

Rapid Assessment of Bhutan's Health Management Information System

FINAL RESULTS 1 September 2000

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List of Abbreviations Used

ANC	Ante Natal Care
ANM	Assistant Nurse-Midwife
BHU	Basic Health Unit
BHW	Basic Health Worker
CG	Core Group
CH	Child Health
DHSO	District Health Supervisory Officer
DMO	District Medical Officer
EHG	Euro Health Group
EPI	Expanded Programme on Immunisation
FP	Family Planning
HA	Health Assistant
HD	Health Division
HIS	Health information System
HIU	Health Information Unit
HIV/AIDS	Human Immuno-deficiency Virus/Acquired Immune Deficiency Syndrome
HMIS	Health Management Information System
HSPS II	Health Sector Programme Support Phase II
HW	Health Worker
IDD	Iodine Deficiency Disease
IEC	Information Education and Communication
IMTRAT	Indian Military Training Unit
IT	Information Technology
IUD	Intra Uterine Device
JDWNRH	Jigme Dorji Wangchuk National Referral Hospital
LOD	Liaison Office of Denmark
MCH	Maternal Child Health
MOHE	Ministry of Health and Education
MSD	Medical Supplies Depot
MSH	Management Sciences for Health
OPD	Outdoor Patient Department/Out Patient Department
ORC	Outreach Clinics
PHC	Primary Health Care
PHU	Public Health Unit
POW	Plan of Work
PPD	Policy and Planning Division
RGOB	Royal Government of Bhutan
RHU	Reproductive Health Unit
RIHS	Royal Institute of Health Sciences
STD	Sexually Transmitted Diseases
TA	Technical Assistance
TOR	Terms of Reference
WHO	World Health Organisation

Rapid Assessment of Bhutan's Health Management Information System:

Executive Summary

As part of the second stage of Management Sciences for Health/EuroHealth Group's (MSH/EHG) technical assistance for the enhancement of Bhutan's Health Management Information System, a rapid assessment was carried out over a 4 week period from May 22 to June 15th 2000. The rapid assessment was designed and conducted by HMIS Task Force staff from the Ministry of Health and Education with technical support from a 3 person team from Management Sciences for Health.

Data were collected using 4 standard questionnaire formats by 3 separate assessment teams during 5 days of visits in 7 of Bhutan's 20 Districts. A total of 23 health facilities were visited, including Basic Health Units (BHUs), District Hospitals and District Health Supervisor Officer's (DHSO) offices. During this time, a detailed Information Technology Assessment was also conducted – the report of which has been produced as a separate document.

The rapid assessment focused principally upon knowledge and practice of health workers with respect to data management (collection, processing & use), the availability and appropriateness of resources, the general organisation of system procedures. It also solicited health workers' attitudes about problem areas and suggestions for improvement. Five different information sub-systems of the National HMIS were selected for detailed review, these included:

- ◆ STD/HIV/AIDS surveillance
- ◆ Monthly Morbidity reporting
- ◆ MCH/EPI/FP and Nutrition reporting
- ◆ Drug logistics
- ◆ Village/Household surveys.

Data was tallied manually and using electronic spreadsheets in order to prepare thematic data summary sheets, which were discussed by HMIS task force members and other health programme staff during a 2 day workshop. This group interpreted the data and came up with initial conclusions and recommendations.

The principal conclusions from rapid assessment identified the following strengths of the existing HMIS:

1. Generally speaking, adequate resources exist at the service delivery points and district levels for the uninterrupted recording and reporting of data. This includes the availability of materials (registers, forms, stationery, etc...), and adequate staff with sufficient time (in most cases) to carry out the required data management tasks. This appears to also be the case at the district level, where computers are also available and functioned well at the time of the assessment teams' visits.

2. Systems for filing and retrieval of past reports at the BHU/Hospital level are excellent and generally well maintained.
3. Staff have a good understanding of the potential uses of the information they collect, although procedures for its actual use are not well established.
4. At the BHU level staff devote considerable effort to presenting key population and service data on wall charts, graphs and maps. There is, however, scope for improvement in the selection and calculation of some of the indicators that are graphed.
5. Routine reporting from BHUs/Hospitals to districts is very effective as evidenced by very high reporting rates, although there is confusion about reporting deadlines for some of the sub-systems (e.g. Village Summary Sheets and Drug Reports).

The assessment identified or confirmed a number of weaknesses that should become the focus of immediate HMIS improvement efforts. These included:

1. Too much data is collected in current recording and reporting formats and not enough is used. There is also confusion about the calculation of several key indicators and how to estimate population targets (especially in family planning and drug management). These problems seem to be related to the design of the reporting formats that are duplicative and require excessive data and to the lack of written guidelines concerning indicator definitions and procedures for data use.
2. There is a lack of systematic feedback (especially written feedback) from DHSOs to BHUs and Hospitals regarding reporting errors and especially for providing analysis of reported data.
3. There appear to be serious problems with data quality originating at the service delivery point, which are further compounded at the district level.
4. Although computers exist and function well at the district level, they are not used systematically to help with data analysis and electronic communications. There is no mechanism, either at the central level or within districts, to build upon the individual initiatives of certain districts and cross-fertilise these uniformly throughout the country. At the national level there are also adequate numbers of computers, but the small team within the Health Information Unit is inadequately staffed and lacks skills in database management and computer hardware troubleshooting which are necessary to support more effective use of this technology.
5. Following recent staff changes at the central level, the Health Information Unit now lacks personnel with training in epidemiology and health service delivery. This expertise is critical for ensuring that surveillance functions at the national level are carried out effectively and for helping to interpret data on significant disease or service trends for feedback reports and the annual health bulletin.

Recommendations were made for enhancements in each of the following areas, some which are highlighted in bullet form under each heading:

1. Data transmission, feedback and supervision
 - Clarify reporting deadlines – especially for the Village Summary Reports and Drug Reports.
 - Improve the design of several recording & reporting formats (the Village summary sheet, household survey, morbidity reports, family planning registers, etc...) to make them simpler

to complete and easier to analyse. Similarly, the MOHE should consider dropping some formats (IDD reports) or collecting the data in other ways.

- Prepare a manual documenting standard guidelines for report transmission and feedback mechanisms and explore more efficient mechanisms for transmittal from remote BHUs. These guidelines should be widely disseminated.
- Stress the need for supervisory visits by DHSOs to each health facility regularly (at least once each quarter?), and determine what data management tasks should be reviewed or discussed during these visits. These could be included in a standardised supervisory checklist.
- DHSOs should provide written feedback to BHUs and Hospitals about their performance on regular basis (at least bi-annually).

2. Presentation and use of information

- Clearer definition and standardisation of indicators for routine presentation would help ensure data comparability
- Monitoring, graphing or charting of key trends and setting of targets should be reinforced at every level
- Health unit staff should discuss the information collected monthly before submitting their reports. They should discuss accuracy of data, achievement of targets, outbreaks of any diseases and any other management issues that are highlighted by the data.
- HMIS enhancement efforts should take full advantage of existing computers and software in order to improve mechanisms for data aggregation and analysis starting at the District levels.

3. Data quality

- The development and provision of documentation in the form of a procedure manual related to standards/guidelines to all health workers involved in data collection.
- Develop simplified tools to facilitate aggregation of data for reporting (e.g tally sheet for morbidity reporting from service delivery points) with reduced errors.
- Enhance usage of computer and other information technology both at the district and national level to facilitate data validation.
- Develop new processes and/or share and standardise error trapping and correction procedures developed by some districts to control data quality.
- Define acceptable levels of error, for example 5 or 10%, and select indicators to routinely monitor data quality such as reporting rates, and on rapid data audits at health facilities.

4. Resources

- Provide simple solar/battery operated calculators to all the staff of BHU/Hospital/DHSO
- Establish a minimum supply list and adequate budgets for stationery including pens, poster paper and coloured markers and ensure that the supplies are provided as per the list.
- Strengthen the Health Information Unit at the Central level in order to:
 - Screen all new, or re-designed, recording or reporting formats before they are introduced at the health facility level
 - Cater to the health information needs of different projects from in and outside the MOHE.
 - Support computer systems development and maintenance and enforce standards.

- Recruit a clinician with training in epidemiology or demography to prepare more useful epidemiological analysis of data.
- Hire or train an existing staff member in computer hardware/network troubleshooting. More complex hardware problems should be dealt with by contracting with a local computer firm.
- Explore various learning approaches for formally institutionalising health worker training on data management with the introduction of the enhanced HMIS. This could be through some combination of the supervisory system (especially for continuous re-enforcement of data use), through short workshops built into district level staff meetings, and/or more formal training methods.

5. Storage and retrieval of information

- DHSOs should consider making more effective use of their computers to store more data (both current and historical) and facilitate easy retrieval and analysis.
- In some facilities additional supplies, furniture and space may be required to further improve storage conditions.

6. Information technology

Based upon the successful experience with the installation of computers at the level districts thus far, the provision of computers to all Health Units down to BHU grade I should be considered.

In addition:

- Some existing computers in districts need replacement or upgrades.
- There is a need for better standardisation of software version numbers (many different versions of the 'standard' software were running)
- With reasonably priced access to the Internet at the district level, Internet use needs to be increased for electronic mail, data exchange and eventually other purposes (e-learning, data querying, web site maintenance). The MOHE should consider a variety of approaches to help staff learn how to use the technology more effectively.
- District and central level staff's job descriptions should be reviewed to identify specific data management tasks both manual and computerised that they should be responsible for.
- In some districts, both automatic voltage regulators and un-interruptible power supplies should be provided to protect the computer equipment against power fluctuations. Similarly, phone line surge protectors need to be supplied to avoid damage to modems from lightning and other voltage spikes carried through the phone lines.

At the central level:

- The HMIS enhancement project should help develop the capacity of the Health Information Unit (HIU) to design and maintain specialised database applications at both the centre and district levels to meet data processing needs.
- An Information Technology cell should be established within the HIU and made responsible for standardisation and maintenance of Information Technology throughout the country
- The HIU should continue with the work currently in progress to network central level computers into a local area network and establish Internet/intranet links.
- The task force should establish a small team to recommend more detailed software standards, especially for database management, and to develop a plan to implement the new standards at all levels.

- As noted earlier additional staff should be recruited or selected HIU members should receive refresher training in hardware troubleshooting especially.
- The Ministry should either recruit or have a support contract with a full-fledged computer technician or firm for backup services. This is not for basic trouble-shooting or warrantee maintenance, but rather for helping with more complex issues that will arise about the need for equipment upgrades and helping clarify technology options and standards.
- Use of computers for data transmission and tele-medicine should also be further explored, building upon the start that has already been made in the field of radiology.

Rapid Assessment of Bhutan's Health Management Information System:

As part of the second stage of Management Sciences for Health/EuroHealth Group's (MSH/EHG) technical assistance for the enhancement of Bhutan's Health Management Information System, a rapid assessment was carried out over a 4-week period from May 22 to June 15th 2000. The rapid assessment was designed and conducted by HMIS Task Force staff from the Ministry of Health and Education with technical support from a 3-person team from Management Sciences for Health.

Assessment Objectives & Approach:

The objectives of this assessment were to:

- ◆ assess current performance of the Health Management Information System both through quantitative and qualitative measures identify functional problems, if any, which will then be targeted in designing improvements in:
 - ◆ data recording & reporting
 - ◆ data analysis, presentation, and communications
 - ◆ the use of health data for decision-making and action

A detailed scope of work for the assessment is included in Annex 3.

A participatory approach was adopted for the development of the assessment instruments, conduct of the survey, and analysis of the results in order to engage Ministry of Health and Education (MOHE) staff in the process and to ensure the relevance of the assessment to the local context.

This approach also:

Emphasized the BHU/Hospital and DHSO levels. Although some information was collected at the national level (mainly as part of the information technology assessment, which is presented as a separate

Bhutan HMIS Assessment Framework

A. Data Management

	Collection	Processing	Use
Knowledge			
Practice			

B. Resources (material, human, financial)

Recording/reporting formats available & appropriate?
Personnel trained?
Equipment for data analysis available & functional?

C. Organisation

Data flows efficient?
Data & information accessible?
Time & effort required reasonable?
Documentation exists & up to date?

D. Attitudes

Individual complaints with system in general?
Suggestions for improvement?

document), the principal focus of the task force's efforts was on the community and district service delivery levels and district health supervisors.

Included the collection of both quantitative and qualitative information. It was felt that the assessment should gather some quantitative data in addition to qualitative and anecdotal information. The quantitative information helps to measure the extent of problems and provide a baseline against which the results of interventions can be measured

Focussed on key indicators and functions selected by the task force. The majority of the assessment's questions were designed around:

- ◆ The health problems, services and resources selected during the workshop on essential health indicators and
- ◆ Key functions identified during the two 1-day workshops on district level information needs assessment

Assessed health worker's knowledge, attitudes and practice with respect to the HMIS as well as the availability of resources.

Provided immediate feedback to staff from participating health facilities. Too often, assessment teams gather data from service providers and there is rarely any on-the-spot feedback to the staff members involved in the survey. Data is usually analysed at the national level and conclusions are presented at the same level. This assessment included a one-page feedback form that was filled in by the assessment team and discussed with the health facility staff immediately after the assessment (see example in Annex 2). Although this feedback is based primarily on the assessment team's observation, without the benefit of more in depth analysis, it encourages health facility staff to continue good practices and enables them to make immediate changes to their record keeping and reporting system to overcome problems that were identified.

Assessment instrument design:

Members of the HMIS task force participated in a series of meetings to develop the assessment instrument. The following table describes the key steps in this process and the results/outcomes of each step:

Step	Activity	Result/Product
1	Card exercise to identify perceived problems related to the HMIS from the perspective of HMIS task force members	List of perceived problems grouped under the headings: <ul style="list-style-type: none">◆ data collection◆ data analysis/processing◆ data use◆ system organisation
2	Identification of principal HMIS structure and key sub-systems	A schematic diagram listing the key HMIS sub-systems : <ul style="list-style-type: none">◆ Surveillance◆ Routine service reporting◆ Administrative systems◆ Civil Registration
3	Presentation of HMIS assessment framework	List of domains of HMIS to be included in the assessment selected through consensus among task force members.

Step	Activity	Result/Product
4	Use of Delphi technique to select priority sub-systems to become the focus of investigation	List of 5 sub-systems that became focus of assessment
5	Small group work to identify for each priority sub-system, key questions related to data collection, processing and use that should be included in the assessment.	List of requisite knowledge and practice related to data collection, processing and use for each selected sub-system.
6	Small group work to identify resources required for effective use of the HMIS.	List of resources to be verified/observed during assessment.
7	Development of draft questionnaires for service delivery level	Draft questionnaires for Interview and Observation
8	Discussion on the draft questionnaires for service delivery level	Questionnaire ready for pre-testing at the service delivery level
9	Pre-testing of questionnaire, first at Denchholing BHU and following initial modifications, a second time at Dawakha BHU.	Questionnaire ready for HMIS assessment
10	Development of questionnaires for DHSO	Questionnaire ready for use at DHSO

Some of the products of this process are included in boxes on these pages (Assessment Framework and Inventory of Sub-systems). The final questionnaire formats are included in annexes 5 through 8.

Using a Delphi technique, task force members selected the following HMIS sub-systems for detailed assessment (these are also highlighted in italics at right):

- ◆ STD/HIV/AIDS surveillance
- ◆ Monthly Morbidity reporting
- ◆ MCH/EPI/FP and Nutrition reporting
- ◆ Drug logistics
- ◆ Village/Household surveys.

The MSH team members created rough drafts of the questionnaire based upon the results of steps 5 and 6, above. Once the questionnaires were drafted, the task force members reviewed them for language clarity. After incorporating some changes recommended by the group, these formats were then used in a pre-test at Dechencholing Basic Health Unit, just outside of Thimpu. Further modifications were incorporated after this pre-test and a second pre-test was conducted at the BHU in Dawakha

Once the service delivery level questionnaires were finalised, the MSH team adapted those formats for use at the district level: adding questions related to data aggregation, feedback report preparation, use of computers and supervisory activities. (See examples in Annexes 7 & 8). Some questions were based upon the functional analysis of district level information needs conducted earlier in the mission.

Information related to several district level functions was selected by the Task force members to be considered during the assessment visit. The functional areas identified included:

- ◆ Information management
- ◆ Disease surveillance
- ◆ Training
- ◆ Human resource management
- ◆ Supervision

Initial Inventory of HMIS sub-systems in Bhutan

Epidemiological surveillance

- ◆ Zero reporting for Acute Flaccid Paralysis
- ◆ *STD/HIV/AIDS surveillance*
- ◆ Iodine Deficiency Disease Monitoring (Salt)
- ◆ National Health Survey

Routine service reporting

- ◆ *Monthly Morbidity reporting*
- ◆ Monthly Mortality reporting
- ◆ *MCH/EPI/FP and Nutrition Reporting*
- ◆ Lab report

Special program reporting

- ◆ TB (Monthly + quarterly)
- ◆ Malaria (specific districts)
- ◆ Leprosy (Monthly + quarterly)
- ◆ IDD report (Quarterly salt)
- ◆ IUD monthly reports (trained personnel only)

Administrative sub-systems

- ◆ *Essential drug logistics system*
- ◆ Human resource management system
- ◆ Training/IEC information system
- ◆ Annual/5 year planning & budgeting system
- ◆ Financial accounting/imprest system
- ◆ *Vaccine /cold chain monitoring (special surveys)*
- ◆ Monitoring and supervision system

Civil Registration

- ◆ *Village/Household surveys*

Sampling

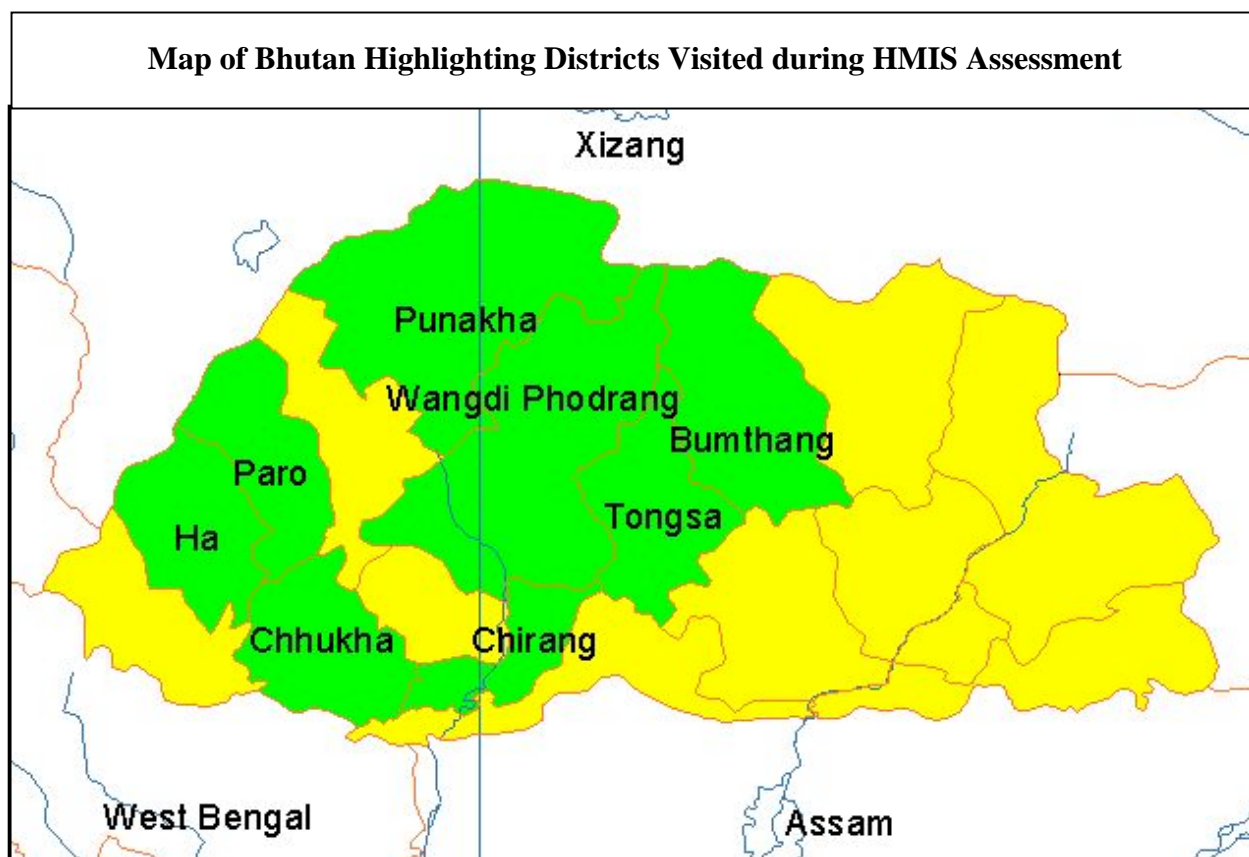
A convenience sample of health facilities (both at the community and district levels) and offices of District Health Supervisors (DHSO) was selected by task force members for the assessment. Although not randomly selected, the MSH team felt that the facilities included in the assessment were fairly representative of health facilities in Bhutan. This was both in terms of their geographic distribution (a total of 7 districts, out of a total of 20) and in terms of the levels of the health care hierarchy that they represented. Efforts were made to select both service delivery points and district supervisory offices from the same district in order to better understand the relationship between the service delivery points and the district offices that supervise them. In addition, the MSH team felt that there was a good balance in the representation of high performing and low performing facilities in the sample.

In each district, efforts were made to visit at least one hospital, 2 BHUs and the DHSO during the 4-5 days allocated for field visits. Three survey teams were set up, each team consisting of several task force members and 1 MSH facilitator (assessment team members are listed in Annex 4). With one exception, task force members administered all of the interviews and completed the observations (due to a last minute cancellation, one team had only one task force member). The teams were unable to administer the questionnaires adequately in the IMTRAT hospital in Haa as it did not report data through the usual channels and did not maintain the previous year's records, nor were they able to administer the DHSO questionnaires in Bumthang because the DHSO was not present during the assessment team's visit.

Table 1, below, lists a summary of the number of each type of facility visited (See Annex 1 for the detailed list).

District	BHU I	BHU II	BHU III	DHSO	Hospital	Grand Total
Bumthang		2				2
Chukha		1		1		2
Haa	1			1	1	3
Paro		1		1	1	3
Punakha		1	1	1	1	4
Trongsa		2		1	1	4
Tsirang		2		1		3
Wangdi Phodrang	1			1		2
Grand Total	2	9	1	7	4	23

The area with dark shading in the map of Bhutan, below, indicates the geographic coverage of the assessment:



Data Analysis:

Once the assessment teams returned to Thimpu from their field visits, the data from the questionnaires were analysed together by task force members and the MSH team. Most of the data were processed manually on flip charts, although some (i.e. data audit, inventory of resources) were entered onto an Excel spreadsheet for simple analysis (means, minimum, maximum, etc...) and graphic presentation.

Based upon this analysis, a number of data summary sheets covering different themes were prepared (see samples in Annex 9). These were later used by task force members in a one-day data analysis workshop during which key findings were reviewed in small groups. These data summary sheets covered the following themes:

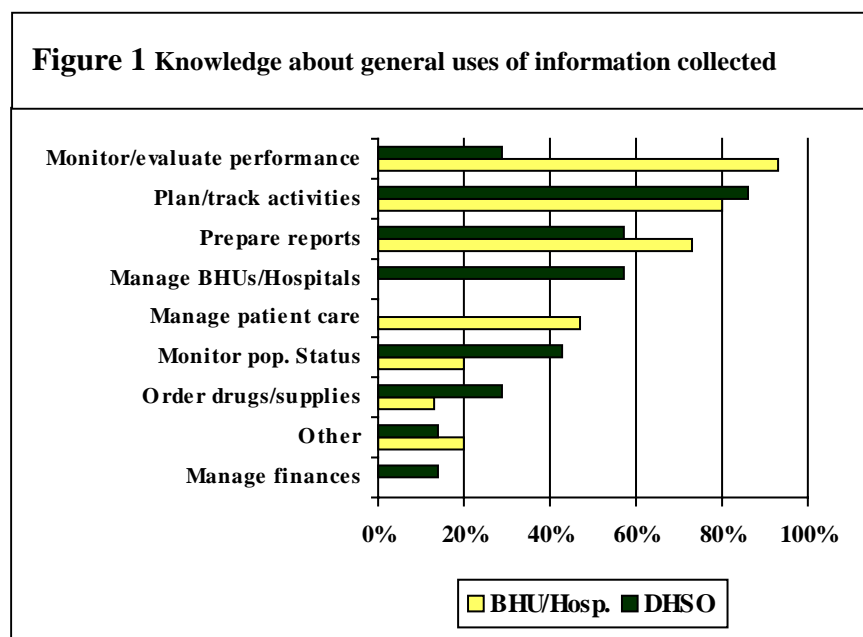
1. Data transmission, feedback and supervision
2. Presentation and use of information
3. Data quality
4. Information technology
5. Resources
6. Storage and retrieval of information

The work groups interpreted the key findings for each theme, identified potential causes of problems and suggested ways in which they could be resolved. Their suggestions have become the basis for the recommendations listed in this report.

Findings:

A discussion of the findings from this assessment are described on the following pages. Although the rapid assessment methodology does not include a large enough sample to provide statistically significant results, the assessment does provide descriptive evidence of a system with a variety of strengths and weaknesses.

KNOWLEDGE AND PRACTICE ABOUT GENERAL USES OF INFORMATION:



When asked how health workers use the information they collect, there was a fairly diverse range of answers. Figure 1 illustrates the distribution of these responses. At the service delivery points the most common unprompted responses were to monitor/evaluate performance, to plan/track activities or to prepare reports. Only about half of the service delivery points visited indicated that the data were useful for individual case

management.

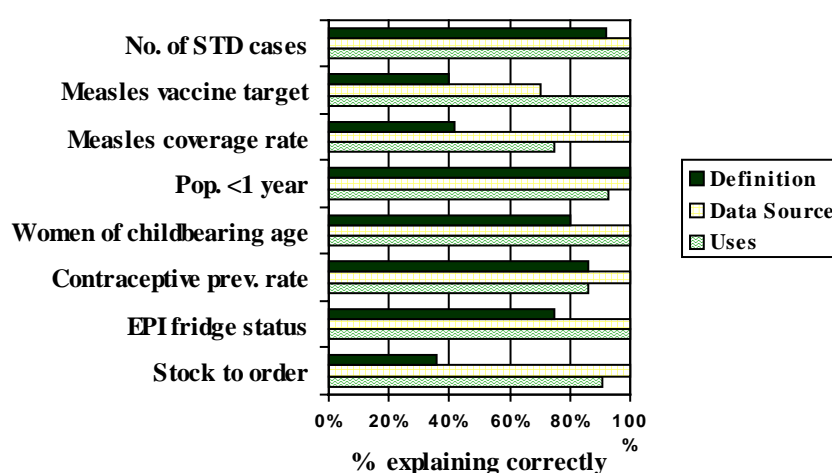
Surprisingly, only about a third of the DHSOs interviewed indicated that they used HMIS data to monitor/evaluate performance. This was in contrast to the large majority of service delivery level staff who saw this as an important use.

Specific examples of actual information use by the health facilities were stated in response to a subsequent open-ended question. Over half of the examples (16 out of a total of 31 comments or 52%) cited an increase in IEC activities (workshops, social mobilisation etc.) as the response to information showing an increase in numbers of selected health problems (e.g. diarrhoea, ARI). Over a third of the examples (12 out of 31 or 39%) cited planning or management areas where use of information was made (e.g. outbreak response, annual target setting, etc.)

KNOWLEDGE ABOUT DEFINITIONS, DATA SOURCES AND USES OF INDICATORS:

When health workers were asked to identify the definitions, data sources and uses of selected indicators an interesting pattern was noted. In nearly every case, staff were able to identify appropriate ways in which the information could be used (besides just for reporting purposes), however for several of the indicators there was confusion about the definition of the indicators.

Figure 2 Knowledge of the definition, data sources and uses of key indicators



This was particularly an issue for women of childbearing age, where some staff used the 15 to 49 age groups, while others used 15 to 45. Still others only considered married women as opposed to those who counted all women in the age groups. There was also confusion about how to calculate drug stock requirement and childhood immunisation targets.

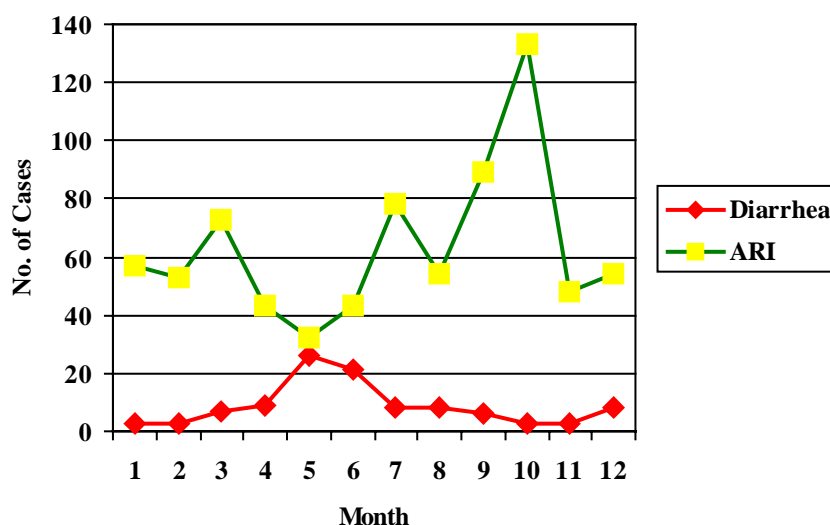
KNOWLEDGE OF DISEASE TRENDS:

Another observation related to data use was the extent to which health workers were familiar with disease trends at their facilities and the degree to which perceived trends were supported by the data they collected.

This was determined by first asking them to describe morbidity trends over the last year for ARI, diarrhea and all cases combined and then comparing the responses with data reported in their monthly morbidity reports. Figure 3 illustrates the seasonal trends for ARI and diarrhoea from one facility that maintained good quality data

The trend shown in figure 3 notwithstanding, the overall results of this exercise were not encouraging. Figure 4 suggests that less than half of the

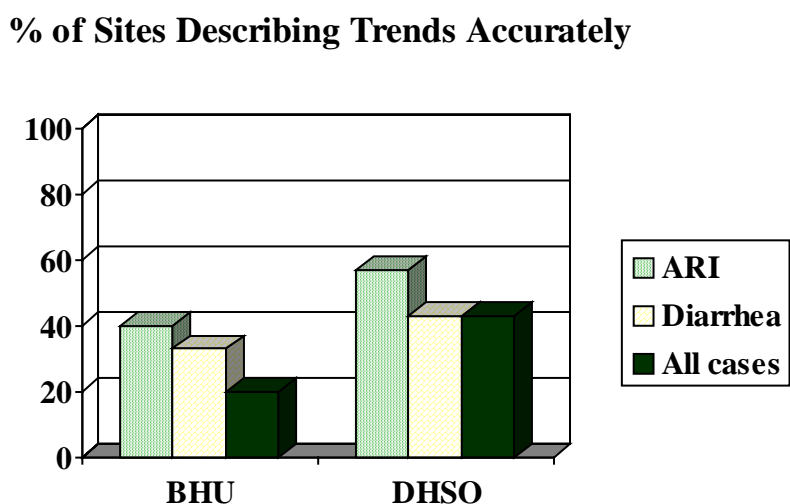
Figure 3 Selected morbidity trends from one BHU



facilities were familiar with disease trends at their sites. This situation was somewhat better among district supervisors, nearly 60% of whom were able to identify district wide trends in diarrhoea.

The task force members felt that these levels of knowledge about morbidity trends were inadequate, but since there are no standard procedures defined for monitoring disease trends and no particular training has been provided to health facility staff in this subject, these results were not very surprising. Trend analysis is also somewhat confusing because of the variability of the caseloads within many of the BHUs visited. Several health facilities saw sharp increases in clinic attendance during the months of April and May – even though this did not correlate with any epidemiological season (e.g. rainy season for diarrhoeal diseases and winter for ARI). It was suggested that this increase may relate more to increased numbers of school children during this period or to slack times in the agricultural calendar.

Figure 4 Percent of Health Facilities describing morbidity trends accurately



It is important to note that there might have been some errors while conducting the rapid data audits to verify the trends during the assessment process. Nevertheless, data gathered from some sites did reflect expected epidemiological trends, so assessment team members felt that the process was generally reliable.

In a follow-up question, respondents were asked to identify particular actions that should be taken if information indicates that specific disease trends are increasing. IEC-related actions were again the most often cited (12 out of 22 responses, or 55%). The additional responses referred to investigation of the causes, followed by some type of intervention (e.g. test water, chlorinate water sources).

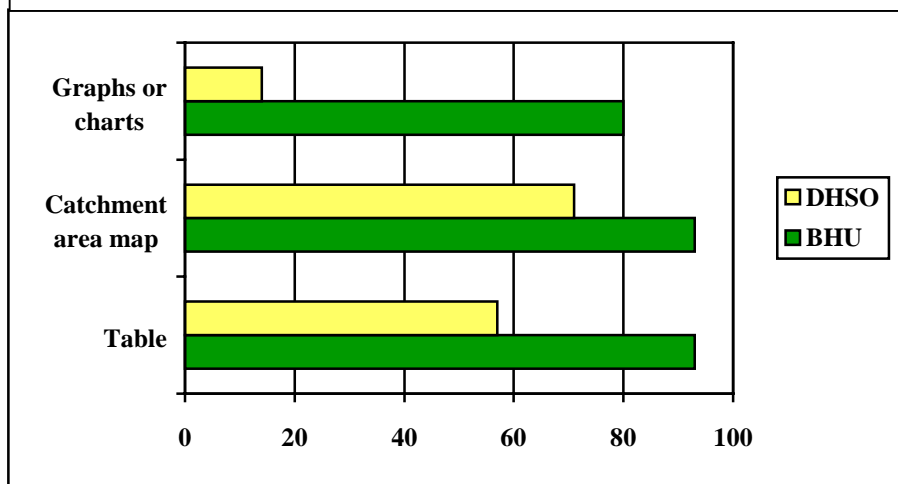
PRESENTATION OF INFORMATION:

One of the most positive findings during this assessment was the widespread practice of analysing and displaying data in various formats on the BHU walls.

Figure 5 indicates the types of presentations that were observed and suggests that this practice is much more common at the service delivery level than in district supervisor's offices. The assessment teams observed that

much of the data presented in this manner were drawn from the household surveys. This included tables identifying key population target groups, numbers of households with latrines as well as immunisation beneficiaries and family planning users. In addition to catchment area maps, several facilities prepared family planning stratification maps to illustrate the coverage rate in different outreach clinic areas. Annex 11 includes some photos with examples of some of these.

Figure 5 Types of data presentation observed in health facilities



During discussions with BHU staff, it was pointed out that there are no particular standards for determining what data to present nor which type of presentation would be most useful. In several instances numbers of family planning users or numbers of immunised children were graphed rather than rates, so it was somewhat difficult to compare data from year to year or between facilities. Assessment team members also found some technical problems with the way some graphs and charts were drawn (for example pie-charts totalling more than 100%). Several staff members interviewed suggested that it would be helpful for some of these techniques to be standardised, especially in view of the high mobility of staff between different BHUs.

Although there seemed to be a considerable amount of attention paid to data presentation in BHUs and hospitals, some service providers did not fully appreciate their use. When asked why they prepare graphs and charts, the staff from one BHU said “the graphs are for visitors.”

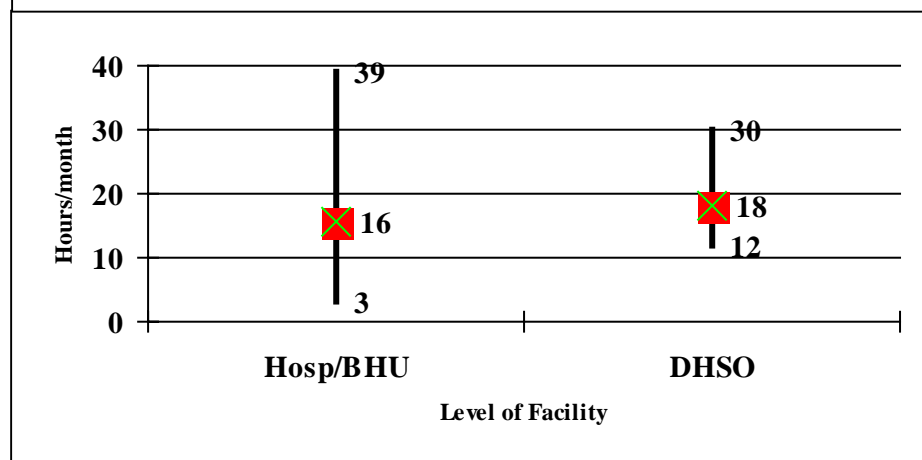
TIME SPENT ON HIS REPORTING:

The assessment team asked health workers at both service delivery and supervisory levels to estimate how much time they spent preparing reports on a monthly basis. Figure 6 illustrates the variation in responses to this question. BHU's and Hospitals reported an average of 16 hours per month, or about 2 days, while DHSOs averaged about the same (18 hours). There was, however, considerably variation in responses at the service delivery level – a quick analysis of the data suggests that this is due primarily to differences in caseloads: facilities with more patients take

more time to tally and report their data. Conversely, the assessment teams observed that facilities with very light caseloads often devoted more time to preparing and wall charts and graphs.

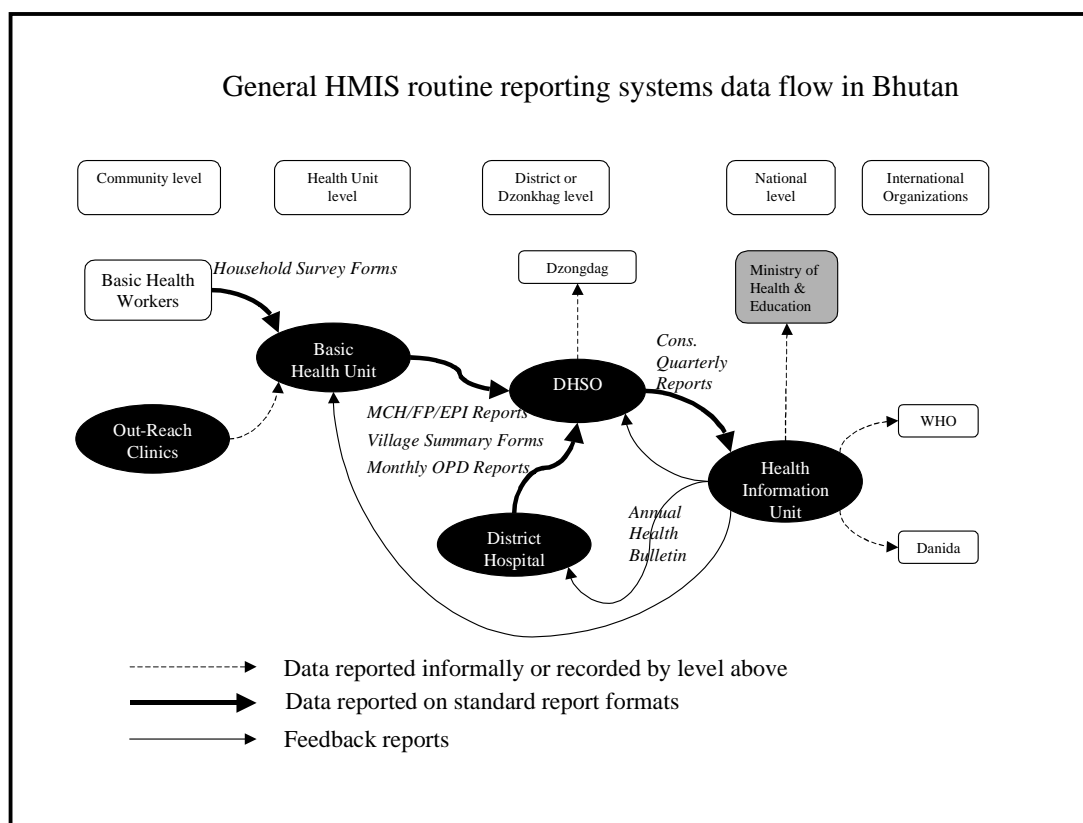
At the DHSO level, supervisors who reported taking more time to prepare HMIS related reports were also those from districts with a higher number of BHUs. In the districts that were visited, the numbers of BHUs varied from 2 to 9, with one district reporting as many as 53 outreach clinics (outreach clinic data is consolidated by BHU level staff before being reported).

Figure 6 Time spent preparing HMIS related reports



REPORTING FREQUENCY & DEADLINES:

Generally speaking, most of the reporting sub-systems follow the report transmission route illustrated by the following flow chart.

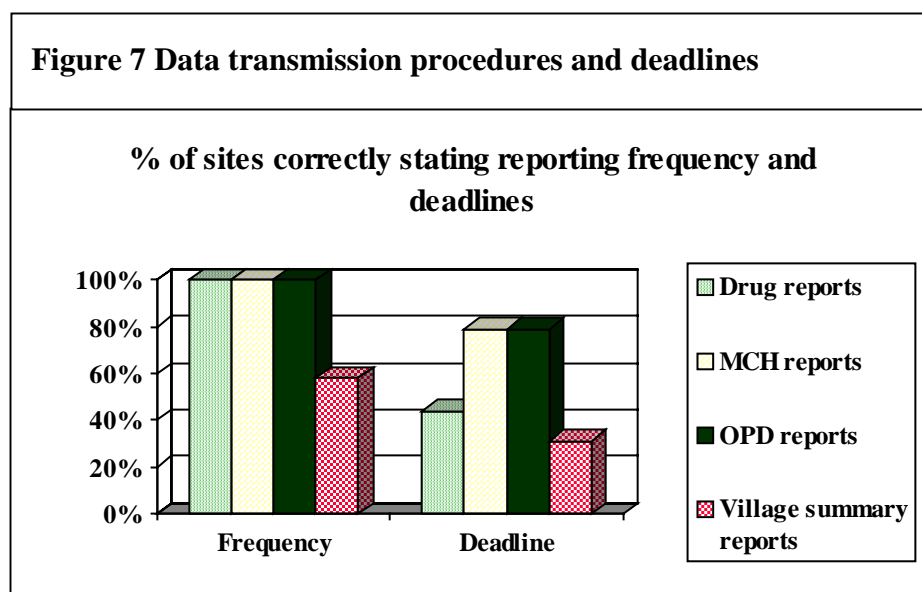


A number of problems were highlighted during the assessment team's visit with respect to routine data flows. These included:

- ◆ Problems with data reporting from Out-Reach Clinics. Currently BHU staff maintain separate registers for key activities carried out in each ORC (MCH, FP, Immunizations, Out door consultations). However, at the end of each month the data about these activities are consolidated and reported with BHU data. It is therefore difficult to determine the relative performance of ORCs at the community level. In addition, some BHUs just report total numbers of consultations for ORCs and do not break them out by type of health problem.
- ◆ At the Hospital level, each department prepares monthly reports on their own activities and these are consolidated into a single report for the Hospital. Out door patient visits are, in fact, tallied by the dispenser after patients receive their prescriptions. This can result in diagnostic errors when prescriptions are not complete with diagnosis and disease code. It also means that patients who do not receive medication are not counted.
- ◆ The district aggregates most data on a quarterly basis in order to prepare consolidated reports that are sent to the national level. It is not clear whether or not there is any way to tell if reports are missing from these consolidated reports, and if so which ones. If computerised data entry could be done at the district level on a facility by facility basis, the preparation of consolidated reports would be simplified, and the data transmitted to higher levels so that adjustments could be made more systematically for missing data. This would also reduce the data entry burden on Health Information Unit staff at the central level.
- ◆ At least one District requires BHUs to prepare Quarterly Consolidated Reports as well as Monthly Reports. This is extra work for the BHU staff that is not useful to them – it only simplifies work for District level staff.
- ◆ Only one significant standard feedback report was widely observed in the Districts and BHUs, This was the Annual Health Bulletin prepared by the Health Information Unit. While this is a useful reference document, it takes a long time to prepare and does not provide feedback in a timely manner so as to promote local level action.

Figure 7 suggests that there was widespread consensus among all facilities about the frequency of most reporting, however the actual date that reports are due (deadline) was less obvious. This is likely to be related to the lack of formal procedures or guidelines governing HMIS reporting. Interestingly, of the sub-systems reviewed, there was the most confusion about village summary reports and the drug reports. For the

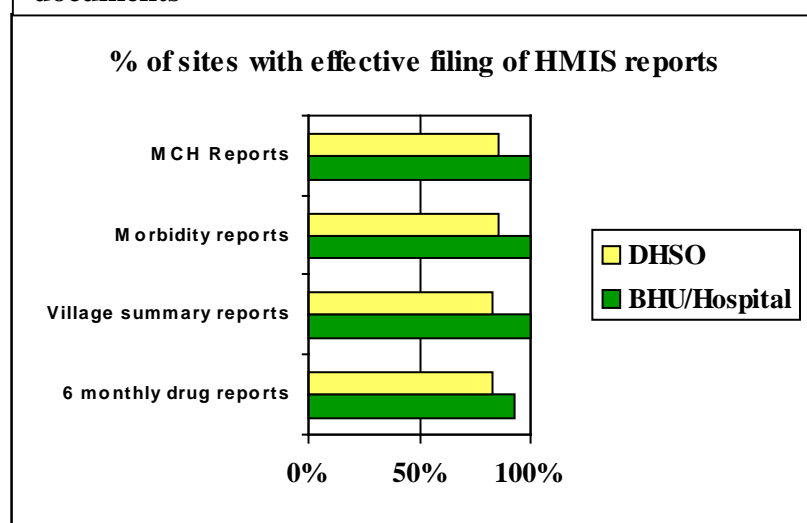
Figure 7 Data transmission procedures and deadlines



village summary reports, this is largely due to a change in the reporting frequency from twice a year to annual that has not been well disseminated.

EFFECTIVE STORAGE & RETRIEVAL OF HMIS REPORTS:

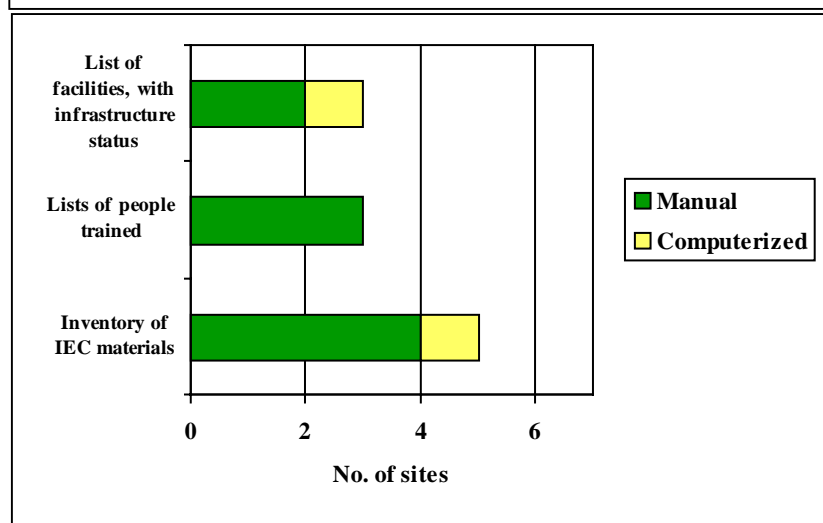
Figure 8 Effectiveness of filing systems for HMIS documents



One extremely positive finding in virtually all sites visited was that archived copies of reports were easily accessible and filing systems were well organised. Virtually all BHUs/Hospitals had nicely labelled ring binders for each of the types of reports that were requested. Figure 8 shows that copies of most of the specific reports that the assessment teams requested were easily retrieved. This facilitated assessment activities and provides an efficient ‘database’ for health workers to analyse trends over time.

In the District Health Supervisory Officer’s workplace, the situation was only slightly less organised, but this is understandable given that this is an administrative office that processes a lot more paperwork. On a related front, the assessment teams asked DHSOs about whether or not they had established any kind of register systems to maintain certain types of information. Unlike chronological or subject files, such registers/lists or ‘databases’ make it much easier for

Figure 9 Existence of systems for maintaining special data



health workers to aggregate data when tracking certain indicators or activities. For example, if DHSOs maintain a training register, it is much easier to respond to queries such as “How many of your staff have had training in syndromic management of STDs in the last year?” Answering such queries using personnel files would be rather complicated, since many individual files would have to be reviewed.

As indicted by figure 9, only about half of the DHSOs had

established such systems in three of the areas we had queried them about: health facility lists, training lists and inventories of IEC materials. Only one of the DHSOs visited had used a computer to help maintain such data. Since there are no standard systems yet established, nor is the expectation that supervisors should maintain such data included in DHSO job descriptions, this finding is not surprising. It does, however, further demonstrate the untapped potential of the computers that are installed (and functional) in each of the district offices.

SUPERVISION & FEEDBACK:

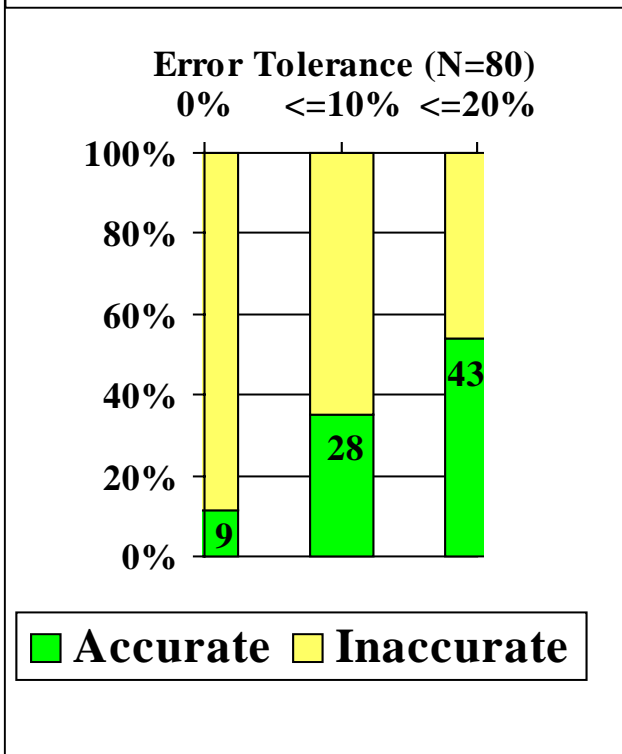
The links between data and supervision were explored in several ways during the rapid assessment. All BHUs reported having been supervised at least twice over the last 12 months, which was in line with what supervisors suggested as the expected norm. This may not be the case for less accessible BHUs, which were not included in our sample because of the short time available and convenience sampling methodology used. . Several sites located in the district capital reported monthly or even more frequent supervisory visits from their DHSO because of their proximity. It would be interesting to gather additional data about how frequently supervisors are able to get to health facilities that are more than 2 days walk from the district capital.

Almost all (10 of 11) BHUs and all DHSOs reported that information recording & reporting tasks were considered during supervisory visits. In nearly all cases, this involved verifying the registers and discussing errors that might have been made. Less frequently, supervisors reported that they discussed disease or service coverage trends, data presentation, drug stock level monitoring and the implications of the data on work planning.

Another important data management task for supervisors is to help control the quality of data reported from service units. More than 2/3 of hospitals and BHUs reported receiving comments from DHSO about errors in their reports during the past year. This suggests that supervisors take this role seriously, although most agreed that this type of feedback was mostly oral and not done very systematically. Given the poor quality of data reported by health facilities, it is likely that more attention should be paid to this area in future.

About half of the BHUs and Hospitals reported receiving other types of feedback, such as an analysis of disease or health service trends in the district, but nearly all was oral or took place only once a year during the Annual Review Meeting held at the district level. This is understandable given the fact that most DHSOs noted that there are no standard procedures for feedback reporting to BHUs & Hospitals.

Figure 10 Data accuracy at BHU/Hospital levels



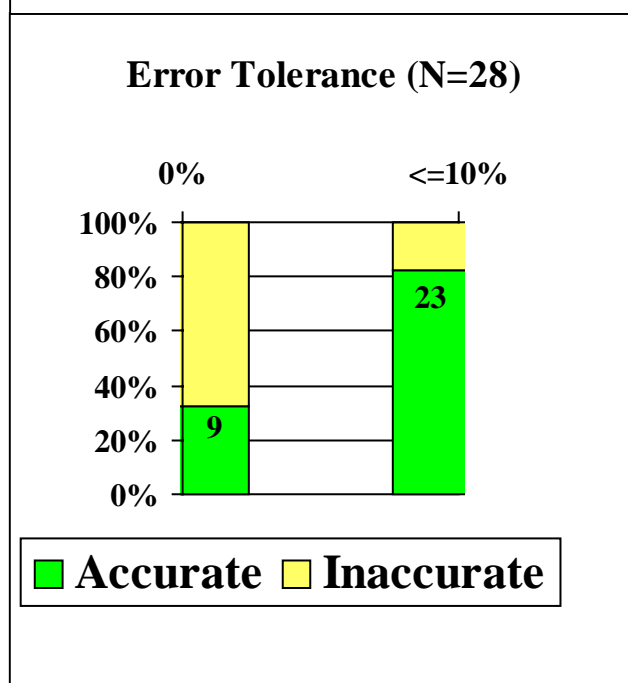
DATA QUALITY AT BHU/HOSPITAL LEVEL:

Perhaps the most surprising finding related to the quality of data reported by health facilities. These data were gathered through a data audit conducted by comparing figures from monthly morbidity reports with data from the registers used by staff to tally these reports. Only the monthly morbidity reports were used for this analysis, so it is difficult to infer much from these observations about the quality of other types of data that are reported such as population figures communicate on the village summary forms, or ANC visits reported on the MCH reports. Because of the small sample size, these results need to be used with caution even with respect to the morbidity data. Figure 10 indicates the extent of the problem at different levels of error tolerance at the BHU/Hospital levels. Of 80 figures audited only 11% were exactly correct. Even if one tolerates a plus or minus 20% margin of error, the accuracy rate still doesn't increase much more than 50%.

It must be noted that the processing of data at health facilities can be very tedious and error prone. At the end of each month BHU/hospital staff must go through their register and tally the data into 4 age categories and by sex for 48 different morbidities. There are no standard tally sheets to facilitate this effort and, until very recently, the report format itself was very condensed making it easy for people to accidentally note figures in the wrong column or row. In addition, data quality is likely to be affected by the quality of the registers (how well the writing can be read and whether or not disease code numbers are used) and the total number of cases to be tallied.

The picture is not quite as bad at the DHSO level. Of 28 figures audited 32% were exactly correct. If one tolerates a plus or

Figure 11 Data accuracy at DHSO level



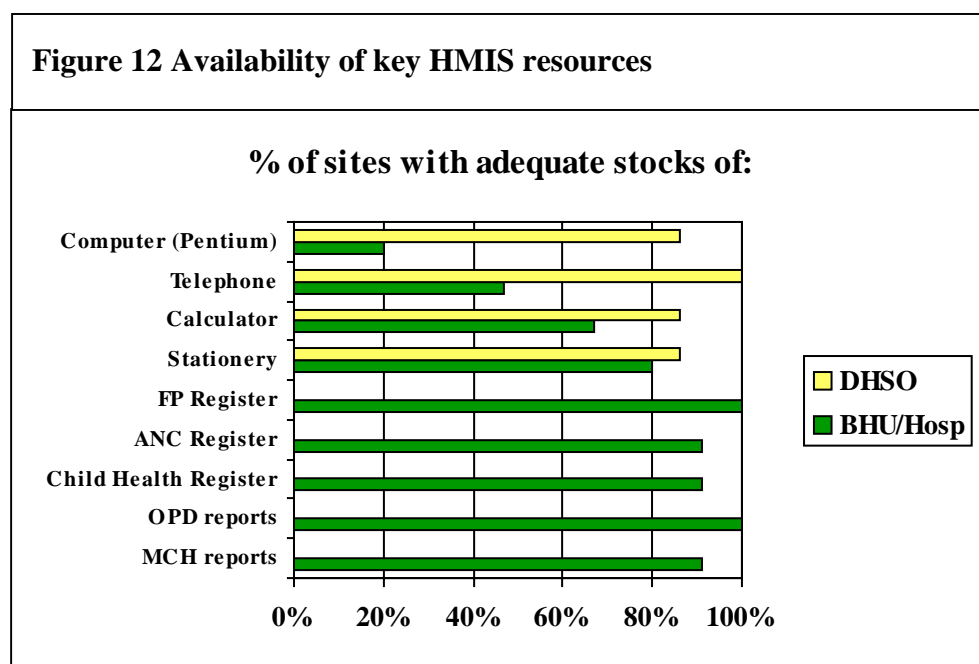
minus 10% margin of error, the accuracy rate reaches 82%. These analyses are difficult to compare between the different levels, since the data processing work required at the service delivery level is quite a bit more complicated than that required of district health supervisors. DHSOs are only responsible for aggregating data from three monthly reports from each of their BHUs/Hospitals (the districts visited had between 2 and 9 service units reporting to them). The analysis suggests that the majority of the errors originate at the primary data source (BHUs and Hospitals) and are sometimes compounded further at higher levels.

AVAILABILITY OF HMIS RESOURCES:

In the observation portion of the rapid assessment, inventories were taken of key resources required for the effective use of the HMIS. These included tools: such as calculators, computers and telephones to facilitate data analysis, communication and action; and reporting forms and

registers needed to record and transmit the data.

Figure 12 gives an overview of the status of the availability of some of these materials.



Overall the situation looks quite good. Virtually all of the health facilities had more than one and a half months of stock of registers and

reports. In fact there were substantial overstocks in some areas, as is demonstrated in Table 2 (on the following page). For example, one site had enough Child Health Registers to last for 325 months, or 27 years, at current service volumes. This is due in part to the fact that revised formats of these registers had recently been printed and distributed before old stocks were used up.

Table 2: Months of stock of selected report forms and registers in BHUs.

BHU ID	MCH Reports	OPD Reports	CH Register	ANC Register	FP Register
SD3	11.5	25.0	0.0	87.3	18.9
SD5	5.0	95.0	45.5	256.5	120.0
SD6	6.0	45.0	89.2	28.0	39.2
SD7	11.0	50.0	325.7	56.2	2.4
SD8	7.5	38.5	38.8	198.7	18.2
SD9	0.0	50.0	Missing	60.0	38.5
SD11	16.5	1.5	16.4	40.0	5.7
SD12	12.5	12.5	147.1	90.0	18.0
SD13	6.5	100.0	121.2	149.0	1.7
SD14	10.0	50.0	240.0	24.8	3.3
SD16	12.5	12.5	11.8	12.5	11.1
Average	9.0	43.6	103.6	91.2	25.2
No <=1.5	1	1	1	0	0
Minimum	0.0	1.5	0.0	12.5	1.7
Maximum	16.5	100.0	325.7	256.5	120.0

HUMAN RESOURCES FOR HMIS:

Staffing in most Districts and BHUs visited was adequate for the performance of all HMIS related tasks. In all of the BHUs, staff indicated that each staff member was responsible for data recording for the services they deliver (entering patient data on registers or patient cards), while most staff members worked together as a team to tally data for the monthly reports. Final report preparation and the control of data quality tended to be a separate responsibility of the Health Assistant who is in charge of the facility.

At the District Hospital level, there was more of a division of labour with respect to data processing. The head of each clinical unit (Indoor patients, Laboratory, Maternity, etc...) prepared the data from their section and then one member of the staff pulled together the report (in at least one case, this was done by the DHSO who was based in the hospital). The reports are then checked and signed by the DMO. During the course of the data audit, it became apparent that the current procedures for tallying data for the monthly morbidity reports may be problematic and contribute to the problems of poor data quality.

This function is performed by the dispenser, based upon notes s/he makes in a register from clinician's prescription forms. This introduces several sources of error:

- ◆ If the clinician has not clearly stated the diagnosis on the prescription form, the dispenser must guess the diagnosis before noting something in the register. This can be a source of error given the fact that certain essential drugs are used to treat multiple conditions and the lack of clinical knowledge on the part of the dispensers.
- ◆ If a patient is seen, but does not require any medical prescription, s/he may never be counted in the morbidity reports. Under current practice, it is apparently very unusual for patients to leave without some form of medication, but with efforts to promote rational prescription of

essential drugs this data collection approach may begin to result in a more serious undercount.

In two of the larger districts visited, the DMO or DHSO noted that the appointment of a Health Statistical Assistant would have been useful to handle the higher volume of work – and would help to ensure better data quality. Current MOHE policy is not to fill the vacant posts of Statistical Assistants. In the current setting, where procedures for data analysis and use are not very well defined, nor particularly demanding, this policy is probably appropriate. However, once improvements are made to HMIS procedures – and particularly if they involve more systematic computerised data entry and processing at the district level – this policy may need to be reviewed. This is especially the case for districts with a large number of health facilities and consequently higher volume of work. Although computers can save time on specific tasks, the experience in most countries has been that they also create new uses of data that require additional human effort.

With respect to training, there appears not to have been any specific program to train BHU or Hospital staff in the areas of data collection, processing and use – either during initial training or in-service training. In most cases, new forms and registers were reported to have been introduced through the DHSOs - either during supervisory visits, through their monthly staff meetings or simply sent by post or messengers. While this strategy may be acceptable for communicating simple changes in reporting formats, it is probably inadequate for training staff to record and use data more effectively to improve service delivery. The unstructured nature of this approach probably explains the wide variation in indicator definitions and formats for data presentation that were observed by the assessment teams. Contributing to these problems was the fact that no written guidelines or manuals were available related to HMIS (except for the 6 Monthly Drug Reporting system where detailed instructions are printed on the cover of the booklet of forms).

COMPUTER RESOURCES: CENTRAL LEVEL

A separate report has been prepared about the information technology situation in Bhutan. To sum up some of the findings at the central level, it appears that access to computing resources is very good in Thimpu. The ratio of staff to computers is 1.5 staff/computer in the three central units visited: the MOHE (secretariat, programme offices and finance office), IECH, CMS. The Ministry is on the verge of networking many of their computers together, but until this is accomplished staff will not enjoy the benefits that IT can offer for improved communications using electronic mail. Bhutan has recently introduced the Internet through the national Internet service provider: Druknet. Currently only 15% of staff have direct access to the Internet from their desks, while another 3 % can access it from another shared computer. Druknet's proactive pricing policies enable district level staff to access the Internet at the cost of a local call from anywhere in the country. Once Druknet's next phase of expansion is complete later this year, the ratio of dial-in lines to users and the gateway speed should be much improved.

In house technical support for computerisation is limited to 1 programmer, 1 web designer, 1 person with basic training on networking. There is no one within the MOHE who has any specialised training in hardware maintenance. Hardware maintenance is done through a variety of external service arrangements. Judging from the assessment team's observations, de facto

standards for software are MS Office & Windows, but many different versions are in use – some of which are no longer compatible. Several specialised database applications are in use at the central level, but were developed in outdated software by external consultants and there is no local support to maintain or update them.

COMPUTING RESOURCES: DISTRICTS

Almost all districts have access to computers (usually both the DMO and the DHSO have their own). All of the computers observed were functioning well. This was a very positive finding given that a number of them have been installed for more than 3 years. Most staff use computers mainly for writing reports, while only about 2/3 use them to analyse data. A few good individual initiatives for application development were demonstrated to the assessment teams during their visits, but they are not standardised so that other districts might benefit from them. Although Internet access is available from districts, only 2 of 7 districts visited are currently connected.

All DHSO's had some basic training on computer use during their initial training at the Royal Institute of Health Sciences (RIHS). This appears to have been sufficient to enable staff to use the basic features of Microsoft Word and Excel. However, few had developed the more advanced skills with Excel or Access database software, which are necessary to create applications to systematically use their computers to analyse HMIS data. The exception to this was one DHSO who had special training on database management (in Thailand). Interestingly, the DMO in the same district had also made considerable progress teaching himself how to use the MS-Access database software by relying on his colleague's training notes.

Conclusions:

Following the assessment and presentation of initial findings, the HMIS task force met to review the assessment data in more detail and develop specific conclusions & recommendations. This was done in small groups using thematic data summary sheets covering the following themes:

1. Data transmission, feedback and supervision
2. Presentation and use of information
3. Data quality
4. Resources
5. Storage and retrieval of information
6. Information technology

The conclusions of this assessment can be summarised by the following list of major strengths and weaknesses.

Strengths:

Overall, the HMIS task force concluded that the existing HMIS had a number of strong points:

- ◆ Generally speaking, adequate resources exist at the service delivery points and district levels for the uninterrupted recording and reporting of data. This includes the availability of materials (registers, forms, stationery, etc...), and adequate staff with sufficient time (in most

cases¹) to carry out the required data management tasks. This appears to also be the case at the district level, where computers are also available and functioned well at the time of the assessment teams' visits.

- ◆ Systems for filing and retrieval of past reports at the BHU/Hospital level are excellent and generally well maintained.
- ◆ Staff have a good understanding of the potential uses of the information they collect, although procedures for its actual use are not well established.
- ◆ At the BHU level staff devote considerable effort to presenting key population and service data on wall charts, graphs and maps. There is, however, scope for improvement in the selection and calculation of some of the indicators that are graphed.
- ◆ Routine reporting from BHUs/Hospitals to districts is very effective as evidenced by very high reporting rates, although there is confusion about reporting deadlines for some of the sub-systems (e.g. Village Summary Sheets and Drug Reports).

Weaknesses:

The assessment identified or confirmed a number of areas that should become the focus of immediate HMIS improvement efforts. These included:

- ◆ Too much data is collected in current recording and reporting formats and not enough is used. There is also confusion about the calculation of several key indicators and how to estimate population targets (especially in family planning and drug management). Some of these problems seem to be related to the design of the reporting formats that are duplicative and require excessive data and to the lack of written guidelines concerning indicator definitions and procedures for data use.
- ◆ There is a lack of systematic feedback (especially written feedback) from DHSOs to BHUs and Hospitals regarding reporting errors and especially for providing analysis of reported data.
- ◆ There appear to be serious problems with data quality originating at the service delivery point which are further compounded at the district level.
- ◆ Although computers exist and function well at the district level, they are not used systematically to help with data analysis and electronic communications. There is no mechanism, either at the central level or within districts, to build upon the individual initiatives of certain districts and cross-fertilise these uniformly throughout the country. At the national level there are also adequate numbers of computers, but the small team within the Health Information Unit is inadequately staffed and lacks skills in database management and computer hardware troubleshooting which are necessary to support more effective use of this technology.
- ◆ Following recent staff changes at the central level, the Health Information Unit now lacks personnel with training in epidemiology and health service delivery. This expertise is critical for ensuring that surveillance functions at the national level are carried out effectively and for helping to interpret data on significant disease or service trends for feedback reports and the annual health bulletin.

¹ At certain Hospitals with high service volumes, it was apparent that the large numbers of consultations made report preparation very time consuming for certain staff members (particularly the dispensers who tally OPD records and maintain drug stock data)

Recommendations:

Based upon the assessment findings, the groups' key recommendations for system enhancement are described below:

1. Data transmission, feedback and supervision:

Reporting deadlines should be feasible and practical yet flexible for BHUs that are very remote. Reporting due dates for most monthly or quarterly reports from BHUs and Hospitals should be specified as within 7 days of the end of each month, with the exception of the Village Summary sheets that should be reported by the 15th of March. The actual data collection for the household survey should take place only once a year during January and February, so the data will be current as of the end of previous year. Care should be taken so that this data is available when the planning cycle begins.

Improve the Village summary sheet and household formats in order to make these two formats more compatible, thereby simplifying data aggregation and reducing potential sources of error.

Prepare a manual documenting standard guidelines for report transmission and feedback mechanisms and explore more efficient mechanisms for transmittal from remote BHUs. These guidelines should be widely disseminated.

Stress the need for supervisory visits by DHSOs to each health facility regularly (at least once each quarter?), and determine what data management tasks should be reviewed or discussed during these visits. These supervisory tasks could perhaps be incorporated into a more standardised supervisory checklist. Where the number of BHUs and/or distance makes this frequency of supervision difficult, a strategy should be developed to select health facilities that require more frequent visits. One such strategy might be to hold a meeting at a convenient point to cover more than one BHUs in case frequent visits to the actual sites is very difficult.

Procedures for checking data accuracy are not uniformly performed. In light of the significant problems the assessment discovered with respect to data quality, there is a need to develop new processes and/or share and standardise error trapping and correction procedures developed by some districts.

Health unit staff should discuss the information collected monthly before submitting their reports. They should discuss accuracy of data, achievement of targets, outbreaks of any diseases and any other management issues that are highlighted by the data. DHSOs should provide written feedback to BHUs and Hospitals about their performance on regular basis (at least bi-annually).

In some cases there is a need for simpler, better standardised reporting forms (e.g. morbidity reports, family planning registers). These should require capturing and reporting only the relevant and useful information. These can be designed by reviewing the content of all reporting formats to ensure that they no longer contain data that is not necessary for the calculation of the newly selected priority health indicators or for satisfying the information needs identified during

the district level functional analysis. Similarly, some health staff wanted certain formats to be discontinued. For example, several noted that the IDD Salt Monitoring Report and the Lab report were not useful and wanted them be dropped.

HMIS enhancement efforts should take full advantage of existing computers and software in order to improve mechanisms for data transmission from the District levels to the centre.

2. Presentation and use of information

In general presentation of information in both district and facility levels is satisfactory, but it could be enhanced through:

- Clearer definition and standardisation of indicators for routine presentation would help ensure data comparability (e.g. MWRA 45? 49?)
- Monitoring, graphing or charting of key trends and setting of targets should be reinforced at every level
- There should be more uniformity of presentation of information. This can be enhanced through health worker training on data management and use and provision of guidelines.

The task force members also identified several other ways in which more effective use of data should be encouraged including:

- Including data as an input to regular monitoring and supervision
- Through the design of enhancements to the feedback system (new feedback report formats, for example)
- By building use of data into improved performance review and evaluation procedures.

3. Data quality:

Data quality was clearly one of the most troublesome issues identified through this assessment. Task force members felt that addressing this problem should be one of the highest priorities, since without quality data inputs, any enhancements in data use would be rendered useless (i.e. "garbage in, garbage out"). The assessment team recommended the following interventions to begin to deal with the data quality issue:

- The development of a strategy for providing specific training on HMIS (in-service and pre-service) to health workers at all levels.
- The development and provision of documentation in the form of a procedure manual related to standards/guidelines to all health workers involved in data collection.
- Considering making a more uniform disease coding system and enforcing its use to simplify morbidity tallying (e.g. ICD-10)
- Improve and simplify forms, formats and registers (like the OPD registers)
- Develop simplified tools to facilitate aggregation of data for reporting (e.g tally sheet for morbidity reporting from service delivery points) with reduced errors.
- Consider the possibility of maintaining individual patient records (in particular for the OPD in Hospitals, although this might also be manageable at BHUs as well because of the low numbers of cases.)

- Enhance the usage of computers and other information technology both at the district and national levels
- Define acceptable levels of error, for example 5 or 10%, and select indicators, such as reporting rates, to routinely monitor the completeness of data. Conduct rapid data audits at health facilities during supervision to monitor data quality.

4. Information Storage and retrieval

Understanding and practice with respect to information storage and retrieval was felt to be generally very good. The assessment team members did, however, recommend a couple of opportunities to strengthen this area even more:

- DHSOs should consider making more effective use of their computers to store more data (both current and historical) and facilitate easy retrieval and analysis. This may also solve some space problems (since old paper reports could be archived outside of the DHISO office or eventually disposed of).
- In some facilities additional supplies, furniture and space may be required (some were storing on the window shelves...) to further improve storage conditions.

5. Resources

The HMIS Task Force felt that material resources (supplies and equipment necessary for HMIS tasks) were mostly in good supply with some few exceptions:

- Provide simple solar/battery operated calculators to all the staff of BHU/Hospital/DHISO
- Establish a minimum supply list and adequate budgets for stationery including pens, poster paper and coloured markers and ensure that the supplies are provided as per the list. Supply problems can be included in the monthly reports to ensure speedy replenishment.
- The Health Information Unit should be strengthened as a central resource to support HMIS developments and take on several additional functions, including:
 - All new, or re-designed, recording or reporting formats should be routed through the information unit before being introduced at the health facility level. The Health Information Unit can help to avoid unnecessary duplication of data collection and provide assistance with the forms' introduction and use.
 - Another critical role of the Health Information Unit would be to cater the health information need of different projects from in and outside the MOHE. (One DHISO mentioned that quite a few different projects ask for the same information. They even ask districts for information that already exists at the centre.)
 - The staffing of the Health Information Unit needs to be reviewed in order to ensure the following staff members are included in the team:
 - at least one physician or epidemiologist to provide clinical and public health perspectives.
 - one person should be hired, or an existing staff member trained, in computer hardware/network troubleshooting. More complex hardware problems should be dealt with by contracting with a local computer firm.

- Although staffing is adequate at the BHU and Hospital levels, in some populous Districts with more than 5 BHUs and no Statistical Assistant, there was a need for additional clerical staff to help with data entry and aggregation.

Also under the heading of resources came the group's recommendations regarding human resource development or training.

Some basic training in computer use is provided for DHSOs, during their initial training at the RHIS, and ANMs, HAs and BHWs have some experience in data recording by during their practicum (also during initial training). Apart from that, there appears not to have been any formal training specific to data management or HMIS. Various learning approaches should be explored for formally institutionalising health worker training on data management with the introduction of the enhanced HMIS. This could be through some combination of the supervisory system (especially for continuous re-enforcement of data use), through short workshops built into district level staff meetings, and/or more formal training methods. The development of a strategy of the implementation, or roll out of enhanced HMIS formats and procedures will be the focus of the 5th phase of this project.

6. Information technology at central and district levels

The assessment team members noted that the introduction of information technology at the central and district levels has been generally successful. Although computers are not used to their full potential, nearly all computers the assessment team observed during visits to the facilities were functional and the basic preconditions of adequate electricity supply and security appear to be in place.

At the district level, task force members recommended the following:

- Based upon the successful experience with the installation of computers for DMOs and DHSOs thus far, the provision of computers to all Health Units down to BHU grade I should be considered where reliable electric supply and local support are available. Some existing computers in districts need replacement or upgrades
- There is a need for better standardisation of software version numbers (many different versions of the 'standard' software were running)
- With reasonably priced access to the Internet at the district level, Internet use should be increased for electronic mail, data exchange and eventually other purposes (e-learning, data querying, web site maintenance). The MOHE should consider a variety of approaches to help staff learn how to use the technology more efficiently.
- Computer resources should be shared among DMOs and DHSOs. In general, DMOs seem to restrict others from using their computers -- and they currently have more powerful computers, even though they generally have less demanding data processing tasks. An effective mechanism for the shared use of computers by the DMO and DHSO should be formalised, especially in the event of a computer breakdown.
- District and central level staff's job descriptions should be reviewed to identify specific data management tasks both manual and computerised that they should be responsible for.

- In some districts, the quality of power supplies is not good. The voltage fluctuates a lot. Both automatic voltage regulators and un-interruptible power supplies should be provided for these regions to protect the equipment. Similarly, phone line surge protectors need to be supplied to avoid damage to modems from lightning and other voltage spikes carried through the phone lines.

The assessment team concluded that computer resources were largely sufficient at the central level, with a ratio of 1.5 users per computer. Equipment was generally in good working order and used appropriately for basic functions such as word processing and electronic spreadsheets. Software standards were also a problem at this level. The team noted, also, that there was a lack of specialised application programs for HMIS data management and that those that exist are outdated and also difficult for health information unit staff to maintain.

The group recommended that:

- The HMIS enhancement project help develop the capacity of the Health Information Unit (HIU) to design and maintain specialised database applications at both the centre and district levels to meet data processing needs.
- An Information Technology cell should be established within the HIU made responsible for standardisation and the coordination of backup maintenance services for information technology throughout the country
- The HIU should continue with the work currently in progress to network central level computers into a local area network and establish internet/intranet links.
- The task force should establish a small team to recommend more detailed software standards, especially for database management, and to develop a plan to implement the new standards at all levels.
- As noted earlier additional staff should be recruited or selected HIU members should receive refresher training in hardware troubleshooting especially.
- The Ministry should either recruit or have a support contract with a full-fledged computer technician or firm for backup services. This is not for basic trouble-shooting or warantee maintenance, but rather for helping with more complex issues at will arise about the need for equipment upgrades and helping clarify technology options and standards.
- Use of computers for data transmission and tele-medicine should also be further explored, building upon the start that has already been made in the field of radiology.

More detailed recommendations on computer use and management are included in the separate Information Technology Assessment Report.

Annex 1: Detailed list of Health Facilities Visited

Site name	Type	District	# BHUs	# ORC
1. Tang BHU II	BHU II	Bumthang		
2. Chhumi BHU II	BHU II	Bumthang		
3. DHSO Chukha	DHSO	Chukha	8	53
4. Chapcha BHU II	BHU II	Chukha		
5. DHSO Haa	DHSO	Haa	3	15
6. Military Hospital – IMTRAT Haa	Hospital	Haa		
7. Bali BHU I	BHU I	Haa		
8. DHSO Paro	DHSO	Paro	2	23
9. Drugyel BHU II	BHU II	Paro		
10. Paro Hospital	Hospital	Paro		
11. DHSO Punakha	DHSO	Punakha	5	7
12. Punakha Hospital	Hospital	Punakha		
13. Kabesa BHU II	BHU II	Punakha		
14. Shangana BHU III	BHU III	Punakha		
15. DHSO Trongsa	DHSO	Trongsa	5	28
16. Rabten BHU II	BHU II	Trongsa		
17. Langthel BHU II	BHU II	Trongsa		
18. Trongsa Hospital	Hospital	Trongsa		
19. DHSO Tsirang	DHSO	Tsirang	2	1
20. Khorsaney BHU II	BHU II	Tsirang		
21. Lamidara BHU II	BHU II	Tsirang		
22. DHSO Wangdi Phodrang	DHSO	Wangdi Phodrang	9	23
23. Bajo BHU I	BHU I	Wangdi Phodrang		