

Assessment of quality of antiretroviral therapy services in India, 2014–2015

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Background: Following a decade of provision of free antiretroviral therapy (ART) in India, a nationwide assessment of ART services was conducted to review quality of care at ART centers. This paper presents the methods and defines replicable model of undertaking large scale assessments.

Methods: During the period January 2014–March 2015, 357 ART centers were reviewed under four domains, namely, operations, technical, monitoring and evaluation (M&E), and logistics. Mixed methods, comprising of desk review and on-site facility assessment; random sample of records, interviews with both health-care staff and people living with HIV (PLHIV) were used. Grading for each of the domain was done on a scale of 5, with 1 (Very poor) being the lowest and 5 (Excellent) as highest.

Results: 1720 health-care staff and 1762 beneficiaries were interviewed; 34 600 patient cards were reviewed. Of the 357 centers assessed 60, 169 and 128 scored Excellent, Average and Poor, respectively, in operations domain; 147, 176, 34 in Technical domain; 215, 115, 27 in M&E domain; 263, 71, 23 centers in logistics domain scored Excellent, Average and Poor, respectively. About 95% (1698/1785) of PLHIV were satisfied with the care provided at ART centers.

Conclusion: The methodology used for the assessment of ART centers in India yielded insights on the different domains that impact implementation and quality of service delivery. The design of this exercise may inform other researchers and managers planning similar large-scale assessments.

Keywords: ART centers, Assessment, Data quality, HIV/AIDS, HIV-TB co-infection, India

Introduction

Globally, 36.7 million people were living with HIV in 2015 and, as of June 2015, 17 million people were accessing treatment, up from 13.6 million in June 2014.^{1,2} In India an estimated 2.1 million people are living with HIV³ and 0.97 million are on ART, the second-largest number in the world.⁴ India has been witnessing a decline in new HIV infection because of the sustained efforts of the Government of India's National AIDS Control Organisation (NACO), which implements the National AIDS Control Programme (NACP). Globally acclaimed as one of the most successful programs, NACP has evolved through three phases of implementation, and is currently in its fourth phase. The unique strengths that contributed to the success of NACP in India include prevention-focused policies, evidence-driven strategies, community-centric approaches, designs for scale, dynamic multi-stakeholder response, openness for innovation, and country stewardship.⁵

The focus during, NACP-I (1992–1999) was mainly on HIV surveillance, screening of blood and blood products, and public education campaigns. During NACP-II (1999–2006) the strategy shifted to raising awareness and promoting behavior change. ART roll out was also implemented in this phase. In the third phase, NACP-III (2007–2012) the focus was on halting and reversing the epidemic by 2012, by focusing on prevention efforts and integration of care, support and treatment strategies. Currently, the fourth phase of the program is being implemented with the objective of accelerating the process of reversal of HIV and further strengthening the response to the epidemics.⁶ Provision of comprehensive prevention, care and treatment services has been the hallmark of NACP's public health approach to the problem.

The free ART initiative was launched on 1 April 2004, in eight government hospitals in six high prevalence states.⁷ Over the past decade, NACO has, through efficient planning and rapid

scale-up, established the HIV care and treatment program. A three-tier model of service delivery for ART has been developed by strengthening the existing health care systems. NACO has been augmenting the existing health facilities through the provision of additional technical, human and infrastructure support to establish ART centers.⁸ Seeking to expand the geographical access to ART and decentralize service delivery to beneficiaries, NACO also decided to provide services through 'Link ART Centres' (LACs) at district and sub-district hospitals and Community Health Centres (CHCs), to bring services closer to patients' residence. The LACs are linked to a Nodal ART Centre, which is within an accessible distance. LACs are responsible for: providing drugs to beneficiaries at their facility; monitoring adherence to ART, the side-effects and opportunistic infections (OIs); and managing the latter wherever possible.⁹

Since its launch in 2004, the ART initiative has been scaled up substantially across the country, with 527 ART centers and 1169 LACs in the year 2016. The scale up of free ART is estimated to have averted more than 4 450 000 HIV/AIDS-related deaths in the country, and an estimated 50 000–60 000 deaths are expected to be averted annually in the next five years.¹⁰ Wider access to ART has had a very significant impact in producing a drop in AIDS-related deaths by 54% from 2007 to 2015.¹¹

While the positive impact of ART on the health and longevity of PLHIV is well known, there has not been, even at the international level, a commensurate research focus on the quality of service delivery of public ART facilities. Appraisal of the quality of service delivery at such facilities is one of the methods to make this assessment. UNAIDS has delineated the conceptual framework for monitoring and evaluating HIV/AIDS care and support services.¹² However, only few middle and low-income countries have undertaken facility assessments with patient satisfaction surveys to assess the quality of ART service delivery.^{13–16} The need for such an assessment is imperative for a country like India, where, despite the fast-paced scale-up of ART centers and a sizeable beneficiary population of PLHIV, a comprehensive assessment of ART centers has not so far been attempted on a large scale. The only initiative in this regard, in India, is the assessment of 27 ART centers, which was undertaken in 2008.¹⁷

Addressing this need, especially in view of the completion of a decade of free ART provision in India, NACO decided to review the quality of services being delivered by ART centers across the country. NACO's Operational Guidelines for ART Centres, July 2012, was used as the gold standard for comparing the services and program elements. NACO collaborated with the US Centres for Disease Control and Prevention (CDC), their implementing partner SHARE India, and WHO India for this assessment. A core team was constituted to coordinate the design, management of the assessment and data analysis. The tools for the assessment were based on the UNAIDS M&E framework for evaluation of care and treatment services¹² and WHO standards for quality of HIV services.¹⁷

The assessment of ART centers across India, the largest ever such assessment globally, had two key objectives: assess the quality of ART service delivery and review the quality of the data being reported by ART centers. This paper presents details of the methodology that was employed to identify the systemic barriers that impede quality service delivery and patient care in ART centers across India. The paper draws from the comprehensive

report that was prepared after the assessment exercise.¹⁸ The design of the assessment exercise, which this paper explains, may help other researchers and managers plan and implement similar large-scale assessments in the future.

Methods

For the assessment of ART centers in India, a mixed-method approach, combining both qualitative and quantitative methods, was employed and the review was conducted in two phases: desk review and on-site assessment of ART facilities. Data collection methods included checklists, structured observations, individual interviews and review of records. Interviews were conducted with both health-care staff at ART centers and PLHIV beneficiaries belonging to various groups. The checklist was designed based on the ART operational guidelines issued by NACO. The areas for assessment were divided into four areas or 'domains': operational, technical, monitoring and evaluation (M&E), and logistics. The domains were structured based on the UNAIDS M&E framework. The operational domain assessed two key input elements that are needed to operate health services and are essential for the success of any public health program—infrastructure and human resources. The technical domain assessed the key process and outputs of ART care and treatment. The M&E domain assessed the availability of complete and accurate data, which is vital for the development of program policy and planning and facilitates corrective action for improvement. The logistics domain assessed drug management. Each of these four domains had two or more sub elements, which were termed as 'attributes'. This was done to avoid the impact of one particular domain on the overall grading of the ART center.

Selection of ART centers

ART centers that had been operational for at least 1 year by March 2013 were considered for assessment. Based on this criterion, 367 out of the 453 functional ART centers qualified for the assessment. Ten ART centers (nine from Mumbai and one from Chhattisgarh) were excluded as they did not have a Master Line List (MLL) of all the PLHIV ever registered for services, which was a pre-requisite for the assessment. MLL is a Microsoft Excel-based spreadsheet that captures the standard variables determined by NACP. The variables capture the patient's demographics, details of CD4 count, ART initiation and the status of the PLHIV in HIV care. It provides a quick understanding of the status of PLHIV in HIV care at each ART center.

Based on the above criteria, 357 centers were assessed, of which 150 were located in district hospitals, 152 in medical colleges, 35 in sub-district hospitals and 20 in public private partnership (PPP) model/other hospitals. Of the 357 ART centers assessed, 10 were Centres of Excellence (CoE), six were pediatric CoE (pCoE), 35 ART Plus centers and 306 ART centers.

Sampling of respondents

The respondents for the review included both health staff working at ART centers and the PLHIV availing services at these centers. Nodal officers and the contractual staff provided by NACP, such as

senior medical officers, medical officers, staff nurses, and counselors, were among the health personnel that were interviewed. A maximum of two counselors were interviewed from each center; if a center had more than two counselors, the newest and oldest counselors were chosen, preferably one male and one female. A total of 281 nodal officers, 183 senior medical officers, 368 medical officers, 270 staff nurses and 618 counselors were interviewed.

Five beneficiaries were also interviewed from each ART center to understand their perspective about the services being provided and to assess their satisfaction levels. In order to understand the varied concerns and experiences, PLHIV belonging to different groups or typologies were randomly selected for interview from the groups listed below. If such beneficiaries were not in attendance at the time of the review, or were less than five in number, men and women from the general population were selected for the interview:

- (1) High-risk group [female sex worker, men who have sex with mean, injecting drug user, or a vulnerable group (such as truckers/ migrants)].
- (2) Lost to follow-up cases that were retrieved.
- (3) HIV-TB co-infected patients.
- (4) Pregnant and lactating women vs. the general population.

Based on the above-mentioned criteria, beneficiaries were consecutively selected until the sample size of five was achieved in each center during the days of the on-site visit. In all, 1762 beneficiaries were interviewed, including 892 men, 857 women, and 36 transgender persons.

Sampling of records

In order to assess the quality of program data reported by an ART center, the reviewers compared data from individual patient

treatment cards with the ART-center's monthly report and the center-specific Master Line List (MLL) of all PLHIV ever registered at that ART center. The total registrations recorded in the MLL by each ART center up to 31 October 2013, formed the criteria for sampling of records. A 10% sample or a maximum of 250 patient treatment cards from each center, was selected using a stratified systematic random sampling process. The data was stratified by years to ensure sample from all the years since 2005. This process not only ensured an unbiased review of records, but also ensured adequate representation of various patient categories. The sampled record details were reviewed for quality of service delivery, as well as for validation for correctness, completeness, and consistency across the patient treatment card, MLL, monthly report, ART register and the 'pre-ART' register.

Data collection tools

As mentioned earlier, the performance of ART centers was assessed across four key areas or domains: operations, technical, M&E, and logistics. Each domain was further categorized into two or more sub-domains or 'attributes', totaling 12 in number. Within each attribute, there were a number of elements and sub-elements. The list of domains and attributes is provided in Table 1. Two tools (A and B) were developed to capture information for each attribute. Tool A was qualitative and consisted of five sub-sections. Tool B, on the other hand, was an Excel-based tool consisting of 11 worksheets that were used for data validation, assessment of the technical aspects of service delivery and inventory management.

A beneficiary interview checklist was also designed to ascertain end-users' views on the availability, accessibility and quality of services at the ART center and their satisfaction with these services. Qualitative questions to the beneficiaries included on

Table 1 Details of domains and attributes

Domains	Attributes	Max weighted scores	Grading of domains on scale of five
Operational (O)	Infrastructure	7	5 – Excellent (90–100%)
	Human resources	8	
	Sub-total	15	4 – Good (75–89%)
Technical (T)	Counseling	10	3 – Average (55–74%)
	Linkages/infection control/attitude		
	Referrals and linkages	4	
	Infection control procedures	3	
	Attitude towards patients	2	
	Technical service delivery	29	
	Sub-total	48	2 – Poor (30–54%)
M&E (M)	Reporting	10	1 – Very Poor (0–29%)
	Recording	17	
	Sub-total	27	
Logistics (L)	Inventory management	9	
	Financial system	1	
	Sub-total	10	
Total		100	

access to ART services, ART service deliver related to TB, side effects, referral for CD4 count, adherence to ART, referral to social benefit entitlements, stigma discrimination and availability of drug stock. The interview schedule for the health personnel included questions that assessed their technical knowledge and job satisfaction. The checklists were pretested and standardized before use in one high caseload and one low caseload ART center.

Data collection process

The assessment was conducted in two phases:

- (1) Desk review.
- (2) On-site assessment of facilities.

The desk review was carried out to assess data quality. It had two main activities:

- (1) Verification of the completeness and consistency of the ART center's monthly reporting and MLL.
- (2) Preliminary review of some core indicators of service delivery through the data reported in the ART center's monthly report and MLL.

During on-site assessment, teams of a minimum of two assessors, depending on the facility's caseload, visited the assigned ART center and administered tools A and B. Each

team spent three days at the facility, undertaking the activities described in Figure 1.

Data entry and data quality audit

The assessors used physical copies of tool A to record the data, which was entered into the Excel-based data management software. For tool B, which was an Excel sheet, soft copy of the tool was used by the assessors to enter information. This tool had in-built output sheets that autogenerated certain scores, as well as the percentage variation in ART center data. The process for ensuring data quality was defined, and both the tools (A and B) had defined steps for quality check (Figure 2).

Scoring and grading

Each of the four domains and the attributes were assigned maximum possible numerical scores (out of a maximum of 100 points), which were weighted based on the importance in the optimal functioning of the ART center, as ascertained after rigorous deliberations. Scores for each attribute under a domain were added together to give a total score for each of the four domains. Based on these scores, the centers were also graded separately for each of the domains, in order to enable a more insightful understanding of where the successes and challenges for a specific facility lay. The grading was on a scale of 5, with the lowest graded 1 (very poor) and the highest graded 5 (excellent).

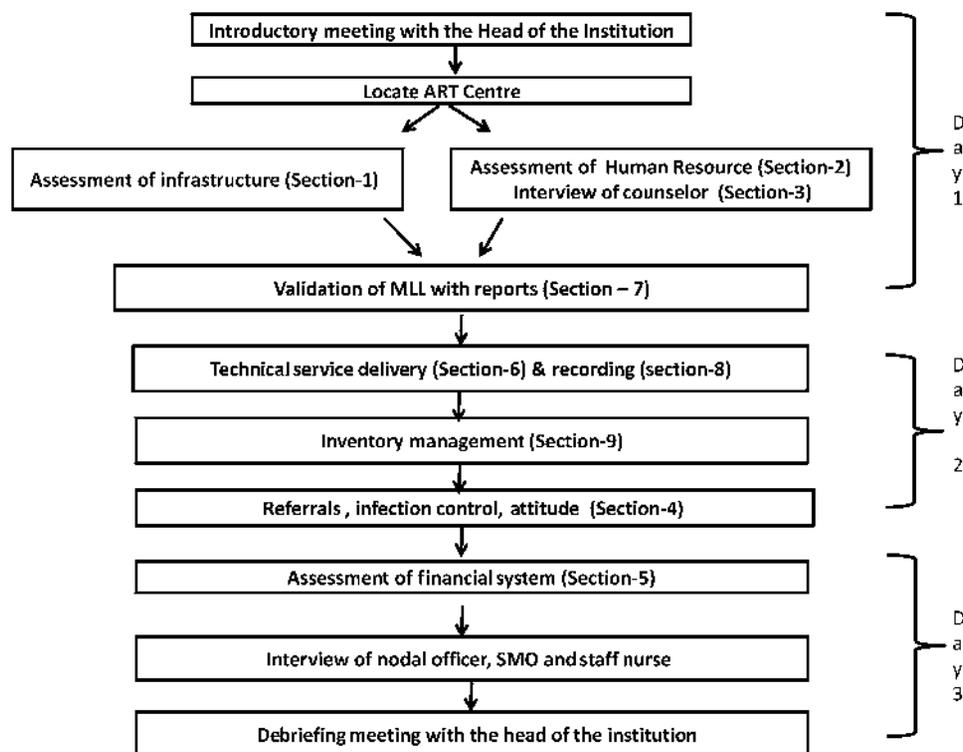


Figure 1 Flow chart depicting the process of on-site assessment of ART centres.

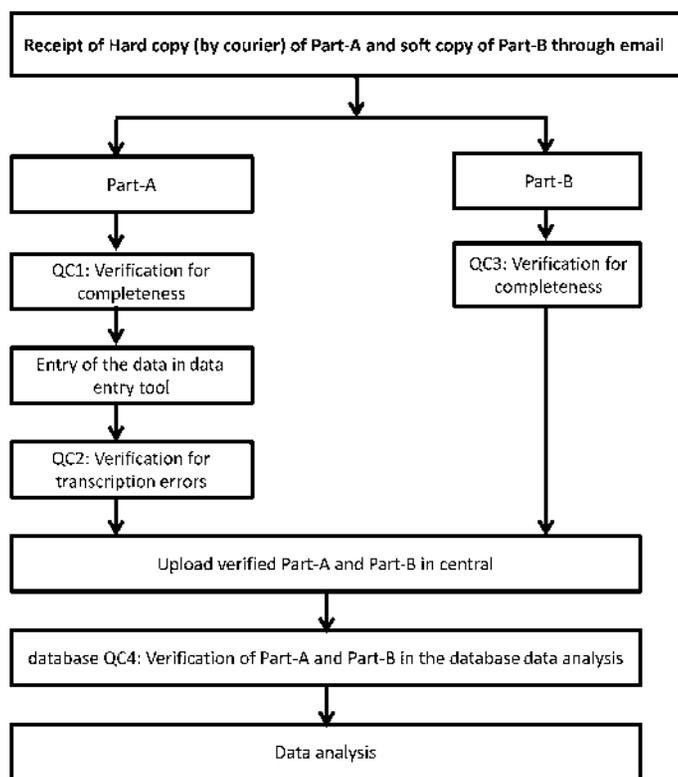


Figure 2 Step wise process of data quality assurance.

Data analysis

Analysis was done with basic frequency tables and charts using Excel. Scores and grades across each domain were generated. The detailed status of each element, sub-element, and the overall scores and grades were shared in the form of a center-specific report for each ART center visited as part of the assessment exercise. Data from all the centers from a state were then analyzed to generate state-specific reports, which captured the overall successes and generic gaps across each state. The reports were used to make state-specific recommendations and develop proposed action plans to improve the facilities and services at the ART centers in each state.

Confidentiality and ethical considerations

Confidentiality was maintained at every step of data collection, compilation, analysis and storage. All the reviewers had to sign a data confidentiality form and were instructed not to carry the original or photocopies of any documents from the ART center or take any photographs or record any videos. During the collection and reporting of beneficiary-level data, no personal identifiers were used. A unique identification number was given for each beneficiary to maintain confidentiality. The objectives, methods, benefits and risk of participation in the assessment were explained to the participants, and written informed consent was taken from each beneficiary.

Results

As part of the assessment, the assessment team:

- (1) Looked closely at the functioning of 357 ART centers.
- (2) Interviewed 1720 health personnel and 1762 beneficiaries.
- (3) Reviewed a random sample of 34 600 patient cards and 4998 registers.
- (4) Conducted 1814 drug stocks observations.

In total, 1620 man days were spent on on-site assessment across the country. This is largest ever such assessment carried out anywhere in the world.

Findings from the assessment brought to fore the key strengths and weaknesses in the functioning of ART centers across the country in each of the four domains, namely, operations, technical, M&E and logistics.

Operational domain

The Operational domain assessed two vital input elements—infrastructure and human resource.

Infrastructure

Most (285/357) facilities were found to be clean and well maintained. However, the pharmacies in 40% (143/357) of the ART centers needed space, storage and shelving. Separate rooms for the ART staff were available in the majority of centers, but availability of nursing stations and counselling rooms with audio-visual privacy were the key components of concern in almost half of the centers.

Human resource staffing status

80% (3500/4436) of the ART staff positions were filled. The recruitment status for most positions, such as counsellors, pharmacists, data managers, care coordinators and laboratory technicians, was close to or more than 90% (380/415). While about three-quarters (74%; 367/496) of the medical officers were in position against the requirement, almost half (47%; 168/357) of the senior medical officers positions were vacant and nearly 18% (81/470) of the nurse positions were vacant.

Technical domain

The Technical domain was further categorized into five attributes—counselling; referral and linkages; infection control procedures; attitude; and technical service delivery.

Counselling

This attribute was designed to assess the quality and effectiveness of counselling services. Counsellors were found to be well informed about counselling topics pertaining to 'pre-ART', ART preparedness, positive healthy living, ART care and treatment adherence. However, areas such as regular use of condoms or HIV-TB, Prevention of Parent to Child Transmission needed strengthening. The quality and

effectiveness of counseling was reflected in the knowledge and responses of the beneficiaries. The majority of the beneficiaries reported being satisfied with the counseling services. The beneficiary interviews indicate that counseling has laid a good foundation to facilitate the retention in care and adherence to treatment. The beneficiary feedback on this attribute overall was very positive.

Referral and linkages

The NACP has laid down structured mechanisms for facilitating coordination, and linkages between ART Centres and other facilities—integrated counseling and testing centers/Prevention of Mother to Child Transmission Revised National TB Control Programme (Figure 3) and LAC/LAC Plus. More than 90% (326/357) of the centers were maintaining the case-based list of PLHIV referred to Revised National Tuberculosis Control Programme units and the results of the referrals, and more than 95% (333/357) of the centers have initiated both ART and TB treatment to the co-infected PLHIV. The feedback of PLHIV reaching the ART center is not intimated to the integrated counseling and testing centers in 19% (69/357) centers. This attribute assessed adherence to these mechanisms and their effectiveness. The average score attained by the centers under ‘Linkages’ was 3, out of a maximum score of 4.

Infection control

The parent institutions of 65% (233/257) of ART centers had constituted an infection control committee. This, perhaps, is a reflection of the overall functioning of the health systems and is not specific to the management of the ART center. Of the facilities where the committee had been established, a nodal officer was a member of the committee in only 61% (141/233) of centers.

Attitude towards patients

A functional grievance redressal mechanism is necessary as it provides a platform for the patients to make their voices heard if they face any issues at the health facility. None of the intensive interviews with the PLHIV (which included all categories of patients—female sex workers, men who have sex with men,

injecting drug users, positive pregnant women, HIV/TB co-infected, and general men and women), revealed any instances of stigma and discrimination by the ART staff. While about 88% (314/357) of the facilities had a complaint box installed, these were placed in a location that was accessible to the patients in only 61% (219/357) of the centers. There were only nine instances of stigma and discrimination recorded in the complaint register in the ART centers assessed, of which six had been addressed by the institution.

Technical service delivery

This service was being provided to almost all (97%) (13 727/ 14 152) of the patients. Nearly 60% (6539/10 898) of patients on ART had undergone a CD4 investigation every 6 months and nearly 89% (9658/10 898 patients), at least once a year (Figure 4). Nearly 36% (1188 out of 3254 patients) on ‘Pre-ART’ care had undergone a CD4 investigation every six months and nearly 74% (at least once a year). However, there has been an increase of 67% (2408/3254) for ‘pre-ART’ and 81% undergoing regular CD4 count as per analysis done for the last 3 years.

Baseline basic investigations

A total of 64% ($[8145/12745 \times 100 = 64\%]$) patients on ART regime underwent most of the required investigations regularly every 6 months and 83.2% (10620/12765) has been initiated on ART. In ART-eligible patients 83.4% (11021/13215) ART preparedness was done and documented by the Counsellor in the previous month (n=1707). The median time taken to initiate ART was 9.4 days.

Monitoring and evaluation domain

Almost two-thirds (233) of the centers had an updated MLL consistent with the ‘pre-ART’ register. The variation between the two sources of information was less than $\pm 2\%$. Nearly two-thirds of the centers were graded as ‘good’ or ‘excellent’ under this domain. The performance of ART centers ranged from 61 to 100%

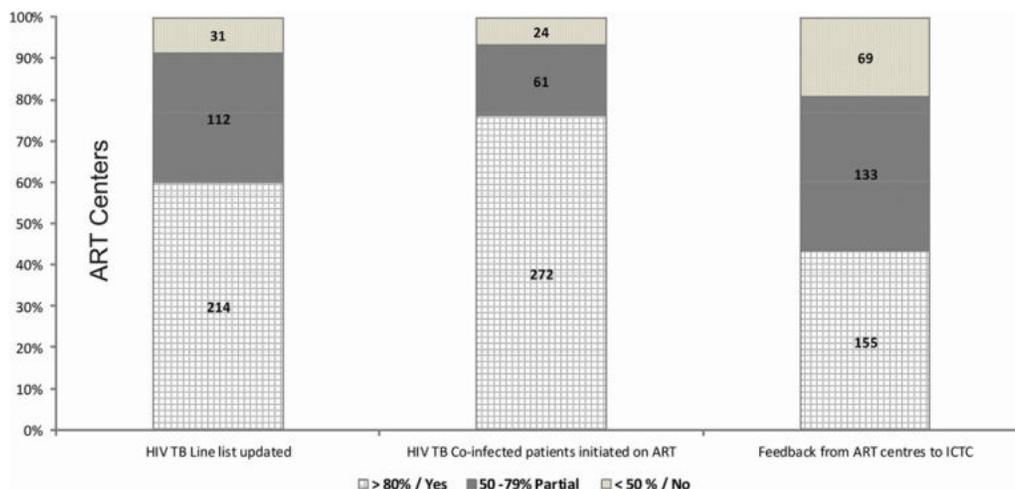


Figure 3 Proportion of PLHIV linked to other HIV related services from ART centers.

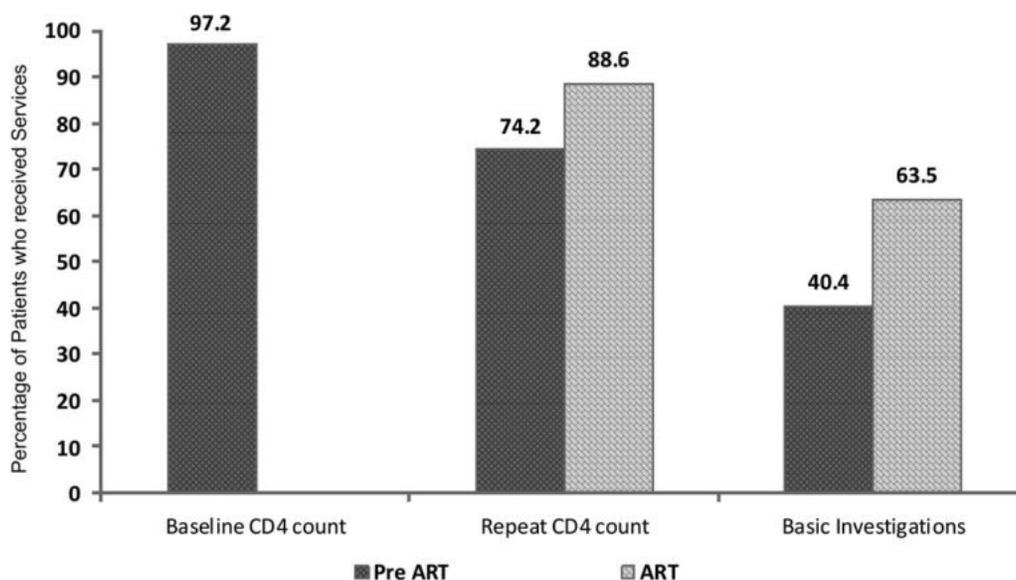


Figure 4 Achievement of ART centers in Technical Service Delivery.

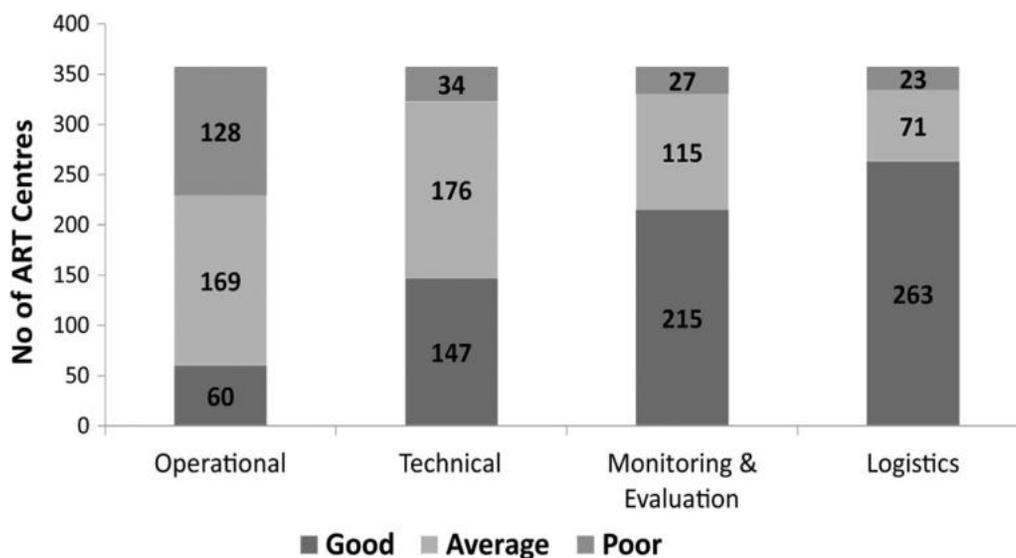


Figure 5 Overall assessment grades obtained by the ART centers across domains.

Logistics

More than 75% (267/357) of the centers were managing their inventory well with the performance varying from ‘Excellent’ to ‘Good’. The recording and reporting was found to be as per the guidelines in the majority of the centers. The drug stocks data from most of the data sources more or less matched with each other, and was found to be correct and consistent, although these records were being manually maintained by the ART pharmacists/nurse. Dispensing practices also tallied with the prescription in almost all centers.

A total of 90% (322/357) did not exhibit any variation between stock register and monthly report, and 77% (275/357) were following basic drug management systems. Most centers were following the financial management guidelines specified by NACO.

Overall

While the majority of the centers were graded ‘Average’ for the operations and technical domains, the grading shifted to ‘Good’ and ‘Excellent’ for the other two domains (Figure 5). While none of the states had at least 50% of centers graded as ‘Good’ or ‘Excellent’ in the operational domain, seven states met this mark in the Technical domain, and higher numbers – 17 and 18 states achieved this under the M&E, and logistics domains, respectively.

Discussion

The largest ever nationwide assessment of ART centers has provided some key insights about the various factors that affect

the functioning of ART centers and the PLHIV access to quality, stigma-free care and treatment. The predominant focus of the assessment exercise was on adopting a comprehensive approach, one that not only ensured representation of performance of ART centers geographically, but also captured the voices of the stakeholders, namely, the service providers and beneficiaries. With this in view, the respondent sample was selected to ensure representation of all cadres of ART health staff, as well as beneficiaries from different population groups. Similarly, the thematic focus of the assessment also ensured a comprehensive evaluation of the multiple domains that impact the functioning of the ART center, namely operations, technical aspects, M&E and logistics. Each domain was accorded different maximum possible scores, based on how crucial a domain was perceived to be in the optimum functioning of an ART center. Apart from assessing the functioning of ART centers, the review also sought to gauge beneficiaries' satisfaction with services, and the quality and integrity of the data reported by ART centers.

The study team employed a mixed methods approach to conduct the large-scale assessment, using qualitative and quantitative data collection methods, including observations, interviews, checklists, and review of records and registers. The choice of mixed methods¹⁹⁻²² was aimed at bolstering the insights and perspectives that would emerge from the assessment. Although both qualitative and quantitative methods were used, the analysis of data was primarily quantitative (scoring). The use of mixed methods enable triangulation of data collected from different sources and provided valuable insights about the situation on the ground. Keeping in view the need for understanding where the challenges and strengths for each facility lay, the study team also decided against using a collective score to grade a facility, choosing to instead to grade the facility separately for each of the four different domains.

Focus on quality and confidentiality was maintained at every step of data collection, compilation, analysis and storage of data. The emphasis on quality assurance, whether through training of assessors, development of a guidance note, or the features built into the tools, ensured data quality at all levels of data management. Given the stigma attached to HIV/AIDS and the discrimination faced by PLHIV, the reiterated focus on confidentiality and its practices secured the ethical imperatives of the exercise.

Analysis of the collected data revealed in-depth information about the current functioning of ART centers across the country. The comprehensive package of services that ART centers make available to PLHIV, and the role it plays in enabling PLHIV to lead healthier and more productive lives makes the ART program a key HIV/AIDS initiative in the country. The findings of the assessment, highlighting the current strengths and weaknesses, would contribute to addressing the gaps, and improving access to and quality of ART service delivery. The findings point to the need for, among others:

- (1) Mainstreaming HIV/AIDS programing and improving linkages.
- (2) Addressing human resource constraints.
- (3) Ensuring availability of drugs.
- (4) Emphasis on adherence to guidelines.
- (5) Rigorous monitoring and supervision.
- (6) Use of computerized online systems to ensure data integrity and efficient management.

Following the sharing of the findings, NACO, with its commitment to ensuring access to quality, stigma-free treatment and care, initiated several actions to improve the effectiveness of ART centers and the availability of free, high-quality ART services for PLHIV.

There are few limitations that need to be considered while interpreting study results. Items related to the assessment of infrastructure were derived from the operational guidelines that are specific to the country needs and may not be generalized to all settings. Completeness of data was measured against key data elements, however, the records were incomplete for other elements that were not measured. A sample size of five beneficiaries per site with varied typologies was determined and if the required typologies were not available in the center on the day of assessment, although the aggregate sample was sufficient to interpret the variability.

The tools used in this assessment can be adapted and implemented as part of the regular monitoring of services at the ART centers by the program managers. This can be followed by corrective actions for the gaps identified at the individual centers.

Based on the findings and the recommendations, NACO initiated several actions to improve the functioning of ART systems, such as feedback sharing with ART center staff and emphasis on following guidelines:

- (1) Conduct of training sessions on technical service delivery and programmatic aspects.
- (2) Development and implementation of an Inventory Management Systems.
- (3) Improved monitoring of center-specific action plans.

Conclusions

The methodology used for a nation wide assessment of ART centers in India has yielded valuable insights on the different domains that impact implementation and quality of service delivery. The findings of assessment would contribute to strengthening the ART program, which is a key component of India's HIV/AIDS strategy. The design of this assessment exercise may inform other researchers and managers planning similar large-scale assessments.

Author contributions: BBR and RA conceived the Methods; RA and RRA designed the study protocol; NC, RRA and RA piloted the data collection instrument and performed data quality checks. RRA, NC and RA analyzed and interpreted the data and drafted the manuscript; BBR and ASR critically revised the manuscript for intellectual content. All authors read and approved the final manuscript. BBR is the guarantor of the paper.

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Ethical approval: This is an assessment of the ART centers, which was primarily a National Health Program mandate to understand the program efficiency. National AIDS Control Organization, Government of India has approved the assessment of the ART centers.

References

- UNAIDS. AIDS by the Numbers 2015. Geneva: UNAIDS, 2015. http://www.unaids.org/sites/default/files/media_asset/AIDS_by_the_numbers_2015_en.pdf (accessed 7 May 2015).
- UNAIDS. How AIDS changed everything—MDG6: 15 years, 15 lessons of hope from the AIDS response. Geneva: UNAIDS. 2015. http://www.unaids.org/sites/default/files/media_asset/MDG6Report_en.pdf (accessed 17 May 2015).
- NACO. Annual Report 2013–2014. New Delhi: Ministry of Health and Family Welfare (Government of India) 2014. http://naco.gov.in/sites/default/files/NACO_English%202013-14.pdf (accessed 2 August 2017).
- NACO and National Institute of Medical Statistics, ICMR. India HIV Estimations 2015: Technical Report. New Delhi: Ministry of Health and Family Welfare (GoI). <http://www.naco.gov.in/sites/default/files/India%20HIV%20Estimations%202015.pdf> (accessed 4 August 2017).
- NACO. ART Monograph 2013. <http://www.naco.gov.in/sites/default/files/ART%20Monograph.pdf> (accessed 14 August 2017).
- NACO. Mid-term appraisal of National Aids Control Programme phase IV: Technical report. New Delhi: Ministry of Health and Family Welfare (GoI). <http://www.naco.gov.in/sites/default/files/Report%20of%20the%20MTA%20of%20NACP%20IV%20-%20August%202016.pdf> (accessed 14 August 2017).
- Tanwar SS, Rewari BB Integration of healthcare programs: a long-term policy perspective for a sustainable HIV program for India. *Indian J Public Health* 2013;57:166–8.
- NACO. ART Monograph 2013. <http://www.naco.gov.in/sites/default/files/Operational%20Guidelines%20for%20LAC%20%20LAC%20plus%20Jan%202012.pdf> (accessed 14 August 2017).
- NACO. Operational guidelines for Link ART centres. New Delhi: Ministry of Health and Family Welfare (GoI). 2008. <http://www.indiahivinfo.naco.gov.in/naco/resource/operational-guidelines-link-art-centres> (accessed January 2017).
- NACO. National AIDS Control Programme Phase- IV (2012–2017) Strategy Document. New Delhi: Ministry of Health and Family Welfare (GOI). <http://naco.gov.in/sites/default/files/NACP-IVStrategyDocument.pdf> (accessed 14 August 2017).
- NACO. Technical Report: HIV Estimates 2012. <http://files.unaids.org/en/media/unaids/contentassets/documents/data-and-analysis/tools/spectrum/India2012report.pdf> (accessed 14 August 2017).
- UNAIDS. National AIDS Control Programmes: A Guide to Monitoring and Evaluating HIV/AIDS care and support. 2004. http://www.unaids.org/sites/default/files/media_asset/jc1013-caresupport_en_0.pdf (accessed 20 August 2017).
- Olowookere SA. An assessment of quality of care service provided to people living with HIV/AIDS by a secondary healthcare centre at Osogbo, Nigeria. *S Afr Fam Pract* 2013;55(5):439–44.
- Batamwita R, Moore DM, King R, Mills E, Stangl AL. Assessment of antiretroviral therapy knowledge and willingness of persons with HIV to support its uptake in Uganda. *Patient Prefer Adherence* 2011;5:499–506.
- Tessema SB, Adane MM. Assessment of antiretroviral treatment (ART) care service provision in Tigray Region health centers, North Ethiopia. *BMC Health Serv Res* 2015;15:368.
- Kinkel HF, Adelekan AM, Marcus TS et al. Assessment of service quality of public antiretroviral treatment (ART) clinics in South Africa: a cross-sectional study. *BMC Health Serv Res* 2012;12:228.
- Sogarwal R, Bachani D. Assessment of ART centres in India: client perspectives. *J Indian Med Assoc* 2009;107:276–80.
- WHO. Standards for Quality HIV care: a tool for quality assessment, improvement, and accreditation. Geneva, Switzerland, 2004. http://www.who.int/hiv/pub/prev_care/en/standardsquality.pdf (accessed January 2017).
- NACO. Assessment of ART Centres in India National Report. New Delhi: Ministry of Health and Family Welfare (GOI). 2015. <http://naco.gov.in/sites/default/files/ART%20Assessment%20National%20Report-Final%2028092015.pdf> (accessed November 2016).
- Bulsara C. Using a mixed methods approach to enhance and validate your research. Brightwater Group Research Centre. 2015. <https://www.scribd.com/document/251893008/Using-Mixed-Methods-Approach-to-Enhance-and-Validate-Your-Research> (accessed 20 August 2017).
- Creswell JW, Plano Clark CVL. Designing and conducting mixed methods research. (2nd edn). Thousand Oaks, CA: Sage; 2011.
- O’Cathain A, Murphy E, Nicholl J Why, and how, mixed methods research is undertaken in health services research in England: a mixed methods study. *BMC Health Serv Res* 2007;7:85.