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A Quality Improvement Collaborative for Adolescents Living With HIV to Improve Immediate Antiretroviral Therapy Initiation at 25 Health Facilities in Lusaka, Zambia

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Abstract

HIV testing with rapid antiretroviral therapy (ART) initiation are life-saving interventions for adolescents living with HIV. However, in Zambia, HIV diagnosis and immediate ART initiation among adolescents living with HIV is lagging. In collaboration with the Zambian Ministry of Health, the U.S. Health Resources and Services Administration, the U.S. Centers for Disease Control and Prevention in Zambia, and ICAP at Columbia University designed and implemented a quality improvement collaborative (QIC) to improve adolescent immediate ART initiation at 25 health facilities in Lusaka. Over the 12-month implementation period, quality improvement teams tested and identified targeted intervention, that significantly improved ART initiation within 14 days of receiving positive test results, from 24% at baseline to more than 93% for the final 6 months of implementation. The quality improvement collaborative approach empowered health care workers to innovate addressing the root causes of suboptimal performance and produced a package of successful interventions that will be shared throughout Zambia.

Key words: Adolescent HIV, ART, collaborative, QI, Zambia

Zambia, a lower-middle-income African country, has a generalized HIV epidemic and a prevalence of 11.3% among adults (ages 15–49 years), with 1.2 million people living with HIV (PLWH; Joint United Nations Programme on HIV/AIDS [UNAIDS], 2019). HIV incidence is slowly decreasing, and in 2018, the incidence was 2.97% among all people of all ages (UNAIDS, 2019). Over the past decade, Zambia has made substantial progress toward achieving the 2030 UNAIDS 95-95-95 targets of 95% of PLWH will know their HIV status, 95% of people who know their HIV status will be accessing treatment, and 95% of people on treatment will have suppressed viral loads (UNAIDS, 2014). In 2018, the Zambian Ministry of Health (MoH) HIV program efforts had achieved 87% of PLWH knowing their status, of which 89% of PLWH were on treatment,

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and of which 75% were virally suppressed (UNAIDS, 2019). Analysis indicates that special populations have not achieved full realization of the 2030 targets, including adolescents (defined by UNAIDS as ages 10–19 years old), especially adolescent girls, who are disproportionately affected by HIV.

Background

HIV is the leading cause of death for adolescents globally and in Zambia (Lake & Sidibé, 2016). Although 70% of adolescents living with HIV (ALWH) in Africa acquired the infection in utero or as infants from their mothers who were living with HIV, adolescents are especially vulnerable to new HIV infection as well (STOP AIDS, 2016). Numerous sociocultural and behavioral risk factors increase an adolescent's risk, including engagement in condomless sex, sexual debut before the age of 15 years, child marriage, and having older sexual partners who also have multiple concurrent sexual partners (STOP AIDS, 2016). Zambian 2018 administrative program data highlight that diagnosis and treatment for adolescents and young people are suboptimal, with merely 42% of individuals between the ages of 15 and 24 years being aware of their HIV status, 72% on HIV treatment, and 71% of those on treatment virally suppressed (PEPFAR, 2018).

Rationale

National HIV programs must ensure that adolescents have timely identification of HIV with rapid antiretroviral therapy (ART) initiation to achieve targets and, ultimately, epidemic control. To reach ALWH, the Government of Zambia rolled out the National AIDS Strategic Framework 2017–2021 and the new Adolescent Health Strategy 2017–2021 (UNICEF, n.d). Zambian HIV national guidelines dictate that all adolescents (ages 10–19 years) receive HIV testing in all service delivery points (SDP) within health facilities (HFs) and in community-based settings. If found to be living with HIV, ALWH should be started on ART on the same day or within 2 weeks (Zambia Consolidated Guidelines for Treatment and Prevention of HIV Infection, 2016).

Notwithstanding the ubiquitous availability of adolescent-specific policies, program standards, training, staff, and supplies, current data point to a considerable "know-do gap" that impedes consistent and high-quality delivery of adolescent-focused services. This common phenomenon, the "know-do gap," describes the large difference between what health care workers (HCWs) know should be done and what health systems actually do to improve health outcomes (Haines et al., 2004). Utilization of contemporary quality improvement (QI) methods continues to grow in popularity to address this challenge by empowering HCW teams to select a quality challenge, systematically identify root causes, design locally appropriate interventions, and conduct rapid, iterative tests of change that, ultimately, lead to sustained system improvements (Heiby, 2014).

ICAP at Columbia University partnered with MoH, the Lusaka Urban District (LUD) Health Management Team (DHMT), the U.S. Centers for Disease Control and Prevention (CDC) in Zambia, the U.S. Health Resources & Services Administration (HRSA), and local implementing partners to address the ALWH testing and ART initiation gap. ICAP at Columbia University responded to this quality challenge by using the well-established QI Collaborative (QIC) approach. The QIC approach empowers vanguard HCWs to explore and address the root causes of suboptimal adolescent HIV testing and meager performance with rapid ART initiation. The QIC was implemented at 25 high-priority HFs in the LUD, a densely populated area in Lusaka Province that has the highest HIV prevalence (16.6%) in Zambia.

Methods

Context

Quality improvement collaborative design phase. The QIC system is an evidence-based approach in which QI teams from multiple HFs work together to address a shared quality challenge with the support of external experts and coaches (Catsambas et al., 2008; Franco & Marquez, 2011). Typically implemented over a 12- to 18-month period, QICs include identification of a shared quality challenge, as well as development of a shared target ("aim statement") and indicators. Following training and baseline data collection, multidisciplinary teams at each HF are supported to identify innovative, locally designed change ideas and, subsequently, perform swift, iterative, and ongoing tests of change using the Model for Improvement and Plan, Do, Study, Act cycle methodology. Quarterly in-person learning sessions provide a venue for participants to share successful change ideas and innovations while comparing their progress to the shared targets; friendly competition often provides additional social incentives and extrinsic motivation for teams to improve performance (Tawfik et al., 2012). Between learning sessions, QI teams are supported with monthly mentoring and data supervision visits. At the end of each QIC, a "change package" of tested interventions, tools, and related innovations is

developed to disseminate and scale-up improvement to additional facilities and regions (Wells et al., 2018).

Quality Improvement Collaborative project launch. Beginning in March 2018, ICAP at Columbia University launched the QIC to improve ART initiation among ALWH (ages 10–19 years) in collaboration with a panel of technical experts, including representatives from the Zambian MoH, U.S. CDC in Zambia, HRSA, Lusaka-based province and district leaders, and local partner stakeholders. Design phase activities included site selection, development of QIC indicators, baseline data collection, and analysis. Eligibility criteria for site selection included support from the U.S. President's Emergency Plan for AIDS Relief (PEPFAR), a minimum of 10 ALWH identified in the past year, previous staff training on adolescent HIV services, and already had an existing QI team at the HF. Twenty-five HFs were selected, which included five first-level referral hospitals, 16 health centers, and four health post dispensary level facilities. In Zambia, the health service delivery system has three levels, which includes (1) the health post dispensary level, where basic community-level health services are provided primarily by nurses, (2) the health center level, where a higher level of diagnostic and treatment services are available, and (3) the first-level referral or specialist hospitals, where a comprehensive package of advanced diagnostic, surgical, emergency, and maternity services are available and provided by medical specialists (Directorate of Clinical Care and Diagnostic Services, 2016).

Twelve-month retrospective baseline data (August 2017 to July 2018) were collected for the QIC shared indicators. Baseline aggregate monthly data were abstracted from national MoH HF registers by facility staff using a standardized paper-based tool. Zambian MoH registers included ART, linkage, HIV testing and counseling, index testing registers, along with the longitudinal HIV care and treatment register. ICAP Zambia staff entered the data into an ICAP at Columbia University District Health Information Systems (DHIS2) database and conducted descriptive analyses using basic summary statistics and time series analyses on run charts.

In April 2018, an adolescent HIV service delivery situational assessment was conducted at each of the 25 HFs to promptly analyze performance to the national quality standards specific for adolescents and youth-friendly HIV care and treatment services. ICAP Zambia developed a checklist of general standards for youth-friendly service delivery inputs and processes such as facility hours, costs of services, appropriate staffing, peer education and counseling, consent requirements, and data quality. Teams of ICAP Zambia, MoH, province and district leaders, along with local partners, performed the HF assessments, and findings confirmed the presence of numerous "know-do" quality gaps at most sites. Assessments demonstrated that although most of the 25 HFs had staff specifically trained in adolescent HIV with focal persons available, all HFs had few high-quality adolescent and youth-friendly services actually readily available. Other issues identified included poor data quality, significant time lags between identification and treatment initiation, and significant numbers of newly identified adolescents lost to follow-up. Building on these discoveries, a panel of technical experts developed a QIC shared driver diagram that included nationally endorsed drivers with suggested change interventions grounded in evidence-based practices for youth-friendly HIV services. A useful and practical QI tool, a driver diagram is a visual display of a team's theory of change to achieve the project aim. Used as a hands-on design and implementation tool, it provides a clear picture of a QI team's shared vision and is useful for communicating to a range of stakeholders where a team is testing and working (Svoronos & Mate, 2011). The QIC driver diagram served to provide HF QIC teams with recommended change interventions categories to further define and adapt for their own specific needs.

Based on leadership technical expertise and the 12-month baseline data HFs established the QIC aim to focus efforts on achieving: 25 HFs in LUD with aims to increase the proportion of adolescents (ages 10–19 years) who are initiated on ART within 14 days of receiving a positive HIV test result from 25% to 95% between August 2018 and July 2019.

The QIC also agreed to track indicators developed through a process mapping of critical steps beginning with HIV testing at all key service delivery points (SDP) through to ART initiation. QIC shared indicators included:

- Percent of new ADWH (Adolescents Diagnosed with HIV) per SDP by age group and sex (SDP includes: Voluntary Counseling and Testing, Outpatient Department [OPD], Maternal and Child Health [MCH], Index Testing, and Community Outreach)
- Percent of new ADWH initiated on ART by age group and sex (including positives tested but not initiated in previous months)
- Percent of new ADWH initiated on ART the same-day HIV diagnoses are received by age group and sex
- Percent of ADWH initiated on ART within 14 days of receiving positive test results by age group and sex.

Intervention

Quality improvement collaborative implementation phase. ICAP Zambia convened the first learning session in July 2018 for QIC teams from the 25 participating

HFs showcasing a QI curriculum based on nationally relevant and practice-based QI training methods (Dougherty et al., 2018). HF QI teams comprised three HIV program nurses and the nurse-in-charge. The 4-day QI capacity-building workshop provided participants with training on contemporary QI science tools, including the Model for Improvement and the Plan, Do, Study, Act cycle methodology. Participants performed root cause analyses using fishbone diagrams and process maps and generated change ideas based on the system weaknesses, bottlenecks, and barriers to adolescent ART initiation. The HF QI teams then prioritized potential change ideas from the QIC driver diagram using a prioritization matrix tool and practiced tracking progress with run charts consolidating their QI and adolescent ART knowledge. Each team left the first learning session with a well-constructed QI strategy with plans to implement and test their first change ideas immediately on returning to their facilities.

Following the first learning session, monthly supportive supervision visits were made to each facility by ICAP Zambia staff in collaboration with the MoH, province and DHMT officers, and local partners. From August 2018 to September 2019, ICAP Zambia led over 300 supportive supervision and QI coaching visits to the 25 HFs. During supportive supervision visits, ICAP Zambia QI and monitoring and evaluation staff provided coaching and mentorship to strengthen QI skills and build capacity among the HF staff. ICAP Zambia worked with each facility team to review key QI concepts and progress toward achieving the QIC aim. Each month, the collaborative supervision team reviewed change interventions to gauge their effect on program data.

Between August 2019 and September 2019, ICAP Zambia convened three additional follow-up face-to-face learning sessions for peer exchange on a quarterly basis (November 2018, March 2019, and August 2019). These 2-day learning sessions provided a platform for HF QI teams to present progress toward achieving the shared aim, exchange best practices and lessons learned, review aggregate data, discuss implementation challenges, and collectively develop solutions.

Study of the Intervention

On completion of the QIC in September 2019, results were shared at a stakeholder meeting convened with the MoH, Province and DHMT officers, U.S. CDC in Zambia, HRSA, PEPFAR Zambia agency representatives, and implementing partners. The final stakeholder meeting provided aggregate QIC data review and successful strategies. A "change package" of the most successful interventions and tools was reviewed, and time was provided for stakeholders to develop a draft plan for dissemination outside the original QIC.

Measures and Analysis

Health facility QI teams used a paper-based tool to collect monthly performance data that were plotted on run charts to track monthly progress and link progress to targets with change interventions. ICAP Zambia staff then entered the aggregate anonymized data from each HF into a secure, online District Health Information Software (DHIS2) database for storage and analysis of descriptive statistics. Using the ICAP DHIS2 database, ICAP Zambia generated aggregate and site-level visualizations to monitor progress toward improvement. Data quality assurance verifications were built into the DHIS2 database and systematically reviewed; errors identified were immediately addressed with support from HF QI teams.

Facility-level and aggregate data for the shared indicators were monitored monthly and analyzed quarterly. Aggregate data were analyzed quarterly and at the conclusion of the project. QIC indicator performance was assessed for each participating facility during the 12-month period (August 2018 to July 2019); the mean, median, and range across facilities were calculated at the conclusion of the QIC. Time series analysis using all the HF run charts was performed to demonstrate the magnitude, speed, and sustainability of improvements made during the QIC in respect to the QIC aim indicator only.

In addition to the descriptive statistics, performance during the 12-month baseline period (August 2017 to July 2018) was compared with performance during the 12-month intervention period (August 2018 to July 2019) using the Wilcoxon signed rank statistical test, which was performed in STATA® version 13 (StataCorp. 2013).

Results

All 25 HFs participated in the QIC for the full 12-month intervention period. Learning sessions were well attended, with an average of 125 participants per session. The QI teams tested interventions suggested in the QIC driver diagram over 12 months, including locally adapted interventions designed to improve primary drivers related to clinic flow, community engagement, client factors, health workforce factors, and data quality (Table 1).

Aggregate data showed that these local, QI team-grown and focused change interventions and the QIC

Table 1. Successful Change Interventions

Change Idea	Key Steps in Change Idea Implementation
Clinic workflow process improvements	
Use adolescent peer educators from the HF youth-friendly space to conduct escorted referrals from all HIV testing points to the ART clinic provider(s) to prevent delays in ART initiation	Following meetings between appropriate departments and staff, selected peer educators from the youth-friendly designated space are placed at all service delivery points to identify and escort adolescents from registration through HTC to ART services. Linkage of all ALWH to ART services are monitored and confirmed using the HTC, linkage, and ART registers.
Pair peer educators of adolescent ART clients with new adolescents on ART to provide a support system and deter refusals; interactions between peer educator and adolescent during the escort process through different service delivery points along the client flow also provides an opportunity for ongoing counselling	A meeting is conducted to orient all adolescent peer educators on the change idea, and volunteers for the intervention were requested. A timetable is drawn to ensure that adolescent peer educators are readily available to provide counselling in the youth-friendly space.
Escort referrals from the community-based HIV testing to the ART clinic prevents missed opportunities and improves the linkage to ART services for ALWH	Implementing partners who support HTC services in the community are requested to conduct escorted referral to the ART clinic for all ALWH. Complete records of contact details of all ALWH are generated to facilitate easy follow-up, particularly if same-day initiation is not possible.
Use peer educators to conduct intensified index testing with immediate escorted referral to ART provider to increase access for at-risk sexual partners and siblings of ALWH	Lists of ALWH are generated from the HTC registers. The lists of ALWH are shared with counsellors, who conduct community outreach and indexing activities. Mothers living with HIV are linked to community implementing partners for HTC-focused home visits with escorted referral to ART providers for ALWH. All newly tested ALWH were counselled to disclose sexual partners during enrolment into care via index testing protocols.
Include an ART provider on the outreach team during HIV testing at sporting events, VMMC campaigns, and other community outreach activities to improve linkage to ART services for ALWH through on-site ART initiation	An ART provider is assigned to the outreach team providing HTC services. A duty roster is drawn and posted at all service delivery points to coordinate ART providers. Immediate escorted referral services are readily available to bring newly diagnosed adolescents to the HF for same-day ART initiation.
Secure a private, age-appropriate, and designated space for "youth-friendly services" for all adolescent service provision	The head administrator requests a tent from the District Health Office to provide a safe space for adolescent HTC and ART initiation services. Community sensitization campaigns are conducted to provide information on the adolescent-friendly space.
Establish an ART enrolment room at OPD	Appropriate space identified to conduct ART enrolment in the OPD for immediate ART start. Escorted referral from HTC to ART services at enrolment room is conducted by peer educators.
Data quality improvement	
Ensure that contact information is recorded accurately and completely to facilitate easy follow-up of ALWH	Registers are reviewed daily by the senior counsellor to quickly identify gaps in contact information. Staff meetings are held to discuss and ensure a shared understanding of the need for complete and accurate client contact information. Staff are required to verify contact details such as cell phone numbers by calling number on the spot.

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Table 1. (*continued*)

Change Idea	Key Steps in Change Idea Implementation
Conduct daily reviews with correction of all discrepancies of all registers including the HTC, index, linkage, and ART registers to improve data quality oversite	All relevant registers are collected at the end of each day and reviewed by the head nurse and the senior counsellor to assess completion and to identify any gaps in documentation. Meetings are held to understand common causes of documentation gaps. Ongoing orientation on register completion is provided for all new counsellors.
Health care worker mentoring and training improvements	
Conduct orientation session(s) on adolescent ART initiation for nurses and clinicians to improve provider confidence and prevent delayed initiation	An orientation session is conducted on adolescent ART initiation, care, and treatment algorithm for clinicians and nurses. Following the orientation, adolescent ART initiations are monitored through scheduled review and analysis of data on selected indicators.
Experienced counsellors should mentor inexperienced ones to improve counselling skills for HTC and immediate ART initiation	A schedule is created to match up experienced and inexperienced counsellors for at least three mentoring sessions. Direct daily supervision is provided by the head nurse and the senior counsellor.
Enhanced community engagement	
Conduct community-based health education campaigns at schools, churches, colleges, and other adolescent hot spots to increase uptake of HIV testing and ART services	Schools, churches, and other community hot spots for adolescents in the health facility catchment area are identified. Age-appropriate health education messages are developed and pulled from existing materials. Posters with key messages are developed and strategically placed to grab the attention of adolescents. Official communication is provided to schools and churches on the planned intervention. A duty schedule is drawn to coordinate staff participation.
Conduct community education campaigns that encourage parents and caregivers to bring adolescents, especially children ages 10 to 14 years, for HTC and immediate ART initiation	Appropriate health messages for community education are developed. Nurses, community health workers, and HTC committees are assigned to conduct the intervention.
Assign a specific day for adolescent health services to increase access for adolescents	Specific day for adolescent health care services is selected. Community sensitization on adolescent day is conducted and led by adolescent peer educators. Pharmacy and clinical visits for adolescents are scheduled to align with selected adolescent health care service days.

Note. ALWH = adolescents living with HIV; ART = antiretroviral therapy; HF = health facility; HTC = HIV testing and counseling; OPD = outpatient department; VMMC = voluntary medical male circumcision.

approach itself substantially improved ART initiation for ALWH within 14 days of receiving positive test results, from 24% at baseline to more than 93% for the final 6 months of the QIC. Same-day ART initiation improved from 27% at baseline to more than 92% for the final 6 months of the QIC. The average number of months with at least one newly identified ALWH at every HF was 12 of 12 months (median, 12; range, 5–12). On average, it took each HF 2.8 months (median, 1; range, 1–9) to reach the 95% QIC aim. After achievement of the 95% aim, the average number of months each HF sustained greater than 95% was 7.7 months (median, 8; range, 1–11). On average, each HF that achieved the aim had an unbroken stretch of 6 months (median, 7; range, 1–11) where HF sustained performance of 95% or above. It is noteworthy that facilities that were observed to drop below the aim during the implementation phase were found to have identified only small numbers of ALWH (typically less than 5) during the observed months. This translated into

large percentage drops when even one individual was not initiated with 14 days (Table 2).

Statistically significant gains were made when comparing the baseline and intervention monthly mean data for the percentage of newly diagnosed ALWH ages 10–19 years who were initiated on ART within 14 days of receiving a positive test result. Wilcoxon signed rank test demonstrated that at the 95% confidence level there was sufficient evidence to conclude that the observed increase in the average percentage of newly diagnosed ALWH initiated within 14 days of receiving a positive test result was greater during the project implementation phase (August 2018 to July 2019) than the baseline phase (August 2017 to July 2018; $z = -3.061$; $p = .0022$, one-tailed). This statistical test was deemed appropriate to use for these data as two mean values were being compared and normality could not be assumed for the datasets in question. Although causation was not demonstrated, available evidence suggests that it could be postulated that the observed increase was correlated to the interventions implemented during the QIC.

Discussion

Summary

During the 12-month intervention period, 205,232 adolescents received HIV testing, of which 3,355 tested positive (1.6% yield). Our analysis highlights several important elements of process and performance improvement regarding improved HIV testing efficiencies. In March 2019, QIC teams implemented a new Zambian MoH national HIV testing screening tool that had previously not been implemented consistently. The national MoH screening tool was designed to assist HCWs to identify undiagnosed ALWH in a more resource-friendly, efficient, and effective manner. As shown in Figure 1, identification of ALWH improved while the volume of testing numbers remained stable, suggesting that HCWs had improved screening and identification of higher at-risk adolescents. Figure 1 also confirms that adolescent females are testing and testing positive with higher frequency than adolescent males. Although not adequately sufficient, male testing numbers did demonstrate improvement during the intervention period, suggesting that efforts to increase male testing were effective and should be further explored for future implementation.

The aggregated data presented in the run chart in Figure 2 show that during the implementation period there was significant improvement in ART initiation, especially for same-day initiation, while also greatly reducing the number of adolescents who did not initiate

Table 2. Quality Improvement Collaborative Project Data Table Including 12-Month Baseline Data (August 2017 to July 2018) and 12-Month Implementation Data (August 2018 to July 2019)

Indicator(s)	August 2017	September 2017	October 2017	November 2017	December 2017	January 2018	February 2018	March 2018	April 2018	May 2018	June 2018	July 2018	August 2018	September 2018	October 2018	November 2018	December 2018	January 2019	February 2019	March 2019	April 2019	May 2019	June 2019	July 2019
Number of new ADWH (10–19 years)	132	133	121	134	128	124	108	170	133	114	141	115	205	186	150	165	137	144	145	131	141	139	120	139
Number of new ADWH (10–19 years) initiated on ART within 14 days of receiving HIV results	28	29	26	31	28	30	43	62	58	69	64	48	145	129	123	137	127	132	143	126	135	134	112	138
Percent new ADWH (10–19 years) initiated on ART within 14 days of receiving HIV results	21%	22%	21%	23%	22%	24%	40%	36%	44%	61%	45%	42%	71%	69%	82%	83%	93%	92%	99%	96%	96%	96%	93%	99%
Number of new ADWH (10–19 years)	6,832	6,428	4,019	5,722	7,242	6,395	6,320	8,184	7,193	7,584	7,154	6,101	15,353	12,495	9,520	9,750	10,368	10,245	11,588	11,712	10,585	10,032	7,853	6,557
Number of new ADWH (10–19 years)	132	133	121	134	128	124	108	170	133	114	141	115	205	186	150	165	137	144	145	131	141	139	120	139
Percent of new ADWH (10–19 years)	2%	2%	3%	2%	2%	2%	2%	2%	2%	2%	2%	2%	1%	1%	2%	2%	1%	1%	1%	1%	1%	1%	2%	2%

Note. ADWH = adolescent diagnosed with HIV; ART = antiretroviral therapy.

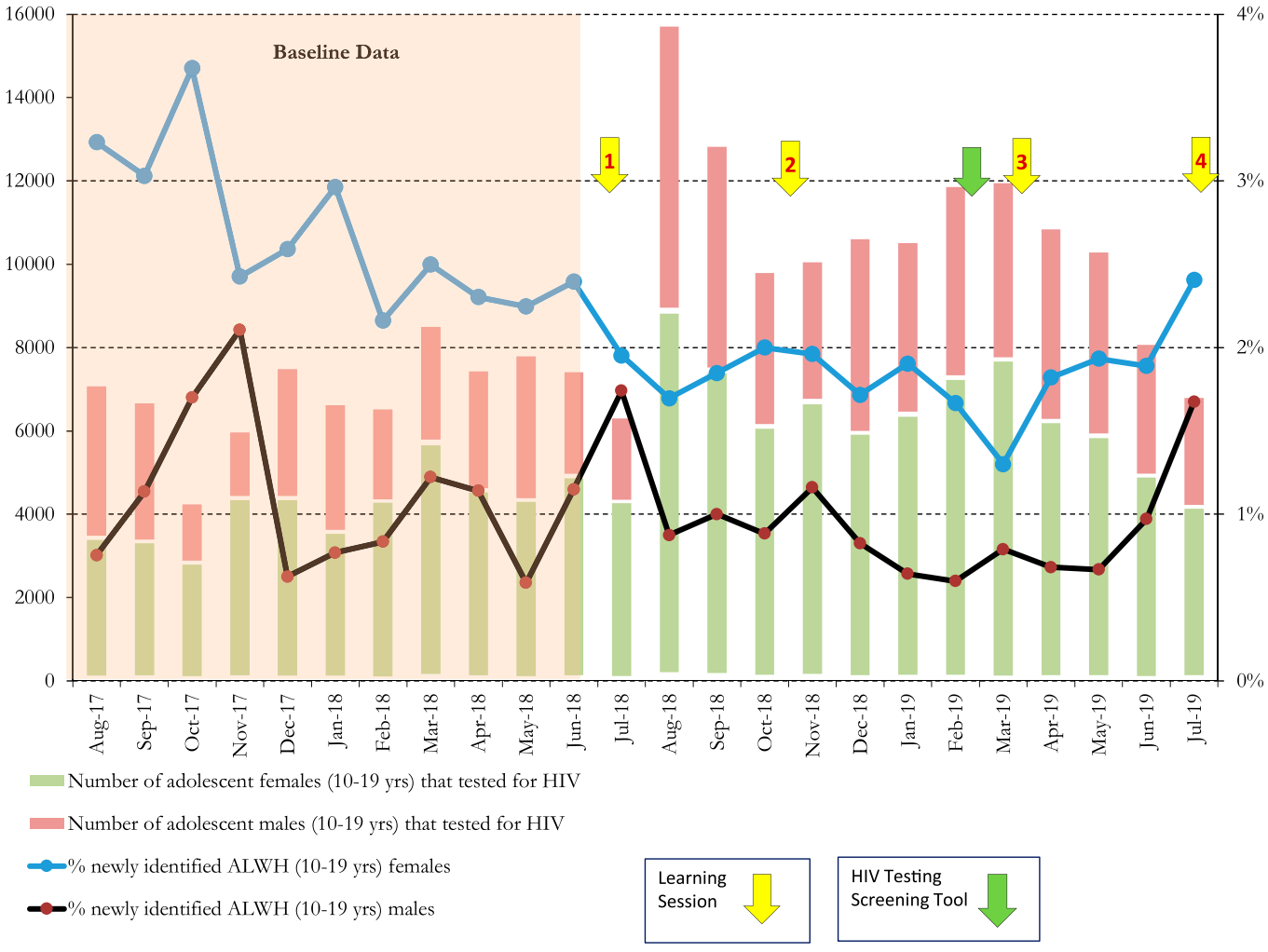

Figure 1. Number of ALWH tested for HIV in all service delivery points (SDPs) by age band and gender and HIV positivity yield. *Note*. ALWH = adolescent living with HIV. This figure is available in color online www.janacnet.org.

ART at all and are considered "missed opportunities." During the QIC design phase, the Zambian MoH operational definition of "same day ART initiation" included all newly identified clients with HIV who are initiated on ART within 14 days of diagnosis. However, the MoH encouraged HF HCWs to start ART immediately after diagnosis within the same 24-hr period—especially for adolescents and other special populations. Our analyses show that during the QIC implementation period, same-day initiation improved. Same-day initiation is a key strategy to reduce the number of ALWH who never initiate ART and who are considered lost to follow-up. Improvement was noted almost immediately after the first learning session and continued to improve. By February 2019, the QIC as a whole had achieved the aim and consistently sustained improvement through the final months of the project.

Figure 3 provides a graphical display of two observed changes: first, a substantial reduction in interfacility performance variation and, second, a collective increase in performance toward the QIC aim of ART initiation within 14 days of HIV diagnosis. It is a well-known concept that reduction in process variation is critically important and is directly responsible for outcome improvement in health care (Diaz & Neuhauser, 2005). Figure 3 highlights important reductions in HF performance variation regarding same-day initiation between the baseline and intervention periods. The large amount of variation in performance between the HFs clearly supports the evidence of poor performance in same-day initiation while demonstrating the inconsistent and irregular implementation of MoH ART initiation policies and standards. Figure 3 provides clear evidence that the QIC learning sessions, supportive supervision visits, and the change interventions rapidly and substantially reduced performance variation, and by the sixth month, the QI teams were consistently able to achieve the 95% aim. This seems to suggest that peer-to-peer learning and friendly competition are essential to the success of the QIC approach and may

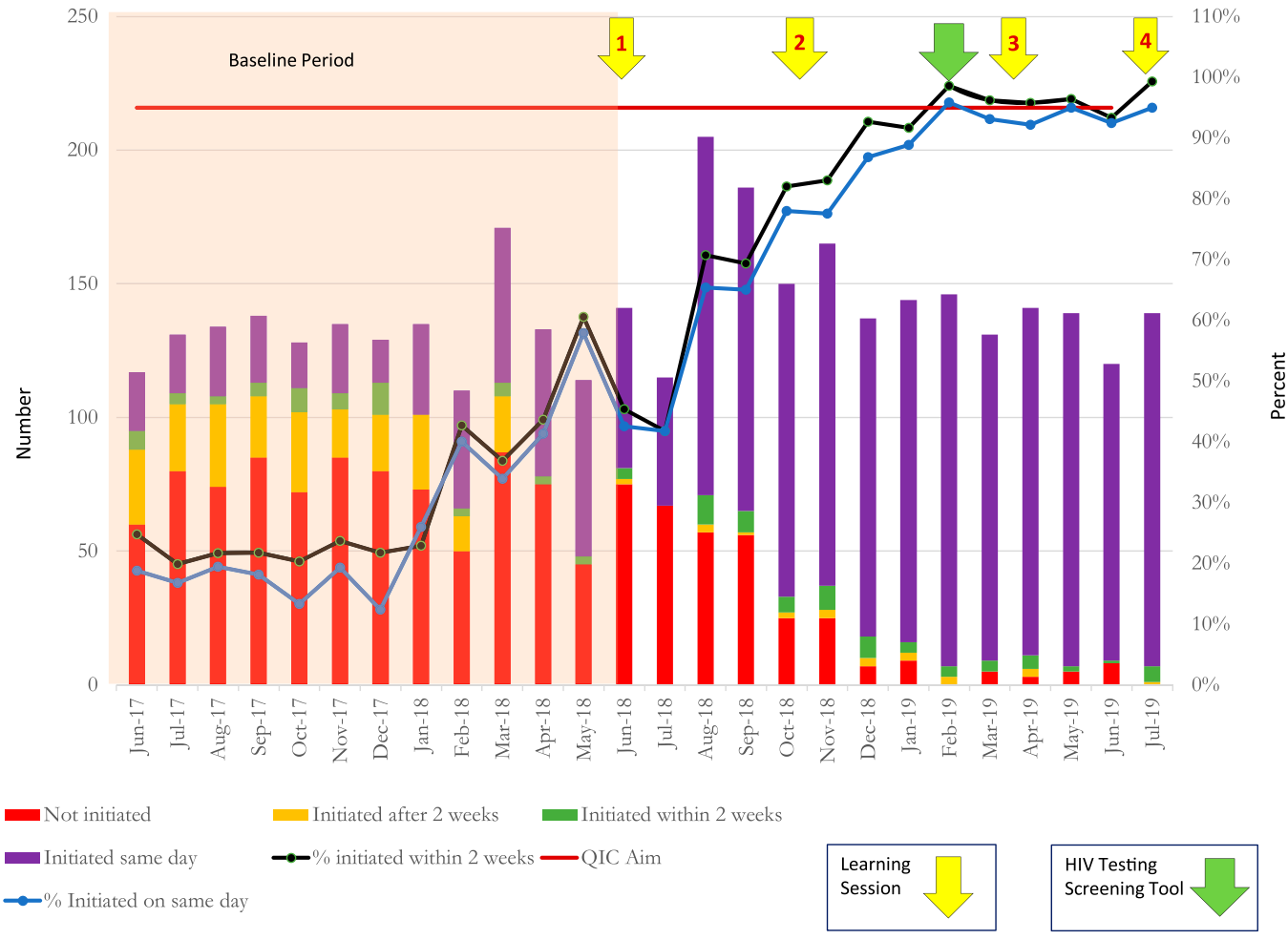

Figure 2. Number and percent of adolescents initiated on ART with baseline and implementation data included. *Note*. ART = antiretroviral therapy; QIC = quality improvement collaborative. This figure is available in color online www.janacnet.org.

enhance HCW compliance with established standards. Lower performing HF teams learn from higher performing HF teams and are able to quickly and rapidly implement changes that demonstrate clear improvement. Our analysis shows that the QIC results are consistent with other published reports of QI projects and QICs, which have shown significant success in enabling facility-level QI teams to design, test, and scale contextually appropriate interventions that improve the quality of health services (Dougherty et al., 2019; Hargreaves et al., 2019; Kassa et al., 2020; Rabkin et al., 2019).

Limitations

Similar to other QIC projects, there was no control group, so results at these 25 HFs cannot be compared with sites not participating in the QIC or generalized to other HFs. However, Neuhauser and Diaz (2007) indicate that randomized control trials to assess QI project success are likely to be an unsuitable method to study QI implementation performance. The intention of QI is to implement evidence-based practices and use generalized knowledge while measuring the progress of interventions and data variation over time. Therefore, statistical process control methods, such as the use of run charts, is the preferred method to monitor for performance improvement over the performance of randomized control trials (Diaz & Neuhauser, 2005).

Conclusions

Globally, adolescents, especially girls, are a special population that is highly vulnerable to HIV and faces complex social and cultural challenges to ensuring identification through testing with rapid treatment initiation. Zambia has made important achievements toward the UNAIDS 95-95-95 targets. However, data indicate that HIV diagnosis with immediate ART for ALWH is an especially problematic period, with missed ART initiation opportunities and eventual clients lost to follow-up. Using the core tenets of the QIC approach, ICAP at Columbia University empowered HCWs to explore and address the root

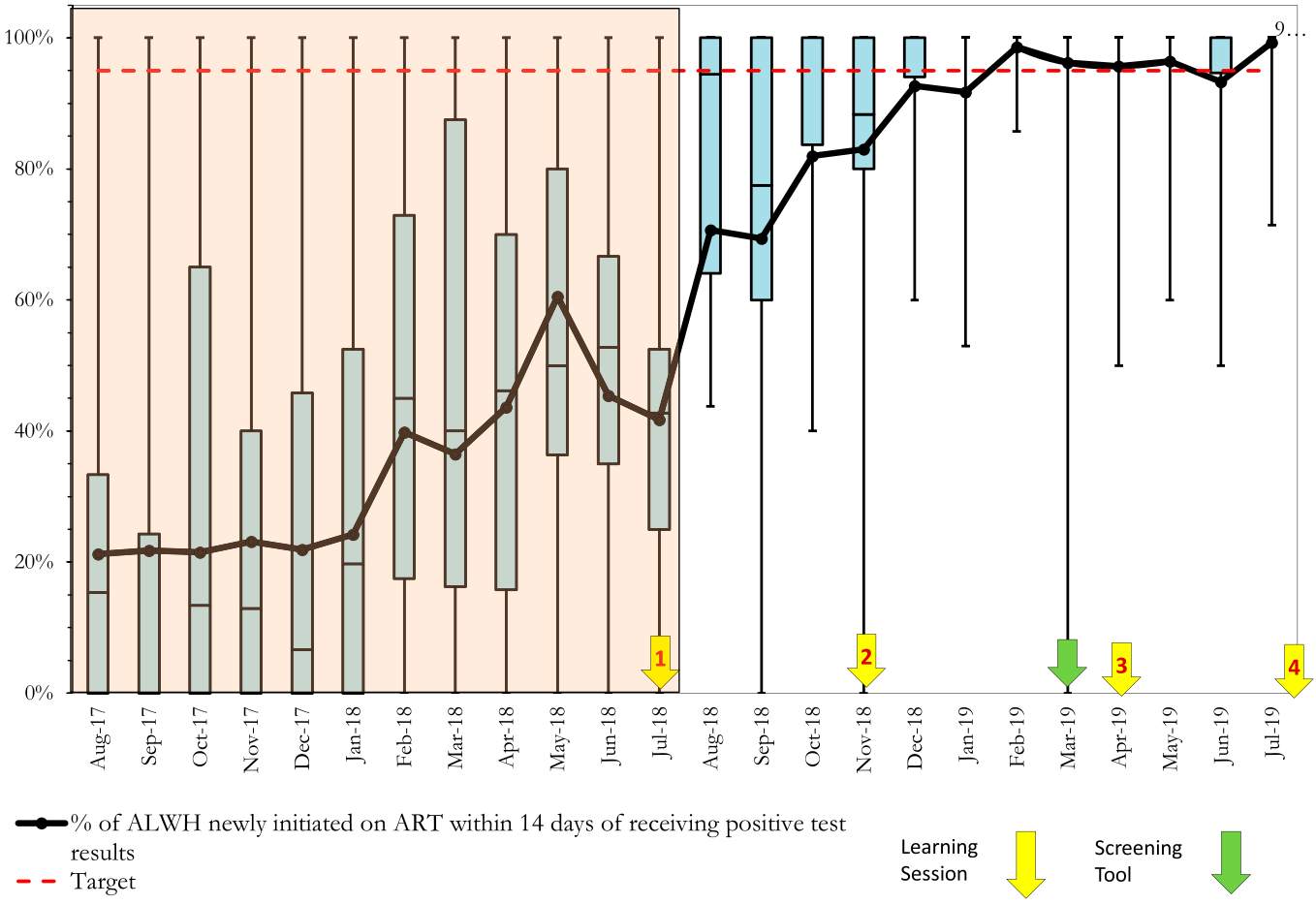

Figure 3. Adolescent ART initiation HF variation in progress to the QIC aim with baseline and implementation data included. *Note*. ALWH = adolescent living with HIV; ART = antiretroviral therapy; HF = health facility; QIC = quality improvement collaborative. This figure is available in color online www.janacnet.org.

causes of suboptimal adolescent HIV testing and meager performance with rapid ART initiation at 25 high-priority HFs in LUD, which has the highest HIV prevalence (16.6%) in Zambia. This QIC project used evidence-based approaches in working together to implement locally driven site-level successful change interventions. During the 12-month implementation period, this QIC demonstrated results that are consistent with other published reports of QI projects and QICs that have shown significant success in reducing the "know-do gap," enabling facility-level QI teams to design, test, and scale contextually appropriate interventions that improve the quality of health services. Specifically, we found that building QI expertise among HF staff to use QI methods and linking them to peers at other HFs via the QIC approach empowered them to address the systems and process issues specific to their context, and to design and test contextually appropriate interventions. During the 12-month implementation period, aggregate data from the 25 HFs that participated in the QIC were correlated with statistically significant, rapid, and sustained improvement in providing adolescent HIV testing at multiple SDPs with immediate linkage to ART initiation on the same day and within 2 weeks—the Zambian national standard for "test and start."

The intention of QI is to implement evidence-based practices and use generalized knowledge while measuring the progress of interventions and data variation over time. Our QIC project implementation, monitoring, and evaluation experiences confirmed other evidence that suggests that statistical process control methods, such as the use of run charts, is the preferred method to monitor for performance improvement in QI projects over the use of randomized control trials.

Disclosures

The authors report no real or perceived vested interests that relate to this article that could be construed as a conflict of interest.

Author Contributions

All authors met the four criteria for authorship as described by ICMJE. G. Dougherty wrote the manuscript

in collaboration with all authors. All discussed and collaboratively agreed on the design, results, analysis, and planning of the manuscript. G. Dougherty led the project, conceptual framework, and overall analysis of data. R. Boccanera designed the concept of the project from the headquarter level and provided critical revision and final approval of the version to be published. M. Adetinuke Boyd designed the concept of the project from the in-country level and provided critical revision and final approval of the version to be published. T. Gantt designed the concept of the project from the headquarter level and provided critical revision and final approval of the version to be published. S. Chilungu Kasonka led the project data collection in Zambia, led the analysis, and significantly contributed to the interpretation for writing and reviewing the manuscript. P. Kasonde designed the concept of the project from the in-country level and provided critical revision and final approval of the version to be published. N. Kaetano led the project concept development in Zambia, QI activities with the collaborating sites, final change intervention analysis, and significantly contributed to the writing and reviewing of the manuscript. C. Madevu-Matson led the design of the monitoring and evaluation strategy from the headquarter level, data collection tools, information system development, data analysis, and interpretation. P. Milimo led the project data collection in Zambia and significantly contributed to the analysis with interpretation for writing and reviewing the manuscript. M. Mwamba led the design of the monitoring and evaluation strategy from Zambia, data collection tools, information system development, data analysis, and significantly contributed to writing and reviewing the manuscript. M. Panya designed the concept of the project from Zambia, led project implementation, and provided critical revision and final approval of the version to be published. B. Senyana led project data analysis and interpretation from headquarter level and significantly contributed to writing and reviewing the manuscript. F. Tsiouris designed the concept of the project from the headquarter level and provided critical revision and final approval of the version to be published. L. Walker designed the concept of the project from the headquarter level and provided critical revision and final approval of the version to be published. N. Zyongwe designed the concept of the project from the Zambia Ministry of Health and provided critical revision and final approval of the version to be published. A. Zulu led the project concept development in Zambia, QI activities with the collaborating sites, final change intervention analysis, and contributed significantly to writing and reviewing the manuscript. M. Rabkin conceived the original project concept and design, overall project leadership and supervision, and provided critical revisions and final approval of the version to be published.

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Key Considerations

- In collaboration with key stakeholders, ICAP at Columbia University implemented a QI Collaborative (QIC) to improve adolescent immediate ART initiation at 25 HF in Lusaka, Zambia. Over the 12-month implementation period, QI teams tested and identified targeted interventions that significantly improved ART initiation within 14 days of receiving positive test results from 24% at baseline to more than 93% for the final 6 months of implementation.
- This QIC demonstrates results that are consistent with other published reports of QI projects and QICs that have shown significant success in enabling facility-level QI teams to design, test, and scale contextually appropriate interventions that improve the quality of health services.

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