

Routine Health Information Network



Third International RHINO Workshop
Information for Action: Facility and Community Focus

February 26-March 3, 2006
Chiang Rai, Thailand



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This report was made possible by support from the U.S. Agency for International Development (USAID) under terms of Cooperative Agreement GPO-A-00-03-00003-00. The author's views expressed in this publication do not necessarily reflect the views of USAID or the United States Government.



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Acknowledgments

The workshop was conceived and approved at the first Routine Health Information Network (RHINO) Steering Committee Meeting in Washington, D.C., in March, 2005. The RHINO Steering Committee (SC) is composed of representatives from donor agencies and countries who all have a strong interest in improving routine health information systems. The SC provides guidance to RHINO on matters of policy and direction. The SC discussed options for the workshop topic and decided that the third workshop would focus on the community and facility levels.

The workshop planning and implementation represented an intense effort that brought together cooperatively the MEASURE Evaluation team, led by Theo Lippeveld and Mark Spohr, and the Mahidol University team in Thailand led by Dr. Sureeporn Punpuing. During the initial planning phase and implementation, the workshop garnered strong support from Dr. Suwit Wibulpolprasert of the Thailand Ministry of Public Health; he provided invaluable guidance and motivation. The workshop itself was coordinated by Mark Spohr and Dr. Sureeporn Punpuing. They were assisted by Katherine Shields, Darin Evans, Alec Moore, and Saowapak Suksinchai. Munira Siddiqi provided administrative and logistical support from the United States and Nigeria. A special word of thanks goes to the Thai Provincial and District Health Offices in the Nan, Payong, and Lampang provinces and to the staff of the Mae Jun and Chiang Rai Hospitals, who provided invaluable support to the organization, especially during field visits.

The workshop had institutional support from MEASURE Evaluation, the Thai Ministry of Public Health, Mahidol University, and the Thailand Institute for Health Systems Research. Financial support was provided by the United States Agency for International Development; Health Metrics Network; John Snow, Inc.; Management Sciences for Health; and many health and development organizations.

Abbreviations and Acronyms

ANC	Antenatal care
ARI	Acute respiratory infection
ART	Antiretroviral therapy
ARV	Antiretroviral
CBHIS	Community-based health information system
CBO	Community-based organization
CD4	A particular type of white blood cell useful for tracking HIV infection
CSMBS	Civil servant medical benefit scheme
DSS	Decision support system
EmOC	Emergency obstetric care
EPR	Electronic patient record
HBC	Home-based care
HIVQUAL	Software to track and improve the quality of HIV care
HIS	Health information system
HISP	Health information systems program (www.HISP.org)
HMIS	Health management information system
HMN	Health Metrics Network
HT	Hypertension
HW	Health worker
ICD	International classification of disease
ICT	Information and communication technology
IMCI	Integrated management of childhood illness
IT	Information technology
JSI	John Snow, Inc.
MCH	Maternal and child health
MDG	Millennium development goals
MIS	Management information system
MNCH	Maternal, neonatal, and child health
MOH	Ministry of Health
MoPH	Ministry of Public Health
NGO	Non-governmental organization
NHIS	National health information system
NHSO	National Health Security Office
NSO	National Statistical Office
OVC	Orphans and vulnerable children
OPD	Outpatient department
PHC	Primary health care
PHCU	Primary health care unit
PLWA	Person living with AIDS
PP	Private practitioner (or provider)
PRISM	Performance of routine information system management
QI	Quality improvement
QIP	Quality improvement program
RHINO	Routine Health Information Network (www.RHINOnet.org)
RHIS	Routine health information system
SAVVY	Sample Vital Events Registration cum Verbal Autopsy
SC	Steering committee
TA	Technical assistance
TOR	Terms of reference
USAID	United States Agency for International Development
VCT	Voluntary counseling and testing
WHO	World Health Organization

Executive Summary

The Routine Health Information Network (RHINO) held its third workshop in Chiang Rai, Thailand, from February 26 to March 3, 2006. The workshop represented a milestone in the development of its user community with the maturing and application of the principles of the discipline of routine health information systems (RHIS). Each of the three RHINO workshops has broken new ground and has advanced the discipline. The first workshop set out the principles and strategies of the network; the second proposed the performance of routine information system management (PRISM) approach for developing district-managed RHIS; and the third proved the utility of the approach by applying it to facility- and community-based data collection and use of information. The RHINO user community has also grown and contributed a large variety of tools to improve the collection and use of routine health information.

RHINO was created in 2001 under the MEASURE Evaluation Project, a project funded by the United States Agency for International Development (USAID), which focuses on improving the use of information for evidence-based decision making. The RHINO Initiative's mission is to advance the state of the art in routine health information systems (RHIS), as well as to improve the practice of RHIS design and implementation worldwide through cross-fertilization of lessons learned and of best practices from various countries and organizations.

The third RHINO workshop focused on data collection and information use at the community and facility levels of the health care system. Those community and facility levels together represent the service delivery interface of the health system, meaning the level "where action takes place." It brought together 130 participants from 32 countries. As public and private managers, experts, consultants, and academics working in the field of RHIS, the participants worked together on the following objectives:

- To examine lessons learned and best practices to advance the state of the art related to the production of quality data at community and facility levels, as well as related to the use of the information for evidence-based decision making that is related to individual and community health interventions.
- To reinforce RHINO as a network to advance the state of the art in RHIS development on a continuous basis through the sharing of knowledge and experiences.

The third RHINO workshop's participants explored the collection and use of information at facility and community levels on the basis of two underlying conceptual approaches:

1. Decentralization of information management as an effective strategy to improve routine information systems: This approach was developed at the second workshop on district information systems in South Africa in 2003. It is expected that delegation of the information system's management responsibilities to the district level will ultimately lead to production of better quality data and to an increased use of information by care providers at facility and community levels.
2. The PRISM framework for improving RHIS performance: The PRISM framework is an analytical process for better understanding RHIS performance. RHIS performance is defined as sustainable production of quality data and continued use of health information for evidence-based decision making. The PRISM framework further assumes that three main groups of determinants will influence the performance of the health information system: the organizational context of the health system, the behavioral aspect of data collectors and users, and the technical and design aspects of information systems.

In order for participants to be able to study data collection and use at facility and community levels, the workshop agenda was organized around workshop themes and cross-cutting topics. Participants were asked to join one of five thematic groups for the preliminary fieldwork and workshop discussions: (1) the community-level group; (2) the first-level care facility group; (3) the hospital group; (4) the maternal, neonatal, and child health (MNCH) group; and (5) the HIV/AIDS group. All thematic groups examined a defined set of seven cross-cutting issues: (1) information needs/demand; (2) data quality; (3) information use; (4) quality of services; (5) information and communication technology; (6) integration; and (7) information system management.

The workshop started Sunday evening with a thought-provoking keynote address by Dr. Suwit Wibulpolprasert of the Thai Ministry of Public Health. On Monday and Tuesday, the participants embarked on field visits. Each field visit group focused on one of the five thematic areas and examined the various cross-cutting issues as related to the theme under study. Discussions on Wednesday and Thursday focused on the five workshop themes by reviewing the state of the art and lessons learned from each theme, according to the seven cross-cutting issues, and by formulating recommendations for each of the workshop themes. On Friday, discussions focused on the cross-cutting issues, and participants were “reallocated” to cross-cutting issue work groups.

Main Workshop Outputs

In the following paragraphs, suggested action and research agendas are summarized by thematic group. We then list the RHINO agenda for improvement of community and facility RHIS as identified by participants at the Chiang Rai workshop.

Community-Level Thematic Group

Action Agenda

- Regular community meetings to review information, give feedback, and take action;
- Need for time-intensive and sustained capacity building;
- Action plan Myanmar: community culture but lack of motivation:
 - Need to empower community volunteers (e.g., training, supportive supervision);
 - Need to link community to facility;
- Action plan Kenya: institutional structure is in place (e.g., Constituency AIDS Councils):
 - Need to convince management of the national health information system to extend to the community level (training in basic HIS issues such as data collection).

Research Agenda

- Study on scaling up of the community-based health information system (CBHIS):
 - Linkage to primary care unit, vital statistics, and so forth, CBHIS in urban settings;
 - Determination of whether there is a standardized approach to countrywide implementation;
- Determination of whether involvement of communities (and, therefore, ownership of data) leads to better data quality and use;
- Determination of how communities benefit from use of information.

First-Level Care Facility Thematic Group

Action Agenda

- Consensus building on minimum data sets for use at primary-care level to be coordinated by national HIS offices;
- Development of manuals and guidelines for use of information by health workers at first-level care facilities;
- Documentation of instances of use of indicators for referral system;
- Establishment of referral monitoring systems (eventually computerized).

Research Agenda

- Study on the link between RHIS and quality of care or services;
- Determination of how culture of information use can be promoted and encouraged at the first level of care;
- Synthesis on data sets, data elements, and indicators used in developing countries to evolve best practices for wider applications;
- Evaluation research of high- and low-performing HIS to generate practical recommendations for HIS design and implementation in developing countries;

- Comparative study on the involvement of dedicated data entry operators versus service providers at first-level of care, with the focus on quality of data as well as of services;
- Operations research to examine referral tracking systems;
- Operations research on confidentiality of health information;
- Operations research on integration mechanisms at the primary level.

Hospital Thematic Group

Action Agenda

- Development by National HIS offices of guidelines on the development and implementation of hospital information systems in the country context;
- Establishment of standard definitions and data sets to facilitate exchange and aggregation of data.

Research Agenda

- Study on the use of hospital information system for evidence-based decision making;
- Study on the use of electronic medical records (linked to health insurance) for chronic diseases (antiretroviral therapy, hypertension, etc.);
- Study of different hospital computerized IS to understand their flexibility and, therefore, ability to accommodate the complex hospital environment.

MNCH Thematic Group

Action Agenda

- Development of systems of data integration at each level (community, first level, and hospital) and between levels;
- Mapping of communities surrounding first-level care facilities focused on risk groups (people living with AIDS [PLWA], pregnancies, neonates, etc.);
- Better integration of denominators between health and administrative departments;
- Development of simple pictorial forms for community-based data collection;
- Organization of monthly meetings for MNCH data review at the community, first level, and hospital.

Research Agenda

- Study on integrated family and patient record (pink booklet in Thailand): how much of the data collected are really used for patient or program management;
- Study on mechanisms for better integration (horizontal and vertical) of the MNCH data into the HIS;
- Study on the development and use of a HIS involving the private and public sector to implement the integrated management of the childhood illness (IMCI) strategy;
- Study on RHIS value added to the use of MNCH services.

HIV/AIDS Thematic Group

Action Agenda

- Development of principles and standards to ensure patient confidentiality and to disseminate best confidentiality practices, including experience from the patient perspective;
- Promotion of standardized HIV/AIDS data elements.

Research Agenda

- Determination of the predictors of HIV/AIDS patient survival;
- Determination of how to develop integrated systems that maintain confidentiality across community and facilities.

RHINO Agenda on Facility and Community HIS Strengthening

- Systematic documentation and dissemination of best practices and existing data collection tools and methods related to facility and community HIS strengthening;
- RHINO to work with Health Metrics Network (HMN) and other partners to advocate for the following:
 - Closer interagency collaboration (national statistical offices and Ministry of Health [MOH]),
 - Harmonization of reporting requirements of donor agencies,
 - Resource mobilization, especially at first level of care;
- Development by RHINO/HMN and other partners of generic low-cost or free integrated software packages, thereby allowing integrated data management at the district level and below, as well as data presentation leading to better use of information for evidence-based decision making;
- Development by RHINO of a position paper on the use of appropriate technologies for data processing and analysis at facility and community levels;
- Organization of the RHINO forum on community HIS;
- Commission of a paper on a “strategy for the development and implementation of hospital information systems in developing country contexts.”

Introduction

The third international workshop organized by RHINO took place from February 26 to March 3, 2006, in Chiang Rai, Thailand. The workshop focused on data collection and information use at community and facility levels of the health care system. Community and facility levels together represent the service delivery interface of the health system, meaning the level “where action takes place.”

The workshop brought together 130 participants from 32 countries representing all the continents. As public and private managers, experts and consultants, and academics working in the field of RHIS, the participants worked together on the following objectives:

- To examine lessons learned and best practices to advance the state of the art related to the production of quality data at community and facility levels, as well as to advance the use of the information for evidence-based decision making that is related to individual and community health interventions;
- To reinforce RHINO as a network to advance the state of the art in RHIS development on a continuous basis via the sharing of knowledge and experiences.

The selection of Thailand as the location for this workshop was not coincidental. Thailand has developed an extensive “culture of health information” with widespread collection and use of information at all levels, including primary- and referral-level health facilities, as well as in communities. The country has an extensive network of community health volunteers and health workers who collect and use detailed information on all citizens. This capability provided a rich learning environment for the workshop.

Background

RHINO was created in 2001 under the MEASURE Evaluation Project, a project that is funded by the United States Agency for International Development (USAID) and that focuses on improving the use of information for evidence-based decision making. The RHINO Initiative's mission is to advance the state of the art in RHIS, as well as to improve the practice of RHIS design and implementation worldwide through cross-fertilization of lessons learned and of best practices from various countries and organizations.

RHINO has held two other international workshops. The first took place in Potomac, Maryland, in March 2001. That workshop investigated the rationale for investing in RHIS in developing countries, the role of RHIS in facilitating and monitoring health sector reform, and the restructuring and strengthening of routine health information systems. A major output was the "Potomac Statement on Investment in Routine Health Information in Developing Countries." This document specified three roles for RHINO: (1) to coordinate investment and learning in RHIS development; (2) to analyze and disseminate best practices in routine health information collection and use; and (3) to promote research, technical meetings, and pilot projects.

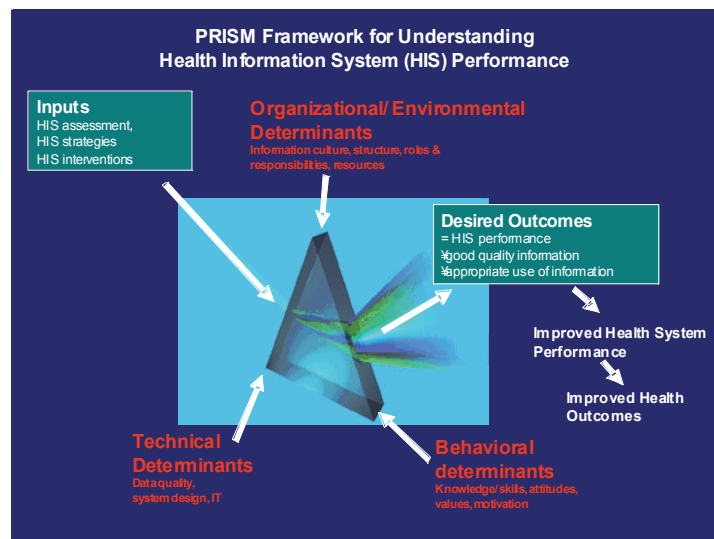
The second RHINO workshop was held in South Africa in October 2003 and focused on enhancing the quality and use of routine health information at the district level. The workshop offered participants a unique program that wedded field-based learning with a residential program that included presentations, discussions, and an informal exchange of experience. Using the PRISM framework, participants examined the factors that influence the production of high-quality data and the use of routine health information in district health settings, and they shared experiences and techniques for building capacity for information use at the district level. As a direct result of the workshop, and drawing on the recommendations of the participants, MEASURE Evaluation Phase 2 staff members have fine-tuned the PRISM framework and have developed a set of tools to assess and propose interventions that will improve district RHIS.

Workshop Conceptual Approaches

The third RHINO workshop's participants explored the collection and use of information at facility and community levels on the basis of two underlying conceptual approaches:

1. *Decentralization of information management as an effective strategy to improve routine information systems:* This approach was developed at the second workshop on district information systems in South Africa in 2003. It is expected that delegation of information system management responsibilities to the district level will ultimately lead to the production of better quality data and to an increased use of information by care providers at facility and community levels. Decentralized information management is also a major step toward integration of individual and community health information systems (HIS). The information produced by a district facility and by at least a partially community-managed HIS can provide the glue to bind together individual and community health interventions.
2. *The PRISM framework for improving RHIS performance:* The PRISM framework (see Figure 1) is an analytical framework for better understanding RHIS performance. It is a logical framework that assumes that a series of inputs and processes leads to the output that is RHIS performance. RHIS performance will then eventually lead to better health system performance (outcome) and better health status (effect). RHIS performance is defined as sustainable production of quality data and continued use of health information for evidence-based decision making. The PRISM framework further assumes that three main groups of determinants influence health information system performance: (1) the organizational context of the health system; (2) the behavioral aspect of data collectors and users; and (3) the technical and design aspects of information systems.

Figure 1. The PRISM framework.

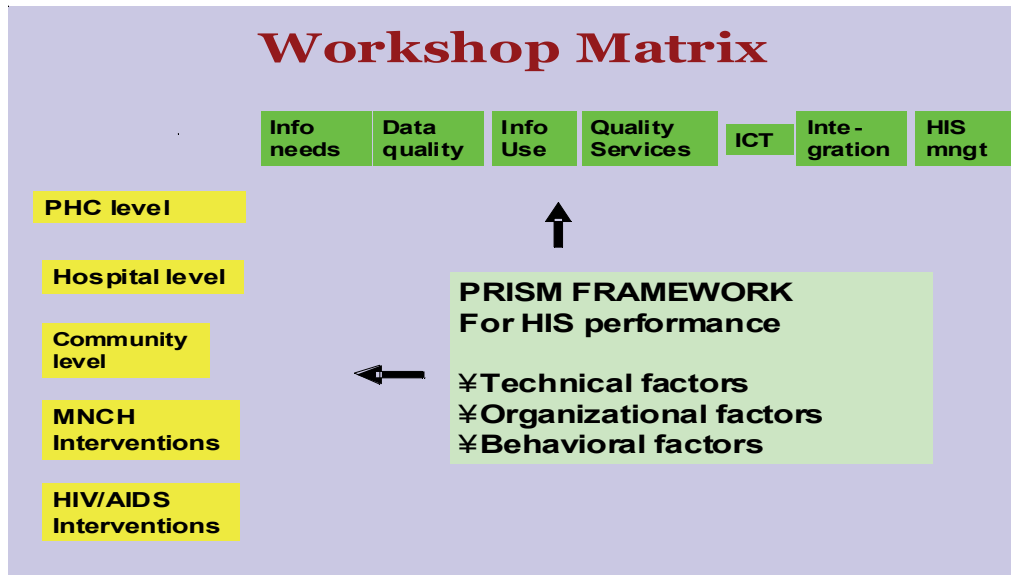


During the workshop, participants were asked to use the PRISM framework as they assessed and identified best practices related to data collection and to the use of information at facility and community levels.

Workshop Organizational Setup

To enable attendees to study data collection and use at facility and community levels, the workshop agenda was organized around workshop themes and cross-cutting topics. Participants were asked to join one of *five thematic groups* for the preliminary fieldwork and workshop discussions. Each thematic group explored *seven cross-cutting topics* within the conceptual framework of the PRISM (see figure 2: workshop matrix).

Figure 2: Workshop Matrix.



Thematic Groups

The workshop participants each joined one of the five major thematic groups: (1) the community-level group; (2) the first-level care facility group; (3) the hospital group; (4) the maternal, neonatal, and child health (MNCH) group; and (5) the HIV/AIDS group.

At the *community level*, workshop topics included the role that communities play in RHIS; differences between utilitarian and empowering community-based programs; event-based data collection versus monitoring and screening systems; differences between clinic-based and population-based programs; vital events registration, including sentinel techniques such as SAVVY; information support to behavior change and communication interventions; and environmental health information.

Issues for consideration at the *facility level (both first-level care facilities and hospitals)*¹ were defining information needs on the basis of functional analysis and standardizing data elements; data collection issues, such as patient-retained versus facility-retained records; electronic medical records; unique patient identifiers and antiretroviral therapy patient tracking; design of data collection and reporting instruments; and resource information systems, such as financial, human resource, and logistics information systems.

Two additional thematic groups developed case studies on two of the main health problems in developing countries: *HIV/AIDS* and *MNCH*. They examined information support to various health interventions at each of the health system levels under study (community, first level, and referral level). Solutions for both of the health problems require consistent performance of many aspects of the health care system over time to achieve success. They also require integration of information at various levels and longitudinal care requesting solid information storage and retrieval functions of the system.

¹ During this workshop, facility-level data collection and information use was studied separately for first-level care facilities (or primary-care facilities) and for hospitals (or referral-care facilities).

Cross-Cutting Issues

All thematic groups examined a defined set of seven cross-cutting issues: (1) information needs and demand; (2) data quality; (3) information use; (4) quality of services; (5) information and communication technology; (6) integration; and (7) information system management.

Information needs and demand: This topic is the most strategic one in building high-performing information systems. Information need should drive demand. The lack of use of facility-based information by the health managers and care providers is often closely related to poor relevance of the data collected for patient and health facility management. This relationship is most applicable to community-based information. Communities should only collect data with an explicit demand, meaning that community members have understood the need of the information generated for management of community interventions.

Data quality: As shown in the PRISM framework (see Figure 1), one of the two main outputs of HIS performance is data quality. Workshop participants explored the factors that could contribute to the production of high-quality data for each of the thematic groups: community, primary, and hospital levels, as well as for HIV/AIDS and MNCH interventions. Issues of data collection, reporting, transmission, processing, and analysis were explored in relation to the production of quality data.

Information use: Routine health information collected at facility and community levels is often used only at higher management and planning levels (if at all) to monitor the health system performance and to plan for resource allocation. However, the best level for use of health information is close to the point of services to individuals and communities. For this to happen, the culture of information use must be promulgated throughout the health system, with particular focus on care providers and managers at facility and community levels. This topic explored a comprehensive set of factors from the PRISM framework to foster and to improve information use at facility and community levels.

Quality of services: The provision of evidence-based quality services is one of the main outcomes of the health system. A well-performing RHIS can provide the necessary information support to the provision of high-quality services, both quality of care to individual clients in the health facilities and the quality of community interventions. Workshop participants explored informational problems relating to the provision of quality services and proposed innovative approaches to this important issue.

Innovative use of information technology (IT) in RHIS: While increasingly used for collecting, processing, and analyzing facility- and community-based information, information and communication technology (ICT) tools have not been widely or systematically evaluated for their appropriate use at those levels in resource-poor settings. Participants assessed the use of IT at the facility and community levels and both the role of ICT in data collection and the use in HIV/AIDS and MNCH programs. Particular attention was given to innovative IT solutions, such as the use of electronic medical records, hand-held devices, smart cards, telemedicine, data warehouses, and others.

Integration of information systems: Integration of information at the service delivery level supports a holistic perspective toward health of individuals and communities. Participants reviewed facility and community data collection and proposed innovative mechanisms to improve horizontal and vertical integration. This was particularly useful in relation to HIV/AIDS and MNCH interventions, whose range of interventions covers all service delivery levels, from the community all the way to the hospital.

Information system management: HIS need to be managed. For users to achieve the desired RHIS performance, the roles and responsibilities at each level in the health delivery system have to be clearly delineated and defined. In any efficient HIS, either community or facility based, each category of staff members affiliated with the health system has a role to play. A RHIS built-in support of the health system has to fit into the overall organizational framework of the national health system.

Workshop Proceedings

The workshop started on Sunday evening, February 26, 2006, with an opening dinner. Various speakers took the stage, culminating with the keynote address by Dr. Suwit Wibulpolprasert, senior adviser to the Thai Ministry of Public Health. The evening ended with a beautiful ceremony of traditional dances from Northern Thailand.

On Monday morning during the opening session, which was lead by Mark Spohr, the PRISM conceptual framework was presented by Theo Lippeveld and Anwer Aqil. Dr. Narong Kasitipradith from the Ministry of Public Health presented an overview of the Thai health system. Following this, the first two days of the workshop consisted of field visits. Each field visit group focused on one of the five thematic areas and examined the various cross-cutting issues as related to the theme under study. Participants visited the geographic area in the vicinity of Chiang Rai and observed the health information system “in action” at the community, facility, referral, and district levels. The visits were facilitated by Thai and expatriate thematic group coordinators. More detailed notes on the field visits are part of the thematic group reports.

The workshop discussions began on Wednesday morning. The participants were introduced, and the workshop agenda was presented. Each field visit group reported to the large group on its activities and preliminary observations. Discussions on Wednesday and Thursday focused on the five workshop themes, reviewing the state of the art and lessons learned from each theme according to the seven cross-cutting issues, and formulating recommendations for each of the workshop themes. On Friday, discussions focused on the cross-cutting issues, and participants were “reallocated” to cross-cutting issue work groups. The participants examined the issues and lessons learned from each cross-cutting issue at facility and community levels, as well as for HIV/AIDS and MNCH interventions. A summary of the workshop discussions is provided under the thematic group reports.

On Wednesday, Dr. Churnrurtai Kanchanachitra and Dr. Norma Wilson presented an overview of the Health Metrics Network. During the evening, a “walkabout” was organized, which gave organizations an opportunity to demonstrate computer and communication technology solutions.

The workshop proceedings were a good mix of site visits with plenary discussions and small breakout sessions. Field visits and breakout discussions were guided by key questions developed on the basis of knowledge of gaps in the literature. The questions were further reviewed while examining the field experiences of the participants. Gallery walks were used to report key outputs of field visits and small group discussions.

Thematic Group Reports

In the following sections, proceedings of each of the thematic groups have been summarized. Each thematic group section starts with conceptual notes. Those notes are a summary of the concept paper on each theme given in the annex. It is followed by a short report on the field visits undertaken, and on the discussions held in the group sessions. The outputs are reported in the section on Workshop Outputs.

Thematic Group 1: Community-Level HIS

This thematic group explored data collection and use of routine community-level information, as well as links with facility-based information systems. Quality data collection and appropriate use of information at this level can provide some of the most valuable information for health services management, as well as for management of essential public health functions—from reporting of births and deaths; to notification of disease outbreaks; to identification of high-risk individuals, pregnancies, and births; and to more peripheral information about household coverage, safe water supplies, and sanitation. There is also the opportunity for complementarity or synergistic integration of health interventions through the sharing of information between facilities and the community. The group focused on issues related to the establishment and scaling-up of such community-level RHIS.

Conceptual Notes

A community-level RHIS consists of a series of activities that collect and manage health data within communities. The analysis and use of data may occur locally (e.g., a facility serving the community might analyze information collected by community volunteers and subsequently share the results with the community) or at a higher level within the public health system, depending on the information system in place. There is some evidence that systems that use a bottom-up, community-based approach to data management(i.e., one in which at least some data are analyzed and used at the community level) are more effective than those in which data go directly to a higher level.

The extent to which a community is linked socially, physically, and technologically to its overarching health system varies greatly, depending on its role within the greater health structure. A successful community-based information system can create such a link by promoting awareness of the health issues that are affecting a community, by providing individuals with the information necessary to address those issues, and by facilitating relations between community members and health personnel.

While a community RHIS is primarily a monitoring system, the means by which data are collected often involve members of communities of interest—from the community health worker who travels from household to household collecting information, to the mother who provides information on her children, to the elders who help facilitate these meetings. The role of an effective information system will be to ensure that the data that have been collected at this level will come back to this level and will address issues of concern to the community. This will ensure that the community members become aware of the health issues they face as a group, encourage further participation in the system, and facilitate continued communication with health personnel.

Field Visits

The community thematic group visited field sites in Nan Province, a four-hour drive from Chiang Rai. The participants received the overwhelming hospitality of Dr. Pisit Sriprasert, chief of the Nan Provincial Health Office, and his team and started their visits with an evening full of social activities. In the morning, they saw a presentation and had a discussion about Nan Province’s HIS . They then traveled to Ainalai Primary Health Care Unit in Wiangsa District. At the clinic, they were able to interview staff members, to review family folders (medical charts), and to review and query the computerized 12-file HIS.

The group then visited the Wiangsa District Hospital where the hospital director gave a PowerPoint presentation, “Linkages of Health Information System in Wiangsa District.” Afterward, there was a lively discussion about data validation techniques, the 18-file hospital information system, and the linkages to the community through outreach workers and the village volunteer system.

At the village of Wangyao (Paka Subdistrict, Bang Luang District), the community health post medical officer gave a brief introductory presentation about the community-based information system. A highlight of the visit was the discussion of a system for monitoring the leading causes of death and tracking risk behavior (e.g., smoking, using chemical fertilizers, eating raw meat). The system covered the entire village and categorized community members by risk group (i.e., healthy, at-risk, minor disease, and chronic disease). This system

seemed to be driven by the national *Healthy Thailand Initiative* and allowed the community to set priorities for interventions, such as an anti-smoking campaign and a program to discourage the use of chemical fertilizers. The lack of infectious diseases on the list of health priorities was unusual.

Discussion Notes

The community thematic group began its discussions by considering the organizational factors in the communities that it visited the day before, and that help to facilitate the successful implementation of a community-based health information system (CBHIS). Participants were able to identify the community-oriented nature of the Thai culture in which, seemingly, no one is marginalized. In addition, there are established mechanisms for sharing information and concerns. There seemed to be a high level of community participation and a strong commitment on the part of the village leadership. Also, most agreed that the system of village volunteers was a major component of a successful system.

The group then discussed characteristics of the Thai CBHIS that had been observed and that lend themselves to the sustainability of the system. The participants generally agreed that the community needs to feel ownership of the system in order for the system to be sustainable. Village volunteers and feedback from the CBHIS to the community are key to engendering community ownership of the system. Also, a system that is responsive (i.e., one in which clear actions result from information provided to the system) is important to gain community buy-in of the system. The “volunteer” system in Thailand is supported by a benefit program that affords the participants free medical care.

The effectiveness of the CBHIS was made evident by the community’s action in the form of health care interventions. For example, the anti-smoking campaign that the group had witnessed during its visit had resulted from the informational finding that cancer and chronic obstructive pulmonary disease were the leading causes of death in the village mortality tracking system. Smoking featured as a prominent behavior in the risk behavior surveillance system. Additionally, the campaign against the use of chemical fertilizers can be linked to cancer as a leading cause of death. Finally, an exercise campaign, particularly among the elderly who formed exercise clubs, resulted from the community’s concern that heart attacks were a leading cause of mortality.

The group then tried to identify best practices for the conduct of community-based information systems and to identify a research agenda. Best practices cited by the group members included the fostering of a culture of volunteerism, because the village volunteers played such an integral role in the community-based systems that the group assessed in Thailand. Ensuring interdependence between the community-based system and the health facility close to the community was also cited as an important practice. The health facility can serve as a hub of coordination for community-based activities and can provide technical support. The community can also provide resources and data for the facility. Regular feedback is necessary to keep the population engaged in the system and well informed. Establishing routine data quality checks and identifying and developing strong leadership are also good practices. Ensuring that the information gathered through the CBHIS results in action will help the system remain relevant and vital.

Finally, the group then considered avenues of research. Among the ideas raised was investigating the hypothesis that the quality of the system improves with community ownership of the data. In addition, the need to investigate whether community-based systems, most often seen in a rural setting, could be replicated in an urban environment was also discussed. Importantly, methods to scale up and sustain a CBHIS and to link it to other sectors (e.g., vital statistics) need to be identified. Finally, research into standardized approaches to national implementation of CBHIS needs to be conducted.

Thematic Group 2: First Level of Care

Participants of this thematic group focused on the first or primary level of contact of individuals and communities with the formal health system. This level plays a central role in data collection and management in a decentralized RHIS. Effective management of an RHIS at this level depends on institutional organization, technical resources, and behavior of HIS staff members. The group focused on each of the three areas, addressing issues such as methods of data collection, management, and storage; quality of data; quality of care using the data collected, including continuity of care; horizontal integration of information between various health programs; and vertical integration with communities and referral levels.

Conceptual Notes

The first level of care forms the core of most health information systems. It is the primary delivery point for services, the principal point of contact for patients, and the primary location for data collection. Facilities at this level include community health centers, dispensaries, and maternal and child health centers, as well as the respective outreach activities associated with those facilities, such as counseling, home visits, midwife services, and so forth.

Most first-level care facilities use community-based activities to promote health among the general population, as well as among specific target or high-risk groups. As such, they often serve as a central position in the health delivery system, as well as an organizing point for many community activities. This point is most often where community health workers are identified, trained, and supervised; where grassroots organizations go for information and assistance; and where individuals go for general care and referrals. It is the point where the vast majority of RHIS data are collected. Because of this valuable data collection, the first level of care depends on a well-structured organization that can help facilitate the collection and management of information. Within a well-integrated system, it can help facilitate program management, identify needs within specific communities or populations, provide higher-quality services, and ensure that accurate data are disseminated to the HIS. In addition, the technical expertise of staff members and the technical resources available to them will also play key roles in quality of data, their relevance, and their analysis.

All of this data usage is closely tied to workforce buy-in and to the data collection behavior of the management staff. Without a proper understanding of motivation behind an RHIS, or a familiarity with the technical aspects of any system, quality, timeliness, and accuracy of information will suffer. Likewise, without appropriate behavior, integration begins to suffer, and technical management becomes more complicated.

Field Visits

Before the field visits, a site visit orientation session was organized for the group of 22 participants. The coordinators gave a brief overview of the thematic group and provided fieldwork and report guidelines.

The first field visit started at the Mae Chan Hospital with an introductory presentation by the director of the hospital and his staff on the following topics:

- Health services management at Mae Chan Hospital;
- Health information management at Mae Chan Hospital;
- Primary services in the primary health care unit;
- Information linkages between the hospital and the primary health care unit.

The presentation was followed by a lively and productive question–and–answer session that demonstrated the high level of participants’ interest in the subject matter. The rest of the afternoon was devoted to preparing the next day’s field visit. For the visit itself, the participants were divided into two subgroups, each visiting the following places:

- Outpatient Division
 - Outpatient’s service data management;
 - Pharmacy division’s service and data management;
 - X-ray and medical laboratory service and data management;
 - Financial service and management.
- Medical Record Information Division
 - Patients database management;
 - Quality control;
 - Method of data collection;
 - Analysis and report.
- Primary Health Care Units Located in the Mae Chan Hospital, in Pharajchathan and Chanchatai
 - Services at the primary health care unit;
 - Database at the primary health care unit;
 - Data collection tools (family folder system, personal record with unique identification, out patient card, and referral form);
 - Data processing and data audits;
 - Data use.

Participants took extensive notes using the guidelines provided. They were very satisfied by the sites they visited, as well as by the field visit guidelines. The participants highlighted some of the best practices:

- Availability of computers at the lowest level of the health system;
- Training of health staff in computers;
- Good data validation procedures;
- Supportive HIS supervision every three months;
- Family folder system;
- Recognition for good performance;
- Decision making at the local level;
- Effective archiving system.

Discussion Notes

Participants categorized their observations or gaps and the challenges or lessons learned from the field visits by category of PRISM determinants and cross-cutting issue. Then, each participant identified two issues. The following issues or challenges were considered most important:

- Development of integrated HIS at first-level care facilities is a big question. Is it possible?
- The data set is already defined (Millennium Development Goals, or MDGs). Each country is unique, with each having health problems; there is no need to define a minimum data set beyond MDGs.
- A private-sector or community-based organization does deliver care. How is that information captured and integrated with the HIS?
- What are best practices for referrals between communities and facilities? How to follow up on referrals if community or NGO systems are weak?

Thematic Group 3: Hospital Level

The hospital-level thematic group also explored issues similar to the primary care level, but with particular emphasis on the referral role of the hospital in the health system organization and in health care delivery. The group focused on the district (or secondary level) hospital rather than on tertiary care hospitals, which have their own specific set of functions. Specific issues at the hospital level are the horizontal integration between and among various services, as well as the development of appropriate computerized data management systems for patients and services.

District hospitals are large, multifunction facilities. They provide a wide variety of services and employ a diverse community of professionals. A crucial role of these hospitals is handling referrals from primary care facilities for specialist care. Information should accompany patients to the hospital and back to their first-level care, but tracking patients is a challenge and is often deficient.

Hospitals cover a wider range of services, including inpatient and outpatient (or ambulatory) care, anesthesia, maternity, rehabilitation services, and diagnostic services (X-ray, laboratory, etc.). Hospitals have to coordinate the work of many professionals, such as doctors, nurses, and administrators. Within those groups, there are often distinct categorizations and hierarchical arrangements (e.g., specialists versus students, matrons versus nurses), which also have to be taken into account when developing information systems. Managing such a multifaceted system remains a challenge to health information systems.

Conceptual Notes

Hospital information systems enable the clinicians to provide quality care and to assess the quality of the care that is provided. Assessment requires an approach that views information systems as systems that can adapt as quality improvement cycles develop and as changes occur. Hospitals are huge consumers of resources, especially when their budgets are compared with those of primary health care (PHC) services. The ability to quantify workload and financial aspects of hospitals' services is important in assessing equity between hospitals, as well as between hospitals and PHC services. Also, funding is often closely linked to information about the services provided; poor-quality information (or underreporting) can have a grave effect on budget allocation.

Hospitals are often the sites of regional labs, and a laboratory information system with appropriate information and communication technology can improve laboratory services, as well as perform important disease surveillance. Patients from the primary health facilities are referred to the hospital for specialized care and then return to their community. Often, crucial information regarding the patient does not follow the patient, leading to suboptimal care.

In a decentralized health system, hospitals, primary care services, and community services are part of an integrated service delivery system that is managed at the district level. As such, the level of integration of the hospital information system, the quality of data, and the information and communication technologies are significant in determining how data are used for decision making, and ultimately the quality of services provided at all levels.

Field Visits

During the field visits, a group of 18 participants spent two days at the Lampang Hospital (a regional referral hospital of about 800 beds), a primary care unit that feeds into the hospital, and at an adjoining smaller community hospital. The factors that participants looked into included data flow between levels, use of data at the community level, information access, and use issues between the community and the hospital. They also studied the hospital's core data set definition, plus data collection and use. The visits to those facilities highlighted a number of issues that contributed to the success of the Thai hospital information systems, as described next.

Leadership was a key aspect that contributed to the success of the Thai hospital information system. The national Ministry of Public Health had provided clear guidance on the data required. An electronic file format was defined and hospitals had to submit data in that format, irrespective of how they collected the data. Leadership

was also provided within the hospital, through the guidance of the senior clinical manager who ensured that teams were established and that they were integrated to create comprehensive quality improvement teams. Hospitals were also required to achieve certain accreditation standards; central to this accreditation was the establishment of quality improvement processes in the various wards and units of the hospital.

A clear *policy environment* had also been established in support of developing information systems. Essentially, accurate reporting was a prerequisite for receiving allocations from the MOH.

The leadership, coupled with the drive to attain accreditation, was a powerful stimulus for the *motivation* of staff members to create a culture of information use throughout the hospital. There were well-defined mechanisms for data collection, and indicators had been defined and were monitored

Information use was apparent; it focused on the quality improvement program (QIP) initiatives, rather than on managerial aspects of hospital information systems.

Discussion Notes

Some key issues emerged around processes in the hospital information system:

- Balance the bottom-up with the top-down processes. The Thai system has identified reporting requirements to the ministry. In addition, a very active bottom-up process has been established and linked to the quality improvement processes.
- Review existing systems before embarking on new systems. It is important to review current systems and to find ways of strengthening and supporting them, rather than replacing them totally.
- Focus on the use of data in staff development. Training on the use of the system and on the QIP focused on these initiatives.

During the group discussions, a number of important issues were raised relating to the three series of factors of the PRISM: the technical, the organizational, and the behavioural factors. However, in trying to distil those issues, the group found it necessary to explore the differences between hospital and PHC information systems. The differences are discussed in the concept paper which appears in the annex.

Technical Aspects

Flexibility in the design of systems was critical. Because hospitals reflect a changing environment (new wards, additional clinics, and changing disease profiles), the software must be able to reflect the changing context. Because the systems required are more sophisticated, hospitals need to consider carefully the aspects of maintaining the technical systems.

The ability to provide rapid feedback and analysis to different units in the hospital is an aspect that is often neglected in hospital information systems, especially because the focus is so often on the collection of information for the electronic patient record (EPR), without attention being paid to the analysis of the information that is generated in the EPR.

Free- and Open-Source Software: A discussion emerged regarding the difference between free open-source software (FOSS), which is being continuously developed and made available free of charge, and proprietary systems (as is the case in Thailand), where each hospital or a group of hospitals pays a vendor for the license to use and customize them. In the proprietary system, the source code is not shared, and the “owners” or software developers make adjustments to the software. Those systems tend to result in the same types of systems being developed in different ways, and the approach results in inefficiencies through duplication and costs as compared with open-source systems (see <http://www.care2x.org>).

Paper and Electronic Systems: Most hospitals use a mixture of paper-based and electronic information systems. The interface between paper and electronic systems can occur in different ways during the care of a patient (as in a fully EPR system versus one in which patient information is captured on paper records, and then a subset of those data is captured on a computer by a clerk). Hospitals may also have fully electronic systems (e.g., for financial accounting or billing), but may use paper systems in the pharmacy. The balance between the paper-based system and the electronic systems reflects the context—the availability of technical resources, the staffing level, and the ability to work with and support highly technical systems—and the volume of data to be collected.

Behavioral Issues

The Thailand visits highlighted a number of behavioral factors that contributed to successful information systems:

- Linking information systems development to accreditation was extremely successful in Thailand and in the Philippines (accreditation linked to health insurance), and the process served as a motivating factor.
- While being a key issue, training was not discussed at length. Briefly, the types of training were reflected on, namely, technical skills related to the use of the system, training related to the use of information, and application of the principles of quality improvement programs.
- A key aspect of the development of the information system should be to empower staff members. The QIPs reflect this goal, but another aspect is how staff members can grow personally through their involvement in the QIPs.

Organizational Aspects

Hospital information system development needs to occur through the initiation of small achievable steps within a long-term plan that is based on a future vision of the hospital information system. This development path is addressed in the technical category too, but the hospital environment/context is where the vision is established.

Another important aspect in this category relates to the allocation of resources to find out if sufficient human and technical resources are allocated to the information system.

Leadership plays an extremely important role. It serves not only to coordinate the development of the information system but also to motivate staff members and to ensure that a culture of information use is developed. The leadership role plays out on many levels and in many aspects of a hospital. A key area is the creation of teams that collect and use information. They need to be multidisciplinary teams that cut across departments and professional groupings. They should work together to develop the system and to analyze the information. Within the teams, individuals have very specific roles, which need to be recognized and consciously documented in their job descriptions and performance appraisals. Protocols and guidelines, plus training about information systems, need to be institutionalized; a key aspect of this approach is the allocation of resources to bring about these leadership changes by management.

The creation of a culture of information use traverses all three categories (technical, organizational, and behavioural). From a contextual point of view, management needs to ensure that roles and responsibilities are defined, that systems are decentralized to the lowest possible units, that coordination exists between units in the hospital, and that the relations with the hospital and its external environment are efficient.

A key aspect of the management role in creating a culture of information use is establishing regular meetings with staff members to share information for evidence-based decision making, as well as establishing benchmarks for different services.

Thematic Group 4: Maternal, Neonatal, and Child Health

The thematic group on the maternal, neonatal, and child health (MNCH) HIS objective was to study MNCH data collection and information use at community, primary, and hospital levels. Growing international attention to health inequalities among women and children during the past two decades has highlighted the importance of maintaining quality data to monitor MNCH at every level of the HIS. Availability of credible information is important for planning and implementing quality MNCH programs and for achieving the best public health effect. Data collection, communication, analysis, and use over the entire continuum of care—from pregnancy, delivery, and neonatal care to child health monitoring and care—are crucial for the effectiveness of MNCH programs. Health interventions and data collection related to reproductive health and childbirth are frequently faced with difficult social, cultural, and behavioral challenges. Those challenges are often made more difficult by situations of poor economics, isolation, low literacy, and a lack of political will.

Conceptual Notes

The MNCH systems were considered a priority area to study facility and community information systems for a number of reasons:

- MNCH issues are priority health problems in most countries.
- Significant MNCH episodes are life-cycle events—pregnancy, delivery, postpartum, neonatal, and early childhood—requiring longitudinal data development.
- Interventions with regard to those events occur at all levels of the health system, but they are more likely to occur in communities than in facilities.
- The interventions are varied, ranging from promotive and preventive to curative services, each with specific information requirements.
- Routine MNCH data (expanded program for immunization, antenatal care [ANC], delivery) are central to the entire RHIS.

Maternal, neonatal, and child morbidity and mortality are among the most frequently used indicators of health. The reduction of death among mothers and children has become a key component of the United Nations' Millennium Development Goals (MDGs). Most of the interventions to improve MNCH are low cost but depend on access and identification. This area is where collection and use of information can significantly affect health. Data collection, communication, analysis, and use over the entire continuum of care—from pregnancy, delivery, and neonatal care to child health monitoring and care—are crucial for the effectiveness of MNCH programs. Data are needed to monitor quality of care and to ensure that patients get the right type of care from the right staff person and in the right places, and that clients understand the key messages.

MNCH programs may have the greatest effect in resource-poor settings. However, the nature of such environments often makes collection and quality of data difficult. For this reason, an effective RHIS requires that the public health infrastructure achieve a level of development that is appropriate to supporting such systems. Some of the challenges often faced by such programs include poor or complicated data collection tools; redundant measurements; poor feedback loops; apathy; vertical, unintegrated data collection systems; and poor training.

Health programs and data collection related to gender and childbirth are often faced with difficult social and cultural challenges. Those challenges are frequently made even more difficult by situations of poor economics, isolation, low literacy, and a lack of political responsibility. The specialized data collection tools, such as verbal autopsies, and the staff, such as trained birth attendants, are often needed to reach populations that are not easily accessed through traditional health systems and monitoring.

Integration plays a strong role in the use of data and provision of quality services for MNCH. If one is to bridge the gap between communities and facilities, it is necessary to have a continuum of information that exists between all levels and that promotes a broader understanding of the problems faced by MNCH.

Field Visits

Field visits were conducted at three sites, thereby spanning the entire range of service delivery points, from tertiary (provincial) hospitals to first-level care and community services. Fieldwork spread over one and one-half days. A checklist of questions was developed to help participants structure their observations. During the site visits, participants wanted to know what data were collected by the Thailand MNCH programs, how the data move through the system, what the quality assurance strategies were, and what community involvement existed. Orientation provided by the Thai colleagues demonstrated that routine data collection is based on targets defined by the 9th National Socio-Economic Development Plan (2002–2006).

Thirteen indicators and their benchmarks are defined by the plan:²

- Rate of mothers who are below 20 years of age at delivery = less than 10 percent;
- Maternal mortality ratio = less than 18 in 100,000 live births;
- Prevalence rate of HIV infection in pregnant women = less than one percent;
- Rate of anemia in pregnancy = less than 10 percent;
- Perinatal mortality rate = less than 9 in 1,000 total births;
- Infant mortality rate = less than 15 in 1,000 live births;
- Birth asphyxia rate = less than 30 in 1,000 live births;
- Incident of low birth weight = less than seven percent;
- Rate of HIV infection in children younger than two years of age = less than eight percent;
- Rate of thalassemia screening in pregnant women = more than 80 percent;
- Rate of exclusive breastfeeding at six months = more than 30 percent;
- Rate of standard growth by age of children under six years = more than 93 percent;
- Rate of development of children under six years = more than 80 percent.

These data are collected routinely in the households by community health workers and at the health facilities. Data collection in the communities is supervised by the community health nurses during routine community outreaches. Data are summarized monthly and are sent electronically to the district or provincial offices or both. We observed limited knowledge of 12- and 18-file systems among the health workers at the sites visited. Most were knowledgeable and actively involved in the collection of MNCH target indicators.

Discussions with the health workers and management of the Thai MNCH programs revealed extensive data quality checks, including these:

- Data cross-checks at the point of data collection and higher levels;
- Double data entry to reduce data entry errors;
- Regular supervision and data review;
- Departmental meetings to review data;
- A two-way communication system, which ensured constant feedback from provincial and district offices on data errors;
- Follow-up by provincial- and district-level personnel to ensure that data errors are resolved;
- Community involvement in the collection, review, and use of data;
- Regional and technical content area meetings, as well as the annual award-giving ceremonies, which help keep workers motivated to collect quality data.

² Source: Chiang Rai Regional Hospital, OB-GYN Department (Dr. Pisanu Kantinpong, Chief).

In general, Thai health workers were well trained and knowledgeable about indicators and data collection timelines. Nevertheless, participants queried the quality of estimates provided (e.g., maternal mortality ratios, infant mortality rates, etc.), particularly because there were no clear guidelines on how denominators were constructed. Estimates of hospital service use (e.g., size of ANC visits at some primary health care units) also appeared inaccurate.

Thailand's maternal information system is computerized to the subdistrict hospital level. The use of ICT was seen in the application of an easy-to-use software program and in well-maintained computers. Data were summarized on computers, verified, and sent electronically to the district hospital. The district hospital collated data from all primary health units in its catchment and forwarded the collated data to the district public health office, to the provincial MNCH office, or to both. The data were then sent to the national data center from the district office. Participants observed some inconsistencies in data from district offices and from those offices that were approved by the provincial MNCH board. Such inconsistencies would indicate that further gains in data quality would depend in part on improvements in communication between the two offices.

Discussion Notes

Workshop discussions were strongly influenced by the observation of Thailand's MNCH system. Even though participants were advised to use the field visits to inform the staff about their own experience, most could not dissociate themselves from what they saw in the field.

Plenary presentation and small-group breakout discussions focused on the role that RHIS plays on the quality and coverage of MNCH services. Citing maternal health service delivery as an example, participants learned that most internationally accepted process indicators in the minimum data set for maternal services are obtainable from data that are routinely collected in the facilities. Similarly, in child health, important information on service use (immunization coverage), diagnosis and treatment, and incidence and prevalence of specific childhood diseases (such as ARI, fever, and diarrhea) can be obtained from the routine facility-based HIS.

Topics discussed in small groups included the following:

- *Information needs and demand at each level:* Expert knowledge recommends basing data development on management needs at every level. The participants wondered if this were, indeed, the case in national HIS. If yes, how did those needs filter through the system? There was no direct answer to the question, but observations of the Thai MNCH system suggested that data elements in successful systems are, indeed, informed by patient and program management needs. Otherwise, the system will not be sustainable.
- *Data integration and service quality:* Data integration plays an important role in the use of data and in the provision of quality services for MNCH. Data integration is the availability of all relevant indicators (which are based on stakeholder consensus) of the health systems in one database or data warehouse that is easily accessible by users. Most countries do not have integrated databases, because either the know-how is not in place or the human capacity has not reached the required level of sophistication. Most MNCH data systems are paper based, making an integrated system an arduous task. For instance, an integrated database requires that appropriate ICT be in place. Participants reiterated the advantages of an integrated database and noted that the benefits of investing in it and its associated technology outweigh the costs.
- *Use of information for service quality:* Participants discussed the limited use of RHIS data in most developing countries. Examples of data use from the Thai system demonstrate the power of information in services quality improvement (QI). Routine data collected at the facilities have helped map the incidence of new diseases (e.g., thalassemia in pregnant women) and to develop strategies for minimizing them. What is not clear from the Thai system is how routine quality improvement practices are integrated into the MNCH HIS system. To the observer, the two systems operate as parallel systems that would be more beneficial if integrated so that HIS targets are informed by QI accomplishments.

- *Health worker behavior:* The heartbeat of any RHIS is the motivated health worker (HW). However, data collection is not the primary task of HWs; their primary task is to provide care, which makes the issue of motivation even more important. Participants queried HWs' perceptions of RHIS on data collection, use, and quality. Participants wanted to know what incentives exist for staff members in the Thai health system that kept HWs so motivated. Observations of the Thai system indicate that incentives are not monetary but symbolic. Most HWs receive minimal pay, but most are given frequent feedback and are made to feel their work is important. Data collection and use are also promoted as attributes of excellent service, and HWs are supported by senior management. Routine HW training or orientation is used to address issues around HW motivation for data collection and use.
- *Organizational support for RHIS:* An important component of RHIS is the organizational structure that is in place to support data development and use. Participants discussed the role of an organization in promoting evidence-based decision making, knowledge management, transparency, and accountability, as well as good leadership. Observations of Thailand's MNCH program show that the MNCH board provides the organizational coverage necessary for the RHIS. With representatives at the primary care unit level, this board places a high priority on quality data and emphasizes the interdependency of data and quality services. Other contextual factors necessary for a sustainable MNCH RHIS (e.g., infrastructure, equipment, and ICT) also require good organizational structure. Participants recognized that cultural values may have an especially strong effect on data collection and program design for MNCH activities and noted that strong leadership is necessary to manage non-RHIS-friendly information cultures.
- *Cross-border sharing of data:* Participants recognized the importance of cross-border data sharing for a global village such as the world community. Those attributes are considered important in being able to curtail infections and improve management of such services. Drawing on the Thai system, participants wrestled with the question of what systems are in place for cross-border sharing of information, arguing that developing such systems are important for infection curtailment and better management of health services.

Thematic Group 5: HIV/AIDS

The HIV/AIDS thematic group studied many of the issues related to the complex set of interventions that are needed to manage the HIV/AIDS epidemic. The involvement of health facilities at primary and referral levels, as well as the community's involvement, is needed to implement the wide spectrum of health interventions, including antiretroviral therapy (ART), voluntary counseling and testing (VCT), behavior change and communication, and care of orphans and vulnerable children.

Conceptual Notes

HIV/AIDS is a chronic complex disease with many medical and social manifestations. As such, it requires comprehensive information coordination at the community level, first level of care, and hospital level. Furthermore, for curative and palliative interventions, this information must be recorded over the life of the patient and must be made available to the entire team involved in care.

Information Design

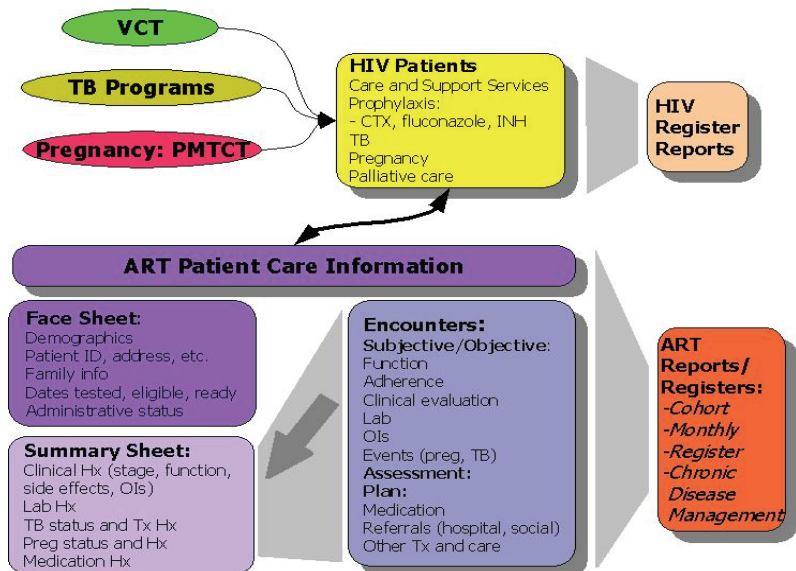
HIV/AIDS is a complex chronic disease that requires information covering each patient's entire longitudinal history if one is to manage care. Therefore, good information system design and implementation are crucial to clinical management of HIV/AIDS patients. The diagram in Figure 3 gives an overview of HIV/AIDS information data collection and use.

At the top of the diagram, HIV patients are identified through voluntary counseling and testing, TB programs, and prenatal prevention of maternal to child transmission (PMTCT) programs. A register of HIV patients is produced from this information. That register is used to organize services for those patients, such as TB care, pregnancy care, drug prophylaxis, and other care and support services. When patients are eligible and ready for ART care, the need for information increases to include expanded medical history (Hx), exam, laboratory, treatment (Tx), and opportunistic infections (OI). This needs to be tracked over time and tied to individual patient encounters so caregivers can track detailed diagnosis and treatment activities.

ART patient care information is used to manage individual patients to ensure that they are receiving optimal care that is tailored to their current status. It is also available for program reporting. In addition, the information can be used for research to gauge response to treatment protocols and to make necessary adjustments.

Figure 3. Information Design for HIV Patient Care.

Information Design for HIV Patient Care



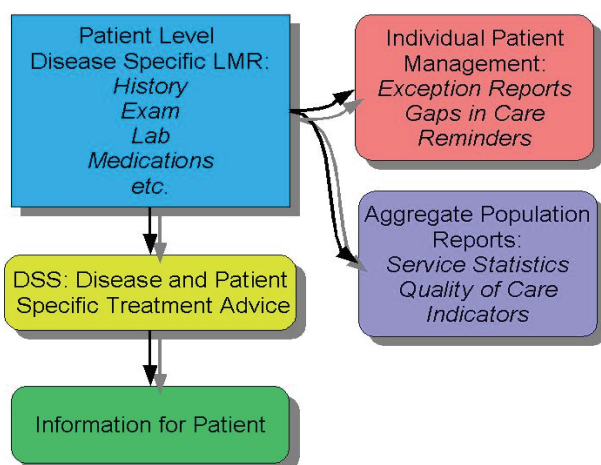
The HIV register information and ART reports are also valuable for coordinating care among community workers, health care workers, and support services.

Disease Management

Chronic diseases such as HIV/AIDS benefit from a disease management system that gathers longitudinal information on patients, that specifies appropriate interventions that take into account the individual patients' entire medical history, and that incorporates best practices. This disease management system also uses the information in the record to produce patient reports, program reports, and population reports.

Figure 4. Disease Management System.

Disease Management System



The disease management system provides information on individual patients so HWs can manage and improve treatment. The system has the ability to aggregate information to measure project effectiveness through service statistics, quality of care, and program indicators. Access to aggregate information is used to evaluate treatment protocols and implementation effectiveness as a part of a process of continuous quality improvement.

The HIV/AIDS thematic group explored the issue of HIV/AIDS care with particular emphasis on the community-level worker's role and on communication with first-level care and district hospital care.

In HIV/AIDS care, it is particularly important to track continuity of care, appropriate patient care, adherence to protocols, and community support services. All of those items are necessary for successful care of HIV/AIDS patients, and they all require access to good information.

The workshop field visits and discussions were a good opportunity to explore the issues and to come up with recommendations, to observe the services in action, and to understand quality improvement processes.

Field Visits

The HIV/AIDS thematic group visited two different hospitals that provide HIV/AIDS care. The first, the small Maijai Hospital, offered two clinic days a week for AIDS patients. It was well staffed and equipped with three computer systems and CD4count laboratory services. Clinical nurses monitored the catchment area and used a network model for HIV care. The information system included paper referral forms, a hospital information system, and the HIVQual software. HIVQual software and methods were developed by the New York State Health Department (USA) and are widely used for quality improvement activities.

The clinic placed a high value on patient confidentiality (the HIV clinic was separated from other patients) and had a good referral system and communication with the community level. It is significant that the quality improvement process was installed at the institution.

The second visit was to the Phayao Hospital, a large institution with 373 beds and more than 1000 staff. The hospital has treated 733 people living with HIV/AIDS in the past two years and runs a separate clinic for HIV patients one day a week. The facility has private voluntary counseling and testing (VCT) rooms and semi-private waiting rooms.

The information system uses paper forms for data collection and enters those data into a computer at the end of each day. If a patient is transferred, his or her information is copied to a floppy disk to move to the new clinic; the electronic record follows the patient. The software was developed locally using Global Fund money to report indicators. This software started as a pilot project four years ago and was implemented nationwide two years ago. The software project has been transferred to the Thai National Health Insurance Program.

The information system seems to work well, but some staff members reported that its operation was a burden to the staff and that they did not get to use the information. In addition, they had a separate VCT/ART system, which required duplicate data entry. They had developed their own clinical monitoring system for individual patient medical records. This system used MS Access and Visual Basic. One important note is that the TB and ART clinics integrated their information on patients. This hospital also uses the HIVQual software for quality improvement.

Discussion Notes

HIV/AIDS provides a fertile ground for discussion of many issues because it is a complex chronic disease that requires a high level of information collection and use.

Issues discussed include patient identification, patient data transfer, coordination of HIV and TB care, HIS development and implementation (including incremental development), confidentiality, continuity of care, links of community and facility information, patient mobility, and optimal data sets. The results of those discussions were used to formulate the best practices, advocacy, and research agenda items listed in the next section.

The group felt that a unique patient identifier was highly important. It serves several functions, but the main function is to uniquely identify the patient, which permits ready access to the patient's record. It also prevents multiple records from being created and prevents cross-linking records with those of another patient. It was felt that the unique patient identification (ID) should be at the national level to permit patients to move from one area to another. Local clinics may also have their own local ID number.

Patient data transfer is an important issue. Patients may reside in different locations during the course of their disease. For instance, as patients become debilitated, they may move to an area where they have family support. As they respond to treatment and feel better, they may move to another area where they have the possibility of working. It is very important that the patient's medical record follow the patient. ART depends on continuity of care and on following protocols that are based on the individual patient's condition, prior treatment, and laboratory. The issue of medical record transfer also includes the definition of the data elements that will be transferred and a common definition of the data so that the receiving clinic will have proper information. Patient data transfer applies within a community because a patient may be seen by community workers, first-level care workers, and hospital referral center workers. Each of those audiences requires a unique view of the information to meet their specific needs.

Developing and implementing an information system for HIV/AIDS treatment is a complex task. The software itself must track a wide range of information and must present it in a format that is useful to a wide variety of people who are involved in patient care and program monitoring. It was felt that it was important to involve stakeholders in developing software and that an iterative design process must be used so that feedback from the stakeholders could be easily incorporated into the system.

It is imperative that the confidentiality of all of this patient information be maintained. Electronic information can be encrypted and the software can have access controls and access monitoring. Paper system security depends on controlling physical access to the chart. All of these safeguards require a high level of awareness during design, implementation, and training so that operating systems do not compromise patient confidentiality.

Workshop Outputs

The outputs of the workshop are organized into four areas:

- *Best practices*: These are replicable lessons learned from functional systems or elements that should be present in all health information systems. Best practices were identified on the basis of field visits and participants' experience.
- *Action agenda*: The concrete recommendations for improvements in RHIS at the community and facility levels that can be put to immediate use in participating countries.
- *Research agenda*: This agenda involves further research and development of the state of the art on improved RHIS performance at facility and community levels.
- *RHINO agenda*: This area covers concrete plans for advocacy and continued networking through the RHINO mailing list server and on-line forums related to RHIS best practices and lessons learned at facility and community levels.

Best practices, action agendas, and research agendas are listed by thematic group. They are followed by selected cross-cutting recommendations. We then list the RHINO agenda for improvement of community and facility RHIS as identified by the Chiang Rai workshop participants.

Finally, various country and regional groups came together at the end of the workshop and drafted action plans for the short-term improvement and the long-term development of facility and community HIS. Illustrative country action plans are listed in Annex 6.

Community-Level Thematic Group

Best Practices

- Community information needs must be based on the community's expressed priorities.
- Use of information at the community level is a premature issue as long as the following occur:
 - Community-oriented services that are available do not meet the perceived need;
 - There is no community ownership of HIS;
 - There is no authority by the community to take action.
- There is a need to manage community expectations.
- The community RHIS seems to function better where there is a tradition of "community culture" and volunteerism: examples of this are Kenya and Myanmar.
- Strong leadership is needed.
- Interdependence between community and facility is essential to achieve common health goals.

Action Agenda

- Regular community meetings to review information, give feedback, and take action.
- Need for time-intensive and sustained capacity building.
- Action plan Myanmar: community culture but lack of motivation:
 - Need to empower community volunteers (e.g., training, supportive supervision);
 - Need to link community to facility.
- Action plan Kenya: institutional structure is in place (e.g., Constituency AIDS Councils):
 - Need to convince management of national health management information system to extend to the community level (training in basic HIS issues, such as data collection).

Research Agenda

- The study of scaling up of community-based health information systems (CBHIS):
 - Linkage to primary care unit, vital statistics, etc., and CBHIS in urban settings;
 - Determination of whether there is a standardized approach to countrywide implementation.
- Determination of whether involvement of communities (and, therefore, ownership of data) leads to better data quality and use.
- Determination of how communities benefit from use of information.

First-Level Care Thematic Group

Best Practices

- Related to information needs and indicators:
 - Standardized definitions of indicators and data elements;
 - Consensus by all stakeholders on minimum data set;
 - Harmonization of indicators—reduce burden of donor data requirements.
- Related to data quality or validation:
 - Daily tallying or totaling;
 - Use of unique identifiers;
 - Data validation or data quality audits (internal and external audits);
 - Quality assurance using medical and nursing schools;
 - District meetings or zonal meetings with feedback to health facilities.
- Use of information for action.
- Comparison of results of one district with another to encourage performance (stimulate competition).
- District-managed data review and feedback meetings.
- Self-assessment through regular management meetings.
- Reward or incentives:
 - Supportive supervision;
 - Authority to take action on findings;
 - Finance resources.
- Computerized data entry and processing:
 - Phased introduction of information and communication technology in health facilities;
 - Only if simplifying and saving time for health workers
 - Paper-based backup system always in place
 - Standardized facility codes.
- Information management:
 - Staff capacity building (especially use of information);
 - Good bidirectional referral system with feedback information;
 - Recognition or incentive for good performance;
 - Clear job description and responsibilities;
 - Decentralization of computerized data processing to the lowest level possible.
- Horizontal integration of program information systems at primary health care (PHC) level:
 - Use of family folders;
 - Unified forms or simplicity;
 - Regular meetings with different program care providers;
 - Supervision or technical support and training.

- Linkage of PHC facility with community HIS:
 - Primary health care unit with an assigned person for community HIS; sources compiled through a community representative (village health worker) who is linked to the primary health care unit (PHCU);
 - Creation of link between PHCU and vital events registration;
 - Provision of feedback to all the sources through monthly health committee meetings.
- Linkage of PHC facility with hospital:
 - Well-established referral form (e.g., Thailand);
 - Patient-retained medical record (e.g., Thailand: pink maternal and child health booklet) so that patients can move between the PHCU and the hospital with their information;
 - Reinforcement of these best practices by the introduction of a referral monitoring system with defined indicators (e.g., number of referrals by reason, service, or site; proportion of persons referred who were received at referral site; proportion of missed referrals receiving follow-up visits).

Action Agenda

- Consensus building on minimum data sets for use at primary-care level to be coordinated by national HIS offices.
- Development of manuals or guidelines for use of information by health workers at first-level care facilities.
- Documentation of instances of use of indicators for referral system.
- Establishment of referral monitoring systems (eventually computerized).

Research Agenda

- The study of links between RHIS and quality of care and services.
- Determination of how a culture of information use can be promoted and encouraged at the first level of care.
- Synthesis on data sets, data elements, and indicators used in developing countries in order to evolve best practices for wider applications.
- Evaluation research of high- and low-performing HIS to generate practical recommendations for HIS design and implementation in developing countries.
- Comparative study on the involvement of dedicated data entry operators versus service providers at the first level of care with the focus on quality of data, as well as of services.
- Operations research to examine referral tracking systems.
- Operations research on confidentiality of health information.
- Operational research on integration mechanisms at the primary level.

Hospital-Level Thematic Group

Best Practices

- Creation of a culture of information use in hospitals requires both leadership and networking among different units or departments.
- Data quality needs to be maintained using techniques such as entering the patient data on the same day of the patient's visit (which also aids timeliness), double data entry for verification, and use of automated software to check for errors.
- The flow of information needs to be carefully mapped to ensure that all units are included in the submission and use of routine information.
- Data collection systems need to be flexible to accommodate changes as they occur.
- Linking information systems development to the accreditation process provides a powerful stimulus for use of information.

- It is important to establish short-term plans that are framed within a longer-term plan—having a broad overall goal for the hospital information system. Because changes in technology occur so rapidly, however, easily implemented practices should be adopted for short-term goals.
- Sharing information horizontally across reporting units, or between hospitals of similar size, is useful for improving data quality and as a stimulus to improve quality of service delivery.

Action Agenda

- National HIS offices should develop guidelines for developing and implementing a hospital information system in the country context.

Research Agenda

- Study about the use of HIS for evidence-based decision making.
- Study about the use of electronic medical records (linked to health insurance) for chronic diseases (antiretroviral therapy, hypertension, etc.).
- Study about computerized information systems in different hospitals to understand their flexibility and, therefore, ability to accommodate the complex hospital environment.

Maternal, Neonatal, and Child Health Thematic Group

Best Practices

The following are best practices around HIS technical capacity:

- Availability of integrated family or patient records (e.g., the pink booklet in Thailand) that contribute to better use of maternal, neonatal, and child health (MNCH) information.
- Standard operating procedures, guidelines, or both for data collection, collation, and reporting.
- Availability of appropriate ICT: simple software that is usable by staff members and well-maintained computers.
- Ensurance of data quality:
 - Data cross-checks at the point of data collection and higher levels;
 - Double data entry to reduce data entry errors;
 - Regular supervision and data review (comparing reports with registers) by facility and district staff members;
 - Two-way communication system, which ensures constant feedback from district offices on data errors with follow-up to ensure that data errors are resolved;
 - Annual award ceremonies to keep workers motivated to collect quality data.

The following are best practices around HIS organizational capacity:

- Institutional mechanism for leadership or champion concept to be in place (e.g., the maternal and child health management board in Thailand).
- Supportive policies to promote data collection and use.
- Data collection, collation, and reporting as part of the job descriptions of staff members.
- Promotion of good management practices (e.g., teamwork, management by objective, and flexibility of organizational procedures).
- Existence of formal feedback mechanisms (e.g., quarterly meetings to review data with health center staff).
- Decentralized decision making on indicators and data needs, action and budget.
- Standard procedures in place for service quality improvement and problem solving.
- Adequate resource allocation of personnel, software development and maintenance, and infrastructure and equipment.
- Ensurance of community-based data collection through trained volunteers to collect data.

The following are best practices around motivation of health workers for data collection and use:

- Health worker with good technical skills and training for the assigned HIS tasks.
- Data collection and use promoted as attributes of excellent service.
- Supportive supervision systems that provide frequent feedback about their work.
- Routine training or orientation that is used to address issues around health workers' motivation for data collection and use.
- Ensurance of an acceptable staffing to workload balance.

Action Agenda

- Development of systems of data integration at each level (community, first level, and hospital) and between levels.
- Mapping of communities surrounding first-level care facilities that are focused on risk groups (PLWA, pregnancies, neonates, etc.).
- Better integration of denominators between health and administrative departments.
- Development of simple pictorial forms for community-based data collection.
- Monthly meetings for MNCH data review at the community, first level, and hospital.

Research Agenda

- Study about integrated family or patient record (pink booklet in Thailand): find out how much of the data collected are really used for patient or program management.
- Study about mechanisms for better integration (horizontal and vertical) of the MNCH data into the HIS.
- Study about the development and use of a HIS involving the private and the public sector to implement the IMCI strategy.
- Study about the value that RHIS add to the use of MNCH services.

HIV/AIDS Thematic Group

Best Practices

- Adopt data standards to ensure common definitions and to facilitate transfer of patients and their information throughout their lifetime.
- Use a formative and participatory process that includes all stakeholders.
- Use a “decision-making model” for HIV/AIDS information system design:
 - First, define decisions to be made;
 - Next, determine what information will lead to decisions;
 - Then, define data elements (numerators, denominators, etc.) that need to be captured in order to make key decisions.
- Design information flow to support the case management process.
- Link information systems for HIV and TB cases.
- Assign a unique patient identifier to ensure complete and accurate patient information; national and facility identifiers can be used.
- Ensure that computer and paper records work together.
- Emphasize the prime importance of maintaining confidentiality.
- Emphasize the prime importance of continuity of care, which can be improved:
 - Adopt data standards to improve data sharing across facilities;
 - Link the community with facility-based information.

Action Agenda

- Develop principles and standards to ensure patient confidentiality and to disseminate the best confidentiality practices, including experience from the patient’s perspective.
- Promote standardized HIV/AIDS data elements.

Research Agenda

- Ascertain the predictors of HIV/AIDS patient survival.
- Determine how to develop integrated systems that maintain confidentiality across the community and facilities.

Cross-Cutting Workshop Outputs

Best Practices on Private Sector Information Systems

- Develop legislation and registration of private provider (PP) hospitals and clinics.
- Set up a steering committee with clear terms of reference at each level of the organization and with monthly reporting and monthly feedback to PPs.
- Provide PPs with data collection tools that are user-friendly with a minimum set of data, and then train the PPs in using the tools.
- Establish social franchising with standards for facilities (e.g., Star system), including reporting requirements.
- Provide preventive products (vaccines and contraceptives) in exchange for reporting.

General Action Agenda on Facility and Community HIS Strengthening

- Formulate HIS task competency tools for various levels of HIS.

General Research Agenda on Facility and Community HIS Strengthening

- Determination of how to integrate the private sector into the national health information system in countries where close to 40 percent of the population gets care in the private sector (doctor’s office).
- Study of behavioral factors facilitating or constraining HIS functioning.
- Attributes of staff tasks schedule and HIS workload that show effective and appropriate balance.
- Constituents of appropriate incentives for information use at the facility and community levels.

RHINO Agenda on Facility and Community HIS Strengthening

- Systematic documentation and dissemination of best practices and of existing data collection tools and methods related to facility-based and community-based health information systems.
- RHINO to provide virtual follow-up and support to the various proposed country action plans.
- RHINO to work with Health Metrics Network and other partners to advocate for:
 - Closer interagency collaboration (national statistical offices and MOH);
 - Harmonization of reporting requirements of donor agencies;
 - Resource mobilization, especially at first-level care.
- RHINO/HMN and other partners to develop generic low-cost or free integrated software packages allowing integrated data management at the district level and below, as well as data presentation leading to better use of information for evidence-based decision making.
- RHINO to develop a position paper on the use of appropriate technologies for data processing and analysis at facility and community levels.
- Organization of a RHINO forum on community HIS.
- Commission of a paper on “strategies for the development and implementation of hospital information systems in developing country contexts.

Concluding Remarks and Next Steps

The Third International RHINO Workshop in Chiang Rai brought together a rich variety of experts and advocates of routine health information systems to focus more particularly on the development of relevant and effective facility and community HIS. Following are some key thoughts and issues that emerged from the collective reflections of the participants in the workshop:

- Leadership is critical in driving and integrating the development of facility and community HIS;
- Facility and community HIS require flexibility and adaptability;
- Both paper-based and electronic data collection systems need to co-exist and innovative thinking is required for smooth integration;
- The extent to which electronic systems are implemented is linked to access to technology, volume of data required, and human resource availability to operate the systems;
- The role of people and their contributions are central to success, and the investment in “peopleware” should neither be underestimated nor neglected;
- To ensure production of quality data and use for decision making, facility and community HIS should be continuously monitored for effective performance.

Under the workshop outputs, participants proposed an ambitious agenda for RHINO to work on in the coming years. While all of these represent important potential contributions to the development of relevant and effective facility and community HIS, we want to single out some interventions which can be implemented immediately:

- Follow-up via the listserv and Web site with country and regional teams on the implementation of actions plans;
- Establishment of a close working relationship with the Health Metrics Network;
- Inventory of best practices on facility and community HIS to be posted on the Web site.

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ANNEXES

1. Agenda
2. Thematic Group Concept Papers
3. Cross-cutting Issues Background Papers
4. Overview of the Thai Health System and Health Information System
5. Walkabout demonstrations
6. Illustrative Country Action Plans
7. The RHINO virtual workshop
8. The RHINO Steering Committee Report
9. Workshop Coordinators and Facilitators
10. Participants

Annex 1: Agenda

Sunday Feb. 26	Monday Feb. 27	Tuesday Feb. 28	Wednesday March 1	Thursday March. 2	Friday March 3
Arrival and registration	9:00 am Plenary: Welcome - Introductions - Conceptual frameworks - RHINO resources - Thai HIS overview - Logistics	Fieldwork	9:00–9:15 am Opening plenary	9:00–9:15 am Opening plenary	9:00–9:15 am Opening plenary
			Debrief on field visits	Gallery walk: Report out from thematic groups	RHINO resources & agenda Prioritization exercise Networking trek
	<i>Tea break</i>		<i>Tea break</i>	<i>Tea break</i>	<i>Tea break</i>
	Breakout: Preparation for fieldwork		Breakout 1: Thematic groups: Best practices	Plenary: Summary of gallery walk exercise Cross-cutting issue overview presentations	Summary of prioritization in plenary Breakout 4: Action plans
	<i>Lunch</i>		<i>Lunch</i>	<i>Lunch</i>	<i>Lunch</i>
7:00 pm Welcome dinner and keynote speaker	Fieldwork Depart 1:00 pm		Plenary: HMN presentation	Brief plenary	Action plan breakout (cont'd.)
			Thematic breakout 1 (cont'd.)	Breakout 3: Cross-cutting issues	Action plan report out
			Breakout 2: Thematic groups: research and action	Report out	Final evaluation
			Daily evaluation (end 4:30 pm)	Daily evaluation (end 4:30 pm)	Closing speeches (end 4:00 pm)
			Facilitator meeting	Facilitator meeting	RHINO Steering Committee
		<i>Dinner</i>	<i>Dinner</i>		
		Information walkabout			

Annex 2: Thematic Group Concept Papers

Theme 1: Community level

Theme 2: First level of care

Theme 3: Hospital level

Theme 4: Maternal, neonatal, and child health

Theme 5: HIV/AIDS interventions

Theme 1: Community Level

Background

A community-based health information system (CBHIS) is a series of systematic activities to gather, order, reflect upon, and use local facts to uplift the health of the community. While primarily a monitoring system, a CBHIS can also inform a complete project cycle, from situation analysis to design, monitoring, refinement, evaluation, and further refinement. Relative to the capacity of many communities, a CBHIS can be complex because it usually involves precise selection of indicators, design of data forms, and extensive problem-solving steps. CBHIS activities are ideally supported by careful selection, training, and supervision of system implementers and are based on community ownership of the system.

Sometimes experts consider a CBHIS an “intervention” itself, perhaps because of its high visibility, the requirement for local leaders’ endorsement, the number of community members involved, its innate intrusiveness (i.e., household visits, personal questions, and the like), and the support visits from afar, among other factors.

Role of HIS

A CBHIS, then, is a strategy to support increased use of health interventions. There are four general approaches to increase the use of health interventions: (1) increasing access and availability of services; (2) improving the quality of services; (3) increasing the demand for services and behaviors; and (4) enhancing the enabling environment. A CBHIS primarily enhances the enabling environment, but it also increases demand because the very act of asking a mother if she practices a certain behavior (which is the main way to monitor household behavior) tends to raise the expectation for, and thus encourage demand for, adopting that behavior.



A CBHIS group visits Wat Phumin temple in Nan, Thailand.

A CBHIS does not directly improve health status; rather, health status is improved only insofar as a CBHIS increases the use of health interventions. Nevertheless, a CBHIS can claim some beneficial direct effects, including the benefits of enhanced community mobilization, social mobilization, and community capacity (such as problem characterization, data for decision making, problem solving, prioritization, planning, tracking, etc.), all of which help in other areas of development. Finally, information chosen and gathered by those who will use it increases the likelihood that it will be used, and used with increased effectiveness, efficiency, quality, and equity.

At the community level, it is important to know what community-based information systems are available and the usability of the outputs by the communities. In some cases, the outputs may not be ideal for local use, but with some simple adaptation, such outputs can be achieved. The use and integration of information from diverse perspectives at the community level provide a reasonable degree of “evidence base” for better-informed decisions. It is also important that the systems outputs contribute to and are integrated with higher levels in the organizational structure.

The different types of community information systems include:

- **Community-initiated empowerment activities** that are described in CBHIS and that empower communities to make informed decisions will tend to keep the data close to the level of data collection. These activities tend not to have formal quality control procedures and can neither be generalized nor aggregated.
- Community-based data collection systems for **monitoring and evaluating health interventions** that are not necessarily delivered directly by the health system (e.g., NGO-supported interventions) are project-oriented systems that would tend to have more in the way of quality control. Many of them seem to be relatively short-term initiatives tied to the life of an intervention project, and they are not necessarily integrated directly into existing structures (e.g., HIV/AIDS community-level information and reporting systems).
- Community-based data collection systems that are designed to provide **demographic, socioeconomic, and health-related data** with a high level of quality control and rigor are intended to be long-term and tightly integrated parts of routine government systems (e.g., Sample Vital Events Registration cum Verbal Autopsy).
- **Facility-based** routine information systems collect information on **outreach activities**.

PRISM: Organizational, Behavioral, and Technical Factors

Communities are varied entities with complex systems of behaviors, diverse environments, and a wide range of educational and experiential backgrounds. The contributing factors of community and institutional organization, individual behavior (among both those directly involved with the CBHIS and general members of the community), and technical expertise within and available to the community play a significant role in determining the ultimate success of any CBHIS. The types and methods of data collection, the perceived value of the CBHIS, and the level of support from other health levels all need to be considered when implementing a CBHIS.

Cross-Cutting Issues

The functionality of a CBHIS depends on the quality of information that is gathered, the successful integration of that information into the local health structure, and the provision of quality services. Those elements are, in turn, influenced at both the community and facility levels by the demand for data, by how the data are used, and by the ability to successfully integrate communication and information technology.

Integration of information is facilitated through a CBHIS. Non-facility-based and facility-based program information overlaps in the community. Non-facility-based and facility-based programs working in communities need to share information. Home-based care (HBC) programs, for example, are a good illustration of the dependence on such a linkage between community-based organizations (CBOs) and facilities. There is often a gap between CBO collection and facility collection of information with respect to HBC medication. The result is that HBC indicators are actually lost. Community-based information systems can and should—by design—facilitate such an exchange between facility and non-facility programs.

Another example is in the provision of care for orphans and vulnerable children (OVC). Care for orphans and children made vulnerable by the HIV epidemic is by its very nature community-based, and, ideally, it is home-based. The children are best cared for within their community (as opposed to state-controlled, centralized institutions), and this care is most effective when applied as early as possible. The most successful and effective care depends on identifying a potentially vulnerable child and then providing a medical and social care plan before that child is orphaned. The plan should be continued afterward, coupled with long-term follow-up that emphasizes preventing the child from drifting to the street. The only way to do this successfully is to use an active and competent information system that includes surveillance of the needs of the children in the community.

Early identification of potentially vulnerable children is tremendously enhanced when such a system is connected to HIV diagnostic and treatment programs (e.g., voluntary counseling and testing, HBC) so that the children of HIV-infected parents can be reached as early as possible, and so work can begin with the child and the family. This approach will also enhance the identification of children infected with HIV and will facilitate the more holistic programming that is available and that is intended to reduce their vulnerability.

For such a linkage between OVC programs and HIV treatment programs to be successful, both of their respective information systems must be competent. The HIV treatment information system is likely to begin in the community but be connected to or even dependent on a facility-based system. Hence, the system as a whole is affected by the competence of the information system at the community level.

Questions to Consider

Organizational

- What factors related to the organization of the community should be in place to help ensure the success of a CBHIS?
- What forms of CBHIS are communities most willing to sustain?

Behavioral

- Which “quality” parameters are most relevant for a CBHIS (e.g., feasible to track, consider, act upon, and expect quality improvement that will result in improved health)?
- What is the evidence for action taken as a result of information provided through a CBHIS?

Technical

- What are the common and feasible “units of analysis” (e.g., child, household, person, community, institution [school], facility, service) in a CBHIS, and what are the most common decisions that are informed by those units?
- What kinds of facilities (both health and non-health) should a CBHIS include, and how should they be linked to the CBHIS?

Theme 2: First Level of Care

Background

The first-level care facility is the core of most health systems. It is the primary service delivery point and is often the first point of contact with the community. As such, it occupies a central position in the health system. It often serves as the organizing point for community health services.

First-level care facilities use community-based activities to promote health. Community health workers are often recruited, trained, or both at those centers and are used to maintain a direct connection between the first-level facility and the communities. Well-functioning first-level care facilities integrate well with community health workers and activities.

Role of HIS

In many areas, the first-level care facility is the primary data collection point. It is at this level that health programs are most often managed. Health information at the first-level facility plays a significant role, not only in facility management and disease monitoring, but also in determining health interventions and services. This level should also be the primary user of data for patient care and for planning to determine what services to provide and how best to provide them. Monitoring and evaluation using those data ensure the appropriateness of the services and help assess their quality and effectiveness.

It is at this level that improved collection and use of information can have the greatest effect on health services.

PRISM: Organizational, Behavioral, and Technical Factors

Health workers at the facility level are responsible for initially collecting, recording, and reporting health data. However, often as a result of weak organizational incentives, they are not encouraged to use this information, thereby missing a crucial opportunity to improve health. To improve the workers' behavior, a culture of information use must be established.

An inadequate supply of human resources is a major constraint in improving the quality of the information, its use, and the overall management of health services. These factors are confounded in resource-poor environments with limited access to information and communications technology.

Cross-Cutting Issues

Even though the first level of care is the focal point for information collection, much of this is not used at the facility level. This lack of use has the perverse effect of reducing the quality of information. From the facility perspective, there is a "burden of data collection" without a corresponding benefit.

The first-level facility point of care is a prime opportunity to foster a culture of information use and a demand for quality information. Because the first level of care is the focal point for data collection from the community, as well as the facility, that point also presents a prime opportunity to use innovative information and communication technology tools to collect information and to integrate data from those levels and also from other levels of the health system and sources, such as censuses, surveys, and vertical programs. Proper management of those integrated data can help give a clear picture for patient and program management at the first level of care and can serve as a powerful tool to improve service quality.

Questions to Consider

- Can we demonstrate that better health information systems lead to better health outcomes?
- What methods or tools can help facilities better use their data to address organizational, behavioral, and technical information system issues?
- What are the issues in linking community-based, facility-based, and district-level health information, and how can they be addressed?
- How can integrated data from the entire health sector be used to advantage at the facility level?
- How can we decrease the workload of data collection at the facility level?
- Do we collect the right data?

Theme 3: Hospital Level

Background

District hospitals are often large, multifunction facilities. They provide a wide variety of services and employ a diverse community of professionals. The link between the district hospital and its patients forms the crux of curative care.

Hospitals cover a wider range of services, including inpatient and outpatient (or ambulatory) care, anesthesia, maternity, rehabilitation services, and diagnostic services (X-ray, laboratory services, etc.). Hospitals have to coordinate the work of a wide variety of professional people, such as doctors, nurses, and administrators. Within those groups are often distinct categorizations and hierarchical arrangements, which also have to be taken into account (specialists versus students, matrons versus nurses). Managing such a multifaceted system remains a challenge to health information systems.

A crucial role of hospitals is handling referrals from primary care facilities for specialist care. Information flow should accompany the patient flow in both directions, but it is often deficient.

Role of HIS

Hospital information systems (HIS) are important for a number of reasons. Funding is often closely linked to information about the services provided; poor-quality information (or underreporting) can have a grave effect on budget allocation. Hospital information systems also enable the clinicians to provide quality care and to assess the quality of care that is provided. Quality of care assessment requires an approach to information systems that can change regularly as quality improvement cycles develop. Hospitals are huge consumers of resources, especially when their budgets are compared with those of primary health care (PHC) services. Being able to quantify workload and financial aspects of hospitals' services is important for assessing equity between hospitals, and between hospitals and PHC services.

Hospitals are often the sites of regional labs. A laboratory information system—with appropriate information and communication technology—can improve laboratory services, as well as perform important disease surveillance.

Patients from the primary health facilities are referred to the hospital for specialized care and then return to their community. Often, crucial information regarding the patient does not follow the patient, thereby leading to suboptimal care.



Group discussions are held at Maejai Hospital.

PRISM: Organizational, Behavioral, and Technical Factors

Hospitals may act as a clearinghouse for community and first-level HIS, or they may report to a district or regional level. The effects of the hospital's organization, the technical skills of the staff, and the resources available for managing data are key elements of a successful routine health information system. In some circumstances, data collection is viewed as superfluous or arduous, leading to undesirable behavior and to a failure to collect accurate and complete data. This failure is often due to a poor understanding of the data's purpose, to collecting too much data, to complicated forms or programs, to poor data management, and to a host of other technical or organizational issues.

Cross-Cutting Issues

Hospitals are a vital link between the community and primary care services and the larger health system. As such, their level of integration, quality of data, information, and communication technologies play significant roles in determining how data are used, the general demand for data, and ultimately, the quality of services provided at all levels. Their expertise in managing those data, in responding to demand for the data, and in promoting a culture of information use can make them leaders in improving health.

Questions to Consider

- How do data from the hospital level flow (i.e., integrate horizontally and vertically) between the various levels: national, district, and referring clinics and communities?
- What information from the hospital level can be used at the community level, and how can the community get that information?
- What are the information issues with patient referral to the hospital and return to the community, and how can those issues be addressed?
- What is the core set of data that the hospital needs for internal use? What are the barriers to collecting and using this information? And how can those issues best be addressed?
- Are there issues where new research is required to better understand and resolve those challenges?

Theme 4: Maternal, Neonatal, and Child Health

Background

The main causes of mortality during pregnancy and delivery include hemorrhage, sepsis, unsafe abortion, obstructed labor, and hypertensive disease of pregnancy. As with maternal deaths, children die from preventable causes; the leading proximal causes of death in neonates are preterm birth (28 percent), sepsis or pneumonia (26 percent), birth asphyxia (23 percent), and congenital malformation (8 percent). Underlying those proximal causes are poverty, quality of care, child nutrition patterns, and their interactions. Maternal, neonatal, and child morbidity and mortality are among the most frequently used indicators of health. The reduction of death among mothers and children has become a key component of the United Nations' Millennium Development Goals. Effective low-cost interventions for lowering mortality levels in children have been identified and are being implemented, but improved collection of quality data is needed to scale up proven interventions and monitor program outcomes.

Role of HIS

Data collection, communication, analysis, and use over the entire continuum of care—from pregnancy, delivery, and neonatal care to child health monitoring and care—are crucial for the effectiveness of maternal, neonatal, and child health (MNCH) programs. Data are needed to monitor service availability, coverage, and quality of care. In maternal care, the United Nations has determined that access to good-quality emergency obstetric care (EmOC) is the key to reducing maternal mortality rates. RHIS data collected from facilities and communities are a good source for tracking MNCH indicators. Levels of immunization coverage, as well as the incidence, prevalence, and case fatality rates of specific childhood diseases, are easily obtained from the national HIS.

PRISM: Organizational, Behavioral, and Technical Factors

It is important to consider organizational, behavioral, and technical factors surrounding information systems for MNCH programs. While MNCH information systems are influenced by many of the same factors as any other information system in the health sector (such as motivation of data collectors, management of information systems, and technical design of data collection mechanisms), they are also faced with unique social and cultural challenges. For example, cultural values may have an especially strong effect on data collection and program design for MNCH activities related to such culturally sensitive areas as reproductive health, family planning, abortion, and childbearing.

Cross-Cutting Issues

Perhaps the greatest challenge for routine health information systems in MNCH is the collection and use of quality data. In resource-poor settings, it is often difficult to collect and retrieve accurate data on mortality and morbidity for the reasons stated earlier. Data that are used at the point of care (where it is collected) tend to be of higher quality. Communication and feedback to those who collect data are also important factors in improving quality.

Simple work-flow protocols can dramatically improve the collection and use of data with a corresponding effect on health. This improvement is an important factor in establishing the momentum for information use.

Integration plays a strong role in the use of data and the provision of quality services for MNCH. If one is to bridge the gap between communities and facilities, it is necessary to have a continuum of information that exists between all levels so as to promote a broader understanding of the problems faced by MNCH. It is a challenge to manage this information and to make it useful and available in response to demand.

As a result of limited resources and training, most MNCH data systems are still paper based. However, there is a large scope for using advanced information technology tools to improve the quality and use of data.

Questions to Consider

- How can you improve the demand for information and its use at the point of care in maternal and child health?
- What is the minimum set of indicators for effective MNCH care?
- How can you improve the management of MNCH community-level and facility information?
- How can the use of MNCH information enhance quality of care?
- How can you ensure that data from different sources (health care system levels and various MNCH programs) are able to be integrated for reporting and use?

Theme 5: HIV/AIDS Interventions

Background

Clinicians at health facilities providing HIV/AIDS care rely on information that must be accurate and reliable to ensure that patient management is as effective as possible. It is critical that treatment regimens are adhered to in order to reduce the likelihood of individuals developing resistance, or worse yet, the emergence of a new drug-resistant strain of HIV. Clinical knowledge and treatment management must work with tools to provide an opportunity for evidence-based medicine; a robust health management information system (RHIS) is one of those tools. In establishing a foundation of longitudinal record-keeping and access to data within a facility providing HIV/AIDS treatment, patients are more likely to receive better care, and clinicians are likely to provide better care.

The PRISM Framework

Using the PRISM framework as a foundation for our discussions, we will explore the relationship between organizational, behavioral, and technical components and factors with respect to data collected in HIV/AIDS care and treatment facilities. We will discuss ways that health facilities and systems can use data to coordinate overall HIV/AIDS care and treatment, including prevention, treatment and palliative care. Specifically, participants in this thematic group will be encouraged to share their experiences in HIV/AIDS data collection, management, and relevance to enhancing their specific program. One of the goals of this thematic group will be for participants to take back ideas and next steps for bettering health system decision making using HIV/AIDS data that are routinely collected at care, treatment, and community-based programs.

Cross-Cutting issues

Information needs demand: This thematic group will explore the information needs for HIV/AIDS interventions.

Data quality: Clinical management and health systems depend on data to be reliable and valid. Data quality is essential for both community- and facility-based interventions.

Information use: Using data generated by the clinical interview at an aggregated level can better inform facility- and community-based programs of their outputs, gaps in provision of services, critical needs of the patient population, and critical needs of the facility or community program itself. Evidence-based medicine is contingent on use of data generated from HIV/AIDS intervention programs.

Quality of services: Until there is a magic bullet for HIV/AIDS treatment and care, services must follow a paradigm of continuous quality improvement. Antiretroviral treatment is an evolving science and medical field. By continuously learning-by-doing and feeding information back into programs, facilities and community-based programs will continue to improve services and patient outcomes.

Workshop participants will discuss their experiences and ideas on a range of questions related to the design, development, and implementation of the HMIS for HIV/AIDS interventions.



Participants discuss patient identification systems during a field visit to Bantam Community Muang District.

Questions to Consider

- How does one generate a culture of confidential and longitudinal medical records systems where one does not currently exist? Can a primary care or community-level facility manage such a system? What are the challenges that need to be discussed with facilities and programs before such a system can be implemented?
- What should be the output of an RHIS?
- How does one generate a unique identification system for patients on ART?
- When is an electronic medical record system necessary? Must every ART delivery facility have an EMR to provide effective treatment? What about in resource-poor settings where capacity is limited?
- Is a national database of patient information desirable? How could this be implemented and what information should it contain? What are the confidentiality issues involved in such a database?
- How do we ensure data are reliable—what are the challenges at the facility level, and what are possible solutions?
- How do we ensure data are accessible to those who need it? How is this a challenge at the facility level and what are possible solutions?

Annex 3: Cross-Cutting Issue (CCI) Background Papers

All thematic groups examined a defined set of seven cross-cutting issues:

1. Information needs and demand;
2. Data quality;
3. Information use;
4. Quality of services;
5. Information and communication technology;
6. Integration;
7. Information system management.

CCI: Information Needs and Demand

Context

A key cross-cutting issue in RHIS revolves around the definition of “true” information needs. Service providers are often burdened with data collection and analysis tasks that are irrelevant to the performance of their service delivery activities. In many cases, those tasks compete for time that could otherwise be used to serve community and patient needs. Data that are collected for other levels of the health system but are not actually used by those who collect them are often of very poor quality and are, therefore, unusable.

Defining information needs can be approached in at least four ways:

- First, you can ask service providers what information they need to do their jobs effectively. This question has considerable appeal, because it engages those who do the real work on a day-to-day basis, and they can provide critical insight into what works and what does not. However, this approach may not be effective in environments in which staff members’ responsibilities are unclear, or in which there is a wide range of experience among service providers. Less experienced staff members typically want more information than those with more experience, usually much more than is really needed. By the time you have interviewed enough service providers, you often end up with an exhaustive list that is painful to reduce to a manageable data set.
- Second, if health workers (HWs) have a difficult time articulating their information needs, you can still involve them in the identification of essential data by having knowledgeable people prepare a list of indicators (and the needed data items to calculate those indicators) and then by discussing with HWs just how they would use such information. “What would you do if this goes up or down, is more or less, and so forth?” HWs can usually tell you whether an indicator would be useful to the way they work with a patient or management issue. Experience in some countries shows that HWs appreciate getting to choose from a well-conceived list of indicators, rather than trying to recreate them from the question, “What information do you need?”
- A third approach consists of engaging knowledgeable and objective observers in analyzing the actual performance of HWs’ service delivery tasks and functions, determining which of those functions involves collecting, retrieving, or analyzing data, and then identifying the data required to support those functions. This direct observation of the performance of service delivery tasks can help us to identify the data that are actually used or needed, and to uncover inefficiencies or opportunities that will simplify or otherwise enhance the information management tasks.
- The approaches that focus on questioning service providers and observing current practice are usually not enough, because part of the motivation for changing health information systems comes from the introduction of new treatment methods or community-based strategies that are not currently in use. The introduction of new methods or strategies highlights the need for a fourth approach to define information requirements for changing service functions. The performance improvement model is one way to help identify the gaps between current performance and desired performance and to establish a road map for changing behavior, defining data requirements, and monitoring progress.

Once there is a consensus about information needs using one or a combination of these approaches, adjustments usually need to be made to information systems and procedures to ensure that the correct data are collected and used. These efforts include but are not limited to the following:

- Establish management and service delivery procedures that rely on and reinforce the use of data (e.g., COPE³ or community health meetings that feature a review of health service performance indicators and that develop plans to improve them);

³ COPE: client oriented/provider efficient. This exercise was pioneered by EngenderHealth and engages all members of a health center’s staff in the process of diagnosing and improving health service delivery.

- Revise recording instruments to support service functions (e.g., household surveys; TB case management forms that guide providers through the process of differential diagnosis, treatment, and follow-up);
- Revise registers and reporting formats to collect only the required data;
- Develop methods and tools that help service providers aggregate data and analyze important trends (e.g., tally sheets, tickler file systems, and ELCO⁴ maps).

Discussion Questions

- What approaches have you used to effectively define information needs for health service providers?
- How have you balanced the need for data at the health facility and community levels with external demands from national health programs and donors?
- In what ways have you been most successful at creating a demand for data among service providers?
- From your own experience, can you identify activities, recording instruments, or tools that have been the most effective at responding to health worker and community information needs?

⁴ ELCO maps: eligible couple maps display the distribution of all potential family-planning users within a community on a hand-drawn map that health workers use to track who is using what methods, to quantify unmet need, and to manage contraceptive logistics.

CCI: Quality of Data

Poor-quality data provides one of the most frequently cited reasons of decision-makers who are asked why RHIS data are not routinely used. According to the PRISM conceptual framework, production of good-quality data is one of the primary outputs of an RHIS (another is use of information). The decision-makers are correct in saying that, unless an RHIS produces good-quality data, it is not accomplishing its goal. But what exactly does “quality” of data mean? When we speak of quality, are we speaking the same language? To improve quality of data, we must agree on what constitutes quality in data so that we can measure the data, identify areas of weakness, and develop solutions. Many factors can influence the quality of data in an RHIS, but herein we shall address five factors and discuss ways to improve the quality of RHIS data.

Aspects of Quality in RHIS Data

An RHIS is deemed to be producing good quality data if the users of the information system are confident that the data it produces reflect the actual status of the health system of which the RHIS is part. Generally speaking, relevance, appropriateness, accuracy, timeliness, and completeness are all factors that contribute to the quality of RHIS data. Relevance and appropriateness pertain to the design of the RHIS, whereas accuracy, timeliness, and completeness relate to implementation.

As defined in *Design and Implementation of Health Information Systems*, RHIS is meant to respond to the information needs of the decision-makers at all levels. But what if the RHIS has not been updated in 10 years, and the list of indicators does not reflect the current focus of the health system? The data produced are not reflective of the health system, nor do they meet the needs of decision-makers. Thus, relevance of data to the current health system is a major factor of data quality.

Appropriateness of the RHIS means that the data requirements are suitable to the health system’s technical capacity. For example, if the system requires a rural health center to report the number of patients newly diagnosed with HIV, then the rural health centers should have the capacity to diagnose HIV.

Accuracy describes how well data are transferred between data collection tools. When people talk about “quality” of RHIS data, they often mean “accuracy.” For example, is there a correspondence between the data in the facility records and the RHIS reports, or between the RHIS reports and the database? Accuracy in the RHIS also concerns how correctly patient data (e.g., name, age, diagnosis, and treatment course) are recorded in a patient register, and how precisely events or individuals are tallied and entered into a database.

Timeliness in an RHIS can be interpreted as “up-to-date,” “on-time,” or “available when needed.” Information is timely if it is available and up-to-date when needed. In RHIS, we assume that frequency of reporting corresponds with the information needs at the time of the design of the information system and that keeping deadlines for the submission of reports is a proxy measure of the timeliness of the data. If the frequency of reporting of certain data does not correspond with the need for the information, the system will not meet the requirements of decision-makers.

Completeness of an RHIS can be defined in two different ways: (1) coverage of the system, and (2) degree of completion of data collection and reporting. RHIS coverage can include geographical coverage (e.g., all districts or areas enrolled in the RHIS, all communities included), service coverage (e.g., all services included in the RHIS actually reported), and facility coverage (e.g., all types of facilities and all facilities in areas enrolled in the RHIS). Areas of coverage are all related to both the design and implementation of the RHIS. Completeness also describes the comprehensiveness with which data are reported (percentage of all fields on a data collection form that is filled in, percentage of all expected reports actually received).

Questions to Consider

Relevance

- Are the indicators produced by the RHIS closely related to national (or regional) health goals?
- Are there priority health issues not represented in the RHIS?
- Are the data elements necessary to calculate the indicators collected through the RHIS?
- Are all regions, communities, and facilities enrolled in the RHIS?
- When was the last time the indicators were reviewed and updated?

Appropriateness

- Are the data collected appropriate for the capacity of the health services?

Accuracy

- Does the RHIS report correspond to the information on the patient registers?
- Do RHIS managers verify the accuracy of data? How often?

Timeliness

- Does the RHIS have deadlines for report submission?
- Do RHIS managers keep track of the dates for report submission?
- What percentage of regions, offices, facilities, and communities submitted the past month's reports on time?

Completeness

- What proportion of all regions, offices, facilities, and communities submitted a report last month?
- Are all data variables in the RHIS report filled?
- Are there any blank spaces in the RHIS report?

CCI: Information Use

This workshop theme emphasizes that information has the power to change the status quo for better. The focus is on facility and community levels where the health system provides its services and attempts to improve the health status of the target population. The information system tracks how efficiently the health system provides the services, their quality, and impact. This brief raises issues and questions for the participants to answer, such as why do information system designers and implementers continue to overlook use of information and paying more attention to informatics gadgets?

Technical Background

The Routine Health Information Network (RHINO) workshop in South Africa defined health information system performance as “improved data quality and continuous use of information.” Thus, information use is considered to be one of the final products of the health information system. However, many contest this claim on the ground that converting data into information is the final product of the information system, and not the information use. The rationale is that once the information gets out of the information system and reaches the hands of the decision-maker, the information may or may not be used. The decision-maker takes into account the consequences of using the information by considering the various stakeholders involved. Thus, information use is not part of the information system, as it has no control over its use.

Issues

The claim that information use is not part of the information system is based on the assumption and experiences that the information system is an independent entity, unit or department within the Health Department or organization. This unit is composed of data collectors and analysts. The data collectors gather and transmit data. The analysts convert/analyze data into meaningful information and submit it to the decision-makers. Thus, decision-makers are seen as outside of the information system and work independently on the information presented.

Others who claim that information use is part of the information system assert that information systems respond to the management function’s needs. Thus, information use is in-built. However, in practice, data analysis and interpretation of information is left to the “information” experts, creating a need for dialogue between decision makers and technical experts on the information interpretations and implications; this remains an unmet need. Second, management is perceived as a function of the top management level rather than seeing that each level of the health department has to perform some management functions, whether in peripheral health units, outreach activities, or in the higher and central levels.

Dividing people into data collectors and users categories may be a limiting factor, as it conveys that data collectors are not information users. Data collectors are managing functions or services themselves and need information to assess their own performance. It is well known that feedback provided to task performers creates a feeling of empowerment, improves motivation and competence, and ultimately leads to better performance.

Understanding information use within an organization depends upon how the senior management defines the role of the information system. Is senior management committed and providing necessary resources to manage the information system? Is it a showpiece or well-integrated into management practices? Is it a reporting mechanism to the senior management or donors? Is it a process to facilitate coordination and information sharing among various departments and stakeholders? Is it independent of the monitoring and evaluation system? Is it a mechanism to create knowledge, document best practices, and transform an organization into a learning organization? Is it a feedback mechanism to improve functions performed and services provided? Is it a mechanism to create transparency and promote evidence-based decision making? Are supportive policies and procedures available to use generated information? Are people empowered to make decisions based on the generated information? Is there a reward system based on the use of information? Are there negative consequences for those who do not use generated information? Is it a mechanism to establish accountability within and outside the organization? Answering these questions has implications for designing the interventions for information use, as well as for measuring the information use of the existing information system.

Like any system, the health information system has its structure, which is usually in line with the management structure of the organization. Thus, the information flows up, down, and horizontally, and is acted upon in accordance with the management structure of the organization. However, in practice, who decides who reports to whom and for what purposes is not clearly articulated and creates confusion in the use of information. These questions also apply to community and hospital-based information systems, with additional questions of whether these systems are part of the organizations which may or may not be part of the public health system. Thus, use of information becomes complex with the addition of multiple substructures and organizations.

Culture of information is the software of the information system. It describes whether the organization promotes knowledge, skills, value, and attitudes to the organizational members which become their internal voice, supporting information system tasks performance. Culture of information is about promoting evidence-based decision making, transparency, empowerment, and accountability. The senior management acts as the role model for the organizational members to use information. It conducts various activities, such as the transmission of success stories of information use via newsletters, feedback reports, rewarding use of information, etc. Thus, promotion of the culture of information should be seen as an indicator of both the use of information and the presence of supportive policies and procedures to enforce the use of information.

Questions to Consider

Promoting and measuring use of information does not relate only to gathering evidence of use of generated information, but also how the information system is designed to promote a culture of information and enable management policy and practices. This generalization may not be acceptable to many, but we would like to provoke a debate on this issue. Thus, we would like to discuss the following questions in relation to use of information:

- Is the role of the information system defined in the management policy of a given public or private sector health organization?
- Are outputs/outcomes of the information system clearly defined and monitored?
- Are the information system and management structure integrated?
- Are there activities to promote culture of information?
- Are there organizational policies and procedures to enforce use of information?

CCI: Quality of Services

The purpose of this concept paper is to facilitate a discussion about the relationship of quality of health services to information systems at the facility and community levels, and to identify ways to improve such information systems so that they can help in the continuous improvement of health systems and services.

Technical Background

Quality of care has become an increasingly important area as consumers of care have become more aware and as providers have become more interested in applying evidence-based standards of care and in achieving better outcomes.

Quality assurance and quality improvement are all those activities undertaken to ensure that care is provided in accordance with standards, that it meets clients' needs, and that it is as safe and effective as possible given the available resources.

Issues

Achieving high levels of health care quality requires the gradual development of a “culture of quality” in which staff members see quality of care as a primary objective of their work and value it as a reward in itself, and in which clients expect quality as their right as citizens and human beings. Providing such quality requires an understanding of the system of care and the activities directed at constantly improving it. Most of the activities must be carried out by facility staff members themselves, and for many community-based services, by community members themselves. The information system must provide facility teams and the community with the information they need to assess the levels of quality, the effects of changes they have made, and the outcomes they have achieved. These provisions may be quite different from the usual driving force and purpose of information systems as seen by Ministry of Health managers and donors. We must also be aware that some data are needed for only a short time to assess the effect of improvement activities or changes on a very specific part of the service process on which an improvement team has been working. Other indicators may need to be permanent ones.

Tables A.1 and A.2 outline the main indicators, data sources, and issues associated with improving and monitoring the quality of health services.

Table A.1. Facility: Examples of quality of care indicators, sources of data, and issues

Quality indicators	Data sources	Issues or comments
Technical quality of care		
Provider compliance with standards of care	<p>HIS (hand tallies of logbooks, automated reports)</p> <p>Abstracts of medical records (manually unless one has electronic medical records)</p> <p>Peer or supervisor observation</p> <p>Self-assessment or reporting</p>	<p>Routine HIS usually has very limited data of provider compliance with standards other than whether certain services were provided.</p> <p>Medical records are often of poor quality and do not allow abstraction of information. Abstraction is time-consuming and costly. It can be done by peers as a self-assessment at lower cost.</p> <p>Observation is time-consuming and not easily standardized.</p> <p>Self-assessment is low-cost and focuses the provider on important standards, but it may not be accurate.</p>
Improved outcomes of care	<p>Logbooks of deaths in facilities</p> <p>Logbooks of children treated with oral rehydration solution in facilities and discharged as rehydrated</p> <p>Adherence rates from patient registers of visits (e.g., for antiretroviral medicine or TB treatment)</p> <p>Cure rates (e.g., for sputum conversion after TB treatment)</p> <p>Community death audits</p> <p>Vital statistics registries of mortality by age group and condition</p>	<p>HIS does not usually report on outcomes; even in hospitals that do, obtaining outcome information should be easier.</p> <p>New logbooks or registers may need to be introduced to ensure collection of required information on outcomes.</p> <p>Special studies or new data collection systems (e.g., community maternal death audits) may be required.</p> <p>Vital statistics are often severely underreported, making valid estimates of changes of rates difficult.</p>
Provider–client communications		
<p>Politeness</p> <p>Listening to client</p> <p>Information sharing</p> <p>Clear instructions</p>	<p>Supervisor or peer observation</p> <p>Exit interviews or written surveys</p> <p>Patient or community focus group</p>	<p>Observation is often not a priority for supervisors.</p> <p>Interviews or surveys require skills in observing such behavior.</p>

Quality indicators	Data sources	Issues or comments
Amenities		
Cleanliness and sanitation accommodations	Checklists and facility records Observation Exit interviews or written surveys Patient or community focus group	Staff members can do exit interviews if they can be motivated to take the time. Patients are reluctant to criticize their providers. Results of surveys need analysis and action based on results. Team QI activities can make improvements in this area.
Waiting times	Time notations on patient records Special studies Exit interviews or written surveys Patient or community focus group	Notations require facility staff members to care about the problem and to reduce waiting times. Special studies are relatively easy and low-cost. The facility's staff members may not have the time or interest to conduct focus groups; they may fear confrontation; the community may be reluctant to criticize the staff directly.

Table A.2. Community services: Examples of quality of care indicators, sources of data, and issues

Quality indicators	Data sources	Issues or comments
Compliance with standards of care (e.g., of community health workers, or CHWs)	HIS (hand tallies of CHW logbooks) Abstracts of CHW medical records Peer or supervisor observation Self-assessment or reporting	CHWs may not report to HIS and may not keep records. Supervision may be very irregular.
Outcomes of IEC/BC information, education, and communication or behavior change activities		
KAP of community members or caretakers Increased demand and use of health services	KAP surveys Facility logbooks (e.g., antenatal care)	Surveys can be rapid but still have costs that usual districts cannot fund. Health facility logbooks may (or may not) exist.
Outcomes of community empowerment in health activities	Community group records Special surveys	Community groups need to be trained and motivated to collect outcome data.

Questions to Consider

- What quality of care indicators can be added feasibly to the usual health information systems without adding cost?
- How can the facility’s staff members assess and monitor quality where medical records are poor?
- How can district supervisors best monitor quality of care (e.g., through observation, record reviews)?
- How can the community make its views known about the quality of care it receives?
- How can facility staff be motivated to assess continuously the client and community perspectives on the quality of care they receive at the facility?
- How can facility staff be trained to collect and analyze important quality of care data to identify problems and to assess the effect of changes on quality?
- What are the pertinent quality of care issues for community services, and what are the associated indicators, data sources, and feasibility of collection?

CCI: Information and Communication Technology

What Are the Learning Objectives?

- Participants will be able to describe the role that information and communication technology (ICT) tools can play at the community/health facility level.
- Participants will be able to identify and describe methods for evaluating relevant ICT tools for use at the community or health facility level.
- Participants will be able to describe an opportunity for practical applications of ICT tools in their own environments at the community or health facility level.

What Is ICT and How Can It Be Used at the Community or Health Facility Level?

Although the demand and use of data at the district and national levels in resource-poor countries has been widely discussed and partially addressed, there has been much less focus on the community level. Yet, this is the location where the majority of the health data originates, and it has perhaps the greatest potential to provide immediate value to clinical providers caring for patients. One of the opportunities to improve these areas is through the adoption and use of ICT. As a starting point for the workshop, ICTs are being defined as *tools that facilitate communication, the processing and transmission of information, and the sharing of knowledge by electronic means*. Examples of such tools include, but are not limited to, portable handheld devices (e.g., Palm Pilots, Handsprings, etc.), flash memory drives, cellular phones, electronic medical records, and smart cards.

What Are the Primary Issues Related to ICT at the Community or Health Facility Level?

Participants in these working groups will assess the use of ICT at the facility and community levels from the perspective of pulling data into the system, turning the data into useful information, and pushing data out to the point of care. Understanding the role of data and their potential usage at the community and facility levels will be a key discussion topic. The primary aspects of ICT for consideration, discussion, and demonstration during the workshop are as follows:

Data collection and display: These features refer to the “human interface” with technology tools. The systems include a display screen and a way to input information through media such as a keyboard, a touch screen, a voice, etc. Important considerations to be reviewed include the ability of the display screen to be viewed, the ease of data entry and retrieval, the logical presentation of information, and the tools provided to assist the user in making decisions about the information collected and displayed.

Data communication: How data get transmitted from one device to another or from one location to another falls into the realm of communication. Key issues to be addressed here concern the speed, reliability, and security of the information being transferred.

Data storage: Technologies for storing data are rapidly changing and improving and are providing significant opportunities to use high-capacity storage devices with improved security and durability, while prices continue to decline. The time and method for data being transferred from paper to electronic systems will also be a key issue for discussion. Simple data storage solutions, such as paper, must still be considered for appropriate situations.

Patient identification: Systems to identify individual patients through a unique patient identifier are of critical importance, particularly in situations where patient populations are mobile; where highly sought-after medical treatments are in short supply, such as antiretroviral drugs; and where patient privacy is of paramount importance. Additional considerations include cost, security, and durability of the chosen ICT.

Data management: Information in an electronic format has the potential to provide comprehensive and rapid assessments for management, monitoring, policymaking, and patient care. Key consideration must, therefore, be given to how data are stored, organized, retrieved, analyzed, and communicated in order to be of use to analysts, program managers, policymakers, and—of particular importance for the focus of this workshop—providers at the community level.

Community-level issues: When one considers the adoption of ICT at the community level, careful planning for the limitations that are often found must occur. Frequently, the infrastructure to support and sustain electronic systems is not available on a regular basis, including consistent electricity, health workers skilled in computer usage, training resources, and high-speed Internet access. Alternative ICTs have the potential to work around gaps in existing power and communications infrastructure. For example, low-powered battery-operated devices, such as handhelds, can be used where reliable electrical power is not available. In addition, devices that can store and forward information can be used to communicate asynchronously when connectivity is not continuously available.

Hospitals: The considerations for ICT evaluation and adoption are more complex within a hospital than at the community level. Multiple units within the hospital capture and use different data. Health care workers are using clinical information for diagnostic and treatment purposes. Hospital administrators are monitoring aspects such as patient flow, need for supplies, and financial operations of the facility. Other staff members may be focused on the reporting of population health statistics within and across hospital facilities. This more complex array of data needs at the hospital level increases the opportunities for ICT application. The level of resources (both technical and human) available at the hospital is typically broader, which makes the use of ICT more likely.

Case studies on the role of ICT in data collection and its use in HIV/AIDS and MNCH programs will be used to provide context for the discussions. Particular attention will be given to innovative ICT solutions, such as the integration of handheld devices and smart cards with electronic medical records systems, telemedicine, data warehouses, and other technologies.

Does ICT Affect Performance?

ICT tools can improve the performance of health care service delivery by providing quality information in a timely manner to providers, policymakers, and the donor community. ICT can improve the quality of data by standardizing inputs and by performing edit and logic checks. ICT can also improve the timeliness of data by reducing the amount of data processing necessary (through automation) and the speed at which data are reported to higher levels (through electronic data transfer). The integrity, continuity, and accessibility of the data can be maintained by using ICT tools for data storage and data warehousing. Multiple copies can be stored on-site and at remote off-site locations to ensure complete recovery in the event of a disaster. Additionally, ICT tools can aid in the collection of data at the point of care, thereby reducing the use of paper-based systems.

Electronic medical records, handheld devices, and telemedicine can aid providers in managing their patient care by providing decision support in the form of on-hand medical histories; drug formularies, dosages, drug-to-drug interactions, and peer-to-peer consultations. Data can also be transferred from the field to central collection sites with the use of ICT tools that obviate the need for continuous electricity or synchronicity, thus avoiding time-consuming and error-prone paper systems and allowing data collection to be conducted in more remote locations.

Questions to Consider

The workshop participants will discuss their experiences and ideas on a range of questions related to the identification, implementation, use, and maintenance of ICT. These questions include:

- How can ICT affect health care delivery in health facilities? Communities?
- What are some of the benefits of ICT? Disadvantages?
- How do local health facility workers currently use ICT? Community-based uses? Is this level of use satisfactory?
- In what ways could ICT be better used? Which aspects of health care could be improved by ICT?
- How available or accessible are ICT tools in your facilities or communities?
- What are the minimum requirements (including infrastructure) for selecting and implementing ICT? How will those ICT tools be supported and maintained?
- Are ICT tools available in the locally relevant languages?
- Do paper-based data capture and reporting systems need to be in place before ICT adoption should be considered?
- What training resources are necessary to implement ICT?
- What methods or tools exist for evaluating appropriate ICTs for implementation?

CCI: Integration of Information

The Issue

The HIS integration issue has already been studied from the perspective of the district health systems during the South Africa RHINO workshop. Some of the thoughts in this paper were actually generated during that earlier workshop.

Routine health information systems (RHIS) have the potential to play a major role in facilitating integration between individual health and public health interventions. Because both individual health care services and public health functions are being carried out within the health services system, the routine health unit-based HIS is the main information source for both types of interventions. While performing their daily health care activities, care providers within the health unit record data for patients or clients and for health unit management. Routine health unit-based data can also be aggregated to generate information on services provided to the population, for disease surveillance, and for other public health functions.

Unfortunately, because of pressures from the donors in the past decades, separate “program information systems” were created that focused on one specific disease (e.g., diarrheal diseases), a specialized service (e.g., family planning information systems), or a management subsystem (e.g., drug management information system), instead of addressing management functions in a comprehensive way. Those “vertical” information systems mostly exist side-by-side with the “general” RHIS, which is considered insufficient and incapable of delivering the data needed for program management. Another form of fragmentation exists between public and private health services.

Separately managed HIS subsystems can certainly provide real information support for central programmatic decisions, and the quality of the information generated by such systems tends to be better than that of a generally managed information system (often because those systems dispose of more financial and human resources). But the net result of HIS fragmentation on the basic health services (district and below) is often catastrophic:

- RHISs have become chaotic and bothersome because of redundant data collection and because of multiple report forms and data transmission problems. Data collection takes an unacceptable amount of the care providers’ time, resulting in poor data quality and availability.
- District managers lack a comprehensive picture of the health situation (vertical program information systems, lack of private sector information), resulting in poor use of information for planning, implementing, and monitoring health interventions.
- Vertical program information systems, by their disease-oriented approach, have endangered the holistic perspective of the basic health services, where integrated information support can be the connection (or glue) that links individual and community health interventions.

Definitions

The objective of integrated HIS is to provide easy and equal access to relevant information for all stakeholders. Integrated HIS is only one dimension of integrated health systems, but it could ultimately drive the functional integration of services. Integration is a difficult concept and has been defined in various ways. In 1996, a World Health Organization study group proposed the following definition of integration: *“the process of bringing together common functions within and between organizations to solve common problems, developing a commitment to shared vision and goals, and using common technologies and resources to achieve these goals.”* Given the multidimensional nature of integration, various frameworks could be used to study the strengths and weaknesses of integrated RHIS.

Use of the PRISM Framework

Integration issues are linked much more to the behavioral and organizational aspects of RHIS performance than to the technical ones. For example, it is quite feasible to integrate data sets from a technical point of view. Integration is also not necessarily the collapse of various systems into a single system. It is important sometimes

to maintain separate systems. During the South Africa workshop, participants focused mostly on the organizational factors linked to integration, while acknowledging that further study of the behavioral aspects would be necessary.

The Functional Perspective

From a functional perspective, integration can be examined in terms of coordination between various routine subsystems that are in use:

- General health services statistics;
- Special program reporting;
- Epidemiological surveillance (combining RHIS and survey data sets);
- Resource information systems (financial, personnel, infrastructure, supplies);
- Vital event registration (which exists mainly outside the RHIS);
- Community-based information systems.

The Organizational Perspective

Finally, from an organizational perspective, integration can be studied by level of intervention: the community and the patient or client level; the facility level; the district level; the intermediate or national levels; and the international level. It can also be studied at each of those levels (horizontal integration) and between levels (vertical integration).

Questions to Consider

Given the setup of this workshop, we suggest studying integration according to the organizational perspective. Therefore, consider the following questions:

Horizontal Integration

- **Community level:** Does the community have access to information of all development or social sectors (health, welfare, sports, education, etc.)?
- **First level of care:** What mechanisms would you propose (on the basis of Thai experience or your own experience) for the exchange of information between the various primary health care services (reproductive and child health, TB, HIV, sexually transmitted infections, etc.) and between care and support services (e.g., clinic and lab or X-ray)?
- **Hospital level:** What mechanisms would you propose (on the basis of Thai experience or your own experience) for the exchange of information between the various departments of the district hospital?
- **HIV/AIDS:** What mechanisms would you propose (on the basis of Thai experience or your own experience) for the exchange of information between the continuum of preventive and curative HIV/AIDS interventions?
- **Maternal, Neonatal, and Child Health:** What mechanisms would you propose (on the basis of Thai experience or your own experience) for the exchange of information between the continuum of interventions from conception to four years of age?

Vertical Integration

- Given the benefits of population-based community health information systems, how can they be effectively linked to a routine health unit-based HIS?
- How can an RHIS be restructured to ensure better integration between primary and referral health services?
- What mechanisms would you propose (on the basis of Thai experience or your own experience) for better integration of public and private sector information systems?

CCI: Information System Management

Rationale

A health information system (HIS) cannot run on its own. It must be managed itself in order to enable it in turn to manage the health services. To meet this objective, the HIS would need to have a management structure to support the decision-making process in a health system. Therefore, it becomes critical to discuss and work out the HIS management protocols early during the design process. To achieve the desired results, the roles and responsibilities of each level in the health delivery system have to be clearly delineated and defined to ensure effective information system implementation. In any efficient HIS, either community- or facility-based, each category of staff members affiliated with the health system has a role to play. Because the HIS is built to support the functioning of health systems, it therefore must fit into the overall organizational framework of the national health system.

Depending on the type of assignment (either supervisory or operational), the responsibilities of each health staff member toward HIS implementation will vary from position to position. For example, in a community-based routine information system in which the systems usually capture and generate data on sets of simple indicators, mostly preventive in nature, there is a need to aggregate and process information at some supervisory level and to draw necessary inference for use by the community itself, the community leaders, and the district health managers. Thus, the situation would demand not only developing an appropriate system to meet the information needs of the health managers and the communities for improving the health status, but also ensuring the appropriate resources, the capacities to run such a program, and the management structure. The outcome of this effort would be how skillfully the information gathered is used at the community level for improving health status and how well it is then transmitted upward to contribute to planning and interventions at the strategic level.

At the first-level care facility level, information management is critical. It largely depends on the functions of those assigned to that particular type of health facility. For example, peripheral health facilities that are somehow formally linked to community outreach services would need a different management pattern than those that are not linked and are working independently from one another. In case the management of the community-based MIS is linked to health facilities, the facility in charge would have a dual role to play. Its manager would be required to ensure not only his or her own data collection, data quality, and use, but also that attributed to community services. Similarly, training health workers to use data collection tools and then having them use the tools at both the health facility and community levels would be the manager's jurisdiction. He or she must also be responsible for ensuring adequate availability of data collection tools, timely information collection, consolidation, and then the appropriate downward and upward feedback. Drawing some inferences from the gathered information for local use would be an added advantage.

The management of information at the facility level is, however, very much linked to the size, nature, and scope (curative or preventive, surgical or medical, etc.) of services that are being offered by the facilities. Given the use pattern and the population it serves, the information management setup at the facility could be either established as a separate entity or delegated to the health staff as an additional assignment.

In view of the scope and multiple functions to be performed by the district hospitals, the management of information becomes equally important and demands deployment of additional human and physical resources. Here, the role of information technology also becomes more explicit. The information management unit or other unit assigned must be the hub of all MIS activities, from its development and initial implementation to maintenance. At the same time, the unit must provide regular information support to the hospital managers. To facilitate the strategic decision-making process, the information generated needs to be compatible with the national standards. The unit should also monitor the availability of adequate resources and the capacity of its staff to run the hospital-based IS.

Finally, to bring harmony and to promote standardized implementation of an HIS, information management is strongly desired at the supervisory (district) or the strategic (provincial and national) levels. The district MIS units are usually given the task of maintaining data quantity, quality, and use at the district level and peripheral

health services. An optimal analysis of the gathered data and their subsequent dissemination to potential users are other significant functions. Additional important assignments in district MIS units are the training of staff members in both data collection and use; the maintenance of logistics, computer hardware, and software (if any); the development of district-specific reports; and the feedback. In some situations, the discussion or sharing of information with the facility staff is also beneficial in improving health services. The management information unit at the strategic level has a much broader role in developing a nationally standardized information system and then building capacities and resources for its subsequent implementation. National-level information consolidation and its use in national-level policy and planning are also desired.

In a nutshell, the management of a health information system would require a thorough analysis and adequate organizational arrangements during its restructuring process for it to be able to produce information for action. It has to be well thought out, and everyone involved in the health care system must be clear about his or her job.

Questions for Field Visits

Community-Based Information System

- Has the MIS system been developed through a consultative process, and is it standardized?
- Is there a focal point or person in the community who is responsible for information collection, processing, and transmission?
- Is there a mechanism of feedback from a local unit to the community or district health system?
- What kind of link exists between the community data collection effort and the nearby health facility, and how do they interact?
- What is the level of skill or expertise that exists at the information focal point?
- How is the information generated being used?
- Is there a process of capacity building for data collection and use at the community level, and how is that organized?

Health Facility-Based Information System (First-Level Care)

- Is there a culture or mechanism for assigning the information management role to a section or individual in the health facility, and how is that organized?
- How are the resources required for HIS operation being managed?
- Is the staff that is involved in MIS coordination trained for the type of job desired?
- Is there a proper record-keeping system, and is the historical record available?
- Is there a practice of data consolidation, analysis, and information feedback, either upward or downward?
- How is coordination established between the community-based information system and the facility-based information?
- Who is responsible for data aggregation, data quality, and its transmission to supervisory levels?

Hospital Information System (Secondary or District Level)

- Is there a proper MIS coordination unit in the hospital?
- Is the staff working in that unit appropriately trained in data collection procedures and the software?
- Is there some regular process of capacity development for the hospital staff members who are involved in data collection methods?
- Is the MIS coordinating unit being adequately staffed and provided with the desired resources?
- Is there a proper record-keeping system?
- Is there a mechanism of regular information collection, consolidation, analysis, and use in the hospital?

- Is the demarcation of tasks clearly defined between the MIS unit and other administrative or operational units?
- How are the resources desired for MIS functioning in the hospital arranged and managed?
- How is the information gathered at the MIS unit being used in improving the hospital's efficiency?

District- or Supervisory-Level MIS Unit

- Is there a well-organized MIS coordinating unit at the district or supervisory level, and is it assigned with clear roles and responsibilities?
- Is the MIS coordinating unit being adequately staffed and provided with the desired resources?
- What are the responsibilities and authorities assigned to the MIS unit?
- How is the MIS of the vertical programs linked to the core national or provincial information systems at the district level?

Annex 4: Overview of the Thai Health System and Health Information System

Presented by Dr. Narong Kasitipradith, Ministry of Public Health, Thailand

The organization of the Ministry of Public Health (MoPH) mirrors the political structure of Thailand with a national office, provincial health offices, regional hospitals, district health offices and district hospitals, and health centers. The reporting structure of the MoPH includes those political units and places hospitals in the hierarchy. Health centers and the district hospitals report to the district health office. The district health office and the regional general hospital report to the region. They, in turn, report to the provincial health office.

Information flows up this hierarchy, and planning, management, and resources flow down the hierarchy. Within the MoPH are administrative clusters that group functions. Those clusters include Administrative, Medical Service, Public Health, and Service Support. The clusters correspond to the the main functions of the MoPH. The Administrative Cluster includes policy and strategy, inspection and evaluation, manpower development, and information and communication technology. The Medical Service Cluster includes finance, planning, technical development, the bureau of nursing, and medical specialty organizations. The Public Health Cluster includes disease control, communicable diseases, occupational and environmental diseases, epidemiology, disease prevention and control, and specialty disease units for AIDS, TB, sexually transmitted infections, vector-borne diseases, and noncommunicable diseases. The Medical Service Cluster provides health services, personnel, and supplies. The Public Health Cluster also includes community sanitation, food and water sanitation, exercise for health promotion, and environmental health. The Service Support Cluster includes health care system development, medical registration, primary health care, health education, engineering, and design and construction. It also includes the division of cosmetics and hazardous substances, biologics, radiology and medical equipment, drugs and narcotics, food quality and safety, laboratory standards, herbal medicine research, the national institute of health, and food and drug administration.

Universal Insurance Coverage

Thailand has set up a system to provide universal insurance coverage through three different schemes, each designed to cover a particular population group:

- The Social Security Scheme, managed by the National Social Security Office, covers the employed population except for civil servants;
- The Civil Servant Medical Benefit Scheme, managed by the Ministry of Finance, covers civil servants;
- The rest of the population is covered by the 30 Bhat Scheme, managed by the National Health Security Office (NHSO).

The recent addition of the 30 Bhat Scheme allows Thailand to provide nearly universal coverage through reasonably priced health services to the population that are not covered by standard health insurance schemes. This scheme reaches out to provide complete coverage to those who are usually left out of most insurance schemes.

Health Information System

The Health Information Division of the MoPH is responsible for collecting most of the health information in the country, with some functions being carried out by the the National Statistical Office (NSO).

Health information systems are divided into population-based HIS and facility-based HIS.

Population-Based HIS

- Population and housing census (NSO);
- Household surveys (NSO):
 - Health and welfare survey (health payments, use, chronic diseases, health status, smoking behavior, alcohol, driving, exercise);

- Population change;
- Disability survey;
- Smoking and alcohol survey;
- Health surveys (MoPH):
 - National health examination survey (health exam, chronic diseases, health status, health behavior, complete blood count, blood sugar, cholesterol);
 - Behavior risk factors surveillance system;
- Provincial health survey;
- Special surveys (mental health, oral health, nutrition, sexual behavior, exercise, expanded program for immunization coverage).

Facility-Based HIS

- Disease surveillance system (MoPH);
- Disease registries (MoPH, University);
- Provincial routine reports (MoPH);
- Electronic patient records (MoPH, NHSO);
- Primary care health information system (MoPH);
- National health account (Health System Research Institute).

Disease Surveillance System

The integrated disease surveillance system includes 47 communicable diseases and 11 environmental or occupational diseases. The integrated disease surveillance system uses electronic file transfer from the health center and district hospital to the district health office, then to the provincial health office, and finally to the MoPH Bureau of Epidemiology, which produces a weekly epidemiological report.

The AIDS surveillance reporting system includes AIDS cases and opportunistic infection cases from hospitals. Other disease surveillance includes HIV sentinel serosurveillance, TB surveillance, and injury surveillance (type of accident, severity, outcome) from hospitals.

Vital Registration System

Thailand has a comprehensive vital registration system that captures all deaths. A death certificate is filled in by a doctor if the death is in a hospital; otherwise, the village head is responsible for the death certificate. The certificates are collected at the district office or municipality and entered into an on-line system in which the data are sent to the Ministry of Interior. The MoPH encodes the deaths using ICD-10 coding.

Routine Reports

The MoPH routinely produces reports on outpatient diseases (21 ICD-10 groups) and inpatient diseases (75 ICD-10 groups). A service use report tracks outpatient visits and admission by insurance. There are also financial reports, injury reports, and health promotion activities reports.

Electronic Patient Records

Thailand has developed an electronic patient records system for hospitals that is used in both inpatient and outpatient departments. It uses a standard data set. It is used for reimbursement from insurance schemes, diagnosis coding and ICD-9-CM for procedures, and morbidity and service use patterns. There are 12 standard files that cover inpatient data, outpatient data, diagnosis, procedures, and cost of service.

Thailand has also developed a standard data set for health centers and primary care units and has implemented an electronic data entry system that covers service provision at facilities, health prevention and promotion activities, chronic disease management, and community health. There are 18 standard files covering those areas.

Annex 5: Walkabout Demonstrations

In addition to the formally organized content of the workshop that focused on the facility and community level, we invited the participants (who are the source of the best ideas) to present their current work. One goal of the workshop was to bring together people working in the field of routine health information so that they could network, share ideas, and present their work. To facilitate this networking, the group held an evening “walkabout.” It was named after the famous Australian walkabout, which is a sojourn in search of knowledge. Sixteen projects were presented in the walkabout, which was held in the grand ballroom in an informal fashion in which all of the workshop participants walked from one table presentation to another and learned about tools, techniques, and systems that the participants had developed and were using. It was a great success, and most people found it a valuable learning experience.

Presentations

Health Metrics Network

The Health Metrics Network (HMN) is an innovative global partnership founded on the premise that better health information means better decision making—and that approach means better health for all. HMN partners are working to improve health and to save lives by strengthening and aligning health information systems around the world.

The HMN presented and conducted training for many participants on the use of their comprehensive health system assessment tool. This tool gathers input on health information systems and resources available at the country level. Through the use of an innovative set of linked spreadsheets, a country can score its health information systems and can highlight areas of strength and areas for improvement.

The HMN is generously funded by the Gates Foundation, and it has funding available to improve country health information systems.



The Health Metrics Network was one of many projects to host a booth at the RHINO Walkabout.

Decision Support System

The Decision Support System (DSS) is an automated data analysis and reporting tool designed to facilitate the process of turning data into action. The DSS allows decision-makers to visualize health indicators collected through the RHIS in easy-to-interpret tables, graphs, and maps. Written in MS Access and having license-free distribution, the DSS is designed to be accessible to all levels of government and private organizations. Its Visual Basic for Applications architecture enables it to function readily with most any Access database, and it is scalable to other database platforms. Using simple bar charts, line graphs, tabular reports, and thematic mapping, the DSS translates raw data into easily understood graphics at the health facility, district, regional, or national level. Indicators can be examined in multiple ways by changing the administrative level, periodicity, geography, or reporting source. The output can then be printed or saved electronically for use in summary reports. Summary data can also be exported to Excel for further analysis.

The DSS was presented by David Boone of John Snow, Inc. (JSI), in conjunction with Michael Edwards of JSI, who was present at the workshop through an Internet audiovisual link.

SAVVY

The community-based Sample Vital Registration cum Verbal Autopsy (SAVVY) tool has been developed through a rigorous process in Uganda as an effective tool to aid in health planning. It uses verbal autopsies to gauge disease burden and inputs this information along with vital registration information into the health planning process. This method provides a rational, objective method to plan resource allocation at the community level. It ensures that resources go to the areas of greatest need. The SAVVY tool was presented by Yusuf Hemed of the MEASURE project.

Ethiopia ART Information Systems (ARTISE)

The presentation at the RHINO workshop included a demonstration of the standard national forms for ARTISE, the antiretroviral therapy (ART) patient-monitoring system in Ethiopia (based on the World Health Organization ART patient-monitoring system). In addition, a PowerPoint presentation was used to describe how ARTISE was developed to capture the information documented on the standard paper forms and was used to provide reports that are useful to clinicians, clinic managers, and public health officers. In addition, the software was demonstrated (date entry, management, and reporting).

ARTISE uses StudyBuilder software to create a specific ART database (data entry, management, user permissions, export and transfer options). Data are then exported from StudyBuilder and are presented to MS Access for queries and reports. All tasks are carried out from a console (MS Access).

Zambia Perinatal Electronic Information System

The Zambia Perinatal Electronic Information System was presented by RTI International, working in conjunction with the University of Alabama, to replace the paper-based perinatal records system at the Lusaka University Teaching Hospital with a Web-based electronic records system known as ZEPRS. The goal of the system is to reduce the very high maternal and infant mortality rate through the use of information. It does that by reminding clinicians of best care practices and by keeping track of important patient information that affects outcome. The software can be viewed at <http://www.rtidemo.org>.

Health Information Systems Program (HISP)

Vincent Shaw and Norah Stoops presented the HISP. It is one of the longest running, most experienced, and most successful health information system programs in the world. It was started in South Africa in 1996 with the development of the District Health Information System for the collection of routine health information in public health service facilities. Since then, it has expanded to public and private hospitals, emergency services, HIV/AIDS treatment, prevention of maternal to child transmission programs, and additional functions. The group has active sites in seven countries in Africa and four in Asia. Its software is freely available for use because it is released as free and open-source software. The presenters emphasized that most of the effort of a health information system is expended in training and educating users.

Malawi Health Management Information System (HMIS)

Chris Moyo and Seshu Babu presented the Malawi HMIS monitoring and evaluation system. Its goal is to organize and present all health information for use in planning, policy, and management. The guiding principles include the integration of all health information from public and private facilities to collect a minimum data set of national indicators. The information is collected at the facility level and is entered into a computer at the district level; it is then transmitted to higher levels for analysis. The information is also fed back to the local level for immediate use in decision making.

Afghanistan HIS

Afghanistan presented a basic health information system that it has assembled in a short period of time to help with health planning and management. This system collects information from health posts and the community level. This information is then sent to the level of the basic and comprehensive health centers and then to the provincial level, where it is integrated with hospital information. This information system allows Afghanistan to collect national-level health indicators for use in health planning and management.

Home-Based AIDS Care Project, Uganda

A collaboration among the AIDS Support Organization, Uganda Ministry of Health, Tororo and Busia District Health Departments, and U.S. Centers for Disease Control and Prevention:

- Identification of eligible patients for screening;
- Screening of the identified people living with HIV/AIDS;
- Enrollment of the entire household for ART-eligible patients;
- Home-based voluntary counseling and testing (VCT) for household members;
- Screening of the positive household members;
- Monitoring of ART patients:
 - Home delivery of antiretroviral (ARV) medicines;
 - Monitoring adherence;
 - Labs monitoring;
- Annual home-based VCT for HIV-negative household members.

ARV Medicine Dispensing Tool

Pharmaceutical Management for HIV/AIDS-ARV Medicine and Opportunistic Infections Dispensing Tool. Availability of ARV medicines has changed HIV/AIDS from being an untreatable terminal disease to a manageable chronic disease. While all medicines need to be carefully managed, ARVs need special attention because they are new and expensive and are given as part of a complex lifelong medicine regimen. Patients must be carefully monitored on their adherence to the prescribed medicines, possible side effects, their response to medicines over time, and how the medicines perform over time. Adding to the complex management of ARV medicines is the fact that their high costs are shared mainly by multiple donor agencies that require different information at different times. ARV pharmaceutical service providers and program managers often face a lack of appropriate information when providing quality patient service, or when expanding or developing new interventions. In general, a patient's medication history is seldom maintained, and those that are kept are not readily available to the dispenser, making it difficult to compile the service statistics needed to support management decisions.

The ARV medicine dispensing tool helps maintain the basic patient profile, medication history, and other data that are essential for the dispenser to know when dispensing. This tool also generates information that is needed to calculate pharmaceutical needs and to make other management decisions.

Cambodia Health Information System

Cambodia presented its comprehensive national health information system, which collects health status and service information at the facility level. Its key focus is to use information for planning and management at all levels of the health system. Monitoring and evaluation for all levels are also supported. Information is collected from health centers, hospitals, and districts. The information covers outpatients, prenatal registers, immunization, birth spacing registers, delivery registers, consultations, and hospitalizations.

Additional Presentations

The walkabout also included these additional presentations:

- *ARV Inventory Tracking Tool;*
- *Kenya Routine Health Information System;*
- *India HIS;*
- *Zambia HMIS;*
- *Georgia Disease Surveillance.*

Annex 6: Illustrative Country Action Plan

At the end of the workshop, participants were invited to draft country or regional action plans based on the workshop outputs. In the following paragraphs, we have listed some examples of the country plans. Those plans are the first rough drafts and are presented to illustrate the value of the workshop; they are not indicative of any country-specific plans.

List Three Actions You Plan to Take in the Next Three Months in Response to the Best Practices, Action Agenda, and Research Agenda Identified at the Workshop.

Nepal

- Design and implement a simple computer application to manage antiretroviral drugs in resource limited settings.
- Explore ways to ensure integration of HIV/AIDS subsystems into the national HIS.
- Explore the possibility of including self-assessment features in the design of the health management information system.

Kenya, Tanzania, and Ethiopia

- Hold stakeholders' meeting through the M&E technical subcommittee of the national AIDS control council.
- Set priorities and simplify community and health facility data collection tools.
- Revive volunteerism at the community level (i.e., strengthen and establish community volunteers).

India

- Develop unified information and reporting formats at the primary care and district levels.
- Develop a system for unique ID at the community level.
- Develop a strategy of providing supervision at the primary and district level.

Vietnam

- Discuss outcomes of the third RHINO workshop with key stakeholders.
- Conduct an HIS assessment.
- Develop core health indicators.

Cambodia

- Share workshop knowledge and experience: dissemination workshop on best practices and action plan.
- Develop best practices by nongovernmental organizations (NGOs) looking at their own organizational systems.
- Establish HIS working group for government and NGOs.

Indonesia

- Hold an internal meeting of the provincial technical assistance (TA) group to discuss a conceptual framework for improving HIS for MNCH.
- Conduct a meeting attended by central level MOH, TA group (provincial level), district team problem-solving to discuss the management information system of MNCH: indicators, information need and demand, flow of information, two-way communication, integration of all data sources, and human resources backup.
- Work with donors and counterparts to harmonize indicators.

Pakistan

- Work on hospital MIS with support of JICA in one of the pilot districts: adopt data collection and use mechanisms.
- Conduct pilot testing for developing mechanisms of referring patients from primary health care to hospital and feedback.
- Register private hospitals and clinics in one district.

Uganda

- Hold a stakeholders' meeting, and agree on the priority areas and action for a RHIS.
- Develop tools and carry out a RHIS assessment with the PRISM concept.
- Develop a comprehensive workshop and budget with all key players.

What Longer-Term Actions Do You Plan to Take over the Next Year?

Nepal

- Explore and find suitable alternatives to make automation successful and effective in resource-poor settings.

Kenya, Tanzania, and Ethiopia

- Roll out the already piloted community tools.
- Integrate HIS.
- Automate HIS at the district level.

India

- Use supportive supervision as a strategy to improve the components of HIS.

Vietnam

- Develop a HIS comprehensive plan for coming years.
- Develop a regulation on collecting data and sharing information.
- Implement changes to the HIS.

Cambodia

- Evaluate the present HIS to see what is good practice already and what needs to improve (to be done by the HIS working group).
- Establish priorities for the best practices in each area to be developed as a pilot in Cambodia and, if successful, to be scaled up on the basis of the PRISM framework (to be done by the working group).

Indonesia

- Build on Thai pink book; look at use, dissemination, socialization, training and distribution, and supervision.
- Improve the MNCH information system.

Pakistan

- Register and collect data from private hospitals in one district of Sindh as a pilot.
- Develop a vital registration and geographic information system.

Uganda

- Integrate the different vertical information systems.
- Upgrade appropriate information and communication technology systems and support.

Annex 7: The RHINO Virtual Workshop

Advances in communication tools now permit the active interaction of larger communities. During the RHINO workshop in Chiang Rai, Thailand, we took advantage of those tools to extend our audience beyond those who were physically present. Because only about 100 of our close to 1,000 worldwide RHINOs could attend the workshop, we decided to hold a “virtual” workshop so that we would have a larger audience and greater participation. Fortunately, our hotel in Chiang Rai had good high-speed Internet connectivity. In addition, our rapporteur had a good set of audiovisual capture equipment. Using this equipment, we could capture audio of all of the presentations, which we made available as “podcasts” on the RHINO Web site. In addition, we offered video clips and photo stills for downloading. Of course, the PowerPoint presentations from the workshop were also made available on the Web site.

As a result, we were able to provide most of the actual content of the workshop on the RHINO Web site during the conference. We e-mailed our RHINO worldwide members as soon as new items were posted, and they went to the Web site to listen and view the workshop content.

One exciting event of the virtual workshop was the Wednesday evening walkabout, in which 16 groups made presentations on tools, techniques, and systems that they were using. During this walkabout, we were able to connect to members in the United States using an audiovisual link so that they could present their tools.

During the workshop, the podcasts, presentations, and videos were viewed from around the world.

The map shows the locations of the people who accessed the Web site to view the virtual workshop. As you can see, we have interested RHINO members on all the continents.

Another measure of the interest in the virtual workshop was the amount of bandwidth that we used during the workshop. Our bandwidth for the the month of the workshop shot up tenfold to 45 gigabytes downloaded.

We are pleased that we could use the Internet to bring the RHINO workshop experience to a large number of our members.

The virtual workshop is available on the RHINO Web site at <http://www.rhinonet.org>, where you can view and listen to the workshop, as well as download presentations, reports, and additional documents.



Annex 8: RHINO Steering Committee Meeting Report (Chiang Rai, March 3, 2006)

Attendees:

Anwer Aqil, MEASURE Evaluation, USA
David Boone, MEASURE Evaluation, USA
Bolaji Fapohunda, MEASURE Evaluation, USA
Yusuf Hemed, MEASURE Evaluation, Tanzania
Theo Lippeveld, JSI, Boston, USA
Anton Luchinsky, PATH, USA
Eddie Mukooyo, MOH Uganda
Stephanie Posner, HISP South Africa
Sureeporn Punpuing, Mahidol University, Thailand
Michael Rodriguez, MEASURE Evaluation, USA
Vince Shaw, HISP South Africa
Katherine Shields, World Education, Boston, USA
Mark Spohr, MEASURE Evaluation, USA
Norma Wilson, HMN, Switzerland
Randy Wilson, MSH, Boston, USA

Workshop Debrief

The meeting started with a general debriefing on the Chiang Rai workshop. Following is a collection of the comments by the participants:

- Excellent workshop with a broad group of information people, managers, and funders.
- Would be good to advance thinking from this workshop with a smaller workshop group.
- Need expanded role of field visits.
- Problems with translation.
- Lack of innovative approaches towards data collection and use.
- Need more promotion of RHINO as a network.
- Need to bring in vital events registration.
- Not enough focus on the PRISM framework.
- Walkabout was an excellent means of communications.
- Not enough participants from Latin America.
- Too much focus on Thai experiences; not enough inputs by participants' experiences.

Action Plan 2006-2007

Next Workshop

- Build more on the state of knowledge from prior workshops.
- Field visits: maybe a different model for smaller groups and shorter visits spaced out.
- Suggestion to organize an interim workshop in 2007 with a smaller number of participants to advance knowledge.
- 2008 workshop: focus on the patient:
 - Information in support of continuity of care;
 - Unique identifier;
 - Electronic medical record.

Other activities

- Online forums to discuss various topics.
- Wikipedia of routine health information.
- Publication of peer reviewed article.
- Incorporate RHINO as NGO (with board of directors).

Annex 9: Coordinators and Facilitators

MOUNKAILA ABDOU BILLO, MD, PhD

Mounkaila Abdou Billo has been a senior monitoring and evaluation adviser at John Snow, Inc. (JSI), for the MEASURE Evaluation Project since May, 2003. He holds a PhD in epidemiology from Tulane University (2000) and an MD from the University of Niamey, Niger (1984). Abdou Billo has more than 20 years of public health experience. His expertise is in malaria, infectious disease epidemiology, health information systems, and medicine. Formerly, he was the regional adviser for health situation analysis at the World Health Organization (WHO) Africa Regional Office. He also served as the director of the Niger National Health Information System from July, 1991 until April, 1995. He has experience in conducting epidemiological studies, training health professionals in disease surveillance, including data collection, analysis, and reporting. Additionally, he developed the management information system for the WHO African Region. Mounkaila Abdou Billo has also served as a district medical director in Niger. He is a native French speaker and is fluent in English.

ANWER AQIL, MD, MCPS, MPH, DRPH

Anwer Aqil is currently working as senior health information system (HIS) adviser for MEASURE Evaluation/JSI, USA. He brings 25 years' experience in research, planning, management, monitoring, and evaluation of public health programs. He has worked in more than 15 countries all over the world. In the past few years, he has worked on the operationalization of the PRISM framework in Pakistan and Uganda.

DAVID BOONE, PhD

David Boone is an epidemiologist and health informatics adviser for MEASURE Evaluation/JSI. He currently serves as the liaison to the Office of the Global AIDS Coordinator for Informatics and provides technical support to countries in M&E and health management information systems (HMIS) for PEPFAR. Before joining JSI, he worked for WHO in Nigeria for the global polio eradication initiative, for sleeping sickness control in the southern Sudan, and for guinea worm eradication in Benin. He has also worked at both state and local public health agencies in the United States for HIV/AIDS surveillance. He earned his PhD in epidemiology from Tulane University.

THADA BORNSTEIN, MEd

Thada Bornstein serves as quality improvement adviser and training director for the Quality Assurance Project at University Research Co., LLC (URC), in Bethesda, Maryland. She has worked extensively in Southeast Asia and Africa, including providing technical assistance to quality improvement teams, leading curriculum development, conducting training, and assessing community-based monitoring for a malaria control pilot project in Vietnam for WHO. Her interests include quality management, human performance technology, and instructional systems design.

DARIN EVANS, MA

Darin is a doctoral student at Boston University's School of Public Health. He has nearly 10 years of experience working with community-level health programs and education in the United States, Peru, Egypt, Vietnam, Nigeria, and southern Sudan. His current work has focused primarily on reproductive and sexual health, and he lectures on community participation in public health programs.

BOLAJI FAPOHUNDA, PhD

Bolaji Fapohunda has extensive expertise in research, HIS, performance monitoring, and evaluation of public health interventions, including child survival, reproductive health, and HIV/AIDS. She is currently senior technical adviser with JSI International Division. Before JSI, she worked as director of research for the National Black Women's Health Project in Washington, D.C.; supervised the implementation of a Centers for Disease Control-funded project in cardiovascular risk reduction (in four states in the United States); and headed the development of new program initiatives in the advancement of black women's health. Bolaji also worked with the Population Council's regional office in Nairobi. She has USAID, United Nations, and university teaching experience.

JITMANEE KANG-ONTA, MA

Jitmanee Kang-onta is a health officer at Maechan Hospital. She received her master's degree from Chiang Mai University in Thailand in 1996. She had worked in the field of family health care for 20 years. She is now a health officer and also works in the Department of Data and Health Insurance at Maechan Hospital in Chiang Rai.

PISANU KANTIPONG, MD

Dr. Pisanu Kantipong has been chief of the OB-GYN Division at the Chiang Rai regional hospital since 2003. He served as chief of the Infectious Control Committee, One Stop Crisis Center, Mother and Child Health Board, and Public Relations Unit at the Chiang Rai regional hospital. He is also a member of the board of Chiang Rai Woman and Child Right of Chiang Rai Province. He received his degree in clinical science from Mahidol University and the Thai Board of OB-GYN from Rajvithee Hospital in Thailand.

UPAMA KHATRI, MPH

Upama Khatri is a monitoring and evaluation adviser at JSI for the MEASURE Evaluation Project. She holds a master's in public health from the Boston University School of Public Health. She is the activity lead for two RHIS-related MEASURE Evaluation projects. The first is the South Africa Data Warehouse activity where MEASURE Evaluation is developing a Web-based reporting system for US Government partners to report PEPFAR indicators. The second is the Nigeria National Response Information Management System activity in which MEASURE Evaluation is working closely with host-country counterparts to set up and scale up a routine HIV/AIDS data collection and reporting system. In addition to Nigeria and South Africa, she has worked in Guyana, Romania, Russia, Kazakhstan, Kyrgyzstan, Egypt, and Nepal on issues related to HIV/AIDS, reproductive health, health systems reform, nutrition, and community participation in primary health care.

WILAIWAN KULKOLAKARN, MD

Wilaiwan Kulkolakarn obtained a doctor of medicine board certification in pediatrics from Chiangmai University in Thailand. She has worked as medical staff in the Pediatric Department of Lampang Hospital since 1978 and has worked as chief of the Pediatric Department since 1991. Her expertise is in the area of pediatric AIDS. At present, she is a senior expert pediatrician level 10, and her position is deputy director and quality management representative of Lampang Hospital, Thailand.

THEO LIPPEVELD, MD, MPH

Theo Lippeveld is senior technical adviser on the MEASURE Evaluation Project and a member of the Technical Advisory Group of the Health Metrics Network. He is a public health physician with more than 20 years of experience in the design and implementation of national routine health information systems (e.g., Chad, Eritrea, Pakistan, Morocco, Niger, Ivory Coast). Together with his colleagues and with the Unit of Country Information Systems of WHO/Geneva, he wrote and edited a book on lessons learned and best practices in routine HIS results that were based on various country experiences. As one of the cofounders of the Routine Health Information Network (RHINO), he was the keynote speaker at the Potomac workshop in 2001.

Lippeveld also is vice president of the International Division at JSI. He has a medical degree from the University of Louvain (Belgium), a master's degree in public health from Harvard University, and a diploma in tropical medicine and hygiene from the Tropical Institute of Antwerp (Belgium). Between 1989 and 1997, he was visiting lecturer at the Harvard School of Public Health.

PRIYA PATIL, PhD, MPH

Priya Patil has a PhD and MPH from Johns Hopkins University in infectious disease epidemiology, and she currently works for the Futures Group, a Constella company. Although her portfolio includes work with Afghani refugees in Pakistan, community development in Uganda, and clinical trials in the United States, she currently leads the patient management and monitoring system development under GHAIN in Nigeria and has worked on a similar system in nine other PEPFAR countries. Through MEASURE Evaluation, Priya is also activity leader for two targeted evaluations in adherence to antiretroviral and palliative care for HIV/AIDS activities that are based in sub-Saharan Africa, South Africa, and Cambodia.

SURACHAI PIYAWORAWONG, MD

Dr. Surachai Piyaworawong is a medical doctor at Maechan Hospital, Chiang Rai. He graduated M.B from Mahidol University, Thailand, in 1984. He is a pediatrician and has worked as the director of Maechan Hospital for 10 years. He also works in the field of preventive medicine and family medicine.

SUREEPORN PUNPUING, PhD

Sureeporn Punpuing is an associate professor at the Institute for Population and Social Research, Mahidol University. She is now a site leader of the Kanchanaburi Demographic Surveillance System with emphasis on the health consequences of population change. Her research focuses primarily on health, migration and environment, and international migration in Thailand. Dr. Punpuing worked temporarily as a population affairs officer with the United Nations for nine months. She holds a master's degree in demography and a doctorate in resource and environmental studies from the Australian National University.

MICHAEL P. RODRIGUEZ, MA

Michael Rodriguez has worked for more than 15 years on the assessment of health information technology (HIT) capacities, evaluation of data and information needs, and development of HIT strategic plans. His work has focused particularly on sharing health care data across agencies for clinical and program management, monitoring and evaluation, and policy improvement. Rodriguez's research has focused on the adoption of information and communication technology tools in resource-poor environments, including barriers to adoption. He has been the project director for the development of a stakeholder-driven effort to support electronic health information exchange among regional service providers, reimbursement agencies, public health authorities, research agencies, and the general patient population. In addition, he has worked as the technical adviser for the development of a data warehouse on HIV/AIDS program indicators for USAID in South Africa, which supports Web-based data capture, reporting, and evaluation for more than 175 program partners.

JONATHAN ROSE, MD, MPH, DABPM

Jonathon Rose, MD, MPH, DABPM, is a physician and international health specialist with expertise in medical epidemiology, quantitative and qualitative study design, execution, and analysis. He currently serves as a medical epidemiologist providing technical assistance to multiple programs at JSI. He also serves as a health information specialist for the MEASURE Evaluation Project. Finally, he provides expert advice on issues related to vulnerable children, including human rights, access to care, and care during complex emergencies. Rose's special interest is working with and on behalf of children living on the street, which he has been doing for 20 years. He is also interested and certified in health and human rights, developing public health systems in post-conflict areas, and complex emergencies. He is an associate at the Center for International Emergency, Disaster, and Refugee Studies at the Department of International Public Health, Johns Hopkins School of Hygiene and Public Health, where he teaches a course titled "Children in Crises."

VINCENT SHAW, MD

Vincent Shaw is a specialist family physician, currently completing his PhD program in information systems through the University of Oslo, Norway. During the post-apartheid restructuring of the health services in South Africa, he worked in numerous positions in the regional and district offices before taking up a position as acting director for district hospitals in the provincial office of the Eastern Cape Department of Health. He occupied this position for five years, during which time he became involved in the development of an information system for the district hospitals in Eastern Cape Province. He has been working for the Health Information Systems Program, South Africa, for the past three years as manager and team member. His area of interest is hospital information systems in developing countries. Besides extensive experience in South Africa, he has also worked in Malawi, Nigeria, and Tanzania.

KATHERINE SHIELDS, MEd

Katherine Shields is a training design specialist at World Education, Inc. She has developed curricula on the use of information and RHIS design for the MEASURE Evaluation Project. She works with public health programs to design job aids, training programs, and other learning materials for health professionals in Africa, Asia, and the United States in the areas of HIV prevention, maternal and child health, and organizational development. She received a master's in education from Harvard University.

SAOWAPAK SIKSINACHI

Saowapak Siksiniachi is a researcher at the Institute for Population and Social Research, Mahidol University. Her areas of interest are migration and health and the minority people. Siksiniachi received her master's degree in population and reproductive health research from Mahidol University, Thailand. She has many years of experience with international workshop and training programs. She was the project manager for the Social Protection Facility, Thailand Office, for three years.

MARK H. SPOHR, MD

Mark Spohr is a consultant working in international health and health care information technology. With an undergraduate degree in electrical engineering and a medical degree, he has a foundation in medical technology. He practiced clinical medicine for 10 years after completing his residency.

In 1985, Spohr founded Pacific Medsoft, Inc., to provide clinical and financial medical information systems. Pacific Medsoft developed computer software applications that performed billing, practice management, patient scheduling, Problem Oriented Medical Record, and managed care analysis functions.

Starting in 1992, Spohr expanded into international health. He has worked with the Asian Development Bank, WHO, the World Bank, USAID, Centers for Disease Control, and JSI on national health planning and HIS projects in Malaysia, Sri Lanka, Pakistan, Ethiopia, Papua New Guinea, South Africa, and Nigeria. He has worked with WHO Health Metrics Network and WHO and UNAIDS on AIDS information systems. He has worked with burden of disease in health planning and policy. He is currently coordinator of the RHINO project (<http://www.rhinonet.org>).

PISIT SRIPRASERT, MD, MPA

Pisit Sriprasert is the chief of the Nan Provincial Health Office. He received his Doctor of Medicine degree from Mahidol University, Thailand, in 1983 and finished his master's in public administration from the National Institute of Development Administration, Thailand, in 1997. From 1984 to 1994, Dr. Sriprasert was the director of three hospitals in Nan Province. He was promoted to an expert in preventive medicine in 1994. Before directing the Nan Provincial Health Office, he had been the chief of the Prajinburi Provincial Health Office.

Sriprasert has conducted many research projects, namely, pediatric measles; community participation of Nam Gian Subdistrict; longitudinal research of Thai children; investigation of diphtheria on the Thai-Lao border; examination of botulism of bamboo shoots in the kerosene can; and an encyclopedia for children. From 1994 to the present, he has worked on the public health on the Thai-Lao border project; from 1999 to present, he has been an instructor of the High Level Administrator on Public Health and Physician Program, Ministry of Public Health.

DAVID (RANDY) WILSON

David Randolph Wilson has more than 20 years of experience in the field of international public health, with a strong focus on the design and implementation of management information systems over the past 12 years. Wilson has 10 years of long-term overseas work experience (six years in the Congo and four years in Madagascar) and lived for 17 years on the Asian subcontinent. Some of his short-term assignments included serving as the principal MIS adviser for MSH projects in Afghanistan (Health Sector Support Project, 1991-1993, and REACH, 2003) and the Pakistan Child Survival Project (in Islamabad) between 1991 and 1994. He has contributed chapters related to information systems and computerization in two WHO publications and has presented papers on geographic information systems and HMIS assessment at international conferences.

In 1999 and 2000, Wilson was director of MSH's popular management training course, Planning and Managing Information Systems. More recently, he coordinated assessments of health-related management information systems in India, Guinea, South Africa, and Bhutan. Between 2000 and 2002, he served jointly as MSH's deputy chief information officer and project director of an HIS enhancement project in Bhutan. He is currently the chief information officer for MSH and is based in Cambridge, where he oversees corporate systems development and information technology infrastructure support.

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