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HIVQUAL-T: monitoring and improving HIV clinical care in Thailand, 2002–08

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Abstract

Objective. We report experience of HIVQUAL-T implementation in Thailand.

Design. Program evaluation.

Setting. Twelve government hospital clinics.

Participants. People living with HIV/AIDS (PLHAs) aged ≥15 years with two or more visits to the hospitals during 2002–08.

Intervention. HIVQUAL-T is a process for HIV care performance measurement (PM) and quality improvement (QI). The program includes PM using a sample of eligible cases and establishment of a locally led QI infrastructure and process. PM indicators are based on Thai national HIV care guidelines. QI projects address needs identified through PM; regional workshops facilitate peer learning. Annual benchmarking with repeat measurement is used to monitor progress.

Main Outcome Measure. Percentages of eligible cases receiving various HIV services.

Results. Across 12 participating hospitals, HIV care caseloads were 4855 in 2002 and 13 887 in 2008. On average, 10–15% of cases were included in the PM sample. Percentages of eligible cases receiving CD4 testing in 2002 and 2008, respectively, were 24 and 99% ($P < 0.001$); for ARV treatment, 100 and 90% ($P = 0.74$); for *Pneumocystis jiroveci* pneumonia prophylaxis, 94 and 93% ($P = 0.95$); for Papanicolau smear, 0 and 67% ($P < 0.001$); for syphilis screening, 0 and 94% ($P < 0.001$); and for tuberculosis screening, 24 and 99% ($P < 0.01$). PM results contributed to local QI projects and national policy changes.

Conclusions. Hospitals participating in HIVQUAL-T significantly increased their performance in several fundamental areas of HIV care linked to health outcomes for PLHA. This model of PM-QI has improved clinical care and implementation of HIV guidelines in hospital-based clinics in Thailand.

Keywords: Thailand, HIVQUAL, quality improvement, performance measurement

Background

Since the onset of the Thailand HIV epidemic in the mid-1980s, 1.1 million cumulative HIV infections are estimated to have occurred, and ~500 000 persons have died, leaving an estimated 610 000 persons living with HIV/AIDS (PLHA) [1]. Over the past decade, public hospitals have developed services for care of PLHA, and all now provide highly active antiretroviral therapy (ART) for persons who meet criteria for therapy. The most rapid expansion period

for ART services in Thailand was in 2003–04 [2]. By 2008, an estimated 153 000 of 250 000 eligible patients were receiving ART [1].

As HIV care is being provided on a large scale, a major concern has been the development of mechanisms for monitoring the quality of care, and for improving care when it is not provided in accordance with recommended guidelines [3–6]. Considering the enormous investment in HIV care and treatment, these systems are critically important to maximize the benefits of ART and other HIV care, to minimize adverse events, including opportunistic infections (OIs), and to limit development of resistant HIV strains through appropriate use of medications [7]. Although hospital staff are familiar with basic quality improvement (QI) concepts from the hospital-wide patient care system led by the Thailand Health Care Accreditation Institute (HCAI) since 2001 [8], there was no QI program specific for HIV care in Thailand. Systematic implementation of QI methods would potentially improve systems through which HIV care is delivered and optimize specific components of HIV care [9].

In 2003, the Thailand Ministry of Public Health (MOPH) began working with the US Centers for Disease Control and Prevention (CDC) and the US Health Resources Services Administration (HRSA) to pilot a system for monitoring the quality of HIV care. We adapted HIVQUAL, an approach developed by the New York State Department of Health (NYSDOH) AIDS Institute in 1992 which has since been adopted statewide and expanded across the USA to many other HIV clinics supported by HRSA [10]. Key components of this approach include (i) systematic reporting of HIV care performance measurement (PM) data by clinics; (ii) development of specific activities to improve the quality of care for PLHA; and (iii) fostering a sustainable QI program structure that supports ongoing improvement in HIV care.

We applied this model to periodically monitor the quality of care provided to adult PLHA at Thai hospital clinics based on MOPH national guidelines for HIV care [11–13]. Information generated from this monitoring was intended for use by hospital staff and public health authorities to initiate QI projects and monitor their results. It would also assist MOPH personnel, provincial health officials and government hospital staff to monitor the extent to which HIV care adults adheres to the MOPH HIV care guidelines. Following HIVQUAL-T implementation in an initial 12 pilot hospitals in 2002, the model was rapidly expanded to more than a hundred hospitals across Thailand in 2006, with technical support from Thailand MOPH and Thailand MOPH-U.S. CDC Collaboration. In 2008, the royal Thai government provided financial support to expand HIVQUAL-T to all public hospitals in Thailand [14]. We report here our experience with initial development and implementation of this system with 12 hospitals of varying size, selected from several regions of the country, during and after the period of rapid scale-up of ART in Thailand. We also compare performance scores among the 12 hospitals participating in HIVQUAL-T in 2002 and those initiating HIVQUAL-T in 2004 and 2006.

Methods

The PM and QI program for HIV care in Thai outpatient clinics (HIVQUAL-T) project was initiated through workshops held in 2002 with collaborators from the Thailand MOPH, Regional Offices of Disease Prevention and Control in Chiang Rai and Ubon Ratchathani provinces; the Bangkok Metropolitan Administration (BMA); Provincial Health Offices (PHO) from Chiang Rai, Chiang Mai, Phayao and Ubon Ratchathani provinces; and 12 major hospitals in these jurisdictions. The 12 participating hospitals were selected on the basis of HIV prevalence, existing collaborations with CDC and the hospitals' interest.

Performance indicators were developed based on Thai national HIV care guidelines to reflect the proportion of patients at each hospital that received recommended services [11–13]. These guidelines recommended triple-drug ART for all HIV-infected persons with CD4 $<$ 200 cells/μl, symptomatic persons with CD4$\leq$250 cells/μl, and those with an AIDS-defining condition. Trimethoprim–sulfamethoxazole prophylaxis for *Pneumocystis jiroveci* pneumonia (PCP) is recommended for persons with CD4 $<$ 200 cells/μl, and fluconazole and itraconazole prophylaxis for infection with *Cryptococcus neoformans* and *Penicillium marneffei*, respectively, is recommended for those with CD4 $<$ 100 cells/μl. National guidelines also recommend an annual clinical assessment for tuberculosis (TB). Although recommendations for annual Papanicolau testing, serologic screening for syphilis and laboratory screening for *Neisseria gonorrhoeae* and *Chlamydia trachomatis* infection were not included in Thai national guidelines, care providers were interested in assessing uptake and screening rates in accordance with internationally recommended practices [15] and chose to include these indicators.

The NYSDOH AIDS Institute HIVQUAL software, a Microsoft Access-based program, was translated into Thai and modified to measure the indicators listed above. Staff at participating hospitals received 2-day trainings on the HIVQUAL-T model, including software used for self-reporting of performance data, use data for planning QI activities and the basic QI process using the plan-do-study-act (PDSA) cycle. The PDSA cycle is an iterative four-step problem-solving process. This process helps ensure that all changes are planned and tested and that feedback is incorporated before widespread implementation [16]. Examples of the QI process for HIVQUAL-T are reported elsewhere [17].

Each hospital made a list of eligible HIV-infected patients under review, identifying them by hospital number, sex and date of birth. Eligible criteria were PLHA aged 15 years and over with two or more visits to the hospital during the calendar year. The HIVQUAL-T software then generated a random sample of the records for review. When medical record review found that a patient was ineligible or when a record could not be located, the case was replaced by selecting the next patient of the same sex from the case list, such that the final case list approximated a random sample. The sample size was initially calculated using the method

employed by NYSDOH incorporating Bayesian estimation methodology to reduce sample size [18]. In 2007, the sample size calculations were changed to include a standard formula for a binomial proportion (50%) with a 90% confidence interval width of ±15%, including a finite population correction [19]. To accommodate the requirements of female-specific indicators, the software sampled a higher proportion of females.

Data on the selected indicators were abstracted from patient records of visits made from 2002 through 2008, recorded on standardized forms and entered into the HIVQUAL-T software. The software applied algorithms to determine the number and percentage of patients who received appropriate care according to the selected indicators. Following data entry, results of analyses were immediately available to each hospital through the report generation function in HIVQUAL-T software. Each hospital provided this information in a report to the HIV care team, the PHO and the Thailand MOPH. The HIV care team used the results to identify areas for improvement, select topics for QI projects and develop QI work plans. While formal PM occurred annually, PDSA cycles were repeated at sites as needed, but usually every 1–3 months with simple review of data and QI processes. Annual benchmarking reports were also produced to compare performance among clinics at provincial and national levels. The PHO and MOPH used the HIVQUAL reports to provide supervision and monitoring to hospitals.

The unit data for analysis was the hospital indicator value; the median indicator values for each year were compared. The statistical significance of trends over time was assessed using the Wilcoxon non-parametric test for trend [20].

The median performance scores of various indicators in 2006 of the hospitals that started implementing HIVQUAL-T in 2002, 2004 and 2006 were compared. The Wilcoxon rank-sum test was used to test differences of median proportion between the hospitals implementing HIVQUAL in different time series. STATA software (STATA Corp., 2005, STATA Statistical software release 9, College Station, TX, USA) was used for analysis.

In 2006, following at least one QI cycle at each facility, which included data entry, report generation, development of a QI plan and follow-up PM, the HIVQUAL coordinator from each participating clinic was informally asked to identify to the QI committee the benefits of the project to the hospitals and challenges in implementation. Coordinators were also asked about time and other resource requirements for HIVQUAL-T implementation.

Implementation of the HIVQUAL-T protocol for data collection was approved by the Thailand MOPH and CDC as a program evaluation activity that did not require an IRB review.

Results

The 12 participating hospitals that initiated HIVQUAL-T in 2002 were located in five provinces and Bangkok (Fig. 1), with a range of size, staffing and HIV case load (Table 1). Overall, the adult HIV case load at the 12 hospitals increased from 4855 patients in 2002 to 13 887 patients in 2008. The total number of patients included in the PM sample increased from 546 patients in 2002 to 1369 patients in

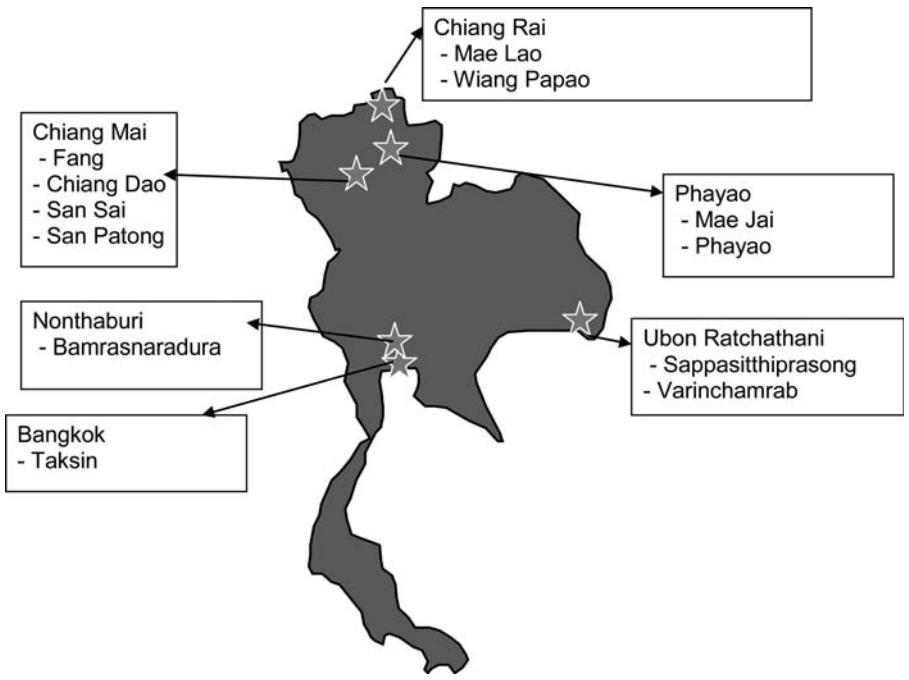

Figure 1 Pilot sites for HIVQUAL-T implementation, Thailand, 2002–08.

Table 1 Characteristics of 12 pilot hospitals using HIVQUAL-T in Thailand, 2005[a]

Province	Hospital	No. of beds	No. of staff		No. of adult HIV patients in outpatient department
			Physicians	Nurses	
Chiang Mai	San Sai	30	5	44	350
	San Patong	120	11	110	760
	Fang	90	6	84	473
	Chiang Dao	60	4	40	179
Chiang Rai	Mae Lao	30	3	37	172
	Wiang Papao	60	5	41	300
Phayao	Phayao	373	33	398	990
	Mae Jai	30	4	37	187
Ubon Ratchathani	Sappasitiprasong	1000	93	999	1032
	Varinchamrab	60	7	77	158
Bangkok	Taksin	439	76	448	554
Nonthaburi	Bamrasnaradura	450	48	204	6246

[a]2005 was selected as a mid-point year for the period of this data collection.

2008. Results for the HIV care indicators for each year are shown in Table 2.

CD4 testing and ART

The median percentage of sampled patients that had ever received a CD4 test increased from 24% in 2002 to 99% in 2008 ($P < 0.001$). The percentage of the subpopulation of patients on ART who received CD4 testing every 6 months increased from 14% in 2003 to 77% in 2008 ($P < 0.001$). The median percentage of patients with CD4 < 200 cells/μl on triple-drug therapy was 100% (0–100%) in 2002 and 90% (52–100%) in 2008 ($P = 0.741$).

Prophylaxis for OIs

The median percentage of eligible sampled patients receiving cryptococcal prophylaxis increased from 65% in 2002 to 94% in 2008 ($P = 0.049$). Because *P. marneffei* infection is prevalent only in northern Thailand, the penicilliosis prophylaxis indicator was applied to clinics in the northern provinces of Chiang Mai, Phayao and Chiang Rai; at those eight clinics, the median percentage of eligible patients receiving prophylaxis increased from 0% in 2002 to 32% in 2008 ($P = 0.011$).

Screening for infections and cancer

The median percentage of patients screened for TB increased from 24% in 2003 to 99% in 2008 ($P < 0.001$). The median percentage screened for syphilis increased from 0% in 2002 to 94% in 2008 ($P < 0.001$). A small percentage of women had a Papanicolau test for cervical cancer screening during 2002; however, this percentage increased to 67% in 2008 ($P < 0.001$) (Table 2).

QI activities

During the 6 years, each of the 12 pilot hospitals initiated QI projects, focusing on areas of their choosing and stimulated by local review of their performance data. The most common indicators selected for projects were CD4 testing, Papanicolou examinations, OI prophylaxis, and TB and syphilis screening. Common improvement strategies used included the development of checklists and flow-charts for physicians. Some of the clinics also addressed structural issues such as establishing a multidisciplinary HIV care team that met regularly to plan appropriate care for patients and linking their HIV QI teams to the hospital-wide QI committees which helped provide resources and support for HIV QI activities (Table 3).

Performance scores among hospitals participating in HIVQUAL-T program in different time series

In 2004 and 2006, 29 and 64 hospitals, respectively, began submitting HIVQUAL-T performance data to Thailand MOPH. The median performance scores of the original 12 pilot hospitals were significantly higher when re-measured than of those that initiated in 2004 and 2006 on indicators, including clinical TB screening, pap smear and syphilis screenings (Fig. 2).

Evaluation of HIVQUAL-T implementation

Twelve clinic staff representing 12 hospitals provided feedback on HIVQUAL-T implementation through formal and informal meetings using both structured questionnaires and unstructured interviews. Nine of these respondents cited the importance of having a PM tool that was easy to use and allowed them to quantitatively assess their clinical service delivery. This tool helped them measure performance rapidly

Table 2 Quality of HIV care at 12 hospitals in Thailand: performance on key indicators, 2002–08

Year	2002	2003	2004	2005	2006	2007	2008	*P*-value[a]
Total HIV patient case load	4855	6415	7006	11 401	12 717	13 488	13 887	
Total sample size (number, %)	546 (11.6)	670 (10.4)	792 (11.3)	842 (7.4)	859 (6.7)	1127 (8.4)	1369 (9.9)	
HIV care services	Median percentage of eligible patients who received service [% (range) (*N*)]							
CD4 testing								
CD4 test, ever (2002) or during last calendar year (2003–08)	24 (5–68) (546)	76 (39–90) (670)	77 (54–98) (792)	95 (77–98) (762)	98 (76–100) (859)	99 (55–100) (1127)	99 (64–100) (1369)	<0.001
CD4 test every 6 months, for patients with CD4 ≤250 cells/μl and on ART	—	30 (13–100) (670)	45 (0–100) (792)	62 (20–86) (762)	71 (2–100) (859)	67 (47–92) (1127)	77 (41–93) (1369)	<0.001
OI prophylaxis								
PCP prophylaxis for patients with CD4 < 200 cells/μl	94 (0–100) (151)	87 (68–100) (455)	88 (74–100) (503)	92 (71–100) (483)	94 (82–100) (365)	87 (36–100) (479)	93 (73–98) (439)	0.951
Cryptococcosis prophylaxis for patients with CD4 < 100 cells/μl	65 (0–100) (107)	85 (52–100) (202)	90 (58–100) (245)	94 (67–100) (229)	83 (0–100) (152)	88 (69–100) (227)	94 (60–100) (201)	0.049
Penicilliosis prophylaxis for patients with CD4 < 100 cells/μl and living in northern Thailand	0 (0–100) (107)	7 (0–56) (202)	14 (0–67) (244)	15 (0–100) (209)	24 (0–83) (152)	28 (0–89) (227)	32 (0–100) (201)	0.011
ARV treatment								
ARV treatment for patients with CD4 < 200 cells/μl or absolute lymphocyte count <1000 cells/μl, symptomatic patients with CD4 ≤ 250 cells/μl, or patients with an AIDS-defining condition	100 (0–100) (151)	79 (44–100) (361)	81 (60–100) (412)	91 (72–98) (422)	87 (74–100) (412)	91 (36–100) (463)	90 (52–100) (484)	0.741
TB screening and treatment								
Clinical TB assessment for patients with previous TB treatment	—	84 (0–100) (84)	95 (0–100) (128)	97 (33–100) (105)	100 (71–100) (184)	100 (86–100) (158)	100 (88–100) (142)	0.001
Clinical TB assessment for patients with no previous TB treatment	—	24 (2–94) (413)	38 (0–100) (558)	93 (4–100) (690)	98 (26–100) (744)	97 (8–100) (969)	99 (47–100) (1227)	<0.001
CXR or sputum AFB examination for patients whose clinical assessment is suspicious for active TB	—	100 (3–100) (41)	100 (60–100) (43)	100 (4–100) (45)	100 (50–100) (71)	100 (38–100) (75)	85 (20–100) (47)	0.542
TB treatment (received TB drugs) for patients diagnosed with active TB	—	100 (50–100) (33)	100 (89–100) (33)	100 (50–100) (24)	100 (100–100) (4)	100 (100–100) (7)	50 (0–100) (2)	0.806
Syphilis screening								
Serologic test for syphilis in last calendar year	0 (0–88) (n/a)	7 (0–71) (587)	7 (0–62) (792)	60 (0–90) (762)	88 (0–100) (859)	93 (2–100) (1118)	94 (4–100) (1369)	<0.001
Gynecologic care (women only)								
Cervical cancer screening (Papanicolau test)[b]	0 (0–36) (68)	8 (0–22) (333)	10 (0–73) (413)	46 (4–81) (422)	58 (7–91) (456)	59 (5–85) (689)	67 (6–100) (872)	<0.001
Screening for gonorrhea[c,d]	0 (0–13) (68)	4 (0–69) (333)	0 (0–89) (432)	0 (0–70) (436)	74 (0–100) (340)	71 (0–100) (493)	96 (13–100) (661)	n/a
Screening for chlamydial infection[c,d]	0 (0–0) (68)	0 (0–73) (331)	0 (0–89) (432)	0 (0–46) (395)	62 (0–100) (340)	8 (0–100) (493)	95 (4–100) (661)	n/a

[a]Wilcoxon non-parametric test for trend.

[b]The denominator (*N*) of indicator for cervical cancer screening in 2002 was for females performed pelvic examination only. The *N* of cervical cancer screening was changed to include screening for all females in 2003–08.

[c]The denominator (*N*) of indicator for gonorrhea and chlamydial screening in 2002 was for females performed pelvic examination only. The *N* was changed to include all females in 2003–2005 and all patients who had active sexual intercourse during the last 3 months in 2006–08.

[d]Indicator for gonorrhea and chlamydial screening in 2003–05 was for females only using lab diagnostics with PCR or GenProbe; in 2006–08, the indicator was changed to include symptomatic screening for all patients. For these reasons, the trend is not shown.

Table 3 Examples of QI activities among 12 hospitals following initial HIVQUAL PM, Thailand, 2002–08

QI approach	Definition	Example of QI activities
Organization of services	Create a culture and mechanisms that promote safe, high quality care	Set up HIVQUAL-T/QI committee Established multidisciplinary HIV care team Formulated plans with hospital patient care team and Hospital AIDS Committee to monitor quality of HIV care Used HIVQUAL for hospital accreditation application
Delivery system	Assure the delivery of effective, efficient clinical care and self-management support	Developed flowchart in patient record Developed flowchart and standard operating procedure (SOP) for CD4 testing, OI prophylaxis and ART Developed 'one-stop' service for HIV care and checklist for all services received including CD4 testing, OI prophylaxis, ART, Pap smear, TB and STI screening Updated HIV clinic SOPs to include routine gynecologic examination and Pap smear for all HIV-infected women Developed flowchart for TB screening and system for medical record documentation Developed Pap smear screening flow chart and SOP for HIV clinic, OPD and lab Developed clinical practice guidelines Developed follow-up system for inpatient HIV patients
Self-management	Support empower patients to manage their health and healthcare	Campaigned to promote Pap smears for HIV-infected women Provided patient education on the importance of CD4 testing, TB screening, ART and OI prophylaxis for HIV-infected patients Provided patient education on the importance of Pap smear and STI screening of women Provided ART training to patients and relatives, and provided patients with peer support and reminders Provided patient education before each visit Provided HIV/AIDS education for PLHA
Information systems	Organize patient data for efficient and effective care	Improved data collection on outpatient card for all indicators Discussed HIVQUAL reports with hospital accreditation/QI Committee Developed electronic HIV database

and allowed them to implement QI processes in a timely manner. They also cited the benefits of being tracking longitudinal performance. Other frequently cited benefits of HIVQUAL measurement included clearly defined indicators and the ability to automatically produce performance data reports. Eight participants noted the benefit of developing and sharing QI strategies to improve care with other providers in their own and other hospitals and the use of these strategies to build larger systems of hospital care. Five participants mentioned the opportunity to engage in a team effort in which all of the staff worked together to identify strengths and weaknesses in their clinic systems. Four respondents noted that HIVQUAL-T provided a useful mechanism for linking simple and effective PM methodologies with the hospital-wide QI system for hospital accreditation already in place in their facilities.

The most commonly identified challenge to HIVQUAL-T implementation was the increased workload associated with data abstraction and entry (seven participants), in part related to difficulties in finding medical records and in computer skills. Resource requirements for setting up HIVQUAL-T implementation are summarized in Table 4.

Discussion

The implementation of HIVQUAL-T demonstrates how a PM system can be established and implemented in a period

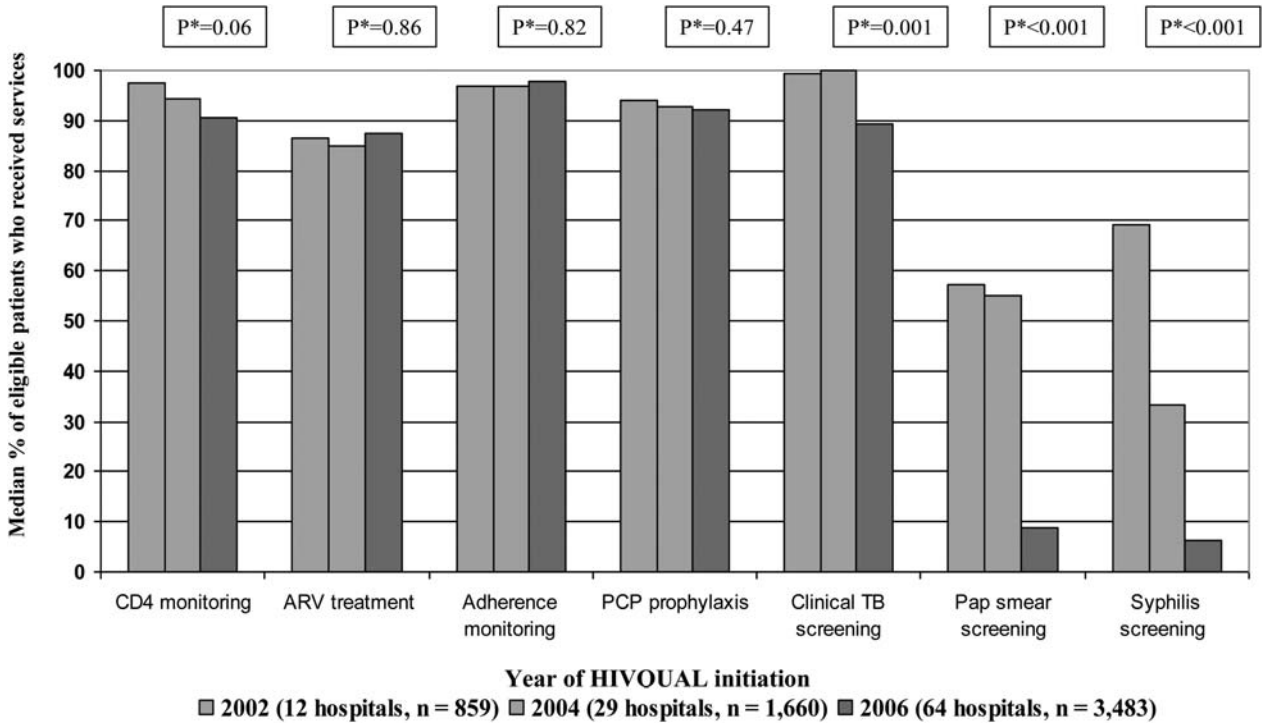

Figure 2 Median HIVQUAL-T PM among different cohorts hospitals initiating HIVQUAL in 2002, 2004 and 2006, Thailand, 2006. Wilcoxon rank-sum (Mann–Whitney) test. *Test for trend across ordered groups.

of 1–2 years in a country that is rapidly scaling up HIV care. It further shows how these data can be analyzed locally and used to address issues affecting the quality of the service delivery system that are specific to a single institution, or common to many facilities. Resource requirements for implementing HIVQUAL-T during the pilot phase were relatively low, and the contributory percentage of full-time staff allocations to the work was quite modest.

Among the 12 hospitals reporting through HIVQUAL-T, substantial increases were seen in the proportion of patients receiving CD4 testing annually and every 6 months, the proportion of patients evaluated annually for TB, receiving syphilis serologic screening, and for HIV-positive women, annual Papanicolau testing. QI projects at individual hospitals led to specific actions to address these issues. Dialog between providers and health officials following review of data resulted in policy changes, including revision of clinical guidelines, involvement of provincial public health officials who sponsored improvement campaigns within their provinces and regional meetings for hospitals to exchange their solutions and tools to improve the quality of HIV care. Conversely, some indicators did not significantly improve often because performance scores were already high, or lack of prioritization of QI activities for those indicators. It is important to note that even if performance is initially good, it can decline if continuous assessment and QI are not addressed [17].

In some cases, changes in performance scores were influenced by external factors [6]. The year-to-year changes in the proportion of eligible patients receiving ART reflect increases in the availability of eligibility screening and subsequently, in the availability of treatment through the national program. In 2002, screening and treatment were provided only through a variety of pilot programs; a small number of patients were found to be eligible for ART and these patients were treated. CD4 testing in hospitals gradually became more available and in 2006, routine CD4 monitoring every 3–6 months for untreated HIV-positive patients was recommended and covered under the national health insurance program. As the number of patients with CD4 testing increased from 2003 to 2005, the proportion of those appropriately receiving ART decreased, but that proportion subsequently increased as the demand for ART was met.

During the introduction of HIVQUAL-T, many challenges were initially encountered. First, a quality measurement system based on statistical sampling of records had not previously been implemented in hospitals in Thailand. Prior monitoring systems had relied on universal reporting through systems of logbooks and reports, which were cumbersome and limited the number of useful variables that could be collected reliably. These data collection systems were often characterized by multiple records for an individual patient, posing obstacles to client-level data analysis. Secondly, HIVQUAL-T was introduced shortly after a system had been developed to monitor and evaluate the numbers and longitudinal outcomes of all persons placed on ART through the national program. Although the need for a more comprehensive program for monitoring the quality of HIV/AIDS care was recognized, the initial concern was that any such activities would be difficult to initiate. Thirdly, each facility had a unique system for recording patient data through hardcopy

Table 4 Resource requirements for HIVQUAL-T implementation in 12 pilot hospitals, Thailand, 2002–08 (Source: informal feedback from HIVQUAL coordinators at central and hospital levels)

Implementation step	Time	Cost (excluding personnel time)	No. of personnel
I. Needs assessment, HIVQUAL software and paper abstract form development			
1. Developed working group, survey and selected hospitals for HIVQUAL pilot implementation	$\frac{1}{2}$ day/hospital	Per diem and transportation	2 consultants from New York State Department of Health and 4 TUC staff
2. Defined indicators and developed logic steps	1 month	One day meeting to discuss and prioritize indicators and meetings to review indicators and logic steps	3 Ministry of Public Health (MOPH) staff (P), 2 TUC staff (P), 3 consultants (P)
3. Developed paper abstract form	2 weeks–1 month	—	3 TUC staff (P)
4. Developed software	1 month	—	1 programmer (F) 2 TUC staff (P)
II. PM and QI pilot phase			
1. Trained staff	2 day-training course	Computer room, meeting materials, per diem, transportation	1–2 trainers, 2 assistants for 30 trainees (P)
2. PM—List cases, collect data, enter data, analyze data, report to QI committee	2 days to 1 month (average 2 weeks)	Overtime payment for hospital staff (average US$* 170/hospital per year)	2–3 persons (hospital staff including HIV care nurses, ± doctor, and staff with computer skill) (P)
3. Implemented QI project—write QI proposal, implement QI project by using PDSA cycle, monitor and evaluate	Reassess HIVQUAL PM annually	QI activities and meeting for QI planning, e.g. meeting materials, patient education materials, logistics for meetings, etc. (average US$* 1000/hospital per year)	Hospital QI committee (P)—Hospital QI team met regularly every 1–3 months to review QI plan and result using PDSA cycle

F, Full time; P, part time; TUC, Thailand MOPH-U.S. CDC Collaboration. Exchange rate: 1 US$ = 30 baht.

or electronic medical records; however, the sampling system of data collection used for HIVQUAL-T was shown to function effectively through either manual or electronic data extraction from these systems. Finally, many hospitals initially lacked a formal clinical registry to generate the HIV case listing required for HIVQUAL-T sampling; they had to compile lists from multiple sources, such as billing systems, scheduling lists and laboratory or research log books. These challenges highlighted the insufficiency of existing monitoring, reporting and other electronic systems to adequately capture information about processes of clinical care. Based on this experience, several hospitals developed a more systematic process for maintaining these records; improvements in medical record systems were also reflected in the national hospital accreditation program.

There are several limitations to the conclusions drawn from this analysis. First, the HIVQUAL-T assessment is limited to patients already diagnosed with HIV infection who present for clinical care. Separate assessments are needed of the coverage of voluntary HIV counseling and testing services, of other medical services that can identify persons who should be referred for HIV testing, of HIV care utilization among persons found to be HIV-infected and of HIV care provided outside of traditional hospital-based services, including day-care programs and home-based care services. However, the infrastructure and processes for PM and QI can be adapted and utilized for other HIV services and potentially, for other aspects of health-care delivery.

Secondly, accurate measurement using HIVQUAL-T depends on the quality and completeness of medical records. In many instances, medical records systems have major gaps. While those deficiencies are a barrier to HIVQUAL-T implementation, they can also be a primary factor leading to lapses in care for individual patients. We have found that the use of HIVQUAL-T leads to recognition and correction of problems in medical records documentation and systems that are then targeted for improvement. Improving medical record documentation helps health-care providers to assess true service coverage as well as provide appropriate clinical management for each patient, which in turn, improves the validity of subsequent rounds of PM.

Thirdly, we were initially concerned that the implementation of HIVQUAL-T would require commitment and human resources beyond the capacity of already overburdened facilities. However, we found that HIVQUAL-T helped address a need identified by hospital staff for clinical data on their facility's performance, provided a tool for generating discussion about aspects of care that some already knew needed improvement, and was effective in building commitment to the QI process. At the same time, it provided training of frontline staff, particularly nurses, in the national guidelines for HIV care and the importance of adhering to these guidelines, and established various QI approaches through which clinic staff could participate in decisions and changes in the care delivery system.

In contrast with the EQHIV study [21] that reported a QI collaborative did not significantly affect the quality of care, in this report, we found that various QI approaches may have led to improvement in HIV care quality, which is in line with reports of other QI studies [17, 22–24].

In this report, hospitals that have a shorter timeframe to develop and implement HIVQUAL activities demonstrated lower performance scores for some indicators when compared with hospitals with earlier initiation of HIVQUAL and QI activities and sufficient time to implement them, suggesting that performance improvement may be attributed to QI activities [17].

As noted earlier, HIVQUAL-T was launched during a period of rapid scale-up and expansion of ART services. In this context, the relative contribution of HIVQUAL-T cannot be isolated. However, in hospitals where HIVQUAL-T has been implemented, the HIVQUAL process has facilitated service delivery and adherence to national HIV guidelines. In some cases, such as with syphilis screening, HIVQUAL-T led to the implementation of this practice at the pilot sites. In other cases, such as with CD4 testing, HIVQUAL-T QI projects were coincident with increasing availability of tests at hospitals, but HIVQUAL-T also facilitated a policy change to provide free CD4 testing for asymptomatic HIV-infected patients, which was subsequently adopted.

HIVQUAL-T promoted multidisciplinary teamwork in HIV clinics, provided an organizational framework for systematic review of performance data, facilitated implementation of delivery system changes to improve care and the organization of these activities within the hospital system. In addition, feedback from hospital staff linked improved care with the processes of PM and QI activities. Overall, a culture of QI practice was created among providers by promotion shared decision-making and team-based use of data. These data were also used to support the hospital accreditation process and for reporting to local and national public health authorities. As shown in other reports, clinics participating in the HIV QI collaborative resulted in organizational changes [25]. Organizations with a more open culture of QI practice tend to have more and comprehensive interventions which may affect the quality of care through their influence on intervention activities [26].

Key factors that facilitated the implementation of HIVQUAL-T were support from the Thailand MOPH and involvement of the National Hospital Accreditation Program, which has integrated QI into its accreditation standards. The implementation of any system of quality assurance requires that there be sustained support from the government or major funding agency, ideally resulting in the integration of the basic elements of QI into the national system for HIV services.

HIVQUAL-T is now being expanded to all 76 Thai provinces, with performance monitoring in place in over half of the nation's 900 HIV clinics [14]. HIVQUAL-T is also being integrated into the national health insurance system as their method for assuring the quality of covered services. The HIVQUAL model has also been adapted to other countries [27] as part of rapid, large ART scale-up programs, adjusting for differences in guidelines, resources and health-care models. In concert with the scale-up of ART and systems for delivery of HIV care, HIVQUAL provides a simple, systematic method to simultaneously monitor and improve the quality of HIV service delivery.

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Conflict of interest statement

The findings and conclusions in this article are those of the authors and do not necessarily represent the views of the US Centers for Disease Control and Prevention. The use of trade names is for identification purposes only and does not constitute endorsement by the US Centers for Disease Control and Prevention or the Department of Health and Human Services.

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