Use of a digital job-aid in improving antenatal clinical protocols and quality of care in rural primary-level health facilities in Burkina Faso: a quasi-experimental evaluation

Abdoulaye Maïga, Anju Ogyu, Roch Modeste Millogo, Angelica Lopez-Hernandez, Matè Alonyeno Labité, Alain Labrique, Smisha Agarwal

INTRODUCTION

Burkina Faso has among the highest levels of maternal mortality rate in sub-Saharan Africa, estimated at 320 deaths per 100000 live births. The high burden of maternal deaths is in part attributable to the low coverage of critical antenatal care (ANC), intrapartum and postnatal services and poor quality of health services across the continuum of maternal care. A study across the continuum of maternal care suggests that 71% of neonatal deaths, 33% of stillbirths and 54% of maternal deaths could be averted per year by increasing intervention coverage and improving health service quality. Within the continuum of care, ANC represents a crucial intervention to avert adverse maternal health outcomes as it provides a platform for prevention, screening and diagnosis of pregnancy-related complications. ANC also provides a platform for health education to further health behaviours and decrease cultural malpractice around pregnancy and childbirth.

STRENGTHS AND LIMITATIONS OF THIS STUDY

- The study assessed the quality of antenatal care based on a comprehensive quality-of-care framework assessing multiple components and subcomponents important for antenatal care.
- We assessed the quality of antenatal care from both the supply and demand sides as patient experience has historically been a blind spot in assessing quality of health systems.
- It was a cross-sectional post-intervention assessment of quality of care between the intervention and the comparison arm but was unable to measure changes over time.
- Baseline characteristics of districts related to health facilities readiness and quality of care including prior training and knowledge of healthcare workers were not captured and could not be controlled for during the analysis.

ABSTRACT

Objective We assessed the impact of a digital clinical decision support (CDS) tool in improving health providers adherence to recommended antenatal protocols and service quality in rural primary-level health facilities in Burkina Faso.

Design A quasi-experimental evaluation based on a cross-sectional post-intervention assessment comparing the intervention district to a comparison group.

Setting and participants The study included 331 direct observations and exit interviews of pregnant women seeking antenatal care (ANC) across 46 rural primary-level health facilities in Burkina Faso in 2021.

Intervention Digital CDS tool to improve health providers adherence to recommended antenatal protocols.

Outcome measures We analysed the quality of care on both the supply and demand sides. Quality-of-care service scores were based on actual care provided and expected care according to standards. Pregnant women’s knowledge of counselling and satisfaction score after receiving care were also calculated. Other outcomes included time of clinical encounter.

Results The overall quality of health service provision was comparable across intervention and comparison health facilities (52% vs 51%) despite there being a significantly higher proportion of lower skilled providers in the intervention arm (42.5% vs 17.8%). On average, ANC visits were longer in the intervention area (median 24 min, IQR 18) versus comparison area (median 12 min, IQR: 8). The intervention arm had a significantly higher score difference in women’s knowledge of received counselling (16.4 points, 95% CI 10.37 to 22.49), and women’s satisfaction (16.18 points, 95% CI 9.95 to 22.40).

Conclusion Digital CDS tools provide a valuable opportunity to achieve substantial improvements of the quality of ANC and broadly maternal and newborn health in settings with high burden mortality and less trained health cadres when adequately implemented.

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Although Burkina Faso achieved substantial improvement in the coverage of ANC from a skilled provider (80.2% in 2018), the quality of care remains challenging particularly in rural areas where populations suffer the double burden of lower access to health services and poor quality of care. The poor quality of care can be attributed to the shortage of skilled health professionals in rural areas which often requires task shifting to lesser-skilled cadres of health workers, limited opportunities for internationally recommended treatment protocols.

Digital clinical decision support (CDS) tools are electronic systems, guidelines and protocols that are available in a digital format that guide the healthcare provider through process algorithms, checklists or step-by-step guidance based on evidence-based clinical protocols. Mobile CDS tools that systematically guide healthcare workers using algorithms based on recommended national or global protocols to deliver services at the point of care represent a promising approach to improve the quality of care. The WHO Digital Health Guideline recommends the use of digital CDS for tasks that are already defined within the scope of practice of the health worker.

The Integrated electronic-Diagnostic Approach (IeDA) is an electronic clinical decision tool developed and implemented by Terre des hommes (Tdh) Lausanne Foundation in partnership with Burkina Faso Ministry of Health. Starting in 2014, the IeDA was developed to improve provider’s adherence to protocols of Integrated Management of Childhood Illnesses (IMCI e-registry). In 2019, the IeDA platform was expanded to include a Reproductive Health and Maternity Care e-registry (REC-Maternity/IeDA-maternity). The goal of the intervention was to contribute to reducing maternal and newborn mortality by increasing midwives and nurses’ adherence to reproductive, maternal and newborn health protocols and improve quality of care by providing enhanced decision support and case management capacity. While digital CDS tools can influence the quality of health provision, there is limited evidence about the efficacy of improving health outcomes and no evidence on the potential deleterious effects. In order to ensure uptake and sustainability of such interventions, it is important that digital CDS interventions are integrated with the broader health system and are evaluated using a quality-of-care framework. The objective of this study was to assess the impact of the REC-Maternity job-aid on improving the process quality of ANC services in rural areas in Burkina Faso.

**METHODS**

**Setting**

Burkina Faso is a land-locked West African country characterised by a rapid population growth (2.9% per year) and a total population of 20,487,979 most living in rural areas (74%). The population growth is primarily driven by a high fertility rate (5.2 children per woman on average) which is one of the highest levels worldwide.

The public health sector is prominent (84%) and mainly composed of primary-level facilities. The remaining 16% are private services, with most (81%) being for profit and located primarily in Ouagadougou. The public health system is characterised by a three-tier service structure. At the first level, there are health districts (70) totalling 2041 primary health centres (Centre de Santé et de Promotion Sociale (CSPS)) and 117 district hospitals (Centre Médical avec Antenne Chirurgicale (CMA) and Centre Médical (CM)). The second level consists of the nine regional hospitals (Centre Hospitalier Régional (CHR)). Lastly, there are six national teaching hospitals (Centre Hospitalier Universitaire (CHU)) that represent the third level. The REC-Maternity intervention was implemented in primary health centres only.

**The REC-Maternity intervention**

The REC-Maternity is a CDS tool implemented by Tdh Lausanne Foundation, a Swiss non-government organisation, in collaboration with Burkina Faso Ministry of Health and Dimagi using the CommCare platform. The programme was funded primarily by Bill and Melinda Gates Foundation, European Union, UNICEF and Burkina Faso Ministry of Health. The platform comprises modules on reproductive and maternity services including prenatal care, labour and delivery care, postnatal care (PNC), post-abortion care, family planning and civil registration (online supplemental figure A1).

In addition to facilitating diagnosis and clinical decision-making, the platform aims to further learning and skill building of providers, strengthen the management of data and improve overall coordination and quality of care. The REC-Maternity intervention has been implemented in 14 health districts out of the 70 in the country from December 2019 to March 2022. During this time, 556 health centres within 14 health districts were covered by the intervention with a total of 1543 health workers trained and using the application. To facilitate adoption of the platform, eleven training sessions of 6 days each were conducted to support the adoption of the REC-Maternity platform. Joint supervision was conducted by Tdh personnel and Ministry of Health officers from the regional directorate of health. A total of 413772 women consultations and 208054 newborn consultations were conducted through the platform.

**Study design and sample size**

The study design was a plausibility (quasi-experimental) evaluation based on a cross-sectional post-intervention assessment comparing the intervention district to a comparison group. The quality of ANC was assessed on both the supply and demand sides based on a comprehensive quality-of-care framework. We conducted direct observations of clinical encounters during ANC visits in November 2021 to understand how comprehensively core elements of ANC visits were delivered at the point...
of care. The district of Toma was selected after a consultation between the programme team and the Ministry of Health. The choice was based on the argument that it was the pilot intervention district where all the consultation forms (ANC, delivery, PNC, post-abortion, family planning) were implemented. It was also a priority district for a few stakeholders including Tdh and the Ministry of Health. The comparison district (Gourcy) was selected based on a set of predetermined criteria to match Toma while minimizing selection bias. The selection criteria include health system data (number of facilities and healthcare personal), accessibility and use of health facilities (eg, population within 5 km radius of a healthcare facility), demographic characteristics (eg, total population, average number of women of reproductive ages), contextual factors (eg, security issues, COVID-19-related disruptions). There were 35 and 38 primary health centres, and a total number of 123 and 143 nurses and midwives in 2021 in Toma and Gourcy district, respectively. The total population was 232685 in Toma district with 160544 living within a 5 km radius of a health facility. These numbers were, respectively, 251267 and 163826 in Gourcy district.24

We estimated a sample of 120 direct observations of ANC encounters and exit interviews with pregnant women, each in the intervention (Toma) and comparison (Gourcy) districts with a minimum of 5 observations/exit interviews per health centre. The sample of 120 observations per district was based on the most conservative assumption of 50% as prevalence of adequate quality-of-care indicators, a precision or margin of error of 10%, a probability of committing a type I error (α) of 0.05, a design effect of 1.2 and a refusal proportion of 10%. The sample provides a precision of 8–10% depending on the indicator and was powered to detect a minimum difference of 20% between the intervention and comparison district with 80% of power. We used a systematic random sampling method stratified by county (commune) to select 24 primary health centres in each district. The sampling frame consists of 31 primary health centres in each district. We targeted a minimum of five observations and exit interviews in each health centre, depending on the total number of health workers providing ANC present on the day of the visit and who consented to participate in the study. Informed written consents were required for the facility manager and each health provider to interview. Informed oral consents were required from women seeking ANC.

Study framework and instruments

The conception of the study and the development of tools were adapted from the Service Provision Assessment (SPA) of the Demographic and Health Survey Program, as well as the Donabedian’s framework on how quality of care can be assessed.26 29 This is a comprehensive quality-of-care framework which contains modules on assessment of women’s health, routine physical examinations and tests, prophylactic treatments, counselling about birth preparation, newborn and postpartum care. These are the main quality components of the tool for the direct observation of clinical encounters. Each component comprises subcomponents which in turn were broken down into items corresponding to issues discussed during the client encounter and actions taken or suggested by the health provider (online supplemental figure A2 and online supplemental table A1). All the items were binary variables and used to construct the process quality indices or scores.

In addition to the direct observation of the provider–client interactions, we conducted an exit interview with each pregnant woman to assess whether she was provided appropriate services for the current stage of the pregnancy and her satisfaction with the clinical encounter. The exit interview also comprises socio-demographic characteristics, details about the current and past pregnancies. Recent research highlights the need to understand not just whether a clinical encounter addressed all the technical and clinical aspects, but also whether it resulted in measurable improvements in the perception of care from the clients’ perspective.27 Data collection was conducted in November 2021 by six teams composed each of a research assistant in social science and a female agent with medical background who was dedicated to the direct observation of the clinical encounter.

Analyses

We calculated a specific quality score for each quality component: health assessment, physical examination, routine tests, prophylaxis treatment and pregnancy-related counselling during the clinical encounter (online supplemental figure A2). We calculated each component score by dividing the sum of actions taken during the client encounter by the sum of expected actions for that component. The proportion was then converted into percentage score. We also computed an overall process quality score. The scores were calculated according to SPA guidelines and computation methods described elsewhere.26 28 29 We also computed the client’s knowledge and satisfaction scores from the exit interview questions. The client knowledge score is based on her understanding of counselling on iron prophylaxis, malaria prophylaxis, maintaining healthy pregnancy, delivery preparation and newborn and postpartum care. We defined the client’s satisfaction based on satisfaction items suggested by the SPA guidelines.30

We computed the mean process quality scores on weighted data accounting for survey sampling design, clustering and stratification to produce point estimates and then performed post estimation tests to determine whether the differences scores were significant.30 Survey-weighted generalised linear modelling was also used to conduct linear regression adjusting for education, type of provider at visit and whether it was the client’s first pregnancy. We ran the analyses using Stata V.16.1 and R (V.4.2.0) software.31 32
RESULTS

Characteristics of health facilities and pregnant women

In total, 331 ANC consultations (161 in the intervention district and 170 in the comparison district) were observed and exit interviews were conducted across all facilities, exceeding the minimum sample size based on the assumption of at least 5 consultations in each of the 48 health centres. We fully completed all direct observations and exit interviews. There were more providers present on the day of the interview and skilled in providing ANC in the intervention district (40) compared with the comparison district. Midwifery professionals including midwives and assistant midwives were predominant in both districts. However, the higher proportion of assistant midwives in the intervention district (40% against 11%) suggests lesser-skilled cadres in that district. Nurses and midwives’ training lasts about 3 years plus 1 year of practical work. This training is accessible to people who have completed at least 13 years of schooling. Assistant nurses and midwives are lower cadres recruited after about 10 years of schooling and trained for about 2–3 years. More consultations were conducted by higher-skilled cadres (nurses and midwives) in the comparison district than in the intervention district (81.2% vs 57.2%) (online supplemental table A2). The gestational age and pregnancy experience were similar among the pregnant women observed across the two districts. About 2 pregnant women out of 10 were at their first antenatal visit during which the woman’s health history should also be assessed (online supplemental table A3).

Process quality during antenatal care visit

Table 1 presents the overall mean quality score and score for each component by district. Individual items that constitute these scores are listed in online supplemental tables A4–A7. Overall, there were no statistically significant differences of process quality of care between the two districts; about 50% of the required process quality items were achieved in both. However, there were significant differences in the subcomponents and individual items. In both districts, about 70% of the health history items were assessed. Providers in the intervention area performed better in checking for signs, though this remained low in both areas. Physical examinations were performed well in both districts with the comparison district scoring significantly higher than the intervention. Conversely, routine tests were poorly performed in both districts (score <20), the intervention district performed significantly better than the comparison for testing of blood group and urine in particular.

<table>
<thead>
<tr>
<th>Table 1 Process quality mean score (%) by component and subcomponent</th>
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<tbody>
<tr>
<td><strong>Process quality component</strong></td>
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<tr>
<td></td>
</tr>
<tr>
<td>Health assessment</td>
</tr>
<tr>
<td>Health history</td>
</tr>
<tr>
<td>Danger signs</td>
</tr>
<tr>
<td>Physical examination</td>
</tr>
<tr>
<td>Routine tests</td>
</tr>
<tr>
<td>Anaemia</td>
</tr>
<tr>
<td>Blood group</td>
</tr>
<tr>
<td>Urine</td>
</tr>
<tr>
<td>Syphilis</td>
</tr>
<tr>
<td>Preventive treatment</td>
</tr>
<tr>
<td>Iron prophylaxis</td>
</tr>
<tr>
<td>Tetanus toxoid injection</td>
</tr>
<tr>
<td>Deworming</td>
</tr>
<tr>
<td>Malaria prophylaxis</td>
</tr>
<tr>
<td>Counselling</td>
</tr>
<tr>
<td>HIV counselling</td>
</tr>
<tr>
<td>Healthy pregnancy</td>
</tr>
<tr>
<td>Preparation for delivery</td>
</tr>
<tr>
<td>Post partum and healthy newborn</td>
</tr>
<tr>
<td>Overall quality score</td>
</tr>
</tbody>
</table>

Statistically significant differences: ns=not significant; *p<0.05; **p<0.01; ***p<0.001.
Provision of preventive treatment was high with only slight variation between both districts and by subcomponent. Iron prophylaxis prescription scored the best among the four treatments, with a score higher than 70 in the two districts followed by malaria prophylaxis (higher than 60). Deworming was not systematically provided or prescribed in either district with scores below 30. Overall, preventive treatment uptake was slightly higher in the intervention district. Counselling overall scores were similar between the two districts, with the intervention district performing better on counselling of healthy newborn and post partum (score: 46) than the comparison (score: 28). More women in the intervention district were counselled on the importance of early, prolonged and exclusive breast feeding (online supplemental table A7). HIV counselling was poor in both districts with a performance score significantly lower in the intervention district (table 1).

Figure 1 shows variation across the process quality components by type of healthcare personnel during the assessment of the women’s health history (median: 22, IQR: 56) and the counselling in the comparison district (median: 33, IQR: 53). The median scores for both items were 42 (IQR: 33) and 40 (IQR: 33), respectively, in the intervention district. This finding with higher IQR in the comparison district suggests a better standardisation of the protocol of health history assessment and pregnancy-relating counselling in the intervention district as a result of the use of the digital tools which systematically guides the health provider through the process. We also found that assistant nurses/midwives in the intervention district performed better than assistant nurses/midwives in the comparison district in fulfilling health assessment and counselling tasks. Health assessment and counselling median scores were 44 (IQR: 22) and 47 (IQR: 27), respectively, in the intervention district against 11 (IQR: 28) and 27 (IQR: 40) in the comparison district. However, there was not much difference comparing the nurse/midwife category of both districts (figure 1). Furthermore, we found that overall the performance of procedures was not statistically significant between both districts although there was a higher proportion of lesser-skilled cadres in the intervention district (42.5%) than the comparison district (17.8%) (online supplemental table A2). The use of the digital tool seems to conceal or lower the disadvantage of being less trained in the intervention district.

The duration of ANC is an additional critical quality dimension to assess whether providers are performing all required procedures. We found a significant difference between both districts regarding time spent conducting clinical encounters. The median time was for conducting ANC consultations 24 min (IQR: 18) in the intervention district. On the other hand, antenatal encounters lasted twice time less (median: 12, IQR: 8) in the comparison district (figure 2). As expected, the average time stamp was higher during the first ANC visit (median 23, IQR: 22) compared with revisits (median 16, IQR: 14) in both districts. By district, the first visit lasted 38 min (IQR: 26) in the intervention district compared with 19 min (IQR: 20) in the comparison district. More variation was however observed in the intervention district.

**Quality of care from client’s perspective**

**Client knowledge**

Pregnant women in the comparison district scored a total of 41 points in client knowledge against 57 points for those in the intervention district (table 2). The score was significantly higher by 16 points (95% CI: 10 to 22) in the intervention district after adjusting for women’s education, multiple pregnancies and type of provider at care. However, we did not find a significant difference whether the woman was educated or not, the category of health personnel and the rank of the pregnancy
Within the subcomponents, knowledge on malaria prophylaxis, healthy pregnancy, preparation for birth and postpartum care were all significantly higher in the intervention district than the comparison district. Knowledge on iron prophylaxis was slightly lower in the intervention district, however, this was not significantly different (p value: 0.69) (table 2).

**Client satisfaction**

In total, the satisfaction score was 77 (95% CI: 73 to 82) in the comparison district and 94 (95% CI: 91 to 97) in the intervention district (figure 3). The intervention district had a significantly higher score of 17 points (95% CI: 10 to 22) after adjusting for all other variables (online supplemental table A8). Across all components, the intervention district scored higher. Specifically, 7 of the 11 components (waiting time, ability to discuss problems or concerns, having privacy, medicine availability, staff treatment and treatment cost) were significantly higher in the intervention district even after adjusting for all other variables. Client satisfaction on explanation received, hours and days of service and cleanliness were not statistically significantly different between the two districts (figure 3).

**DISCUSSION**

The goal of the study was to assess the impact of the use of a digital job-aid in improving antenatal procedures and quality of care during clinical encounters in rural primary health centres, using a comprehensive quality-of-care framework and a quasi-experimental design. Our study does not suggest a statistically significant difference in the overall quality score between the intervention and comparison district. However, there were significant differences between the two districts by subcomponents of quality of care. Despite routine test scores being low in both districts, the intervention district had a higher statistically significant score across blood groups and urine tests particularly. However, the scores for preventive treatment were higher in the comparison district.

While the use of the REC-Maternity job-aid did not yield significant measurable improvements in the supply-side measured as the overall quality of health service delivery, our study observed significant improvements in the perceived quality of care, measured as client knowledge and client satisfaction with the health services. The study also suggests that despite a higher proportion of lower trained cadres in the intervention district, the supply side

<table>
<thead>
<tr>
<th>Table 2 Client knowledge score by subcomponent</th>
<th>Score by district (%)</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Client knowledge by subcomponent</td>
<td>Intervention</td>
<td>Comparison</td>
</tr>
<tr>
<td>Iron/folic prescription</td>
<td>42.0</td>
<td>42.9</td>
</tr>
<tr>
<td>Preventive treatment of malaria**</td>
<td>92.3</td>
<td>82.5</td>
</tr>
<tr>
<td>Counselling on healthy pregnancy***</td>
<td>51.3</td>
<td>32.5</td>
</tr>
<tr>
<td>Counselling on delivery preparation***</td>
<td>48.8</td>
<td>24.8</td>
</tr>
<tr>
<td>Counselling on newborn and post partum**</td>
<td>57.5</td>
<td>40.4</td>
</tr>
<tr>
<td>Total knowledge score***</td>
<td>56.6</td>
<td>41.0</td>
</tr>
</tbody>
</table>

Statistically significant differences: **p<0.01; ***p<0.001.

<table>
<thead>
<tr>
<th>Table 3 Client knowledge total score—linear regression analysis</th>
<th>Univariate (95% CI)</th>
<th>P value</th>
<th>Multivariate (95% CI)</th>
<th>P value</th>
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</tr>
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<tbody>
<tr>
<td>Variable</td>
<td></td>
<td></td>
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<td>District</td>
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<td>Comparison</td>
<td>Reference</td>
<td>&lt;0.001</td>
<td>Reference</td>
<td>&lt;0.001</td>
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<td>Intervention</td>
<td>15.65 (9.27 to 22.00)</td>
<td>&lt;0.001</td>
<td>16.07 (10.04 to 22.11)</td>
<td>&lt;0.001</td>
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<td>Education</td>
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<tr>
<td>No</td>
<td>Reference</td>
<td>0.459</td>
<td>Reference</td>
<td>0.300</td>
<td>135</td>
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<tr>
<td>Yes</td>
<td>1.87 (~3.17 to 6.91)</td>
<td>0.459</td>
<td>2.01 (~1.86 to 5.88)</td>
<td>0.300</td>
<td>135</td>
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<td>Type of provider</td>
<td></td>
<td></td>
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<tr>
<td>Nurse/midwife/nurse</td>
<td>Reference</td>
<td></td>
<td>Reference</td>
<td></td>
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<td>Assistant midwife/nurse</td>
<td>0.17 (~9.15 to 9.49)</td>
<td>0.971</td>
<td>3.26 (~9.08 to 2.57)</td>
<td>0.265</td>
<td>101</td>
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<tr>
<td>First pregnancy</td>
<td></td>
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<td></td>
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<td>No</td>
<td>Reference</td>
<td></td>
<td>Reference</td>
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<td>66</td>
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<tr>
<td>Yes</td>
<td>3.58 (~2.99 to 9.25)</td>
<td>0.680</td>
<td>2.67 (~2.60 to 7.94)</td>
<td>0.313</td>
<td>265</td>
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</table>
quality scores were comparable for health assessment and counselling in the intervention and comparison districts. Additionally, the lower variation of health assessment and counselling scores across healthcare personnel in the intervention district may suggest a better standardisation of procedures due to the digital tool which systematically guides them. The strength of this study was in its assessment of quality of care from both supply and demand sides as in other studies patient experience is often ignored. Our adapted quality-of-care framework allowed granularity into which subcomponents were of poorer standards.

As a cross-sectional study, we are unable to measure changes in quality of care over time attributable to the REC-Maternity job-aids. The intervention and comparison districts were matched on several variables to be comparable, but that does not capture baseline differences that might have existed in the training of healthcare workers, and the availability of supplies and commodities, all of which have significant impacts on the quality of care. For example, we observed that preventive treatment, which depends on multiple factors like the rank of the visit, gestational age, availability of commodities and tests, etc35–37 WHO suggests that 30–40 min are expected for a first antenatal visit and about 20 min for the second visit.38 In this study, the median duration for a first ANC visit was 38 min in the intervention district against 19 min in the comparison district. The time stamp for revisits was 23 min and 11 min in the intervention and comparison district, respectively. We can assume a higher likelihood for comprehensive and quality services during a longer consultation time. However, as has been seen in other studies in sub-Saharan countries, the duration does not necessarily imply comprehensive delivery of recommended care.39 This finding should also be interpreted with caution, as it might also indicate that providers using a digital tool needed more time to navigate the system.

CONCLUSION
Health providers’ adherence to recommended antenatal standards and protocols represents a critical requirement to achieve substantial improvement of quality of maternal healthcare. The aim of this study was to assess the impact of digital CDS tools in improving adherence to protocols, recommended procedures and overall quality of care. We assessed the quality of care on both the supply and demand sides. The overall quality-of-care delivery was largely comparable across the intervention and comparison district despite a significantly higher proportion of lower-skilled cadre (ie, assistant midwives in the intervention districts compared with nurses and midwives in the comparison district) in the intervention district. This might suggest that the use of a decision support tool contributed to guiding the assistant midwives in their delivery of care.

While substantial improvements were not observed in the supply side, they were observed on the demand side, where patients in the intervention district had higher knowledge scores across all subcomponents (malaria prophylaxis, healthy pregnancy, preparation for birth and postpartum care), as well as higher perceived quality of care (waiting time, ability to discuss problems, privacy, staff treatment and costs). Attention has recently been drawn to the importance of relational components and social experiences, including ‘accountability, trust and perceptions of responsiveness and respect’ in assessing quality of care.34 Patient experience has historically been a blind spot in assessing quality of health systems, but research suggests that positive experience is linked to better technical quality, improved retention in care, adherence to treatments and confidence in health systems.27 It determines when and where people seek care.

Our study also indicated that clinical encounters in the intervention area were, on average, longer than those in the comparison areas. Research suggests that the total time spent with a provider is also associated with better trust in the health systems.27 An optimal duration of ANC encounter may not be straightforward to define. It depends on multiple factors like the rank of the visit, gestational age, availability of commodities and tests, etc35–37 WHO suggests that 30–40 min are expected for a first antenatal visit and about 20 min for the second visit.38


Figure 3 Client satisfaction score by component and district.
On the demand side, there was significantly higher knowledge and perceived quality of care by clients in the intervention district. This is a critical finding as positive experience by clients is known to be linked to better technical quality, improved retention in care, adherence to treatments and confidence in health systems.

In sum, while the overall quality-of-care scores was similar across districts, patients were more satisfied with the health services in the intervention district, which in turn, would lead to a higher healthcare seeking behaviour and potentially a decreased risk for maternal mortality. When adequately implemented, digital CDS tools can be innovative solutions to improve the quality of ANC and more broadly maternal, newborn and population health in settings with high burden mortality and less trained health cadres. Given the mixed evidence on the effectiveness of CDS tools on health outcomes, it is important that implementers of digital technologies critically consider whether a digital tool is appropriate, and how it might fit into existing workflows. Evaluators must also consider any advantages that digital tools may offer beyond improvements in service delivery, such as efficiencies in data capture, use and responsiveness, as well as aspects of client satisfaction.

### REFERENCES


33 Fasio B. Ouagadougou. 2021: 117.


