jinja RRH, the percentage of severe PE/E cases seen which received correct treatment (defined as both a loading and a maintenance dose of MgSO<sub>4</sub>, the correct dose of the prescribed antihypertensive, and continuous monitoring of vitals throughout the course of care) and whose treatment was documented in the patient files rose from 4% during baseline to 98% during the end line assessment. However due to the lack of data for this indicator in the control facilities a conclusion on statistical significance could not be made.

QI teams tested a number of change ideas to improve early screening, diagnosis, and management of preeclampsia during antenatal care which contributed to these results. Successful change ideas to improve screening for preeclampsia included reassigning students and redundant staff to take blood pressure measurements during the triage process and creating “mini-labs” within the MCH departments to allow midwives to conduct urine protein testing rather than referring pregnant women to the central laboratory where long waiting times often resulted in women leaving before tests were conducted. To strengthen health worker confidence in administering magnesium sulfate to women diagnosed with preeclampsia, ASSIST introduced a job aid (included in **Appendix 4**) which described how to prepare loading and maintenance doses of MgSO<sub>4</sub> with 5, 10, and 20 ml syringes. In Uganda, standard job aids for management of preeclampsia focus on preparation of MgSO<sub>4</sub> with only 10 or 20 ml syringes which were typically not available in the intervention facilities. Management of preeclampsia with magnesium sulfate was discussed at length during the clinical training component of learning sessions and reinforced during monthly coaching visits in which the management of particular cases was reviewed and gaps in treatment were discussed. Proper monitoring and handover of preeclampsia cases at higher level facilities was also emphasized, with some facilities isolating sections of the maternity ward for PE/E cases so that health workers would be able to easily identify which women required intensive monitoring during shift handovers.

Considering up-to-date evidence, the team realized the importance of preventing pre-eclampsia and eclampsia with calcium supplementation and low-dose acetylsalicylic acid (aspirin 75 mg) in high risk pregnant women. However, considering limited availability of these medications in ANC clinics and the fact that these clinical recommendations have not been adopted in Uganda yet, improvement did not focus on preeclampsia and eclampsia prevention.

## **B. Malaria**

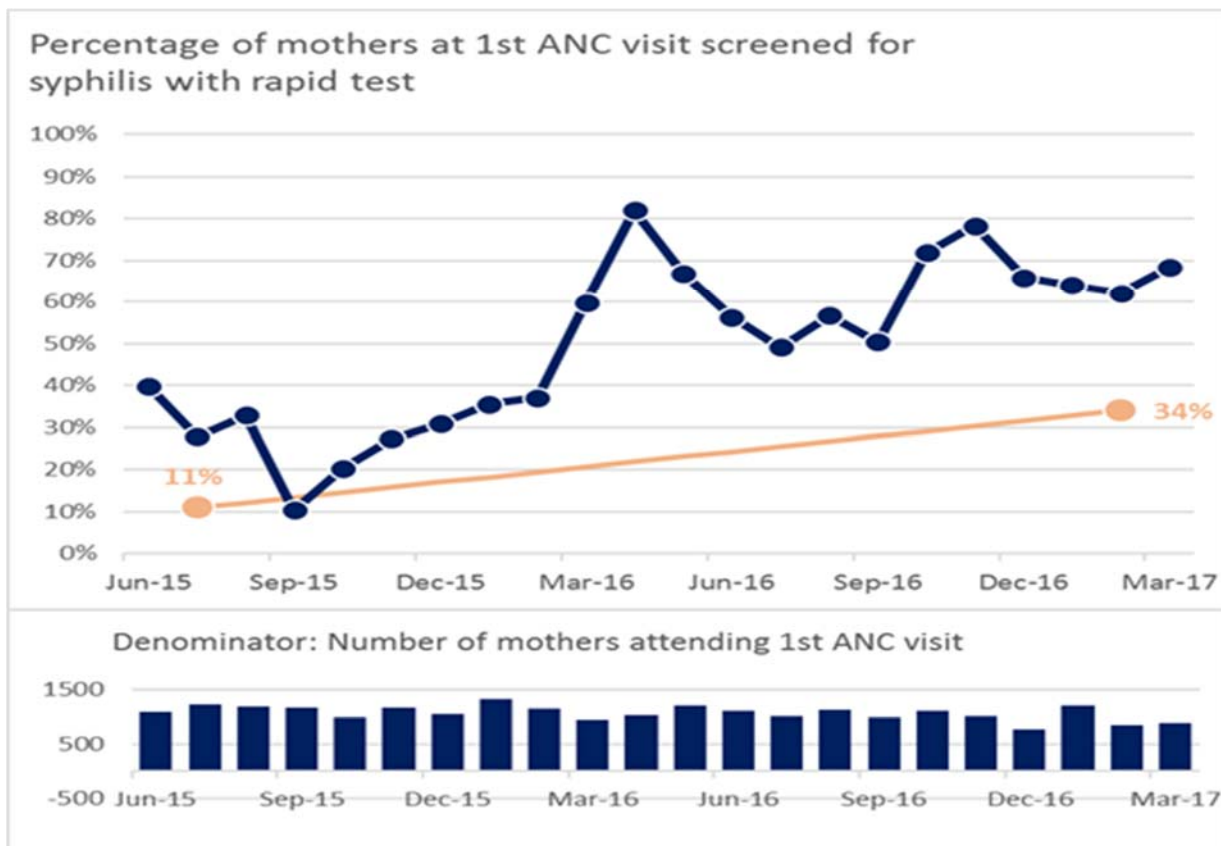
Provision of malaria prophylaxis improved significantly ( $p < .0001$ ) with the percentage of mothers who received at least two doses of Intermittent Preventive Treatment (IPT)<sub>2</sub> between 28-36 weeks' gestation increasing to an average of 68% in the last three months of data collection from a baseline average of 24%, a 61-percentage point overall increase when taking into account the performance of the control facilities during the same period. To ensure compliance with the treatment, all 10 intervention facilities implemented observed swallowing IPT medications. To overcome the lack of water containers, an obstacle to observed swallowing, facilities adapted existing materials (e.g., empty yogurt containers) to be used as vessels for drinking water. The percentage of women who presented with fever or a history of fever during antenatal care who were tested for malaria using a rapid diagnostic test (RDT) did not improve significantly, however a significant increase in the percentage of cases of malaria diagnosed and treated during ANC visits was observed in all 10 intervention facilities, from 1% during baseline to a high of 9% in January 2016. While this percentage dropped to 4% during the end line assessment (January – March 2017), the magnitude of cases correctly diagnosed and treated during ANC remained consistently higher than initial values before the start of the improvement effort. Change ideas that contributed to these results included building staff capacity on malaria diagnosis and treatment guidelines in pregnancy including signs and symptoms, methods of diagnosis, and treatment options according to severity and gestational age of the fetus; creating job aids summarizing treatment algorithms; and introducing dispensing of antimalarial drugs from within the ANC ward.



### C. Syphilis

Rather than sending pregnant women to the laboratory for testing, midwives began screening for syphilis during the course of the ANC visit, in addition to testing for HIV, urine protein, and malaria. Pregnant women were only referred to the lab if the antenatal clinic was short of rapid tests at which point they were given a card indicating that they were being sent from the ANC clinic and should be prioritized for testing. Other change ideas to improve syphilis testing included introducing other testing methods for syphilis, such as Venereal Disease Research Laboratory (VDRL), to combat stock outs of RPR kits; redistributing Rapid Plasma Reagin (RPR) test kits from facilities with sufficient supply to those with low supply; coordinating with laboratory personnel to increase requisitions of syphilis test kits; and building staff awareness of the importance of syphilis testing as a mandatory component of antenatal care. As a result of these change ideas, the percentage of mothers screened for syphilis using a rapid test during the first ANC visit increased significantly ( $p < .0001$ ) from 33% during baseline (June-Aug 2015) to an average of 65% (Jan-March 2017) during the end line assessment, an increase of nine percentage points overall when compared to the control group. Similar improvement was documented by routine monitoring (**Figure 6**). The percentage of mothers in the intervention facilities who were found positive for syphilis during the first ANC visit and who were correctly treated also increased significantly ( $p = .002$ ) to 88% (Jan-March 2017) at end line from 0% at baseline (June – Aug 2015). A decline was noted at the control facilities (31% at end line compared to 50% at baseline) during the same period. Change ideas to improve treatment of syphilis included assigning staff to ensure that Benzathine Penicillin was requisitioned regularly; redistributing drug stocks between facilities; mentoring staff on correct treatment for syphilis in pregnancy; and ensuring that drugs for syphilis treatment were available at the ANC clinic.

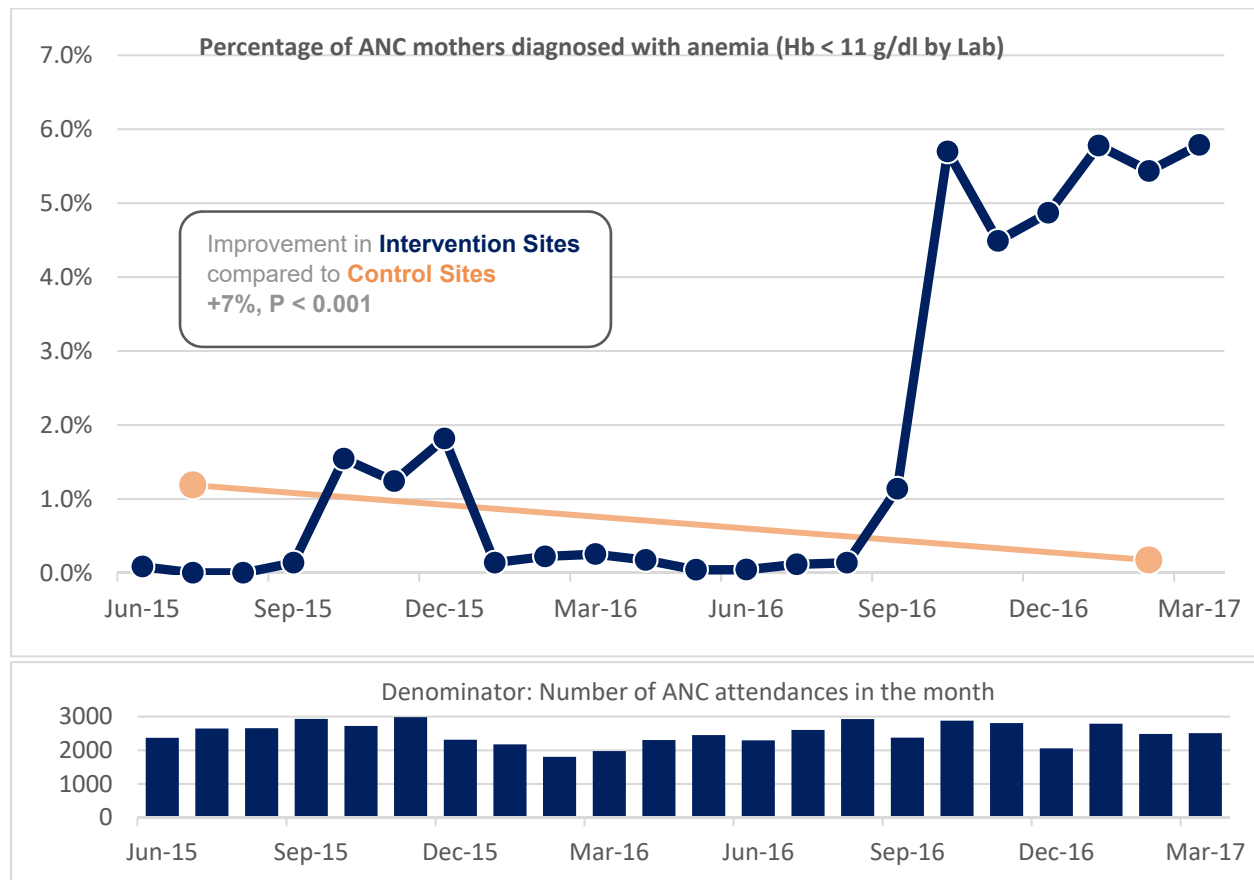
**Figure 6. Improvement in the percentage of women screened for syphilis during first ANC visit in 10 facilities in Jinja District, Uganda (Jun 2015 - Mar 2017)**



## D. Anemia

Prevention, diagnosis, and treatment of anemia during ANC has also shown significant improvement. The percentage of women attending antenatal care who received the correct dosage of iron-folate tablets improved from an average baseline value of 39% to 95% in the last three months of improvement work ( $p < .0001$ ) while the percentage of women whose hemoglobin (Hb) was assessed by the laboratory during the first ANC visit increased from 0% during the baseline assessment to an average of 58% during end line, a 57-percentage point increase when compared to the performance of the control group during the same period. **Figure 7** shows statistically significant ( $p < .0001$ ) improvement in the percentage of women attending ANC diagnosed with anemia ( $Hb \leq 11\text{g/dl}$ ) using laboratory investigations from 0% during baseline to 6% during end line. Performance in the control facilities declined from 1% to 0% during this period. A statistically significant improvement in the treatment of mothers diagnosed with anemia during ANC as per MOH guidelines was not observed.

**Figure 7. Improvement in the percentage of mothers diagnosed with anemia during ANC in 10 facilities in Jinja District, Uganda (Jun 2015 - Mar 2017)**



Change ideas that contributed to improvements in prevention and diagnosis of anemia include integrating counseling on anemia and its effects during pregnancy into the health education talks provided during ANC sessions; counseling women on the importance of swallowing iron-folate tablets and introducing facility based observed swallowing during ANC; introducing observed swallowing of mebendazole; re-distributing stocks of iron-folate tablets from facilities with surplus supplies to those with limited stocks; transporting blood samples from facilities without Hb estimators to those with them for testing and collecting the results the next day; sending pregnant women from facilities without Hb estimators to those with them and collecting the results the next day; advocating to facilities in-charge for procurement of Hb estimators and reagents and/or borrowing them from facilities with adequate stock; and having lab

personnel draw a single blood sample for all required ANC tests, including Hb estimation, and walk the portion for anemia testing over to the main laboratory (Jinja Regional Referral Hospital).

#### **IV. CHALLENGES**

The lack of availability of critical inputs for quality antenatal care presented a significant challenge throughout the implementation of the improvement activity. While the baseline analysis showed availability of magnesium sulfate in 80% of intervention sites, these facilities continued to experience stock outs of magnesium sulfate and other anti-hypertensives which hindered the ability to appropriately manage preeclampsia/eclampsia cases. Stock-outs of urine dipsticks for testing protein in urine, hemoglobin estimators, urine containers, and RPR reagents for syphilis testing were also frequent. To combat these stock-outs, ASSIST worked with both the lower level and higher-level facilities to explore other means of obtaining the necessary inputs. At lower-level facilities (Health Centers II and III), the National Medical Store employs a “push system” wherein inputs are provided based on reported need. ASSIST worked with these facilities to emphasize the importance of reporting on the incidence of PE/E to increase the supply of magnesium sulfate and other anti-hypertensive medication. At the higher-level facilities, ASSIST helped educate mothers on how to leverage the voucher program being implemented as part of the World Bank funded “Uganda Reproductive Health Voucher Program” to purchase essential inputs at a subsidized price when unavailable at the facility. ASSIST also lobbied the MOH at both the district and national levels about the importance of maintaining adequate supplies of key drugs and equipment for quality antenatal care. Timely referrals of complicated cases between facilities also proved challenging due to the lack of a sufficient number of ambulances and periodic fuel shortages. While ASSIST was unable to directly address the issue of transport and fuel availability, QI teams implemented change ideas such as sharing the phone number of ambulance drivers with facilities in-charge and providing early notice to higher-level facilities via cell phone when a patient was being referred so that all necessary preparations could be made. These changes streamlined and improved the efficiency of referrals in spite the lack of sufficient transport.

Treatment of PE/E with magnesium sulfate was one of the most challenging areas for improvement teams. While health workers showed sufficient confidence in diagnosing and treating malaria, anemia, and syphilis, the project observed a considerable lack of confidence surrounding both diagnosis of PE/E and treatment with MgSO<sub>4</sub>. Given the relative rarity of the condition, many health workers had no practical experience in identifying PE/E and administering treatment and often referred patients to a higher level of care without administering a loading dose of magnesium sulfate even when the drug was available. To combat this, ASSIST provided refresher training to facility-based staff within the MCH departments of the intervention facilities, emphasizing through both theoretical and practical, skills-based sessions, the necessary steps to screen for, diagnose, and treat preeclampsia/eclampsia. To reinforce knowledge learned through training sessions, ASSIST identified skilled staff from within the facilities – such as the head of maternal health for a sub-district of Jinja – who could serve as mentors for the rest of the facility on how to handle high-risk cases. To increase exposure to these cases and improve management, coaches emphasized the necessity of calling for assistance from a colleague when treating a preeclamptic/eclamptic patient. Lastly, ASSIST developed and introduced a job aid that demonstrated how to prepare loading and maintenance doses with commonly available supplies as discussed in the results section above.

#### **V. LESSONS LEARNED AND RECOMMENDATIONS**

“Harvest meetings” were held in October 2016 and March 2017, bringing together key members from all ten QI teams to identify and discuss change ideas that helped improve the quality of comprehensive antenatal care and synthesize lessons learned. Four main recommendations on how to improve the quality of antenatal care emerged as part of the discussions:

**Create a managerial environment primed for quality care by strengthening leadership, creating accountability, and recognizing and rewarding staff who prioritize improvement.**

Leadership and accountability for quality care were strengthened at each level of the health system involved in antenatal care. ASSIST worked closely with the District Health Office (DHO) from the outset of the activity to select MCH focal points at the sub-district level to serve as coaches alongside ASSIST staff, ensuring that improving antenatal care was seen as an integral part of the DHO's routine activities and building the capacity of the district to support improvement once project assistance concluded. At the facility level, the facilities in-charge were briefed monthly by QI teams on performance and areas where further intervention was needed, such as the lack of critical supplies and equipment. Within the MCH departments, the MCH in-charge served as the QI team lead demonstrating to all department staff the importance of improving antenatal care delivery. Within QI teams, staff were assigned the rotating role of monitoring performance on key care processes and data, inculcating the notion that improvement is a fundamental part of each person's everyday activities. These staff then held QI meetings at each shift change to update other team members on performance in particular areas, observed gaps in care, successful and unsuccessful changes, and share data on improvement indicators.

**Ensure basic inputs by strengthening health workers' knowledge and skills and increase availability of basic supplies.**

Providing ongoing refresher training for staff on critical elements of high quality antenatal care had a significant impact on the success of this activity. The baseline assessment findings revealed low levels of health worker knowledge of the necessary components of an antenatal care visit as per the focused ANC guidelines of the MOH and a lack of confidence around diagnosing and treating PE/E as discussed in the section above. ASSIST, in conjunction with MOH trainers, provided repeated training on provision of a comprehensive package of ANC services with an emphasis on practical, hands-on skills building to build confidence in providing critical services at learning sessions and during on-site coaching visits to strengthen health worker knowledge and skills. In addition, ASSIST worked with the MOH at the national and district levels, and with facilities in-charge, to increase the availability of basic supplies and equipment necessary for the provision of quality ANC.

**Optimize key care processes by redesigning them and supporting QI teams to test changes and overcome obstacles.**

QI teams sought to improve the quality of ANC by redesigning the way in which care was delivered to ensure that pregnant women received all the necessary services that they required. For example, QI teams identified increasing the percentage of pregnant women attending antenatal care whose blood pressure was measured and recorded within the ANC register from 48% during the baseline assessment to 100% by February 2016 at the 10 intervention facilities as one of their aims to improve screening for preeclampsia. QI teams then determined that a clear process for when and where blood pressure would be measured during ANC visits was lacking. While some patients had their

**Obstacles and successful tested changes to improving screening for PE/E:**

**Weak knowledge and skills of personnel:**

- ✓ Frequent periodic hands-on training, job aids on site
- ✓ Peer-to-peer on-site training

**Heavy workload for midwives:**

- ✓ Redesign of patient flow
- ✓ Task shifting including nurse students

**Scarce blood pressure cuffs:**

- ✓ Establish a sharing schedule among services in the health center
- ✓ Encourage students to bring their own BP cuffs

**Long wait times at lab, mothers leave without being tested:**

- ✓ Redesign process: midwives to do the urine testing
- ✓ Escort mothers with high BP to lab

**Scarce availability of dipsticks:**

- ✓ Share dipsticks among health centers
- ✓ Divide one dipstick in two and use in two mothers

**Lack of urine containers for testing protein in urine:**

- ✓ Use containers provided for sputum samples
- ✓ Sterilize and reuse urine containers

blood pressure taken at the triage table upon arrival, others had the measurement done at the end of the obstetrical examination, and many patients left the clinic without having their BP measured at all. QI teams met with clinic staff to discuss this issue and identified several factors that contributed to poor adherence to BP measurement: the limited number of functional BP machines, limited staffing, the lack of well-defined patient flows, and poor documentation. To address these obstacles, the facilities decided to work on making BP measurement a routine part of the triage process. Functional BP machines were placed at the triage table and redundant staff were reassigned to triage and paired with nursing students to ensure that measurements were taken and recorded for each woman arriving for ANC. QI teams also lobbied facilities in-charge to procure additional BP machines where needed. As a result of these changes, the percentage of women whose blood pressure was measured and recorded within the ANC register reached 92% in February 2016 and rose to 100% a year later across all intervention facilities. The accompanying text box describes several other successful tested changes that address obstacles to screening for PE/E.

***Build a mechanism for continuously measuring and improving care through quarterly learning sessions and monthly coaching to facility-based QI teams.***

Quarterly learning sessions and monthly coaching visits provided facility-based teams with needed structure and support for continuous improvement. Coaching visits generally included a team meeting to review data and check progress against improvement aims, refresher clinical training, and a review of tested changes and served as an opportunity to discuss barriers to improvement and create an action plan to address those challenges. Learning sessions provided teams with a forum for sharing their results and learning from the experiences of other facilities and multiplied the impact of the improvement activity by facilitating rapid dissemination of the most effective changes to improve antenatal care.

## APPENDICES

### Appendix I: List of intervention and non-intervention facilities

Intervention Facilities			
Regional Referral Hospital	General Hospital	Health Centre IV	Health Centre III
Jinja RRH	Buwenge Hospital	Budondo HC IV	Budima HC III
		Mpumudde HC IV	Butagaya HC III
		Buwenge HC IV	Magamaga HC III
			Kakaire HC III
			Lukolo HC III

Non-Intervention Facilities			
Regional Referral Hospital	General Hospital	Health Centre IV	Health Centre III
N/A	Kakira Hospital	Bugembe HC IV	Kakira HC III
		Walukuba HC IV	Mpambwa HC III
		Busedde HC IV	Wakitaka HC III
			Muwumba HC III
			Jinja Central HC III

## Appendix II: Improvement aims and indicators

Focus area	Improvement aim	Indicators
<b>Preeclampsia/ eclampsia</b>	Improve screening and detection of PE/E during ANC visits	% of pregnant women attending ANC whose blood pressure was assessed using a BP machine
		% of pregnant women whose BP was $\geq 140/90$ that were assessed for protein with dipstick
		% of 1st ANC mothers for whom urine was tested for proteins
	Improve diagnosis of women with PE/E during ANC visits	% of cases of PE/E diagnosed among all ANC visits
	Improve management of PE/E	% of women diagnosed with severe PE given pre-referral loading dose of MgSO <sub>4</sub> and referred to RRH/hospital/HC IV
		% of women diagnosed with severe Pre-Eclampsia that were referred from lower health facilities that were admitted at Jinja RRH/ HC IV
% of women admitted with severe Pre-eclampsia / eclampsia that get correct treatment		
<b>Malaria</b>	Improve prevention of malaria during antenatal care	% of pregnant women who received an ITN at first ANC visit
		% of mothers at ANC who received at least IPT2 between 28-36 weeks' gestation
	Improve screening for malaria during antenatal care	% of pregnant women presenting with fever or history of fever at ANC visit who had a malaria test done
	Improve diagnosis of malaria during antenatal care	% of pregnant women diagnosed and treated for malaria during ANC visit
	Improve treatment of malaria during antenatal care	% of women attending ANC that were diagnosed with malaria and treated for malaria
		% of pregnant women at ANC with a positive malaria test who received treatment as per MOH guidelines
<b>Syphilis</b>	Improve screening for syphilis during antenatal care	% of pregnant women screened for syphilis at first ANC visit using rapid test
	Improve diagnosis of syphilis during antenatal care	% of cases positive for syphilis among all first ANC visits
	Improve treatment of syphilis during antenatal care	% of positive syphilis cases treated as per MOH guidelines
<b>Anemia</b>	Improve prevention of anemia during antenatal care	% of pregnant women who received correct dose of iron/folic acid tables at any ANC visit
	Improve detection of anemia during antenatal care	% of pregnant women whose hemoglobin was assessed during first ANC visit
	Improve diagnosis of anemia during antenatal care	% of pregnant women diagnosed with anemia (Hb under 11 g/dl) during ANC
	Improve treatment of anemia during antenatal care	% of pregnant women at any ANC visit whose hemoglobin was found below 11 g/dl and who received treatment as per MOH guidelines

Focus area	Improvement aim	Indicators
<b>Outcome indicators</b>		% of deaths in women admitted with preeclampsia or eclampsia
		% of babies delivered at the health facility with weight under 2500 grams
		% of still births



### Appendix III: Baseline/end line analysis results

Indicators	Intervention/ Baseline	Control/ Baseline	Intervention/ End line	Control/ End line	Dif in Dif	P value
% of pregnant women attending ANC whose blood pressure was assessed using the BP machine	48%	68%	98%	62%	56%	<0.0001
% of pregnant women whose BP was $\geq$ 140/90 that were assessed for protein with dipstick	0%	0%	96%	0%	96%	<0.0001
% of women diagnosed with preeclampsia	0.1%	0.1%	0.7%	0%	0.7%	<0.0001
% of women diagnosed with severe preeclampsia that were given pre-referral loading dose of MgSO <sub>4</sub> and referred to RRH/HCIV	33%	0%	100%	0%	67%	0.078
% of mothers attending 1st ANC visit who received an ITN and counseling on Malaria	37%	66%	30%	41%	18%	<0.0001
% of mothers at ANC with fever or history of fever who had a malaria test done	0%	0%	97%	95%	2%	0.899
% of mothers at ANC with a positive malaria test who received malaria treatment as per MOH guidelines	89%	no data	99%	93%	no date	
% of ANC women attending ANC who received at least IPT 2 doses within 28 – 36 weeks of gestation	24%	54%	68%	37%	61%	<0.0001
% of women attending ANC that were diagnosed with Malaria and treated for malaria	2%	2%	4%	2%	3%	<0.0001
% of babies delivered at the health facility with weight under 2500g	11%	3%	7%	2%	-3%	0.035
Still births per 1000 live births	36.34	3.03	33.95	17.77	-17.13	0.049
% of women attending ANC diagnosed with anemia (Hb $\leq$ 11g/dl) using the laboratory investigations	0%	1%	6%	0%	7%	<0.0001
%of mothers at 1st ANC visit whose hemoglobin was assessed by Laboratory	0%	5%	58%	5%	57%	<0.0001
% of mothers who received correct dose of iron/folic acid tablets in the month	39%	67%	95%	72%	51%	<0.0001

<b>% of mothers at any ANC visit whose Hb was found below 11g/dl and who received treatment as per MOH guidelines</b>	1%	0%	65%	0%	63%	0.128
<b>% of mothers attending 1st ANC visit that were tested for syphilis using a rapid test</b>	33%	11%	65%	34%	9%	<0.0001
<b>% of ANC women positive for Syphilis among all 1st ANC visits</b>	0.3%	0.1%	1.1%	0.5%	0.4%	0.139
<b>% of mothers attending 1st ANC visit who were positive for syphilis and were correctly treated</b>	0%	50%	88%	31%	107%	0.002
<b>% of women positive for Syphilis among all women that delivered at the health facility</b>	0%	0%	0%	0%	no data	
<b>% of babies delivered at the health facility that had a positive test for syphilis</b>	0%	0%	0%	0%	no data	
<b>% of 1st ANC mothers for whom urine was tested for proteins</b>	0%	0%	60%	0%	60%	<0.0001

## Appendix IV: Job aid for administering magnesium sulfate

<b>MANAGING SEVERE PREECLAMPSIA AND ECLAMPSIA</b> <b>DOSE OF MAGNESIUM SULFATE (MgSO<sub>4</sub>)</b>	
<b>LOADING DOSE:</b>	
<b>Take 4gm MgSO<sub>4</sub>, IV as 20% solution</b>	<b>Dilution</b>
Give intravenously (IV) slowly over 10 - 20 minutes  <i>(Follow the guidance in the next column on how to make 20% from 5ml ampoule of 500mg/ml 50% MgSO<sub>4</sub> depending of the syringe size available)</i>	Making 4g of 20% solution from 50% solution: <ul style="list-style-type: none"> <li>• <b>If you have a 20 ml syringe.</b> <ul style="list-style-type: none"> <li>- Get 8mls of 50% solution add 12 mls of water for injection/Normal saline; this is now 20mls of 20% solution.</li> </ul> </li> <li>• <b>If you have 10 ml syringes.</b> <ul style="list-style-type: none"> <li>- Put 4 mls of 50% solution in 2 syringes. Make up to 10mls with water for injection in each syringe. You now have 2 10ml syringes of 20% solution.</li> </ul> </li> <li>• <b>If you have 5ml syringes.</b> <ul style="list-style-type: none"> <li>- Put 2mls of 50% solution in 4 syringes. Make up to 5mls with water for injection in each syringe. You now have 4 5ml syringes of 20% solution.</li> </ul> </li> </ul>
<b>Follow promptly with 10gm as 50% MgSO<sub>4</sub> deep IM</b>	
Give 5gm deep IM in each buttock	<ul style="list-style-type: none"> <li>• <b>If you have 10mls syringes</b> <ul style="list-style-type: none"> <li>- Take two 10ml syringes</li> <li>- Draw 2 ampoules of 500mg/ml MgSO<sub>4</sub> 50% into each syringe (a total of 10mls of 50% MgSO<sub>4</sub> = 5gm in each; <b>10gm in total</b>)</li> <li>- Add 0.5mls of 2% lignocaine in each syringe.</li> </ul> </li> <li>• <b>If you have 5mls syringes</b> <ul style="list-style-type: none"> <li>- Take four 5ml syringes</li> <li>- Draw 4 ampoules of 500mg/ml MgSO<sub>4</sub> 50% into each syringe (a total of 5mls of 50% MgSO<sub>4</sub> = 2.5gm in each; <b>10 gm in total</b>)</li> <li>- Add 0.25mls of 2% lignocaine in each syringe.</li> </ul> </li> </ul>
<b>MAINTENANCE DOSE:</b>	
<b>5gm as 50% MgSO<sub>4</sub> deep IM in alternate buttocks every 4 hourly</b>	
Continue same treatment for 24 hours after delivery or the last convulsion, whichever is the last.	<ul style="list-style-type: none"> <li>• <b>If you have 10mls syringes</b> <ul style="list-style-type: none"> <li>- Take one 10ml syringes</li> <li>- Draw 2 ampoules of 500mg/ml MgSO<sub>4</sub> 50% into the syringe (a total of 10mls of 50% MgSO<sub>4</sub> =5gm)</li> <li>- Add 1ml of 2% lignocaine in the syringe.</li> </ul> </li> <li>• <b>If you have 5mls syringes</b> <ul style="list-style-type: none"> <li>- Take two 5ml syringes</li> <li>- Draw 2 ampoules of 500mg/ml MgSO<sub>4</sub> 50% into each syringe (a total of 5mls of 50% MgSO<sub>4</sub> = 2.5gm in each syringe; <b>5gm in total</b>)</li> <li>- Add 0.25mls of 2% lignocaine in each syringe.</li> </ul> </li> </ul>
<b>Before repeating MgSO<sub>4</sub>, always monitor for toxicity. Withhold or delay if any of the following:</b>	<b>If Respiratory Arrest:</b>
<ul style="list-style-type: none"> <li>• Respiratory rate &lt;16/minute</li> <li>• Patellar reflexes absent</li> <li>• Urine output &lt;30mL/hr</li> </ul>	<ul style="list-style-type: none"> <li>• Assist ventilation with bag and mask or intubation</li> <li>• Give Calcium Gluconate 1gm (10mL of 10%) IV slowly until respiration begins.</li> </ul>





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