Background

Reliable and timely information is essential for effective public health programming and responsive health policies. In many countries, however, data are often incomplete and outdated due to under-investment in health management information systems (HMIS) and fragmentation of the information base due to vertical programs. This situation prevents decision-makers from 1) identifying problems and needs, 2) monitoring progress and assessing the impact of health programming, and 3) arriving at evidence-based policy and program decisions.

The Cambodian Ministry of Health (MOH) has long recognized an HMIS as an essential tool for managers at national, provincial, and district levels. However, the evolution of Cambodia’s HMIS has been erratic. The original HMIS, a mix of stand-alone databases using Microsoft Access (Db1) was updated in 2009 into another Microsoft Access (Db2) database. Unfortunately, the new database proved cumbersome, and the percentage of health facilities reporting monthly into the HMIS fell dramatically. Also, various vertical programs within the central MOH had their own individual program databases and systems. The multiple reporting requirements increased staff workload; introduced copying errors; and, as different information was collected by different vertical programs, precluded standardized reporting.

The Better Health Services Project (BHS), funded by the U.S. Agency for International Development (USAID) and implemented by University Research Co., LLC (URC), has taken a lead role in supporting the MOH’s recent efforts to merge their multiple databases into a single HMIS. BHS partnered with the Ministry’s Department of Planning and Health Information (DPHI) in 2010 to design and implement a single, uniform, web-based HMIS that uses open-source software (MySQL, PHP, and Apache). BHS is now working with the vertical central-level MOH programs to match their program data to the new web-based HMIS, so that more health information will be available to all users and partners at all levels of the health system.
University Research Co., LLC (URC) has been a key contributor to health systems strengthening in Cambodia since 2009 as the lead implementer of the USAID Better Health Services Project (BHS, 2009–2013), building on the achievements of the USAID Health Systems Strengthening Project also implemented by URC (HSSC, 2002–2008). BHS’s overall aim is to improve the quality of care and use of public health facilities, with a particular emphasis on increasing equity of access for the poor. It works with the Cambodian MOH to strengthen capacity through coordinated activities that address both clinical and support services (i.e., health financing, quality improvement, MOH planning, supervision, and health information systems). A global company, URC has been dedicated to improving the quality of health care, social services, and health education worldwide for 45 years.

BHS’s Approach to Strengthening Cambodia’s HMIS

The BHS project is working in several ways to strengthen Cambodia’s health information system:

- Continued development of a single, uniform, web-based HMIS for public, NGO, and for-profit providers (www.hiscambodia.org).
- Integrating the HMIS with the health equity fund (HEF) data base
- Supporting the integration of data from vertical programs (such as HIV/AIDS, PMTCT, TB, malaria) into the HMIS
- Introducing patient level electronic medical records
- Developing data collection tools and data bases to support pay for performance and health reform initiatives in Cambodia
- Developing a registration and membership database for the Cambodian Medical Council, and
- Providing technical assistance to the MOH Human Resources Department (HRD) and its development partners so that the upgraded HRD database will be able to exchange information with the HMIS.

Needs assessment and consensus building

To assess the feasibility of transforming the Microsoft Access-based HIS to a web-based HMIS and identify the processes that would be necessary to do so, BHS and DPHI organized a series of consultative workshops for health officials at national, provincial, and operational district (OD) levels, hospitals, and development partners. In particular, discussions considered the need to 1) further develop and upgrade the HMIS database system as an interface between paper-based systems and the HMIS and 2) meet users’ needs to easily enter, edit, access, and analyze health information.

The goal was to incorporate the best functionality of both the old and new versions into one user-friendly, web-based system that would be available to all users. The database would be accessible by all levels of the Cambodian health system and would feature data entry, data control, data revision, data analysis, and reporting in both Khmer and English. Not making any changes to the existing look of the then-current system greatly reduced training needs.

Database development

To improve data entry and transmission, BHS harnessed new technologies, such as open-source software and dynamic scripting languages (namely, MySQL and PHP) to build a new, user-friendly web interface. The result was a full-featured, web-based application for entering, reviewing, and editing health information at all system levels. The new HMIS also has advanced functionality for reporting to reflect the key indicators in Cambodia’s second National...
CHARACTERISTICS OF THE NEW, WEB-BASED HMIS

Data entry:
- Health statistics nationwide, by province, by operational district, and by health facility
- New health facilities, both public and private, are included
- Data can be keyed in at one time and uploaded later to the website if there is a problem with the internet access

Data list and reporting:
- Allows users to know which health facilities have or have not produced reports and which health facilities are slow in data entry

Data presentation:
- Monthly reports from health centers, referral hospitals, and provincial hospitals
- Allows users to analyze different indicators to identify strengths, weaknesses, and progress by facility

User management:
- The MOH controls user access

This screen shot shows the HIS data entry screen for ANC/pregnancy/delivery/postpartum care.
Until recently, Cambodia’s public health system used three different registers for antenatal care (ANC): an ANC register, a separate register for the prevention of mother-to-child transmission of HIV (PMTCT), and a third register for Linked Response. BHS reviewed the use of these registers and associated reporting forms at health centers and hospitals and assessed how data from each were being used. Findings were presented to all maternal and child health provincial managers in the 24 provinces as well as central level MOH staff and the sub technical working group (sub-TWG) for Maternal and Child Health, which includes the National Maternal and Child Health Center (NMCHC), the Department of Planning and Health Information (DPHI), NCHADS, and health development partners. All agreed that a single ANC register would be more effective and proposed that BHS help develop a single one to replace all three.

The BHS team in collaboration with MOH staff held several meetings with US Government partners, NMCHC, and DPHI to review with them the existing ANC registers and identify information essential to capture in a single ANC register. BHS then worked with all stakeholders to finalize a draft ANC register; it was approved by the MOH in October 2009. In 2010, the MOH began rolling out the new combined ANC register, and with BHS assistance, it has been scaled up nationwide.

**ANC Register Analysis**

**ANC Linked Response**
- 33 columns
  - Entry date
  - Mother’s health book
  - Blood pressure
  - Tetanus vaccination
  - ANC 6+
  - HIV test history
  - Pre-test counseling
  - Accepted test HIV, Syphilis, Hemoglobin
  - Blood sample code
  - Return date for result

**ANC HC1**
- 23 columns
  - Card number
  - Total of ANC
  - Pregnancy HIV+

**ANC PMTCT**
- 20 columns
  - Career
  - Next Appointment
  - 1st and 2nd result (-)(+)(+/-)

**ANC Register Analysis**

**ANC Linked Response**
- HIV test result
- Refer from HBC, VCCT, OI/ART

**ANC HC1**
- Series No.
- Age
- Refer in/out
- Remark

**ANC PMTCT**
- Pregnancy HIV+

**SUCCESS STORY: Integrating facility-based, antenatal care registers**
Health Strategic Plan (HSP 2) and the Millennium Development Goals (MDGs).

The new HMIS allows users to produce four different types of reports:

- **Health center (HC1 report):** This report helps health centers identify their strengths and weaknesses and develop timely and appropriate solutions and action plans. Reports can be produced by month, trimester, and year.

- **Hospital (HO2 report):** The HO2 report helps hospitals in decision-making and resource allocation. These reports can also be produced by month, trimester, and year.

- **Data parameter reports:** The HMIS also offers a feature that helps users produce monthly tallies on key information and services, like antenatal care, deliveries, postnatal care etc. They can then use this information to produce progress reports and formulate future plans.

- **Core indicator report:** The HMIS also has a feature to produce core indicator reports, which the government uses to track and report on progress toward achievement of key health objectives for the country.

Data quality and accuracy are crucial to the HMIS, so the program automatically performs certain functions to ensure data quality. If data are not properly entered such that the system recognizes a mistake, a red warning pops up, saying “Please check again!”

**Striving for complete reporting**

A major goal of the HMIS revision was to motivate every district and facility to find all previously incomplete HMIS data and enter them into the new system, a goal set during the development of the new HMIS. Through a series of consultative workshops with all key players, BHS was able to assist the MOH to recover almost all of the previously missing health center and hospital data and incorporate them into the new HMIS. For example, only 46% of health centers had previously reported data for February 2010; this percentage increased to 91% using the new HMIS. The figure shows how much information was missing from the original attempts to collect data and how much BHS was able to recover.

Another challenge with the new HMIS was a previous data transmission error at the field level. BHS discovered that certain data were not being uploaded to the central level MOH, even though they were uploaded to the district and provincial levels. Thanks to the flexibility of the new database engine, BHS was able to correct this problem quickly.
Key Achievements

With financial and technical support from BHS, DPHI trained 206 staff in mid-2010 in the new HMIS. Participants represented all 24 provinces and municipalities, national hospitals, and health development partners.

- The database itself was started in August 2010 after trainings were completed for MOH officials managing the information system.
- The new HMIS is now live at http://www.hiscambodia.org. It collects and stores health information from around the nation. As of July 2011, it includes data from 990 public health centers, 57 referral hospitals, 24 provincial hospitals, 8 national hospitals, 2 private and 2 NGO supported hospitals, all of which report through the web-based HMIS.

- The number of HMIS users has increased steadily; 71% of authorized users were using the HMIS in May 2011, less than a year after its launch.
- Data quality has also improved with the new HMIS system. A data quality index was developed by DPHI and BHS to assess and track data quality from individual facilities and for the HMIS system as a whole. The results show a significant drop in HMIS data quality prior to BHS assistance and consistent and significant improvement since.
Next Steps

The new HMIS has achieved high utilization and broad coverage quickly and effectively. Data entered at health facilities, health centers, hospitals, and ODs are uploaded into the national HMIS system without the need for any data transmission via e-mail or double entry. The new HMIS reports help managers and decision-makers monitor health service delivery, assess progress in key health indicators, and better allocate resources.

BHS was formally recognized for its collaborative work with the MOH to improve the HMIS in the National Health Achievement Report 2010.

Improving data quality and use

BHS is focusing over the 2011–2013 period on strengthening data quality control, analysis, and use at all levels of the Cambodian health system. Particular attention is being paid to working with health facilities to maintain timely and correct entry of information. BHS will also support managers and decision-makers to more consistently and effectively use HMIS reports for routine monitoring, quality improvement, and planning. In coming years, BHS will introduce management reports specifically designed for the national, provincial, OD, and facility levels to foster the use of data for decision-making.

Integration with other databases

The next stage will also integrate other databases into the HMIS. The databases of vertical programs—such as NCHADS, the National Center for Tuberculosis and Leprosy Control, and other national MOH programs, as well as databases on health equity funds and social health protection—will be linked to the HMIS.

The initiative of the Ministry of Health to develop a web-based health information system will allow more timely, complete and accurate information on health indicators to be available more quickly for evidence-based decision-making.

— Draft remarks on behalf of Health Partners on the occasion of the 32nd National Health Congress and 9th Joint Annual Performance Review, Ministry of Health
14 March, 2011

BHS is also testing a Hospital Medical Record System (OpenMRS) that integrates patient and health financing information, introduces unique patient identifiers, improves individual patient records, and standardizes a patient database for both health center and hospital levels. OpenMRS has traditionally been used for management systems related to antiretroviral therapy; BHS is the first to use OpenMRS in an attempt to develop an integrated and comprehensive hospital information system in a developing country. The OpenMRS system may also be integrated with the HMIS.
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