Strategies for More Effective Monitoring and Evaluation Systems in HIV Programmatic Scale-Up in Resource-Limited Settings: Implications for Health Systems Strengthening

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Abstract: Program monitoring and evaluation (M&E) has the potential to be a cornerstone of health systems strengthening and of evidence-informed implementation and scale-up of HIV-related services in resource-limited settings. We discuss common challenges to M&E systems used in the rapid scale-up of HIV services as well as innovations that may have relevance to systems used to monitor, evaluate, and inform health systems strengthening. These include (1) Web-based applications with decentralized data entry and real-time access to summary reporting; (2) timely feedback of information to site and district staff; (3) site-level integration of traditionally siloed program area indicators; (4) longitudinal tracking of program and site characteristics; (5) geographic information systems; and (6) use of routinely collected aggregate data for epidemiologic analysis and operations research. Although conventionally used in the context of vertical programs, these approaches can form a foundation on which data relevant to other health services and systems can be layered, including prevention services, primary care, maternal–child health, and chronic disease management. Guiding principles for sustainable national M&E systems include country-led development and ownership, support for national programs and policies, interoperability, and employment of an open-source approach to software development.

Key Words: HIV/AIDS, monitoring and evaluation, aggregate indicators, health systems strengthening, health information systems, operations research, open-source software

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INTRODUCTION

With the dramatic expansion of HIV programs in resource-limited settings, initiatives for monitoring and evaluation (M&E) have also proliferated. M&E systems are ideally a cornerstone of HIV services, providing aggregate data to inform national programs and priorities while guiding the delivery of high-quality prevention, care, and treatment. M&E indicators should enable the assessment of processes, outcomes, and impact,[1,2] providing a reliable evaluation of the success or failure of a project or a program. In resource-limited settings, indicators used for M&E are often hand tallied from paper-based sources and reported from service outlets to district, regional, provincial, and, ultimately, national and international agencies.[3,4] Reported indicators must then be translated from raw data into useful information, with timely feedback and dissemination to key staff at individual health facilities/program sites and others responsible for program implementation to facilitate program planning, evaluation, and improvement. However, M&E systems face several fundamental challenges, some intrinsic to the overall context in which programs are being implemented and some reflective of the manner in which the health services are organized. In some countries, these challenges have limited progress toward the shared vision of a single national HIV M&E system articulated by the "Three Ones" principles for the coordination of national AIDS responses.[5]

National M&E systems in resource-limited settings tend to be chronically challenged, with persistently incomplete reporting and inaccurate data posing a major threat to their utility.[6–8] Reasons include competing priorities and limited resources for collection and use of data; inadequate training of data collection personnel; lack of timely feedback of useful data to those in a position to improve programs; outmoded, duplicative, or irrelevant indicators; lack of proper reporting tools (eg, registers and forms); poor documentation of services provided within health facilities; and overly onerous reporting requirements. National HIV M&E systems may also have limited flexibility to rapidly accommodate the need for new or modified indicators as different HIV care and treatment programmatic activities are introduced, diversified, and expanded. There are tensions regarding the complexity of HIV M&E systems, and some questions whether M&E systems associated

with HIV scale-up are too elaborate relative to M&E for other public health priorities, especially in settings where the burden of other major diseases, such as malaria and tuberculosis (TB), is similar to or higher than that of HIV/AIDS.[9,10] Unfortunately, the multiple donors and implementing partners supporting HIV scale-up can fuel creation of parallel M&E systems whose indicators and reporting requirements are not always harmonized with, and may be more elaborate than, those used by ministries of health.[11] Parallel M&E systems pose an added reporting burden, redundancy, and risk of confusion among staff at site level, who are responsible for compiling and reporting indicators.[5]

To address these common challenges and weaknesses of HIV M&E systems, we discuss potential avenues for improvement that may have relevance to the development and strengthening of health-related M&E systems more broadly.

WEB-BASED SYSTEMS WITH CAPABILITY FOR DECENTRALIZED DATA ENTRY AND REAL-TIME ACCESS TO SUMMARY REPORTING

To ensure acceptable completeness and accuracy, ongoing review of M&E indicators is required at multiple levels of the health system (eg, at site, regional, and national levels). In areas with Internet access, Web-based systems can facilitate decentralized data entry and can provide around-the-clock access to enter, view, update, and analyze information, including real-time summary and trend reports. Staff at all levels can have simultaneous access to current data for planning, implementation, decision making, and evaluation. Because Web-based systems can provide data in real time, they have the added advantage of allowing all stakeholders to simultaneously see the same up-to-date information, reducing the amount of time spent reconciling discrepancies. Although Internet coverage of health care facilities in resource-limited settings is scant, Internet access in the global South is rapidly increasing.[12,13] Mobile phone networks are also expanding rapidly, as is their use in health applications.[14] At least one national HIV/AIDS M&E system, TRACNET[15,16] (www.tracnet.rw), in Rwanda, is Web based and uses solar-powered mobile phones for data entry. The M&E systems of at least 2 multicountry HIV implementing partners of the United States President's Emergency Plan for AIDS Relief program, including the Elizabeth Glazer Pediatric AIDS Foundation[17] and the International Center for AIDS Care and Treatment Programs (ICAP), are Web based, and each has a high degree of reporting completeness, suggesting that Web-based M&E systems are acceptable and feasible to implement on a large scale across multiple resource-limited settings.

TIMELY FEEDBACK AND DISSEMINATION OF INFORMATION TO SITE AND DISTRICT STAFF

A common weak link of M&E systems is their failure to provide timely and useful feedback to site-level staff, district managers, program implementers, and other stakeholders in the form of information that enables the continuous improvement of quality, scale, access, equity, and impact. Although implementation of health services occurs at the local level, routinely reported M&E indicators often end up in district, provincial, national, and international databases. Similarly, reports are often designed to meet the needs of donors and ministries of health rather than site- and district-level implementers, focusing on cumulative rather than current or new enrollment data, for example.

As scale-up of HIV programs continues and the number of sites continues to rise, it has become increasingly challenging to provide feedback systematically, regularly, and in a timely fashion on progress and quality to each program site. Automated dissemination of district and site-specific feedback reports may be an important means of complementing and reinforcing conventional approaches to M&E feedback. Web-based systems with built-in trend and summary reports for region, district, and site-level data could play a critical role in such feedback. Site and district staff could log on to retrieve real-time automated feedback reports (ie, reflecting the latest reported data) that are viewable online and via printout to assist them in site-support activities. Feedback reports could also highlight data quality (focused, eg, on completeness and accuracy), facilitating improvement efforts when needed.

INTEGRATED M&E SYSTEMS

A major challenge to successful national M&E systems is the lack of integration of traditionally siloed yet related M&E indicator data across different disease program areas.[1,2] Silos exist even *within* disease-specific programs. Within HIV programs, examples of such silos include prevention of mother-to-child transmission (PMTCT), voluntary counseling and testing, provider-initiated counseling and testing, HIV care, and antiretroviral therapy (ART), TB services for HIV patients, and HIV testing for TB patients. Site staff and other program implementers are often presented with independent data summary reports on activities that are, in fact, related or part of a comprehensive effort. This makes it challenging to integrate the information (eg, to triangulate and correlate the number of persons testing positive in voluntary counseling and testing with the number of enrolled in HIV care and treatment in the same facility or district) and to adequately monitor the intersection of key components of comprehensive HIV services. The challenge is often further compounded when indicators are combined across multiple facilities or jurisdictions (eg, districts, regions, provinces).[7] Aggregate data combined in an integrated reporting system are essential for examination/assessment of the relationship between activities in different areas of the health system and, ultimately, to health systems strengthening. Designing national M&E systems that integrate disease- or program-specific data within the context of broader primary care services is a high priority.

In most national M&E systems, health facilities represent the lowest unit of data collection and reporting (ie, reporting is per facility per reporting period). Typically, sites generate and submit separate M&E reports for each program area (eg, malaria, TB, HIV). These reports are rarely integrated with one another at the site level yet their integration is critical because this is where most efforts aimed at program improvement ultimately occur and where

programmatic interrelatedness must be taken into account. A site census module within an integrated M&E system could bridge this gap, providing a current list of health facilities and the specific activities and services that require reporting at each one. A well-designed database enables facility-level integration of information across traditionally siloed program areas (Fig. 1). A site census module ideally houses basic information (facility name, district, longitude, and latitude [for mapping]) and current site status (active, planned, closed) and captures information on the range of program activities supported at each site, their associated funding sources (facilitating donor-specific reports, where needed), and their performance targets (to assess progress towards goals). In contrast to MOH or donor-required reports, which are generally aggregated and produced only monthly or quarterly, these site census modules should be kept up to date by designated staff and available for viewing and modification in near real time.

Linking incoming reports from sites via a site census, summary reports, and dashboards can present national, district, or site-level data in an integrated fashion (Fig. 1). A filtering function allows users to choose and group data for any combination of sites or an individual site and view summary and trend data for all reported indicators. This functionality makes it possible, for example, to view the number of women in a PMTCT program newly diagnosed with HIV alongside the number of women newly enrolled into HIV care and treatment at the same site or group of sites. A well-maintained site census also facilitates rapid assessment of reporting completeness (ie, number of reports received from sites vs those expected).

LONGITUDINAL TRACKING OF PROGRAM AND FACILITY CHARACTERISTICS, AND PROGRAM QUALITY

The rapidly evolving nature of HIV programmatic scale-up and its impact on broader health systems (eg, staffing, renovations, training and supportive supervision, provision of equipment and supplies, and support for clinical, laboratory, pharmacy, and medical records functions) is difficult to measure with conventional M&E indicators. Clinic-level longitudinal monitoring of programmatic activities is an important adjunct to conventional aggregate M&E indicator data.

Conventional M&E indicators such as the number of persons diagnosed, enrolled, and initiating ART do not capture critical contextual information about facilities and communities that have relevance across different disease areas. Such information could range from disease burden in the community to availability of complementary services to site staffing patterns. Monitoring aspects of HIV programmatic scale-up not captured in conventional numeric M&E indicators can facilitate implementation planning and a more holistic evaluation of program performance, and can be a relatively efficient means of gathering information on activities for which no traditional indicators exist—for example, status of infrastructure and availibility of ancillary services. Useful indicators might include contextual information (catchment area, background HIV prevalence, urban/rural); characteristics of the facility in which the HIV clinic is housed (eg, whether it is at primary, secondary, tertiary level); clinic policies and practices (such as hours and days of operation); availability of on- and off-site laboratory tests or ancillary services (patient support, adherence support, nutrition support, peer education) or allied/linked services (PMTCT, testing and counseling, TB care); and staffing characteristics (eg, number/type of providers). Conducting such assessment periodically allows program implementers to monitor the evolution of services, programs, staffing, and infrastructure over time, as when a descriptive analysis examined the extent and types of nutrition support provided in HIV care and treatment programs and how they evolved in several sub-Saharan African countries.[18] The Service Provision Assessments of Measure DHS (Demographic and Health surveys Web site; www.measuredhs.com),[19] routinely conducted in many countries at national level, are a good example of an approach to obtaining cross-cutting information on health care system capacity to deliver quality health care.

Finally, because sustainable, high-quality health services are the ultimate HIV program implementation goal, there is also a need to develop and incorporate meaningful quality indicators that go beyond conventional M&E indicators and numerical progress toward targets.
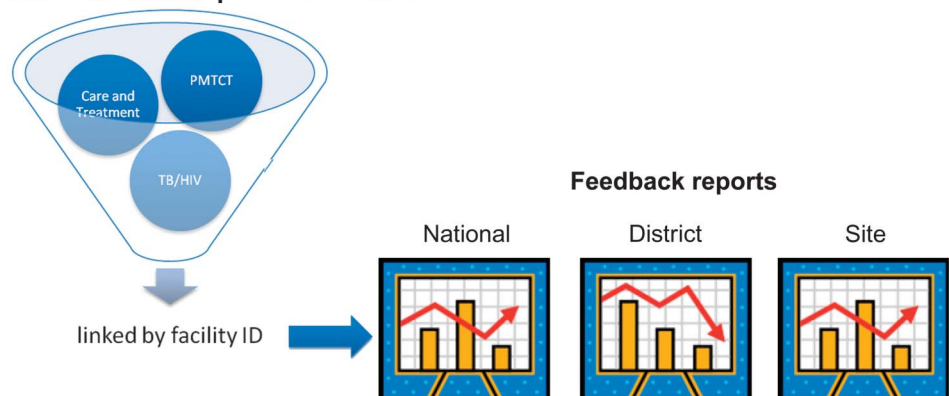

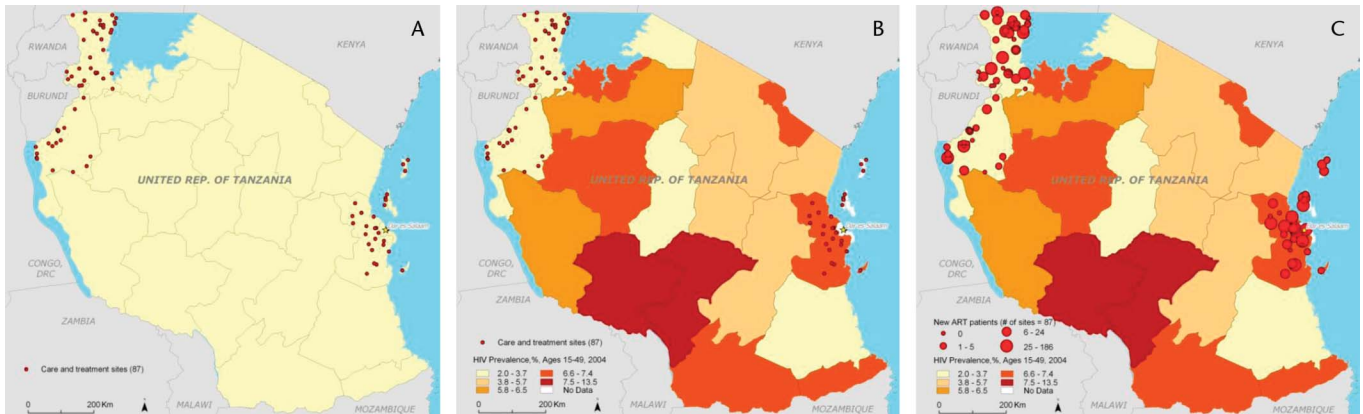**FIGURE 1.** Schematic of report submission, linkage, and feedback in an integrated M&E system.

FIGURE 2. HIV care and treatment facilities directly supported by ICAP in Tanzania (A). The map of Tanzania showing HIV care and treatment facilities directly supported by ICAP from is overlaid with HIV prevalence data from the Demographic and Health Survey (B), and with circles for each site sized according to an M&E indicator value—in this case, persons newly initiated on ART over a 3-month period (C).

GEOGRAPHIC INFORMATION SYSTEMS

Geographic Information Systems (GIS) can be useful components of M&E systems, and resources are available online for GIS in public health,[20,21] and for HIV specifically.[22,23] Thematic maps created by such systems enable visualization of health facilities in the context of variations in geographic factors such as population density, disease incidence and prevalence, other health indicators, distribution of health facilities, and proximity to major roadways. GIS also provide a means of assessing coverage of general or specific health services in relation to need[24] and how service programs are related to communities, to one another, and to the larger health infrastructure. Capturing the longitude and latitude of site locations makes it possible to create simple spot maps of site locations (Fig. 2A), which can also include layers of data from other sources, such as population density or HIV prevalence (Fig. 2B), and specific indicators, such as the number of patients newly initiating ART during the quarter (Fig. 2C).

CAPABILITY TO CONDUCT EPIDEMIOLOGIC ANALYSIS AND OPERATIONS RESEARCH

With HIV programmatic scale-up still in its early stages, it is especially important for routinely collected M&E data to be used for epidemiologic analysis and operations research aimed at improving programs. Rapid analyses are particularly useful to ensure that program design and service delivery are evidence informed. Combining routine M&E indicators with program and facility data allows for correlation of implementation approaches with process, outcome, and impact measures. Extant data, such as census data, AIDS Indicator Surveys, Demographic and Health surveys,[25] and Service Provision Assessments[18] may also prove useful in examining the role of context (eg, HIV prevalence and stigma) on program outcomes, and the use of these data combined with routine M&E data may prove a fruitful and powerful approach toward identifying optimal program implementation strategies. For example, combining routine M&E indicator data with program-level data showed that HIV care and treatment programs that provided micronutrient support to ART patients were associated with higher retention rates[26]; that colocation of TB treatment and HIV care and treatment was associated with higher TB screening rates for HIV-infected patients enrolling in HIV care[27]; and that direct linkage between PMTCT programs and outreach services targeted toward pre-ART patients were associated with a higher median CD4^{+} count at ART initiation.[28] Although aggregate M&E data and program-level data often lack the depth of patient-level data, aggregate data do have the advantages of wider availability, generalizability, and the potential for yielding inferences at program level rather than at patient or client level.

CONCLUSIONS

The unprecedented scale-up of HIV services in resource-limited settings has provided substantial resources and lessons learned for M&E, including methods development and capacity building. This in turn has catalyzed creativity and innovation, and harbors the potential to greatly enhance similar efforts aimed at health systems strengthening. Although many new systems were developed in the context of vertical HIV programs, they can be readily strengthened and expanded to encompass additional health services and systems, including those focused on prevention, primary care, maternal–child health, and chronic disease management. To maximize limited resources and minimize duplication, redundancy, and siloing, guiding principles for comprehensive, integrated, and sustainable national M&E systems include country-led development and ownership, support for national programs and policies, interoperability, and employment of an open-source approach to software development.

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