

**COSTS AND RESULTS OF INFORMATION SYSTEMS FOR POVERTY MONITORING,
HEALTH SECTOR REFORM, AND LOCAL GOVERNMENT REFORM IN TANZANIA**

**NO. 1: DESCRIPTIONS OF INDICATOR COVERAGE AND SYSTEMS WITH PRELIMINARY
COMPARATIVE COSTINGS**

Vanessa Rommelmann ¹

Philip Setel ^{2,3}

Yusuf Hemed ²

Hamisi Mponezya ²

Gustavo Angeles ¹

Ties Boerma ⁴

¹ **MEASURE Evaluation**

Carolina Population Center

University of North Carolina, Chapel Hill

² **Adult Morbidity and Mortality Project (AMMP)**

Ministry of Health, United Republic of Tanzania

³ **University of Newcastle upon Tyne**

⁴ **University of North Carolina, Chapel Hill**

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The members of the AMMP Team are (alphabetical order): Richard Amaro, Yusuf Hemed, Gregory Kabadi, Berlina Job, Judith Kahama, Joel Kalula, Ayoub Kibao, John Kissima, Henry Kitange, Regina Kutaga, Mary Lewanga, Frederic Macha, Haroun Machibya, Mkamba Mashombo, Godwill Massawe, Gabriel Masuki, Louisa Masayanyika, Ali Mhina, Veronica Mkusa, Ades Moshy, Hamisi Mponzuya, Robert Mswia, Deo Mtasiwa, Ferdinand Mugusi, Samuel Ngatunga, Mkay Nguluma, Peter Nkulila, Seif Rashid, JJ Rubona, Asha Sankole, Daudi Simba, Philip Setel, and David Whiting. AMMP wishes to thank the local councils and council health management teams of Hai, Igunga, Ilala, Kigoma Urban, Morogoro, and Temeke for their collaboration and support, and the residents of the demographic surveillance areas who have participated with the project since 1992.

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EXECUTIVE SUMMARY

There is a growing demand for new knowledge about the “cost-effectiveness” of information systems. Donors, governments, and national program managers are becoming increasingly knowledgeable consumers of data and information generation tools for monitoring and evaluation (M&E). In order to make best use of scarce M&E resources, they require a greater appreciation of what returns their investments in any of the various M&E methodologies are likely to bring. Decision-making in this area is complex. Managers must be cognizant of the tradeoffs between total system costs, recurrent costs, quality of data, scope of indicator coverage, human capacity demands, frequency of indicator generation, level of data disaggregation, and costs denominated by the population benefiting from programs being monitored or evaluated.

Our overall aim was to answer the question: Can we better equip managers to make decisions about the use of new M&E assets, or assist them if they chose to re-allocate existing human and financial resources? In doing so, we had three specific objectives. First, we sought to develop a methodology for assessing the comparative costs and results of the principle health and demographic information systems used to provide indicators for major M&E initiatives in the country. Second, we sought to provide stakeholders with a tool for efficient and rational decision-making by assessing and comparing options for carrying out long-term M&E programs in poverty reduction and health. Third, we hoped to stimulate further discussion on approaches for assessing the cost-effectiveness of information systems.

This report presents findings from a participatory assessment of the costs and results of information systems in the United Republic of Tanzania carried out in 2002/2003. Briefly, findings are based on cost and output data provided by 11 information systems in four government ministries, offices, and executive agencies. We collected data using questionnaires, face to face interviews with system managers, and field visits. Results were assessed against a composite list of 38 health, demographic, and poverty indicators taken from the Poverty Monitoring Master Plan, Public Health Sector Performance Profile, District Health Plans, and Local Government Reform Program. Findings were fed back to participants at a workshop, and revisions to the assessment made on the basis of that activity. It should be noted that due to constraints of time and resource it was not possible to conduct a full comparative assessment of cost-effectiveness of these information systems. Nor was it within the remit of the study to formally rate the quality of the indicators produced by the systems.

These constraints notwithstanding, to our knowledge there have been no previously published assessments of this type. We hope that the comparative costs and results presented here may assist in any expansion or consolidation of information collection efforts undertaken in Tanzania, and that our methods might be built upon in other contexts.

KEY FINDINGS & CONCLUSIONS

Coverage of Health and Poverty Indicators

- Ten of the 11 information systems included in the study generate routine indicators of health and poverty.
- Most have had significant impact through research, analysis, and dissemination unrelated to M&E indicator production.
- The current set of information systems can calculate all of the selected poverty and health indicators (save one) from published M&E guidelines for four major poverty reduction and reform programs.
- Most indicators are available from multiple sources.
- Half of the information systems in Tanzania collect 12 or more of the 38 required health, demographic, and poverty indicators.
- The majority of systems use multiple quality assurance strategies to ensure data quality, regardless of differences in sampling and coverage.
- Nine systems can provide local authorities with indicators, though coverage of these systems either across or within districts (other than the national census) is very limited.
- Two systems are capable of generating indicators for the entire Tanzanian population, and four others can do so for the Tanzanian mainland.

Comparative Costs

- Estimates of the systems costs should be interpreted with caution, as it was not possible to obtain cost data of uniform type and quality from all systems, and capital costs were frequently unavailable.
- The large national surveys had the highest per participant costs (up to \$20), followed by the demographic surveillance systems (up to \$3).
- The annualized per capita costs for nine of 11 information systems were less than \$0.10.
- Based on the data collected for this study, approximately \$0.53 in total is spent per year for every Tanzanian on information systems capable of generating poverty, health, and survival indicators needed for national programs of monitoring and evaluation.

Relationship Between Cost, Coverage and Quality Assurance

- Three systems have participating populations above 100,000 and costs below \$1,000,000. Two of these produce national-level indicators.
- Three systems have coverage below 100,000 and system costs of \$1,000,000 or greater. One of these produces nationally representative indicators.
- The census and the two facility-based routine systems all produce national estimates and have the highest participating populations along with the highest costs. Of these, the census has the most rigorous quality assurance procedures.
- Five systems have samples of 100,000 or more and per participant costs of \$1.00 or less.
- Tanzania's demographic surveillance systems and the Demographic and Health Surveys produce half or more of the required M&E indicators. DHS per participant costs are between six and 23 times higher than for demographic surveillance.
- Five systems produce from zero to 12 indicators with per participant costs ranging from about \$0.10 to about \$0.60.

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LIST OF ABBREVIATIONS

AMMP-2	Adult Morbidity and Mortality Project, Phase 2
ANC.....	Antenatal Clinic
CEP.....	Consumption Expenditure Proxy
CSPD.....	Child Safety, Protection, and Development
CWIQ.....	Core Welfare Indicators Questionnaire
DANIDA	Danish Agency for Development Assistance
DFID.....	UK Department of International Development
DHS.....	Demographic and Health Surveys
DSS.....	Demographic Surveillance System
EA.....	Enumeration Areas
EPI.....	Expanded Program on Immunization
HERA	Health Research for Action
HMIS.....	Health Management Information System
IDS.....	Integrated Disease Surveillance
IDWE.....	Infectious Disease Week Ending
IHDRC.....	Ifakara Health Development and Research Centre
IMCI.....	Integrated Management of Childhood Illness
LGRP.....	Local Government Reform Program
M&E.....	Monitoring and Evaluation
NACP	National AIDS Control Programme
NBS	National Bureau of Statistics
NHBS	National Household Budget Survey
NIMR.....	National Institute for Medical Research
NMS	National Master Sample
NSS.....	National Sentinel System
PMMP	Poverty Monitoring Master Plan
PORALG.....	President’s Office of Regional Administration and Local Government
PSU.....	Primary Sampling Units
SES	Socio-economic status
TANESA	Tanzania and Netherlands Support AIDS Research Center
TEHIP.....	Tanzania Essential Health Interventions Project
TSh	Tanzanian Shillings

PART I: STUDY DESCRIPTION, FINDINGS, AND CONCLUSIONS

1 BACKGROUND, AIMS, AND OBJECTIVES

1.1 Background

The need for reliable, current, and longitudinal indicators of demographic and health conditions in developing countries is rapidly escalating. Such indicators are increasingly in demand by governments, development partners, and multi-lateral lending institutions. Growing financial commitments to poverty reduction (with health as a priority sector), health sector reforms, sector-wide approaches, and global health initiatives such as the Global Fund to Combat AIDS, TB and Malaria come with major obligations to monitor and evaluate progress and impact. At the same time, the spreading paradigm of “evidence-based” policy and practice is creating its own demands for high-quality information on local health conditions.

With certain notable exceptions, such as fertility and family planning, there is widespread agreement that the impact of investments in health of the past 20 to 30 years in developing countries is largely unknown and unknowable. For example, it has recently been concluded that reliable data do not exist to evaluate progress towards reducing maternal mortality ratios, an indicator with high levels of inequality among nations (1). The reason usually cited for this lack of data is the absence of functioning and reliable information systems to produce repeated measures of representative and appropriate indicators.

The United Republic of Tanzania is one country where demands for information are acutely felt. Major monitoring and evaluation (M&E) plans are being put in place to assess progress in poverty reduction (through the Poverty Monitoring Master Plan (2)), the national fight against AIDS, malaria control, local government reform (3), and health sector reform (4). Substantial investments have been made in the development of routine health management information systems (5), and administrative data sources at the local level where “bottom-up” participatory planning has become a *sine qua non* of the ongoing Local Government Reform” (3, p. 2). In addition, national surveys such as the Demographic and Health Surveys (6–9) have become integrated into the national Poverty Monitoring Master Plan (PMMP), and the Ministry of Health is establishing a National Sentinel System for monitoring the burden of disease based on linked demographic surveillance sites (10).

In Tanzania, as elsewhere, those responsible for producing indicators and reporting on progress in the health sector are faced with important decisions about how best to invest resources for M&E. How are they to objectively evaluate their options? Based on what criteria should additional resources be put into, say, facility-based health information system versus repeated nationally representative surveys, a one-off evaluation study, or a more innovative community-based information system?

Despite initial efforts to streamline health information systems (11), guidance is lacking; a review of the literature yielded no formal studies of the cost effectiveness of information for policy and decision-making.¹

¹ A comparative survey of infectious disease surveillance systems was conducted in Tanzania in 1998 with the intention of designing an integrated disease surveillance system (IDS) for the country (12, 13), but not with the primary aim of assessing comparative costs and results. We have drawn upon this work wherever possible.

1.2 Aims and objectives

Initially we set out to undertake a study of the cost-effectiveness of information in order to address this gap in knowledge. Due to resource constraints as well as inherent problems in conceptualizing and operationalizing “effectiveness” in the context of information, we refined our objectives to be more descriptive than comparative. The resulting survey of costs and results of information systems in the United Republic of Tanzania was intended to accomplish three aims:

- (1) To develop a methodology for assessing the comparative costs and results of the principle health and demographic information systems used to provide indicators for major M&E initiatives in the country
- (2) To provide government, development partners, and the scholarly community in Tanzania with a tool for efficient and rational decision-making by assessing and comparing options for carrying out long-term M&E programs in poverty reduction and health
- (3) To stimulate further discussion on approaches for assessing the cost-effectiveness of information systems

The process by which specific indicators were selected in the various M&E programs and the population subgroups intended to be represented is an important topic, but falls outside the scope of our study.

The report is divided into two main parts. **Part I** describes the study purpose, methods, and presents summary findings. **Part II** contains more detailed profiles of the different systems surveyed.

2 METHODS

As noted above, there is currently no scholarship on the comparative costs and effectiveness of information systems of the type we originally sought to undertake. Hence, there was no established methodology that could be readily applied or adapted to this study. Our protocol development and methods were as follows.

2.1 Selection criteria and sample

We attempted to include all systems in Tanzania that had the ability or potential to produce health, demographic, and poverty indicators required in the M&E programs of the Poverty Monitoring Master Plan (PMMP) (2), health sector reform (4), and local government reform (Local Government Reform Program, private communication). The full list of indicators published as of 2002 and the M&E programs for which they are required are contained in Table 2.1.²

Only information systems that were either capable of producing a range of population-based indicators on this list, or that are specifically mentioned in the PMMP were included in the survey. Surveys that have been implemented in Tanzania and are capable of producing many indicators, but that are not part of an existing or planned information system, were also excluded. The Core Welfare Indicators Questionnaire (CWIQ) developed by the World Bank and implemented in a few urban authorities in Tanzania was thus not included in our survey. We also excluded single-purpose or disease-specific information systems of vertical programs within the Ministry of Health such as the National AIDS Control Program and the National Malaria Control Program. Again, these were previously reviewed in detail elsewhere (13). Although dedicated infectious disease surveillance systems were not included, we did include the Integrated Disease Surveillance system (IDS), which is in the process of being established. When functional, the IDS will play a major complementary role in the Ministry of Health to the HMIS, and its outputs are intended for use at all levels within the health system.

The following eleven information systems were selected for this study. The information systems are grouped by the governmental departments in which they are located.

National Bureau of Statistics

- (1) National Housing and Population Census (2002)
- (2) National Household Budget Survey (NHBS; 1991/92, 2000/01)
- (3) National Demographic and Health Surveys (DHS; 1991, 1994, 1996, 1999)³

President's Office of Local Government and Regional Administration

- (4) Village Register System

Ministry of Justice and Constitutional Affairs

- (5) Vital Registration

² Indicators for the PMMP were revised in 2003 (14), and indicators for tuberculosis and family planning were added.

³ The 1994 survey was entitled the Tanzanian Knowledge Attitude and Practices survey (8), and the 1999 survey was called the Tanzania Reproductive and Child Health Survey (9).

Table 2.1 Indicators Included in the Study by Topic and Source		Source of Indicator*			
		PHSPP	DHP	PMMP	LGRP
Indicator					
Socio-economic Characteristics					
1	Headcount ratios for- basic needs poverty line			+	
2	Headcount ratios for- basic needs poverty line (rural)			+	
3	Headcount ratios for- food poverty line			+	
4	Asset ownership (as a proxy for income poverty)			+	+
5	Proportion of working age population not currently employed			+	+
6	Overall GDP per growth annum			+	
7	GDP growth of agriculture per annum			+	
8	Percent of rural roads in maintainable condition			+	+
9	Girl/boy ratio in primary education			+	
10	Girl/boy ratio in secondary education			+	
11	Transition rate from primary to secondary			+	+
12	Literacy rate or literacy rate of population aged 15+			+	
13	Net primary enrolment			+	+
14	Gross primary enrolment			+	
15	Drop-out rate in primary school			+	
16	Percent of students passing Std 7 with grade A,B,C			+	
17	Percent/proportion of households with access to safe and clean water			+	+
18	Proportion of child-headed houses			+	
19	Proportion of children in the labor force			+	
20	Proportion of children in the labor force and not going to school			+	
21	% of elderly living in a household where no one is economically active			+	
22	Ratio of reserves to monthly inputs			+	
23	Districts covered by active AIDS awareness campaign	+		+	
Mortality and Survival					
24	Infant mortality rate	+		+	+
25	Under-five mortality rate			+	+
26	Life expectancy			+	
27	Maternal mortality rate or maternal mortality ratio	+		+	+
Adult and Child Health					
28	Percent of ARI in under-fives			+	
29	Prevalence of diarrhea in under-fives			+	
30	Proportion of children <1 or <2 year(s) immunized against Measles, Polio, BCG and DPT or percent of infants completed vaccination per health center	+	+	+	+
31	Births attended by a skilled health worker	+	+	+	
32	Percent of women of child bearing age (15-49) using family planning or proportion of clients receiving family planning by method		+		+
33	% malaria cases for <5 years of all cases presenting at OPD or proportion of malaria cases for <5 years or malaria in-patient case fatalities for <5 years.	+	+	+	
34	Percent of TB cases or proportion of TB cases completed treatment		+		+
35	Seropositive rate in pregnant women or prevalence of HIV at ANC clinics	+	+	+	
Nutrition					
36	Stunting (height for age) of under-fives	+		+	
37	% of <5 children with a body weight less than 60% or underweight (weight for age <5)	+	+	+	+
Extreme vulnerability					
38	Proportion of orphaned children			+	

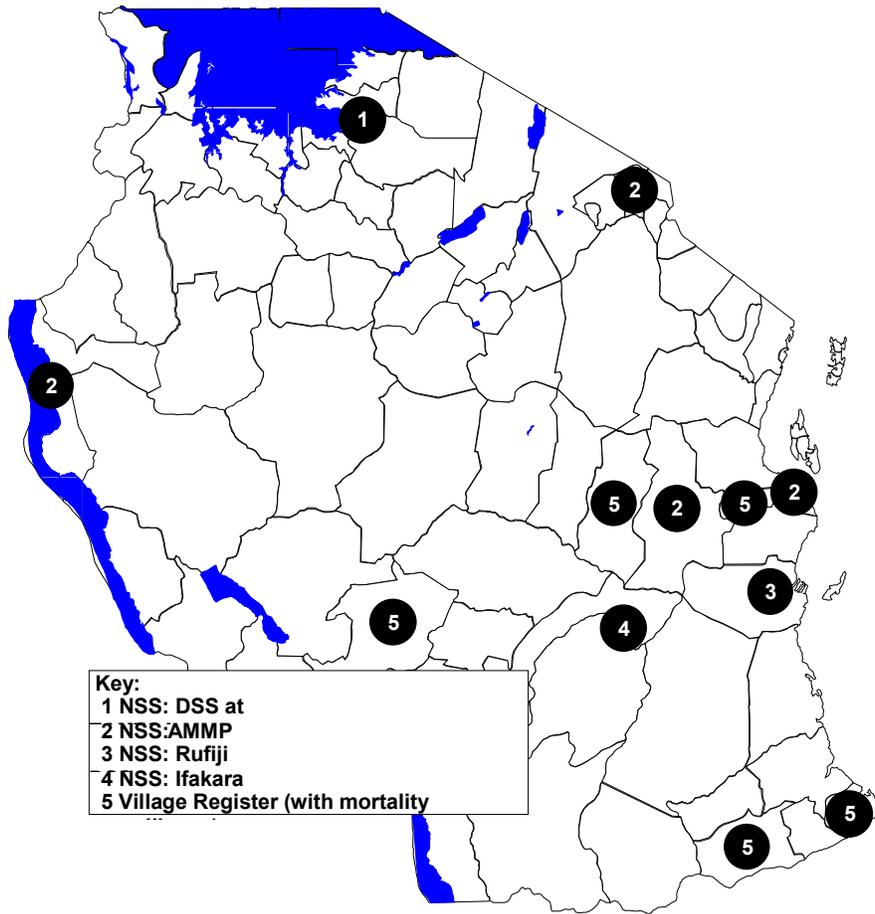
Key:

+ = indicator required

Note:

* PHSPP=Public Health Sector Performance Profile; DHP=District Health Plans; PMMP=Poverty Monitoring Master Plan; LGRP=Local Government Reform Program

Figure 2.1 Map of Tanzania showing Demographic Surveillance System sites and District/Local information systems included in study



Ministry of Health

- (6) Health Management Information System (HMIS)
- (7) Integrated Disease Surveillance (IDS)
- (8) National Sentinel Surveillance System (NSS): Ifakara Health Research and Development Centre Demographic Surveillance System (IHDRC; Ifakara DSS)
- (9) NSS: Rufiji Demographic Surveillance System (Rufiji DSS)
- (10) NSS: Adult Morbidity and Mortality Project – Phase 2 Demographic Surveillance System (AMMP)
- (11) NSS: Kisesa, Demographic Surveillance System at Tanzania and Netherlands Support AIDS Research Center (DSS at TANESA)

Figure 2.1 shows the location of the demographic surveillance system sites making up the NSS. The districts from which village register system data are available to the NSS include only the ones using mortality surveillance based on “verbal autopsy.” Verbal autopsies are structured questionnaires that are administered to surviving family members and caregivers of deceased individuals in order to ascertain the probable cause of death (15). Verbal autopsy methods are used as a “community diagnosis tool” in settings where coverage of vital registration and medical certification of cause of death are low. Table 2.2 provides a comparison of the information systems by distinguishing characteristics. These are examined in greater detail later in the report.

Table 2.2 Characteristics of Information Systems

Information System		Year Started	Data Collection Methods	Area of Coverage	Population under Surveillance (estimate for 2001)
1	National Housing and Population Census	1967	<ul style="list-style-type: none"> Population-based census Long form survey 	Nationwide	33,616,801
2	National Household Budget Survey	1991/2	<ul style="list-style-type: none"> Household Survey 	Nationwide	108,672 ^a
3	Demographic and Health Survey	1991	<ul style="list-style-type: none"> Household, community and facility-based surveys 	Nationwide	43,636 ^b
4	Village Register	1985	<ul style="list-style-type: none"> Population-based forms Mortality surveillance using verbal autopsy in 6 districts 	57 districts throughout Tanzania	Uncertain
5	Vital Registration	1979	<ul style="list-style-type: none"> Population-based forms 	72 districts throughout Tanzania	3,126,362 ^c
6	Health Management Information System	1993	<ul style="list-style-type: none"> Facility-based forms 	Health facilities nationwide	16,640,316 ^d
7	Integrated Disease Surveillance	2002	<ul style="list-style-type: none"> Facility-based forms 	Health facilities nationwide	16,640,316 ^d
8	NSS: Ifakara Demographic Surveillance System	1996	<ul style="list-style-type: none"> Population-based census Mortality surveillance using verbal autopsy (since 2000) 	Parts of Kilombero and Ulanga districts	66,000
9	NSS: Rufiji Demographic Surveillance System	1998	<ul style="list-style-type: none"> Asset index Population-based census Mortality surveillance using verbal autopsy 	Parts of Rufiji district	82,355
10	NSS: Adult Morbidity and Mortality Project – Phase 2	1992	<ul style="list-style-type: none"> Asset index Population-based census Mortality surveillance using verbal autopsy Household consumption expenditure proxy survey 	Parts of Hai and Morogoro Rural districts, and Ilala and Temeke municipalities; Parts of Igunga district, Kigoma Urban municipality (since 2002)	347,000
11	NSS: Demographic Surveillance System at Tanzania and Netherlands Support AIDS Research Center	1994	<ul style="list-style-type: none"> Population-based census Mortality surveillance using verbal autopsy Population-based HIV surveillance 	Parts of Kisesa ward, Magu district	23,000

^a 22,178 households times an average household size of 4.9

^b Average number of DHS interviews times an average household size of 4.9

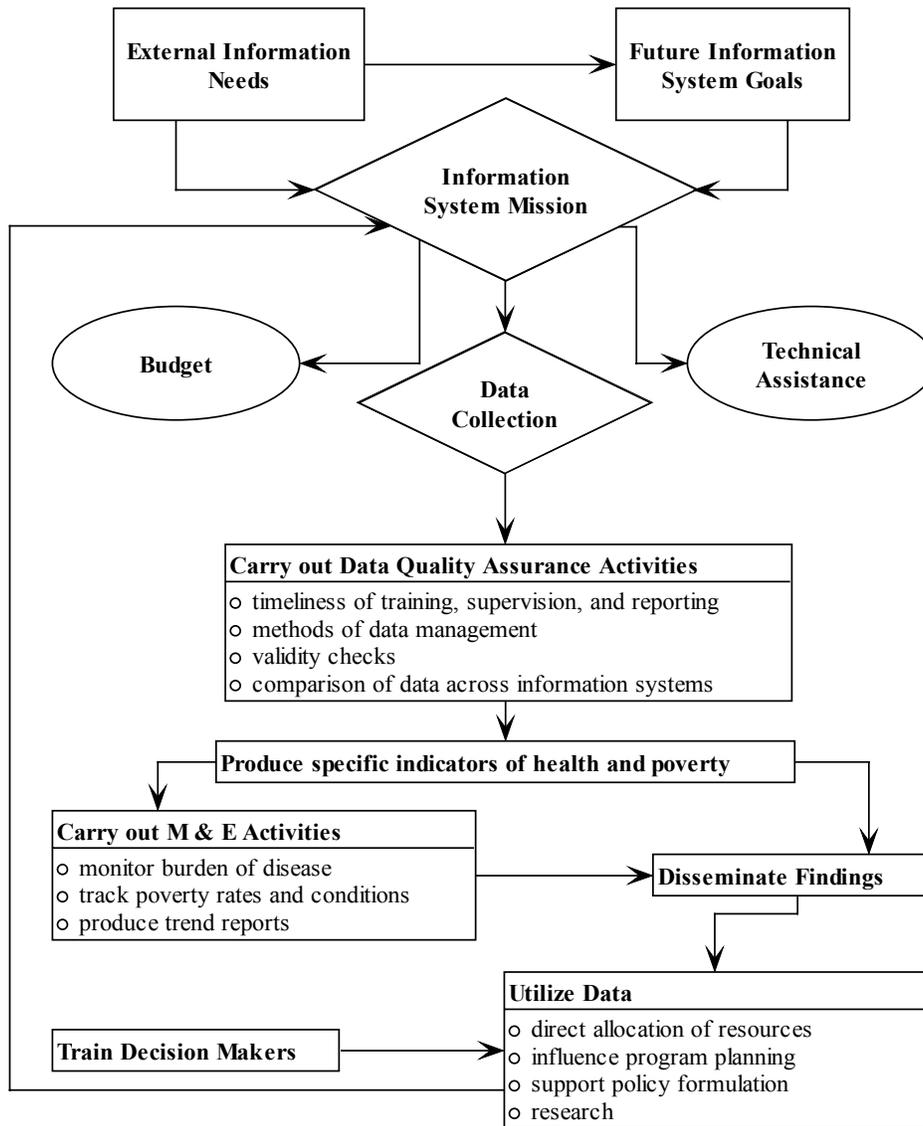
^c 15% coverage for 72 districts

^d The total coverage of the per cent of the population reporting having consulted any government source when last ill (49.5%)

2.2 Conceptual framework for data collection

The conceptual framework for factors influencing the quality and utilization of the outputs produced by the information systems is presented in Figure 2.2. In this scheme, forces such as changing donor needs may externally influence the mission of an information system. For example, as happened in Tanzania, the government’s response to multilateral donor requirements for poverty-related M&E in the context of debt relief caused information systems to broaden their mission to encompass poverty monitoring. Information system managers may also re-evaluate their mission in light of emerging technologies such as the availability of mapping tools or more cost-effective tests for biomarkers.

Figure 2.2 Conceptual framework



Changes in the core purpose and objectives of an information system will influence its budget, the quality and type of the data it produces, and the technical support it requires. For instance, an information system with the mission to produce precise population parameters with little sampling or measurement error requires enough financial and technical support to generate these high-quality indicators. In addition, the information system’s mission dictates the scope of indicators that may be produced. Cost, quality and technical support then influence the production of specific indicators of health and poverty. For example, calculating high-quality estimates of HIV prevalence among pregnant women at antenatal clinics requires properly trained clinic and lab staff, testing equipment, refrigeration, and quality assurance mechanisms.

After indicators are produced, dissemination and training of decision-makers influences the utilization of the data. For instance, public officials with an understanding of how to use indicators for making program and planning decisions may be more likely to utilize the findings

than their untrained counterparts. This was the case in Morogoro district in Tanzania, where the District Health Management Team utilized indicators relating to the place of death among children dying from acute febrile illness with seizures (largely due to cerebral malaria) to re-prioritize health issues requiring intervention (16).

2.3 Measuring “results”

2.3.1 System and indicator questionnaires

We developed two questionnaires to measure the “results” produced by information systems, and to assess the effort going into the production of those results. The first questionnaire elicited information about overall characteristics of the system, and the indicators that the system produces including:

- Training and retraining of staff
- Supervision
- Reporting
- Quality control
- Indicator production
- Ability to analyze trends
- Ability to analyze equity
- Impact and utilization

The second questionnaire focused on characteristics of specific indicators, including:

- Standardization and representativeness of indicator definitions across levels
- Impact and utilization

The questionnaires were pilot tested and modified. Team members from MEASURE and AMMP-2 then administered the questionnaires to senior management of each of the information systems included in the sample. The system and indicator questionnaires are contained in Annex 1.

2.3.2 Uses and dissemination other than indicators

Despite their importance to national and international M&E, other uses and applications of the information produced by the information systems, aside from indicator production, are of equal or greater importance in considering the overall results and impact of a system. As in the case of most DSS sites, such outputs (rather than indicators) may also be the primary basis for obtaining funding. These other uses and their impact must be factored into a properly constructed measure of information system effectiveness. In order to do this, we solicited additional information on information utilization in the areas of:

- Allocation of resources
- Directing program decisions
- Influencing policy decisions
- Distribution to government departments and ministries
- Additional research and other dissemination

2.3.3 Open-ended interviews

In order to gain a more complete picture of the information systems under consideration, we developed an open-ended interview schedule. This instrument was developed to account for the fact that measures of quality-control effort, reporting frequency, and even of the numbers of

indicators and the levels at which they are produced are not adequate to capture the “results” and effectiveness of an entire system.

The interview schedule (Annex 2) included questions on topics such as how important generating indicators is to the system, the relevance of poverty monitoring to the system’s mission, and where, in the opinion of system managers, future resource investments in information generation should be made.

2.4 Counting costs

Costing health information systems is complex. For example, costing centralized (e.g. National Population and Housing Census) and decentralized (e.g. Village Registers) information systems requires different costing techniques. In addition, several approaches exist for assessing the cost of time spent on surveillance activities by staff carrying out multiple duties. Costing is also made difficult by the fact that sources of information vary widely in detail and interpretation. For some systems, only budgets were available. These may not reflect actual expenditures. In other systems, records of expenditures were available, but were not always complete. In other cases, such as highly decentralized systems where funds and time resources are allocated at multiple levels, no overall or summary fiscal information was readily available. The literature offered some guidance in dealing with a few of these issues, but not all.

Given the organizational characteristics of the information systems and available data, we used two costing approaches (“top-down” and “bottom-up”) to assess costs. The following sections contain an explanation of the top-down and bottom-up approaches. For both approaches interviewers collected expenditure reports wherever possible. Budgets were used to supplement actual expenditure data, or were used for costing when no other sources of information were available. Expense or budget lines were grouped into capital and recurrent costs to derive total costs.

We also collected information about the size of the samples or populations covered, and converted these figures into 2001 population estimates using growth rate adjustments when necessary. An official estimate of the size of the national population was also obtained from the National Bureau of Statistics (NBS).

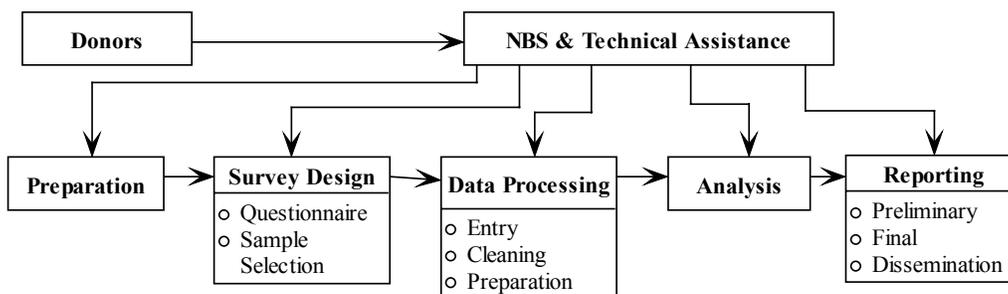
These data were used to estimate:

- Total annualized cost of the system for a single year (expressed in 2001 US\$);
- Annualized cost per participant (i.e. individuals covered by or participating in surveillance); and
- Annualized cost per Tanzanian citizen in 2001.

The total cost estimate gives an idea of the overall scope of investment required for each system. The overall costs divided by the population covered by these systems yields an “annualized per participant cost.” The per participant cost gives an idea of the cost of data collection at each data collection point, interview, or encounter.⁴ For the third type of cost estimate, we made the assumption that the production of information and indicators for national M&E programs can be considered a public good that benefited all Tanzanian citizens through better policy, planning, and program decisions. To derive this cost, we divided total system costs into the estimated Tanzanian population in 2001.

⁴ The coverage of several systems had to be estimated. Details of the estimations and assumptions used in making them are described below.

Figure 2.3 Tasks involved in centralized information systems considered for top-down costing



2.4.1 Top-down costing

Top-down costing analysis involves collecting data from expenditures and budgets starting at the highest organizational level of the information system, and moving down to the most disaggregated level (17). This method applies to surveys and centralized and newly established information systems. The costs of DHS, Census, NHBS, Ifakara DSS, Rufiji DSS, AMMP-2, the DSS at TANESA, and IDS were evaluated using this approach. The costs of Vital Registration were also assessed in this manner due to limited study resources.

As with any costing exercise, it is essential to include all activities and supplies required for running the information system. For the surveys (DHS and NHBS) and the National Census, costs are accumulated, beginning with the NBS and major funders and moving down towards the actual points of survey design, implementation and analysis. Figure 2.3 shows the flow of financial support from the Tanzanian government and donors to the various survey tasks that were considered in the costing assessment.

As with the surveys and National Census, all running and capital costs for the various activities carried out by the DSS sites (Ifakara DSS, Rufiji DSS, AMMP-2 and DSS at TANESA) were considered in the assessment. These costs include activities for all levels of the information systems, from central to facility level, where applicable.

2.4.2 Bottom-up costing

Bottom-up costing examines how funds are spent for specific tasks by starting at the point of initial data collection (e.g., health facilities) and moving upward in the organizational hierarchy to the central level (17). This involves determining how much money was spent on (or budgeted for) each task at a sample of bottom-level data collection points, and a construction of the total cost from the bottom to the top of the organization. Since this approach works well with decentralized systems, the assessments for HMIS and Village Register were done using this approach. The formula used to estimate the total cost using the bottom-up approach is as follows:

$$\sum_{i=1}^n P_i \times Q_i = \text{Total Cost}$$

where:

P = Price (salary/market price of material) and
 Q = Quantity (labor/physical inputs)

The flow of data in the HMIS and the Village Register systems moves from villages or health facilities first to the ward or district, then to the region, and finally to the central level. At each applicable level of surveillance, costs of staffing, equipment, and supplies were considered. Some appropriate costing data were available for HMIS through a review done by Health Research for Action (HERA) in 1999 (18). The costing done by HERA considered all work related to the HMIS. Estimates were based on the 1998 Health Statistics Abstract (in terms of the number of health facilities in Tanzania and activities performed at these facilities) and on interviews in the field. HERA estimated person-years of work and capital and recurrent costs (18).

Since this type of analysis had not been completed for the Village Register, questionnaires were developed to assess running costs at all levels. These questionnaires assessed personnel time, supplies, and equipment needed for all activities of the Village Register. Interviews were carried out at four village, two district, and two regional offices and the central level to obtain this information.

2.5 Feedback and revision of preliminary study findings

The MEASURE and AMMP-2 Team members held an in-country feedback session at which preliminary results were presented to representatives of the participating information systems, government officials, and donor representatives. Comments and questions from the feedback meeting were addressed in the preparation of this final report.

3 FINDINGS

3.1 Summary of health and poverty monitoring indicators produced by Tanzanian information systems

Table 3.1 presents information on the number of systems that provide estimates of the M&E indicators listed in the composite list contained in Table 2.1. It is important to reiterate that this list is not exhaustive of health and poverty indicators required for M&E. For example, some common indicators of fertility and migration are not included on this list because they were not among the published lists of indicators required for poverty monitoring, health sector reform, and district health planning in 2002. Additionally, some indicators are specified in multiple M&E systems. The right-hand column of Table 3.1 shows the number of M&E programs requiring each indicator.

More than half of the indicators are required in at least two M&E programs, and two (immunization coverage and wasting of children under five) are utilized in all the national M&E programs in Tanzania. These indicators are produced by five of the 11 information systems.

Figure 3.1 shows the indicators used by two or more of the M&E programs and produced by four or more of the information systems. Over half of the information systems produce established health and poverty indicators such as infant mortality, births attended by a skilled health worker, and net primary enrollment. The most commonly generated indicator across systems is the percent of households with access to safe and clean water.

Six of the indicators required by two or more of the M&E programs lack sufficient coverage by the systems. Figure 3.2 illustrates these findings. Few information systems produce indicators that monitor the spread and prevention of HIV. Three of the M&E programs require indicators on the seroprevalence of HIV in pregnant women attending antenatal clinics; however only one of the information systems measures this indicator on a repeated basis. One indicator in the original PHSP and PMMP lists (number of districts with active AIDS control programs) was not measured by any system, and was removed from the revised PMMP list for 2003.

Although information system managers recognized the importance of routine indicators to their systems, they expressed reservations about the composite list of indicators. Some thought that important indicators such as fertility and migration were being overlooked.

Table 3.2 provides a summary of which M&E indicators are currently produced and at what frequency by existing information systems. For each system the table reports which indicators have been measured only once (+), which are produced repeatedly (++), and which have not been measured to date, but could be produced (P). The bottom panel of the table sums the indicators in each of these groups for each system. Most of the indicators were measured repeatedly by the different information systems, and several systems provide estimates of the same indicators. Seventy-six percent (29 of 38) of the indicators on this composite “essential list” have been produced at least once by two or more information systems, and 58% have been or are produced by four different information systems. Eighty-seven percent of the indicators have ever been measured, and there are repeat measures available for all but one of these. According to the data provided by the information systems, five indicators have never been measured, and only one, “overall GDP growth per annum,” could not be produced by any of them. The systems also have the potential to produce a total of 18 indicators on the composite list that they are currently not estimating.

	Number of Information Systems by Indicator and Frequency of Measurement				Number of M&E Programs Requiring Indicator* (n=4)
	Not Calculated but Possible	Measured Once	Repeated Measure	Ever Measured	
1. HH w/access to safe and clean water	0	1	7	8	2
2. Under-five mortality rate	1	0	7	7	2
3. Net primary enrolment	1	0	7	7	2
4. Infant mortality rate	1	0	7	7	3
5. Literacy rate or LR of pop aged 15+	1	1	6	7	1
6. Girl/boy ratio in secondary education	0	1	6	7	1
7. Girl/boy ratio in primary education	0	1	6	7	1
8. Asset ownership-proxy for income poverty	0	3	4	7	2
9. Maternal mortality rate or ratio	0	1	5	6	3
10. Births attended by skilled health worker	0	1	5	6	3
11. Proportion of orphaned children	1	2	4	6	1
12. Life expectancy	1	0	5	5	1
13. Working age population not currently employed	0	1	4	5	2
14. Under one or under two years immunized	1	1	4	5	4
15. Prevalence of diarrhoea in under-fives	1	1	4	5	1
16. Wasting (Weight for age)/Weight<60%	1	2	3	5	4
17. Women aged(15-49) using family planning	2	0	4	4	2
18. Gross primary enrolment	1	0	4	4	1
19. Drop-out rate in primary school	2	0	4	4	1
20. Proportion of children in the labour force	0	1	3	4	1
21. % of ARI in under-fives	1	1	3	4	1
22. Proportion of malaria cases for under 5 years	1	0	3	3	3
23. Kids in the LF and not going to school	0	0	3	3	1
24. Elderly in household no one economically active	0	0	3	3	1
25. HR basic needs poverty line (rural)	0	2	1	3	1
26. Headcount ratio basic needs poverty line	0	2	1	3	1
27. Proportion of child-headed houses	1	0	2	2	1
28. % of TB cases/or completed TB treatment	1	0	2	2	2
29. Stunting(height for age) of under-fives	3	1	1	2	2
30. Transition rate from primary to sec	3	0	1	1	2
31. HIV+ rate in pregnant women/anc	1	0	1	1	3
32. GDP growth of agriculture per annum	0	0	1	1	1
33. Ratio of reserves to monthly inputs	1	1	0	1	1
34. Headcount ratio for food poverty line	1	0	0	0	1
35. Districts covered by act AIDS campaign	1	0	0	0	2
36. % of students pass Std 7 with grade A,B,C	1	0	0	0	1
37. Overall GDP per growth anum	0	0	0	0	1
38. % of rural roads in maintenance condition	2	0	0	0	2

Note:

* M&E programs include: Public Health Sector Performance Profile; District Health Plans; Poverty Monitoring Master Plan, Local Government Reform Program

Indicator	Frequency of Measurement by Information System											
	National Census	NHBS	DHS	Village Reg.	Vital Reg.	HMIS	IDS	Ifakara DSS	Rufiji DSS	AMMP	DSS at TANESA	
Socio-economic Characteristics												
1 Headcount ratio basic needs poverty line		++									+	
2 HR basic needs poverty line (rural)		++									+	
3 Headcount ratio for food poverty line									P			
4 Asset ownership-proxy for income poverty	++	++	++					+	++		+	
5 Working age population not curr employed	++		++						++		++	
6 Overall GDP per growth anum									++			
7 GDP growth of agriculture per annum									++			
8 % of rural roads in maint condition									P			
9 Girl/boy ratio in primary education	++		++	++				++	++	++	++	
10 Girl/boy ratio in secondary education	++		++	++				++	++	++	++	
11 Transition rate from primary to sec								++	P		P	
12 Literacy rate or LR of pop aged 15+	++	++	++	++				++	P		++	
13 Net primary enrolment	++	++	++	++				++	++			++
14 Gross primary enrolment	++	++						++				++
15 Drop-out rate in primary school	++		++					++	P			++
16 % of students pass Std 7 with grade A,B,C									P			
17 HH w/access to safe and clean water	++	++	++			++		++	++	++	++	
18 prop of child-headed houses				P					++			
19 prop of children in the labour force			+						++	++	++	
20 Kids in the LF and not going to school									++	++	++	
21 Elderly in hh no one economically active									++	++	++	
22 Ratio of reserves to monthly inputs			+						P			
23 Districts covered by act AIDS campaign										P		
Mortality and Survival												
24 Infant mortality rate	++		++		P	++		++	++	++	++	
25 Under-five mortality rate	++		++		P	++		++	++	++	++	
26 Life expectancy	++				P			++	++	++	++	
27 Maternal mortality rate or ratio			+			++		++	++	++	++	
Adult and Child Health												
28 Percent of ARI in under-fives			+			++	++	+		++	++	
29 Prevalence of diarrhea in under-fives			++			++	++	+		++	++	
30 Under one or under two years immunized			++	++		++		+	++	++	++	
31 Births attended by skilled health worker			++			++		++	++	++	++	
32 Women child bearing age(15-49) using fp			++			++		++	P			++
33 Prop of malaria cases for <5 yrs						++	++	++				
34 % of TB cases/or completed TB treatment						++		++				
35 Seropositive rate in pregnant women/anc						P						++
Nutrition												
36 Stunting(height for age) of under-fives			++			P		+	P			
37 Wasting (Weight for age)/Weight<60%			++	++		++		+	+			
Orphanhood												
38 Proportion of orphaned children			++	P				+	++	++	++	+
Total measured repeatedly	12	7	17	6	0	12	3	18	16	16	16	5
Total measured once	0	0	4	0	0	0	0	7	1	3	3	1
Total ever measured	12	7	21	6	0	12	3	25	17	19	19	6
Total possible, but not yet measured	0	0	0	2	3	2	0	0	9	2	2	0

Key:

++ = Repeated Measure; + = Measured Once; P = Possible, but not yet measured

Table 3.3 Methods of Quality Control

	National Census	NHBS	DHS	Village Reg.	Vital Reg.	HMIS	IDS	Ifakara DSS	Rufiji DSS	AMMP	DSS at TANESA
Re-test/re-interview of sub-sample	+	+	+	+				+	+	+	--
Translation/back-translation of tools	+	+	+						+	+	--
Regular meetings with enumerators	+	+	+			+		+	+	+	--
Correction/clarification in the field	+	+	+	+	+	+	+	+	+	+	--
Logical checks of responses		+	+					+	+	+	--
Internal checks and comparisons	+	+	+	+		+	+	+	+	+	--
Double data entry								+	+	+	--

Key:

+ = quality assurance technique used; -- = information not supplied

Table 3.4 Levels of Geographical Coverage and Data Disaggregation

	National Census	NHBS	DHS ^a	Village Reg. ^b	Vital Reg. ^c	HMIS ^d	IDS ^e	Ifakara DSS	Rufiji DSS	AMMP	DSS at TANESA
Mainland & Zanzibar	+		+								
Mainland	+	+	+			+	◆			E	
Rural	+	+	+			+	◆			E	
Urban	+	+	+			+	◆			E	
Region	+	+	+		◆	+	◆	E	E	E	
District/Municipality/DSS site	+			+	◆	+	+	+	+	+	+
Ward/Village	+			+	◆	+	+	+	+	+	+

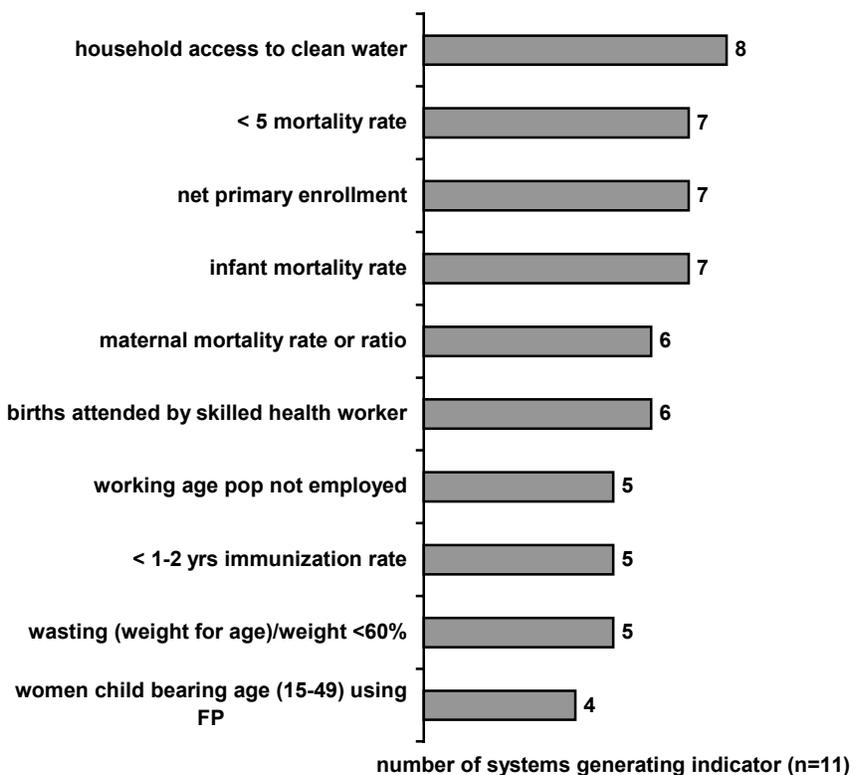
Key:

+ = indicator estimates available at this level; ◆ = potential level of indicator; E = estimates are produced based on DSS samples/clusters

Notes:

^a regional level estimates produced for some, but not all indicators^b district estimates available only where village register system well established at district level^c only in districts and regions where vital registration functional and coverage high^d facility-based statistics; low reporting levels in many regions^e facility-based statistics; system only established in pilot districts at present

Figure 3.1 Good coverage of indicators required by 2 or more M&E Programs* by indicator and the number of information systems producing the indicator



Again, the production of particular indicators may not be part of the primary mission of any single information systems. Therefore, some information systems may only produce a few of the indicators from the composite list.

Figure 3.3 illustrates the percentage of indicators from the composite list produced by each information system and the information system “type” (i.e., national census/survey; routine facility-based surveillance; routine community-based surveillance; or DSS). Coverage for indicators ever measured ranges from 65% for Ifakara DSS to zero for vital registration, which has the potential to measure three core indicators of mortality and survival. The median number of indicators collected is 12. In general, the DSS systems appear to measure the greatest number of different indicators, followed by the national census and surveys.

Effort expended in data quality assurance was assessed in a general sense by inventorying the techniques used by each system. Table 3.3 summarizes these methods. Six of the systems use at least five different quality assurance procedures to ensure as little error as possible in the estimates produced by their systems. AMMP-2 has the greatest number of quality control methods (seven), and vital registration uses the fewest (one).

Figure 3.2 Gaps in coverage of indicators required by 2 or more M&E Programs* by indicator and the number of information systems producing the indicator

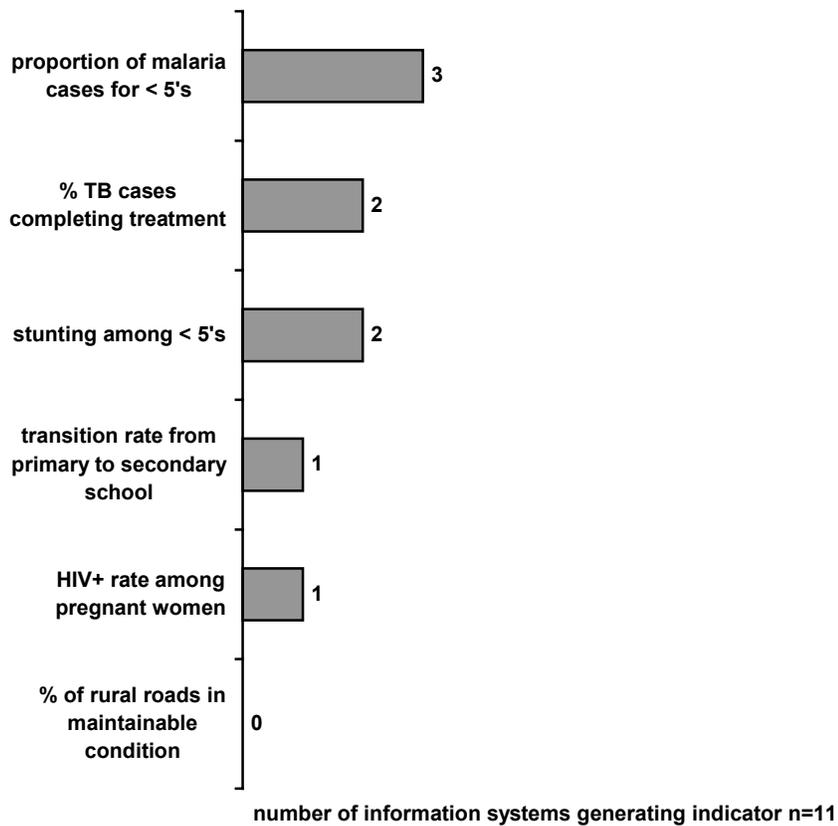
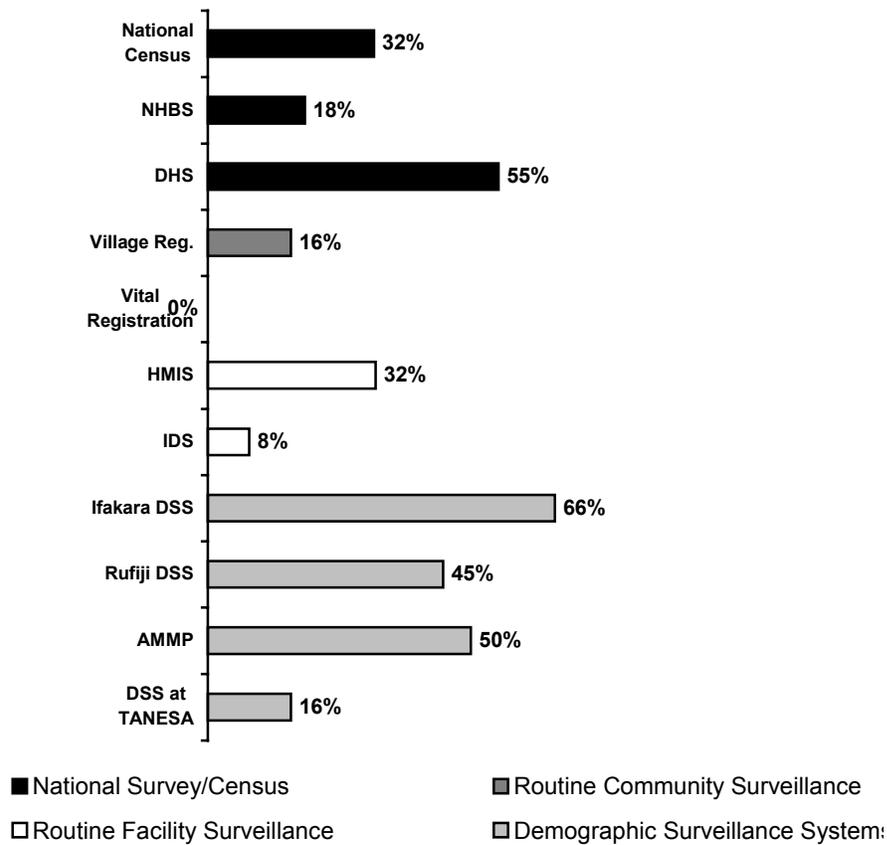


Table 3.4 shows the levels at which each system produces indicators, from the village or ward level up to the national level. Two systems, the national census and the DHS are capable of producing estimates for Tanzania that include both the mainland and Zanzibar. Three systems with high coverage and/or random cluster sampling can produce estimates for the mainland, for rural areas of the mainland, and for urban parts of the mainland, and at the regional level (census, NHBS, and DHS). Four other systems are producing estimates of indicators at this level or have the potential to do so. HMIS gives estimates based on partial reporting; AMMP provides national estimates by applying sampling weights to data sets. IDS and vital registration have the potential to produce national estimates, though the former is not yet operating with enough coverage and the latter is not currently capable of processing data collected or assessing coverage.

Aside from the census, no system has the demonstrated coverage to provide estimates at the district-level and below for the majority of Tanzania's population. HMIS may have adequate coverage in government health facilities to provide most districts and service populations with indicators, but this cannot be determined from central level reporting rates, which are low (18). Vital registration and the village register system cover multiple districts, but coverage of the systems within those districts and over time is in doubt (19). Of the DSS sites in Tanzania, three incorporate parts of two districts or municipalities, and four (including sites established through AMMP-2 in 2002) cover large sections of a single district. The DSS sites routinely provide data

Figure 3.3 Percent of study selected health and poverty indicators produced by information system and type of system



to district authorities, and in many cases the data are formally shared with local authorities in neighboring districts.

3.2 Dissemination and use of data aside from indicators

Analysis of interview transcripts and data on non-indicator uses of information showed that this aspect of information system performance is at least as important, if not more so, than the production of routine indicators. Several of the DSS sites, for example, were initially established to answer specific research questions. More recently they have come to play a dual role in which they produce high-quality research output for dissemination to the academic community across a wide range of topics, as well as disseminating these outputs to policy makers and program managers along with M&E indicators (20, 21). In most cases, the production of indicators for national M&E efforts is almost a by-product of the funded research that keeps DSS sites operating. National surveys such as the DHS provide a wealth of data suited for in-depth analysis far beyond the scope of generating a few select indicators. Data from HMIS, which produces about 32% of M&E indicators, have been used in many policy and program decisions.

In Part II we summarize the mission and objectives of each information system in detail, including the role and importance of indicator production, and we provide tables that summarize additional information on data utilization.

3.3 Comparative costs

Here we present preliminary cost estimates for each of the information systems. Full costing results will be contained in a forthcoming publication. Table 3.5 includes total annual costs, estimates for annualized per participant cost, and per capita costs. All measures are expressed in 2001 US dollars. Unless otherwise noted, the estimates include both capital and recurrent costs. Capital costs have been annualized using the methods described for each system whenever sufficient information was provided. The information systems are ordered in the table from lowest to highest per capita costs.

The findings presented here should be interpreted carefully for several reasons. Most importantly, it was not possible to obtain cost data of uniform type and quality from all systems. For example, some systems were able to supply five-year budgets while other systems provided expenditure reports or cost estimates for a one-year period. The resulting estimates, while presented in a common metric, should be compared with caution. Specific concerns are noted in table 3.5 and discussed below. Detailed cost components and estimates can be found in Annex 3.

	Total annual system costs (2001 US\$)	Per participant annualised costs *	Per capita annualised costs *
Ministry of Health: NSS DSS at TANESA ^a	\$13,352	\$0.59	\$0.0004
Ministry of Health: NSS AMMP ^b	\$96,049	\$0.83	\$0.003
Ministry of Health: NSS Ifakara DSS ^c	\$203,289	\$3.08	\$0.01
Ministry of Health: NSS Rufiji DSS ^d	\$200,992	\$2.44	\$0.01
Ministry of Justice and Constitutional Affairs: Vital Registration ^e	\$719,427	\$0.23	\$0.02
NBS: Household Budget Survey ^f	\$822,139	\$7.57	\$0.02
NBS: DHS ^g	\$854,164	\$19.57	\$0.02
Ministry of Health: HMIS ^h	\$2,119,941	\$0.13	\$0.06
Ministry of Health: IDS ⁱ	\$4,270,943	\$0.26	\$0.13
NBS: National Census ^j	\$8,244,114	\$0.25	\$0.25
PORALG: Village Register ^k	--	--	--

Notes:

* costs in 2001 US\$

^a based on two year expense estimate of recurrent costs only; includes drug treatment costs in per PSU estimate; denominator for participants is number of people participating in surveillance.

^b average cost of 3 DSS sites; based on costing performed for INDEPTH Network; costs for sites established in 2002 not included; denominator for participants is population participating in surveillance.

^c based on budget data only; denominator for participants is population participating in surveillance.

^d based on costing performed for INDEPTH Network; denominator for participants is population participating in surveillance.

^e no capital costs available, no accurate coverage data for per PSU cost estimate; denominator for participants is population covered by vital registration.

^f recurrent costs only; denominator for participants denominator is total participating households multiplied by NHBS estimate of average household size of 4.9 for 2000/2001.

^g recurrent and capital costs not broken down; average of four DHSs (1991, '94, '96, '99); denominator for participants is total number of participating respondents multiplied by NHBS estimate of average household size for 2000/2001.

^h capital costs not annualised; recent expansion costs not included; no accurate coverage data for per PSU cost estimate; denominator for participants is population covered by HMIS, estimated from NHBS.

ⁱ based on budget data only; no accurate coverage data for per participant cost estimate; denominator for participants is presumed to be equivalent to HMIS once IDS is fully functional.

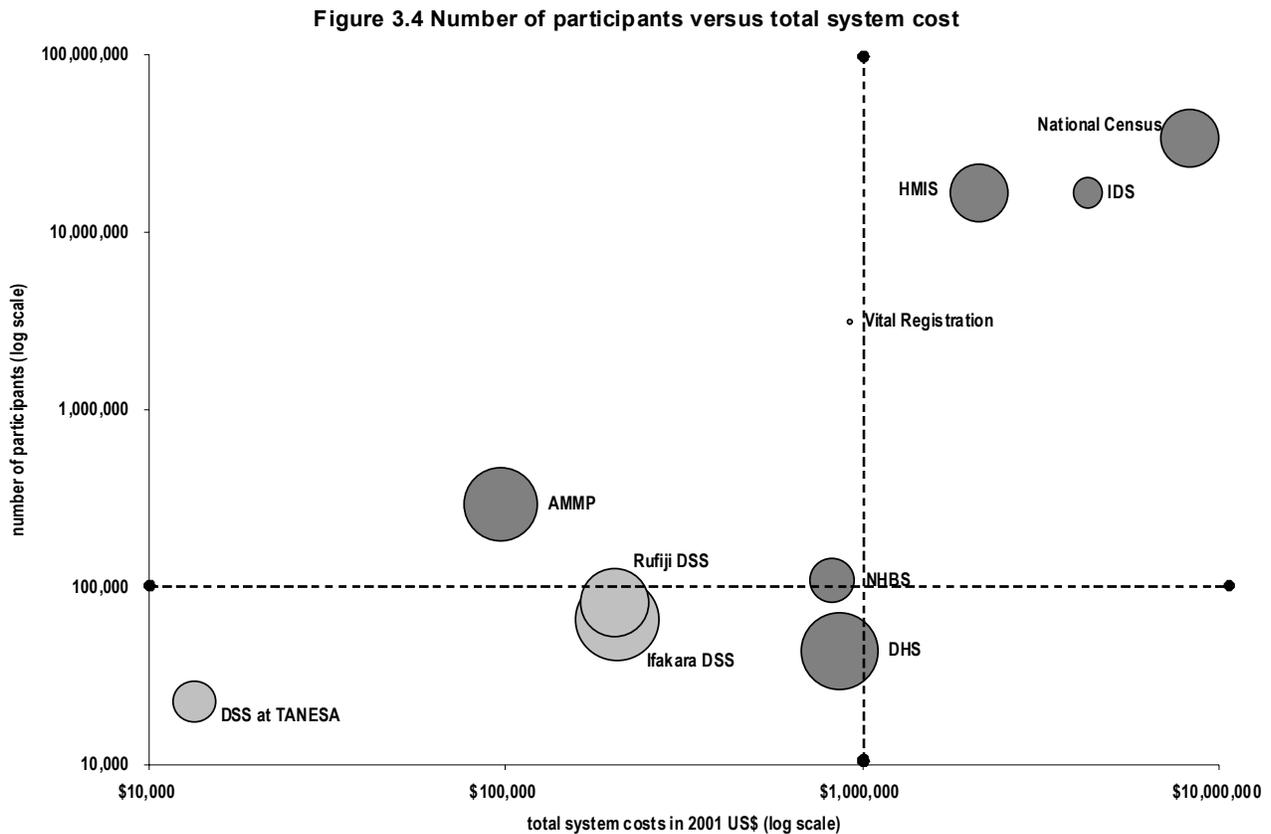
^j annualised costs for five-year period, based on budget data only; denominator for participants is same as per capita cost, as entire population is covered.

^k to be produced in forthcoming publication; denominator for participants is population of covered villages.

At the extremes, total annual costs run from \$13,352 for DSS at TANESA with a sample of about 23,000 to the national census, costing over \$8,000,000. Clearly this reflects the vastly different coverage and, to some extent, different data collection/quality assurance costs. Measured in terms of per participant costs, however, the census costs less than half of the DSS. Looked at from the standpoint of providing indicators of benefit to all Tanzanians, the cost of the DSS at TANESA is less than \$0.0005, while the census cost approximately \$0.25. In terms of per participant costs, the two large national surveys NHBS (\$7.57) and DHS (\$19.57) were considerably more expensive than all the others. The next most costly system was the Ifakara DSS at \$3.08 per participant. Except for the national census and the IDS, the annualized per capita costs for all other information systems in Tanzania was less than \$0.10. Based on the data collected for this study (excluding the village register system), approximately \$0.53 in total is spent per year for every Tanzanian on information systems capable of generating poverty, health, and survival indicators needed for national programs of monitoring and evaluation.

3.4 Relationship between costs, coverage, and quality assurance

Finally, we explored the relationship between costs, coverage, and the number of quality assurance techniques employed. Figure 3.4 charts the relationship between total system costs and system coverage for all systems. Because the distribution of both parameters is so skewed, the axes in the figure are on a log scale.⁵ The size of the bubbles reflects the number of core indicators from Table 2.1 produced by each system; systems producing national indicators are darker gray.



		Total number of participants	
		<100,000	≥100,000
Total system costs	≤\$1,000,000	DSS at TANESA (I=6; QA=n/a)	AMMP (I=19; QA=7) † NHBS (I=7; QA=6) Vital Registration (I=0, QA=1)
	>\$1,000,000	Ifakara DSS (I=25; QA=6) DHS (I=21; QA=6) Rufiji DSS (I=17; QA=6)	National census (I=12; QA=5) HMIS (I=12; QA=3) IDS (I=3; QA=2) §

KEY:
Systems in boldface produce indicators at the national level
'I' = number of selected M&E indicators produced by system
'QA' = number of quality assurance methods; 'n/a' = not available

NOTES:
* village register excluded due to lack of cost estimates
† reliability of national level estimates not yet proven
§ system not yet fully functional at national level

Table 3.6 groups systems into four categories according to the cutoffs indicated by the heavy dashed lines on the previous chart. These cutoffs are: participating population of 100,000 or greater and total system costs of \$1,000,000 or less. The figures in parenthesis in the table cells refer to the number of M&E indicators (from Table 2.1) ever generated by the system, and the number of quality control methods employed by the system (from Table 3.3). Three systems have participating populations above 100,000 and costs below \$1,000,000. These are AMMP, NHBS, and vital registration. Of these, AMMP-2 and NHBS produce national-level indicators. NHBS annualized total costs are roughly eight times that of AMMP-2's, though the validity of AMMP's national estimates is still being tested. DHS, Ifakara DSS, and Rufiji DSS all have coverage below 100,000 and system costs of \$1,000,000 or greater. DHS has costs about four times those of the DSS sites, though it is the only one of the three to produce nationally representative indicators. The census and the two facility-based routine systems (HMIS and IDS) all produce national estimates and have the highest participating populations along with the highest costs. Of these, the census has the most rigorous quality assurance procedures.

This analysis was repeated with cutoff values for: (a) system coverage and per participant costs (Table 3.7), and (b) production of indicators versus per participant costs (Table 3.8). As shown in Table 3.7, five systems have samples of 100,000 or more and per participant costs of \$1.00 or less. Of these, AMMP-2 has the highest per-participant cost (\$0.83), produces the greatest number of indicators, but has the smallest sample. This contrasts with vital registration, which produces no indicators, has per participant costs of \$0.23, and has an estimated coverage ten times greater than that of AMMP-2. The DSS at TANESA, the smallest system examined, correspondingly has the lowest total and per participant costs while still producing estimates of six M&E indicators—including HIV indicators not available from any other multi-purpose information system. The other DSS sites, along with DHS, are considerably larger than the DSS at TANESA (though not larger than 100,000). Their higher per participant costs (from \$2.00 to \$3.00 for the DSSs and \$19.57 for the DHS) may stem partly from larger participating

⁵ Vital Registration was omitted from this analysis because it does not presently produce indicators.

populations, high amount of effort spent on data quality and, in the case of DHS, expenses associated with ensuring a nationally representative cluster sample.

Finally, it can be seen from Table 3.8 that three systems, AMMP, Ifakara DSS and DHS have produced half or more of the required M&E indicators. DHS per participant costs are 23 times higher than those for AMMP-2 and six times higher than Ifakara DSS costs. Five systems produce from zero to 12 indicators with per participant costs ranging from about \$0.10 for HMIS to about \$0.60 for DSS at TANESA. The remaining systems, Rufiji DSS and NHBS produce 17 and seven indicators respectively with the DSS costing about one-fourth of the nationally representative survey.

Table 3.7 Number of participants versus participant costs

	Total number of participants	
	<100,000	≥100,000
Per participant cost		
≤\$1.00	DSS at TANESA (I=6; QA=n/a)	AMMP (I=19; QA=7) † National census (I=12; QA=5) HMIS (I=12; QA=3) IDS (I=3; QA=2) § Vital Registration (I=0, QA=1)
>\$1.00	Ifakara DSS (I=25; QA=6) DHS (I=21; QA=6) Rufiji DSS (I=17; QA=6)	NHBS (I=7; QA=6)

KEY:

Systems in boldface produce indicators at the national level

'I' = number of selected M&E indicators produced by system

'QA' = number of quality assurance methods; 'n/a' = not available

NOTES:

* village register excluded due to lack of cost estimates

† reliability of national level estimates not yet proven

§ system not yet fully functional at national level

Table 3.8 Production of selected M&E indicators versus per participant costs

	Per cent of selected M&E indicators ever produced	
	<50%	≥50%
Per participant cost		
≤\$1.00	National census (I=12; QA=5) HMIS (I=12; QA=3) DSS at TANESA (I=6; QA=n/a) IDS (I=3; QA=2) § Vital Registration (I=0, QA=1)	AMMP (I=19; QA=7) †
>\$1.00	NHBS (I=7; QA=6) Rufiji DSS (I=17; QA=6)	Ifakara DSS (I=25; QA=6) DHS (I=21; QA=6)

4 CONCLUSIONS & DISCUSSION

Our aim in this study has been to bring a general notion of cost-effectiveness into the debate about information generation, monitoring and evaluation, and surveillance. Accordingly, our focus has been on monitoring and evaluation for national efforts of poverty reduction and health reform. Our rationale for undertaking this investigation stems from the fact that demand for information is increasing at all levels, yet resource allocation in information system investments has lacked an evidence base, a comparison of costs and outputs that might inform decisions. Resources have been and may continue to be relatively scarce for service-based M&E efforts within line ministries, as well as for an increasing number of alternatives such as continuous “stand-alone” information systems (e.g., demographic surveillance sites), and cycles of repeated surveys (e.g., DHS or household budget surveys) that are generally carried out by statistics bureaus. It is our hope that the comparative costs and results presented here may assist in any expansion or consolidation of information collection efforts undertaken in Tanzania, and that our methods might be built upon in other contexts.

While a formal analysis of the cost-effectiveness of information systems was our initial objective, it was not attempted. The primary reasons for electing not to conduct a formal analysis related to constraints of time and resource, and the complexity of operationalizing an appropriate effectiveness parameter that could be measured across systems. Instead, we have presented several ingredients that would be needed to undertake such an analysis. We have summarized the data in a series of domains that might broadly constitute “effectiveness,” though no single measure of effectiveness was produced. In addition, cost information provided to the study team was detailed, yet was not adequate (particularly for capital costs) to allow a full and direct comparison of costs across systems. Nevertheless, we have calculated three cost estimates for each system, wherever possible.

With more detailed costing data and agreed measures of data quality and coverage, it should be possible to generate comparable data across systems that would allow direct comparisons to be made. Study limitations notwithstanding, the data presented here point to some conclusions. With the exception of vital registration, all information systems included in the study generate routine indicators of health and poverty. Most have had significant impact through research, analysis, and dissemination unrelated to M&E indicator production. Tanzania’s systems can calculate all poverty and health indicators (save one) listed in published monitoring and evaluation requirements for the four national poverty reduction and reform efforts as of 2002, most of which are available from multiple sources. Half of the information systems in Tanzania collect 12 or more of the 38 required health, demographic, and poverty indicators. The majority of systems use multiple quality assurance strategies to ensure data quality, regardless of differences in sampling and coverage. Nine systems can provide local authorities with indicators, though coverage of these systems either across or within districts (other than the national census) is very limited. Two systems are capable of generating indicators for the entire Tanzanian population, and four others can do so for the Tanzanian mainland.

Finally, it is evident that larger sample sizes and greater system coverage do not always equate with “better” indicators or higher degrees of representativeness, as is sometimes supposed. Within the context of system missions and resource envelopes of each system, there are many trade-offs with respect to system coverage, representativeness, frequency of data collection/reporting, and quality control. Tanzania’s DSSs, for example, have very large community-based samples, and narrow geographic coverage exchanges in-depth sub-group analysis for indicators that may only be generalizable to locations in the country sharing many of the ecological, socio-geographic, cultural, or economic features of the DSS sample populations.

Even though they have wide geographic coverage, “passive” and facility-based systems like vital registration, HMIS, and IDS reflect the experience only of facility-using or reporting populations. This introduces concerns about selection biases in the indicators produced by these systems, as there are often large differences between those who attend and do not attend facilities (16). One routine system at the community level, the village register, though intended to be wide in coverage and actively updated, has few mechanisms for quality control and often generates dubious local population denominators (19). Nationally representative surveys like the DHS and NHBS sacrifice data disaggregation below the zonal or regional level for rigorous sampling and quality control. System missions, and the type of system-by-system trade-offs described here, must be taken into account when considering general descriptions of results and effectiveness, and when interpreting each of the three different cost estimates (total, per participant, and per capita). Doing so may better equip policy makers to make future investment choices in monitoring and evaluation.

PART II: SYSTEM PROFILES

NATIONAL BUREAU OF STATISTICS

1 NATIONAL HOUSING AND POPULATION CENSUS

1.1 Mission, objectives, and role of health and poverty monitoring

The description of the census is derived from interviews conducted as part of the study and from information contained on the census website (22). The mission of the National Census is to provide national estimates of demographic, poverty, and health indicators. Since independence, there have been national censuses in 1967, 1978, 1988, and 2002. Censuses provide data for preparation of social and economic development policies by summarizing the demographic and socio-economic characteristics of the population. They also provide sampling frames for national household surveys, and lend support to the Tanzania Development Vision 2025 and Vision 2020 for Zanzibar and social and economic reforms.

1.2 Indicator production & trend assessment

Of the 36 PMMP indicators relating to health and human capabilities, the National Census measured 12 indicators. These indicators include various socio-economic characteristics such as girl/boy ratio for primary education and mortality rates of infants and children.

The National Census produces indicators every 10-12 years. For population-based indicators, investigators update the denominator each time the census is completed. Of the 38 indicators shown in Table 2.1, the National Census produced 12 during the previous census in 1988. Table 3.2 contains a list of the indicators produced by the National Census. Indicators produced on a repeated basis primarily fall under demographic information from unemployment rates to child mortality. The majority of indicators are available broken down by regional and mainland/Zanzibar estimates.

1.3 Implementing agency & funding source

The government of Tanzania implements the national census through the NBS. In carrying out the 2002 census, NBS received substantial support from bilateral and multilateral donors.

1.4 Sampling strategy, size, and representativeness

The National Census is a de facto enumeration of everyone in Tanzania as of the end of August 2002, regardless of citizenship status. A list of Enumeration Areas (EAs) was prepared serially for each district, making sure that within each district no villages or EAs were missed. These lists of EAs served as the sampling frame. After ascertaining the completeness and accuracy of the frame, the urban EAs were then separated from the rural EAs. Both rural and urban EAs were then arranged in ascending order according to codes of Wards/*Shehia*, village and EAs. It should be pointed out that the sample frame did not take into account the special category EAs of nomadic population or collective households which all used the short questionnaire. There were two types of domains of study, rural and urban areas. The sample sizes varied by domain and number of EAs per district or municipality.

1.5 Data collection methods & quality control

The 2002 census questionnaires were based partly on the 1988 form, with input from international and Southern African Development Community sources. Long and short questionnaires were used (copies can be found on the census website).

Fourteen training workshops were conducted in preparation for the census, covering pre-enumeration, enumeration, and post-enumeration surveys.

The night of 24th/25th of August 2002 was used as the reference date in uniformity with the 1967, 1978, and the 1988 censuses, which were undertaken at about the same time. The month of August has traditionally been selected for census taking due to two main reasons. The dry weather facilitates transportation and communication. Second, most farmers have finished harvesting their crops, which means that seasonal labour migration is slightly lower.

An Evaluation and Quality Control Unit established measures that were undertaken for all stages of census work. At each stage quality standards were maintained to minimize errors. The Evaluation and Quality Control Unit co-operated effectively with the Planning and Analysis Unit as well as with the Data Processing Unit to design, develop, and improve the census questionnaire and related documents in the pre-enumeration phase. The unit also evaluated the census sensitisation messages in cooperation with the Information Education and Communication Unit. The quality of training materials and training were also monitored at all levels.

During enumeration quality-control procedures stressed correct filling in of the questionnaires, and, by observing a sample of interviews, ensured correct interpretation and presentation of questions; proper shading (for scanning accuracy) and handling of questionnaires in the field and consistency checks for questions. The Evaluation and Quality Control Unit ensured quality handling of questionnaires to and from the field, quality storage facilities, and quality editing specifications of questionnaires.

The Evaluation and Quality Control Unit conducted a Post Enumeration Survey in 1.7 percent of the census-enumerated EAs. The survey results will be used to determine the coverage and content errors of the census. In addition, it will be used to evaluate the quality of enumeration areas as a sampling unit for intercensal and household-based surveys and will also furnish information on sources and causes of errors.

1.6 Reporting intervals, dissemination of findings, and utilization

A series of census reports, including preliminary reports, is produced and distributed through a variety of mechanisms. For the 2002 census, preliminary tabulations, reports, and maps were available on the NBS web site just a few months after the completion of the exercise. Analysis of the census data is carried out by a number of parties, including the research and analysis technical working group within the national poverty monitoring program.

Census data are a cornerstone of official national statistics, and have been used in numerous ways for policy, planning, and M&E from the national down to the ward and village level. Until the 2002 census, program planners and evaluators requiring population denominators used official estimates from line ministries or the NBS based on the 1988 census. As mentioned above, the census is used for most national planning and policy development needs, and serves as the sampling frame for national surveys. Dissemination of census findings are planned for the following publications listed on the census website:

- **General Report** contains population by sex, numbers of households, and average household size at the ward, district, and regional level for the Mainland and Zanzibar.
- **Census Methodology** will cover different aspects of the census and will describe methods and procedures used.
- **Census Cartographic** will describe the procedures used in delineating the country into EAs.

- **National Profile: Basic Demographic and Socio-economic Characteristics** will contain tables, text, and figures on basic demographic and socio-economic characteristics of the population such as marital status, education, occupation, and employment, type of disabilities, citizenship, migration, and housing conditions.
- **Regional Profiles** will contain a similar range of information to the National Profile but relating to the individual Regions.
- **District Profiles** will contain a similar range of information to the National Profile but relating to the individual Districts.
- **Fertility and Mortality** will contain fertility and mortality tables down to the district level.
- **Census Analytical Report** will discuss the characteristics of the various population sub-groups (male/female, urban/rural, etc.) and basic socio-economic indicators.
- **Population Projections** will contain the projected population for 10 years at regional and district levels and for selected population sub-groups.
- **Wall Charts** will be produced containing basic demographic and socio-economic indicators from the Census and population projections.
- **Census Atlas:** Will contain thematic maps at the district level covering demographic and socio-economic characteristics. Expected date of publication is June 2004.
- **Post Enumeration Survey:** Will contain survey planning, sample design procedure, data collection, matching rules, reconciliation rules, and estimation procedures. Expected date of publication is April 2003.

1.7 Cost estimates

NBS provided budget and expenditure information for the National Census. An estimated 34,577,073,097 Tanzanian Shillings (TSh) was budgeted for 2000/01–2003/04, to which we added TSh 2,000,000,000 of expenditures on cartography from 1996/96–1999/2000 to make a total of TSh 36,577,073,097. The budget for 2000-2004 includes both capital and recurrent costs. Since the cartography tasks spanned five years and the majority of work for the census spans the period from 2000–2004, the total was divided by five years to produce the annual cost. In order to estimate the cost in USD the average exchange rate for 2001 (\$1 = TSh 887.35) was used, resulting in an estimated annualized cost of \$8,244,114 per year. In order to determine the per capita expenditure for the National Census, the annualized cost was divided by the 2001 estimate of the population of Tanzania. Based on the national growth estimate, the total population of Tanzania for 2001 was 33,616,801 people. Therefore, the estimated annualized per capita expenditure was $\$8,244,114 \div 33,616,801 \text{ people} = \0.25 per person .

2 NATIONAL HOUSEHOLD BUDGET SURVEY (NHBS)

2.1 Mission, objectives, and role of health and poverty monitoring

This section was written from material gathered during interviews with NBS officials and from material contained in the NHBS summary report (23). The main purpose of the survey is to provide data for monitoring progress under the government's poverty reduction policies and to show the trends in many poverty indicators over the 1990s.

2.2 Indicator production & trend assessment

Indicator production is central to the purpose of the NHBS, as is the monitoring of trends. Trends in 30 core poverty indicators in the areas of family life and housing conditions, education, health, water/sanitation, economic activities, and consumption/income poverty were calculated and presented in the summary report.

2.3 Implementing agency & funding source

The NHBS is the largest household survey conducted by NBS and was implemented with the financial support of bilateral and multilateral donors.

2.4 Sampling strategy, size and representativeness

The 2000/01 sample was much larger than previous Household Budget Surveys in order to provide estimates of key poverty measures for each of the twenty regions of Tanzania. The final sample was 22,584 households. The first stage of sampling in the 2000/01 HBS used primary sampling units identified in the "regional" sample of the National Master Sample (NMS). The sample was designed to allow estimates of household-level variables to be made with reasonable precision for each of Tanzania's 20 regions.

A comprehensive household listing was undertaken in each of the sampled primary sampling units (PSUs). Information on a number of socio-economic variables was collected for each household during this listing. This was used to stratify households within each PSU into high-, medium- and low-income households. Separate samples were then drawn from each of these groups. The samples were drawn automatically in the head office and each regional office was supplied with a list of pre-selected households.

For reasons of cost, some rural sampling units were dropped partway through the survey. This yielded a sample biased toward urban enumeration areas, and a set of sampling weights was developed to correct for the over-representation of urban areas. Ninety-eight percent of the (revised) intended sample size was interviewed, including replacements.

2.5 Data collection methods & quality control

Preparations for the survey were made from late 1999 through early 2000. Fieldwork began in May 2000 for ten regions and in June 2000 for the remaining ten. It lasted for 12 months in each region, with all fieldwork being completed by June 2001. The following description of data collection methods is taken from the NHBS report (p 11).

"Two households were enumerated each month of the survey in each PSU. Over the course of the survey, 24 households would normally be interviewed per PSU. Enumerators, resident in or near the PSU, conducted an initial interview with the two households at the beginning of the survey month. They then visited the households during that month on a regular basis to record household transactions, covering expenditure, consumption and income. These visits were

scheduled to take place every day for households without a literate member and every two to three days for others. Enumerators were supervised by field supervisors working out of the NBS regional offices. Supervisors collected and checked questionnaires, which were then sent on to the head office for data entry.

“Data entry, using the data entry programme IMPS, went on in parallel with fieldwork and was completed by July 2001. Automated data consistency checking procedures were run on the entered data during fieldwork. The field staff were informed of the errors identified by these programmes and, where possible, a team in the head office corrected them. Additional consistency checks and cleaning continued until November 2001 and the analysis was completed by June 2002.”

2.6 Reporting intervals, dissemination of findings, and utilization

A large summary report was produced after the survey and disseminated in English in print and on-line form on the Tanzanian government website. Several dissemination seminars and workshops were also held in Tanzania.

NHBS results are used in a variety of M&E and research activities. The main uses have been in the updating of national poverty lines, and in the setting of current baseline conditions for national poverty indicators. NHBS data have also been used to derive location-specific tools for the measurement of consumption expenditure (24).

2.7 Cost estimates

NBS provided an expenditure report and budgets for the running costs of the 2000/01 Household Budget Survey. Although the recurrent costs were complete, the study team did not receive any information on capital expenditures. For the 2000/01 NHBS, investigators sampled 22,178 households with an average household size of 4.9. Therefore, we calculated both per participant ($N = 22,178 \times 4.9$) and per capita cost estimates for this survey. NHBS spent an estimated \$7.57 per participant included in study, and \$0.02 per capita to complete their survey, exclusive of capital costs.

3 DEMOGRAPHIC AND HEALTH SURVEY (DHS)

3.1 Mission, objectives, and role of health and poverty monitoring

During the 1980s and 1990s, Demographic and Health Surveys (DHS) became a virtual staple of M&E in many developing countries, first for fertility and family planning, and eventually for broader maternal and child health and HIV/AIDS-related issues. Four DHSs have been conducted in Tanzania during the 1990s (6, 7, 9, 25).

The mission of DHS is to provide estimates on mortality and fertility, as well as on a wide range of other indicators. Although a “cycle” of DHS surveys is really a series of cross-sectional surveys, it plays a role similar to that of a national information system by providing repeated estimates of many important population parameters.

3.2 Indicator production & trend assessment

DHS reports are structured partly around the production of indicators to assess program process and impact. Traditionally these have included indicators relating to use and knowledge of family planning methods, anthropometric indicators of child nutritional status, use of home-based health interventions such as oral rehydration solution, and more recently AIDS awareness, education, and voluntary testing and counseling programs. Several of these have been incorporated into the PMMP.

3.3 Implementing agency & funding source

DHSs in Tanzania are implemented by the NBS with financial support from USAID and, increasingly, from other bilateral donors.

3.4 Sampling strategy, size and representativeness

DHS employs a complex sampling technique to derive nationally representative estimates of the estimated 34 million people living in Tanzania. Sample sizes for the surveys have ranged from between 6 and 11 thousand. Larger samples allow greater disaggregation of parameters (e.g., by mainland/Zanzibar, age, sex, or regional/zonal groupings). DHS respondents are women aged 15 to 49, men aged 15 to 59, and the children of respondents. Estimates of nationally representative indicators, therefore, are based upon the reported experience of Tanzanians in these age bands. DHS sampling within households is complex and involves interviewing all reproductive aged women from a sampled household. Male and child samples are drawn from among the children and partners of the women interviewed, although there are occasionally separate male samples generated.

3.5 Data collection methods & quality control

Data are collected through a series of household survey modules that are implemented in the sample of adults of reproductive age drawn for the DHS. Aside from the anthropometric measures, most of the data are self-reported or reported about children by mothers. Substantial efforts are put into assuring that data are recorded completely, accurately as reported by respondents, and that the responses recorded make logical sense.

3.6 Reporting intervals, dissemination of findings, and utilization

As part of the PMMP the NBS released a schedule of national household surveys covering the period 1999 to 2012. Taking into account previous surveys, the plan is for DHS data to be available for 1991/92, 1994, 1996, 1999, 2004, and 2009.

DHS usually supports the development of a large summary report with many frequency tables of various indicators, along with some interpretive narrative. These reports are distributed locally through the NBS, and results are also presented at national dissemination workshops. DHS data sets are available for secondary analysis and can be downloaded via the Internet.

The primary output of DHS data are large reports issued after each survey and data sets that are released into the public domain through in-country partner institutions and via the Internet. Much of the utilization of DHS data comes through reference to indicators published in the major survey report. These indicators are used in many published and unpublished reports, M&E assessments, planning documents, and policy papers. In addition, there are important secondary analyses of DHS data that address issues of health equity (26), which are presented as reports or published in academic journals.

3.7 Cost estimates

As with the NHBS, the DHS draws a sample from the entire Tanzanian population to generate nationally representative findings. Therefore, both per participant and per capita costs were calculated for this information system. MACRO International provided expenditure and budget information for the 1991, 1994, 1996, and 1999 DHS surveys. Budgets included the costs of salaries, per diem/allowances, transportation, printing, and other direct costs. The expenditure information includes the overall cost and breakdown by local costs incurred and technical assistance provided. The capital costs do not appear separately in these documents. Therefore, it was not possible to partition the capital and recurrent costs for the DHS. The average recurrent cost totals for the surveys were \$854,164, yielding an average annual per capita costs for all DHSs during the 1990s of \$0.02. As noted above, the DHS generates indicators and information about all members of a household, not only respondents. Therefore we elected to count all household members as “participants” in order to form a denominator for per participant cost estimates. Therefore, we multiplied the number of households in the DHS sample by the 2000/01 NHBS estimate of an average household size of 4.9 people. DHS spent an estimated \$19.57 per participant included in the study.

PRESIDENT’S OFFICE OF REGIONAL ADMINISTRATION AND LOCAL GOVERNMENT (PORALG)

4 VILLAGE REGISTER

4.1 Mission, objectives, and role of health and poverty monitoring

This population-based information system began when UNICEF first established the Child Safety, Protection, and Development (CSPD) Program in Iringa district in 1985.

The Village Register system is intended to build community capacity through training village leaders to collect and use demographic and health information. All indicators are used at the village level so that communities can monitor their situation (e.g., make sure that all the children are weighed and vaccinated). Additionally, the Village Register aims to track births and deaths in order to know composition of community and the population at any time so that decision-makers do not need to rely solely on the National Census data.

UNICEF initially served as the supporting organization for the Village Register, a role that has currently been taken over by the Tanzanian Local Government Reform Program (LGRP). Under the LGRP, districts nation-wide will use the Village Register. Data collected by this information system overlap with the National Census, HMIS (for some indicators) and AMMP-2 (in Hai district).

Poverty monitoring was not one of the original goals of the Village Register, although there was an implied focus on poverty reduction through the production of information about social development. Since it has been absorbed under the LGRP, the register is now intended to contribute explicitly to poverty monitoring. LGRP officials intend for locally collected information on education, housing conditions, and migration to be used locally to improve the well-being of the community.

4.2 Indicator production & trend assessment

The village registers are intended to produce six indicators on a regular basis in the areas of education, survival, and immunizations. Indicators are not routinely pooled above the ward level. The system is longitudinal, so trend analysis should be possible if data quality allow.

4.3 Implementing agency & funding source

After taking over the responsibility for further dissemination of the Village Register system from UNICEF, PORALG/LGRP will be supporting councils to expand their use. Resources will come from both council and central sources.

4.4 Sampling strategy, size and representativeness

As of 2002, 57 districts throughout Tanzania were collecting information using the Village Register. It is intended that where in use, the register be based on the complete enumeration of the resident population. In addition, UNICEF sought to augment the register in six CSPD districts with mortality surveillance and the collection of verbal autopsy data.

Future plans for scaling up the use of the system include exploring the use of simple random samples, as opposed to attempting universal coverage.

4.5 Data collection methods & quality control

Ward and Village Executive Officers complete standard register books to update local data. They are meant to actively seek out and record all the information required to complete the books. Consistency checks found during meetings at the district level are used to detect data problems, and any discrepant reports are resolved at the ward level.

Previous assessments of data quality have indicated that the village registers do not provide accurate population denominators (19). The accuracy of other indicators has not been widely assessed, however *ad hoc* comparisons have been made by some users of the register system with a variety of other information sources.

4.6 Reporting intervals, dissemination of findings, and utilization

UNICEF indicated that the village register system would move from a quarterly and annual reporting cycle to reporting just annually.

When calculating population-based indicators, most of those consulted at the district level indicated that they used projections based on the 1988 census.

4.7 Cost estimates

We collected information from the village, district, regional, and national levels concerning the cost of materials and manpower to run the Village Register. For each task completed, respondents provided information on the person who typically completes the task, the amount of time it takes, and the equipment and materials needed to accomplish the task. Data were collected at four villages, two districts, two regions, and the national level. Since the Village Register was in the process of transferring leadership, interviewers spoke with national managers at both UNICEF and PORALG. One of the central ideas behind the Village Register is that the community take ownership of the system. Therefore, little money was put into the start-up of the system, and many of the people who complete the Village Register are volunteers. Volunteers received motorbikes for their service. However, volunteers are not provided with a formalized salary from the national level. Some communities have decided that these volunteers should be compensated for their valuable work and have given them supplies or money for their efforts. This is by no means a standardized practice, and UNICEF was unable to estimate how many communities have taken on this responsibility or how much on average in monetary terms the volunteers receive. Additionally, whether the community pays the volunteer or not, for the purpose of costing the system some value should be assigned to their work. Therefore, the activities of the volunteers are included in the overall manpower and material list generated during the interviews. Costs, including estimates of person time and materials, will be calculated and included in a future publication.

MINISTRY OF JUSTICE AND CONSTITUTIONAL AFFAIRS

5 VITAL REGISTRATION

5.1 Mission, objectives, and role of health and poverty monitoring

Tanzania's vital registration system is located under PORALG. Its mission is to support the compulsory registration of all births and deaths in the country.

5.2 Indicator production & trend assessment

The vital registration system does not currently produce indicators.

5.3 Implementing agency & funding source

Local authorities implement vital registration, relying on scant local resources and little if any financial assistance from the central authorities.

5.4 Sampling strategy, size and representativeness

The coverage of vital registration in Tanzania is not known, but it is present in 72 of Tanzania's 115 districts. Coverage drops with distance from Dar es Salaam. At least one earlier assessment of vital registration coverage found it to be low in Dar es Salaam, and very low in rural areas (27).

5.5 Data collection methods & quality control

In 1979 Tanzania's vital registration system began using standardized forms support from the United Nations Population Fund. Clerks complete birth certificates and burial permits (a non-medical death certificate), and check all information upon completion. Administrators are also meant to check the information for completeness. Village and municipal authorities are intended to report to District Administrative Secretaries, who keep manually generated records and send them to the central office in Dar es Salaam.

5.6 Reporting intervals, dissemination of findings, and utilization

It is intended that monthly reports from districts be submitted to the central level. However, few districts comply or carry out reporting in a systematic way. The barriers to reporting suggested by the Office of the Administrator General include lack of funds and personnel, equipment failure, and late or incomplete reporting from lower levels.

Vital registration in Tanzania is not computerized. No records have been entered into a database for tabulation, and no routine reports have been generated on counts of births and deaths.

The Administrator General's Office indicated that data are not used for the direction of programs or policies, but that data are openly accessible as a matter of public record to anyone who wishes to consult them.

5.7 Cost estimates

The Administrator General's Office provided expenditure information broken down by recurrent costs per district, personnel costs at the national level, and printing costs at the national level. Vital registration currently operates in 72 districts at an annual total cost of TSh 638,383,127. Managers were unable to provide a reliable estimate of the start-up costs or current capital costs for the system. In addition, they were unable to estimate the population covered by Vital Registration. We did not have enough information to calculate per participant costs for this system. However, we have made crude estimates based on the assumption that the population of

72 districts represents approximately 62% of the national population, and that vital registration reaches at maximum an overall coverage of 15%. This yields a per participant cost of \$0.23. Were vital registration data to be used for national policy, the cost per capita would be \$0.02.

MINISTRY OF HEALTH

6 HEALTH MANAGEMENT INFORMATION SYSTEM, DEPARTMENT OF POLICY AND PLANNING, MINISTRY OF HEALTH (HMIS)

6.1 Mission, objectives, and role of health and poverty monitoring

The Health Management Information System (HMIS) is the foundation of the government's routine health information system. The HMIS is a facility-based system that began operating in 1993. The aims of the system include:

- Evaluating the quality and accessibility of essential services and interventions
- Assessing the impact of sectoral reforms through an integrated and functional Health Management Information System
- Optimizing the provision of strategies and guidelines on the collection, analysis, and use of information at all levels of the health system

This system covers all health facilities and provides information on morbidity and mortality, but it has the following limitations:

- Data are hospital-based with few data being generated from the community.
- Analysis by age is too broad and there is no analysis by gender. Plans are on the way to consider these aspects.
- Poor participation of private health facilities contributes to incompleteness of the data.
- There have been difficulties in processing data in a timely manner.
- High costs involved pose a threat to sustainability.

The production of routine indicators is very important because it creates information that is easy for decision-makers to use. When the data is in the form of an indicator, it is much easier to understand than raw data.

Indicators have different functions at all levels. At the facility, personnel use indicators to take immediate action, e.g., addressing outbreaks and providing immunizations when the data shows that need has arisen. At the district level, the information is used to allocate supplies and staff. At regional and national levels, indicators direct officials to provide support to districts where the greatest need for assistance exists. Indicators also direct policy guidelines, training, and the mobilization of staff.

Officials explained that when establishing the information system, they did not consider poverty a crosscutting issue. However, circumstances have changed and they now recognize HMIS as a valuable contributor to poverty monitoring.

According to the respondents, representatives from the information system have been very involved in selecting poverty indicators and assessing the availability of these indicators given existing information systems. HMIS produces indicators included in the Poverty Monitoring Master Plan and provides this data to regional planners. The medium-term expenditure framework (HMIS budget) reflects this shift in priorities, as they have planned to allocate funds toward addressing poverty monitoring.

6.2 Indicator production & trend assessment

Indicators produced by this information system include data on mortality and cause of death, but they primarily focus on morbidity and specific health interventions. HMIS surveillance also includes a brief community form to assess births and deaths that occur in the community and the availability of water. However, all other information gathered comes directly from the facilities. HMIS personnel funnel data from health facilities to district then regional officials, and ultimately national representatives.

The data collected by this information system overlaps with IDS and Village Register for some of the indicators, as well as DHS facility surveys.

Twelve of the 13 HMIS sites reported that they monitored the same population over time. One dispensary reported that they did not monitor the same population due to a lot of people migrating within their catchment area. All of the sites reported that they produce indicators on a monthly, quarterly, and annual basis, making it possible to produce both short-term (<1 year) and long-term (>1 year) trends.

Seven of the sites reported that a trend analysis had been completed for at least one of the indicators. For example, at the regional level trend reports were prepared for Malaria, TB, HIV, and family planning data.

HMIS produces 13 indicators required by the PMMP at one or more of the interviewed sites. Indicators include health interventions like immunizations and births attended by skilled birth attendants, as well as health conditions, such as proportion of malaria cases. Those indicators not produced by HMIS include absolute measures of poverty that place a percentage of the population below or above the poverty line and indicators of extremely vulnerable populations (e.g., percent of child-headed houses).

6.3 Implementing agency & funding source

HMIS is one of the core functions of the Department of Policy and Planning of the Ministry of Health and has received considerable donor support from the Danish Agency for Development Assistance (DANIDA).

6.4 Sampling strategy, size, and representativeness

The coverage of this information system is national and intended to include all public dispensaries and health centers. Twelve of the 13 HMIS sites reported that for the denominator of population-based indicators they use projections from the 1988 census data multiplied by a regional growth estimate. Respondents from one health center explained that they use population estimates from the Village Register. According to the respondents, the number of indicators produced by HMIS varied by site and ranged from four to 15 indicators. Most sites reported that they produce 12 of the 38 indicators found on Table 2.1. Table 3.2 contains a complete list of the 12 indicators reported by the majority of the HMIS sites we interviewed.

HMIS is intended to collect community-based data and calculate indicators from it. In practice, this rarely happens. The coverage of HMIS has not been measured because reporting up to the central level is uneven (18). Although it is almost certainly an over-estimate, we have used the coverage figure of 49.5% of the Tanzanian population who visited a government health facility in 2000/01 (23).

6.5 Data collection methods & quality control

HMIS personnel use Microsoft Access software to perform checks for consistency and feasibility of data. In addition, as information is funneled to the central level, HMIS personnel ensure that forms are completed properly at lower levels. If a problem is detected, personnel try to arrange for supervision and provide on-the-job training. Officials return forms for clarification when necessary. Regional and district officials use supervisory visits to ensure facilities are following guidelines and calculating indicators properly.

During the interviews, only one respondent identified ways in which HMIS measures poverty. The respondent explained that HMIS captures infant mortality, which has been shown in the literature to relate to poverty.

During ten of the 13 interviews, respondents reported that HMIS results have been cross-checked or compared with data collected by other information systems. Examples include comparisons with the Village Register, DHS, Malaria and AIDS control programs, DSS sites in overlapping areas, onchocerciasis data, and 1988 National Census data.

Interviewers asked respondents if the accuracy of their reports had been internally or externally assessed. The majority of respondents reported that they had been evaluated vigorously both internally and externally. Methods of evaluation are outlined below:

- The EPI (Expanded Program on Immunization) evaluation scrutinized immunization data.
- Data collection methods and capacity at all levels for data processing and analysis were assessed at two internal evaluations in Arusha and Tanga.
- AFROAID evaluation, funded by DANIDA, evaluated the quality and effectiveness of training
- The HERA Report looked at many aspects of HMIS performance from the timeliness of reporting to the skill level of those reporting.
- The SWAP, a Basket Fund Review, identified strengths and weaknesses of HMIS and future directions for the information system.

6.6 Reporting intervals, dissemination of findings, and utilization

HMIS reporting is intended to happen monthly, quarterly, and annually at all levels. HMIS officials indicated that late reporting from lower levels affects timely and complete reporting at the central level.

As can be seen from Table 6.1, HMIS data are heavily utilized in Tanzania.

6.7 Cost estimates

For the purpose of this costing exercise, the study team relied on the 1999 cost estimates calculated for the HMIS review conducted in 1999 (18). The review report contains total capital and recurrent costs. HMIS officials were unable to provide investigators with an estimate of the population covered by the system. Therefore, the study team made crude estimates of per participant costs based on assumptions of the total coverage of the percent of the population reporting having consulted any government source when last ill (49.5%) (23). The participant costs were \$0.13 based on this coverage assumption. Costing HMIS as a benefit to all Tanzanians yields a per capita cost estimate of \$0.06.

Additional factors should be taken into account when interpreting the HMIS cost estimates. Since 1999, HMIS has expanded its coverage to include hospitals. Several capital and recurrent costs have incurred during this period. These costs are not reflected in the costing information from HERA. Furthermore, HMIS personnel were unable to provide an accurate estimate of the number of facilities that report to HMIS. Therefore, the review had to make assumptions about the number of facilities that presently collect information based on the 1998 Health Statistics Abstract. By using the total number of facilities it appears that the review estimates the total cost of running HMIS that would be achieved in a high-participation scenario. If the participation is substantially lower than this, the actual total cost will be different. The reason is that there are fixed costs that do not change with the volume of information processed or the number of facilities reporting. Those fixed cost are, for example, the capital cost at the central and regional level and, likely, the recurrent costs at the central level, as central level staff and supplies are dedicated to HMIS work. In order to have a more accurate estimate of the cost it will be necessary to know the actual number, and percent of facilities that reports to HMIS. Lastly, the costing of capital equipment was apparently not annualized in the HERA report. This would tend overestimate the total system, per participant, and per capita costs.

Table 6.1 Utilization of HMIS data		
Type of Utilization	Finding/Indicator(s)	Result/Policy Issue
Direct Program Decisions	% of ARI in under-fives	Personnel at the district and health facility levels use this indicator to direct staff for community education, prevention and treatment.
	Prevalence of diarrhea in under-fives	Personnel at the district and health facility levels use this indicator to direct staff for community education, prevention and treatment. For example, staff provides information on building latrines for better sanitation.
	%/proportion of households with access to safe and clean water	Personnel at the district and health facility levels use this indicator to direct staff for community education, prevention and treatment. For example, this data informs local programs of community water needs including the FAST Water Program for environmental sanitation or education about digging wells.
	Infant and <5 mortality	Personnel at the district and health facility levels use this indicator to direct staff for community education, prevention and treatment. For example, staff investigates areas where rates are higher and attempts to address the root causes of the problem.
	Maternal Mortality	Although this is a relatively rare event, when it has been a problem, health facilities noted that they respond with education campaigns. For example, several women died due to the use of unsafe traditional practices, and health facilities in that area responded with community education. Additionally, this indicator has been used to show that mothers were dying because they were unable to afford the clinic visit. The findings directed a program, which aims to increase the income of mothers.
	Malaria cases for under-fives	Personnel at the district and health facility levels use this indicator to direct staff for community education, prevention and treatment. Staff responds by going directly to the community with education about ITN and environmental cleanliness.
	% TB cases or proportion TB cases completed treatment	Personnel at the district and health facility levels use this indicator to direct staff for community education, prevention and treatment. At the district level, used to know who completed treatment and if there is any drug resistance.
	Immunization rate	Personnel at the district and health facility levels use this indicator to direct staff for community education, prevention and treatment. Use indicator to help map out how to better cover all kids, for example, vaccination programs are sent to wards that did not perform well.
	Births attended by a skilled health worker	At the Hospital level, always used to direct education, At the district level, always used for planning and training of nurse midwives, and employment of more midwives when necessary.
	Prop. of <5 - Stunting and malnourished	Personnel at the district and health facility levels use this indicator to direct staff for community education, prevention and treatment. For example, high levels of Kwashiorkor resulted in educating people about a balanced diet.

Table 6.1 Utilization of HMIS data		
Type of Utilization	Finding/Indicator(s)	Result/Policy Issue
	Percent of women (15-49) using family planning	At the health facility level, the indicator is always used for this purpose. For example, found that men are a big factor in getting things working, so have outreach for both men and women. In addition, retrain nurses about family planning and birth spacing.
Allocation of Resources	% of ARI in under-fives	Personnel at the district and health facility levels use this indicator to direct the allocation of supplies for prevention and ordering medicines for treatment.
	Prevalence of diarrhea in <5	Personnel at the district and health facility levels use this indicator to direct the allocation of supplies for prevention and ordering medicines for treatment.
	% of HH with access to safe and clean water	At the health facility level, personnel send this information to the districts to build more water lines and direct the allocation of funds when there is a shortage of water.
	Infant mortality rate, <5 mortality rate	Personnel at the district and health facility levels use this indicator to direct the allocation of supplies for prevention and ordering medicines for treatment.
	Maternal Mortality	Personnel at the district and health facility levels use this indicator to direct the allocation of supplies for prevention and ordering medicines for treatment.
	Malaria cases for under-fives	Personnel at the district and health facility levels use this indicator to direct the allocation of supplies for prevention and ordering medicines for treatment, for example direct the allocation of treated bed nets.
	% of TB cases or cases completed treatment	Personnel at the district and health facility levels use this indicator to direct the allocation of supplies for prevention and ordering medicines for treatment, for example used indicator to justify the need for a new ward for isolating TB patients.
	Immunization rate	Personnel at the district and health facility levels use this indicator to direct the allocation of supplies for prevention and ordering medicines for treatment, for example at directing the allocation of vaccines, refrigerators, and manpower.
	Births attended by a skilled health worker	Personnel at the district and health facility levels use this indicator to direct the allocation of supplies for prevention and ordering medicines for treatment, for example resources for community outreach and training TBAs.
	Prop. of <5 - Stunting and malnourished	Personnel at the district and health facility levels use this indicator to direct the allocation of supplies for prevention and ordering medicines for treatment, for example the allocation of food.
	Percent of women of child bearing age (15-49) using family planning	Personnel at the district and health facility levels use this indicator to direct the allocation of supplies for prevention and ordering medicines, for example at directing the allocation of family planning methods and manpower. In addition, respondents said they would order more methods when the demand is greater.
Influence Policy Decisions	Prevalence of diarrhea in under-fives	At the health facility level, used to change hospital policy and enforce the isolation of children with severe diarrhea.

Table 6.1 Utilization of HMIS data		
Type of Utilization	Finding/Indicator(s)	Result/Policy Issue
	<p>Births attended by a skilled health worker</p> <p>Maternal Mortality</p> <p>Malaria cases for under-fives</p> <p>% TB cases or cases completed treatment</p>	<p>At the Hospital level, sometimes used for this purpose, for example, only use trained birth attendants for deliveries.</p> <p>At the Hospital level, sometimes used, if sick patient then it is the policy of the Mission to provide transport.</p> <p>At the Hospital level, sometimes used. For example, since Malaria is endemic, they made it hospital policy to sell ITN nets at a reduced price to patients.</p> <p>At the Hospital level, sometimes used for this purpose. For example, currently the treatment of TB is free, but may need to use this information to determine if the policy needs to change.</p>
Other government departments /ministries	<p>Prevalence of diarrhea in <5, Infant mortality rate, <5 mortality rate, Maternal Mortality, Immunization rate</p> <p>% of TB cases or the proportion of TB cases completed treatment.</p> <p>Malaria cases for <5</p> <p>Prop. <5 - Stunting and malnourished</p> <p>Births attended by a skilled health worker</p>	<p>The Maternal and Child Health (MCH) department requests this information at the central level. At the district level, the District Health Management Team (DHMT) always requests the information.</p> <p>At the central level, the National TB/Leprosy Program and National AIDS Control Program requests this information. The DHMT always requests this information, as well.</p> <p>At the district level, the DHMT always requests the information. At the central level, the National Malaria Control Program requests this information.</p> <p>At the district level, the DHMT always requests the information</p> <p>The Maternal and Child Health (MCH) department requests this information at the central level. At the regional level CSPD requests information.</p>
Other	<p>Infant mortality rate, Under-five mortality rate, % of ARI in under-fives</p> <p>Maternal Mortality</p> <p>Immunization rate</p> <p>Prop. of <5 - Stunting and malnourished, % HH with access to safe and clean water</p> <p>Births attended by a skilled health worker</p> <p>Malaria cases for <5</p>	<p>Integrated Management of Childhood Illness (IMCI), Integrated Disease Surveillance (IDS), Evangelical Lutheran Church Tanzania, Irish AID, UNICEF CSPD, and TFNC request this information. Additionally, students from local universities and researchers from NIMR request this information.</p> <p>IMCI and IDS request this information. Women with maternal death related to FGM were also investigated.</p> <p>Students from local universities, UNICEF, WHO, and MOH request the information.</p> <p>Tanzania Food and Nutrition Center, students from local universities and UNICEF request this information.</p> <p>UNICEF requests this information.</p> <p>Local malaria programs, UNICEF and Family Health (GTanzania) request information.</p>

7 INTEGRATED DISEASE SURVEILLANCE (IDS)

7.1 Mission, objectives, and role of health and poverty monitoring

The mission of IDS is to strengthen district-level surveillance and respond to priority diseases, integrate surveillance with laboratory support, and translate surveillance and laboratory data into specific and timely public health actions. IDS produces three of the 36 PMMP indicators on a repeated basis.

7.2 Indicator production & trend assessment

Since IDS aims to monitor and respond to the spread of infectious and chronic diseases, the production of routine indicators is fundamental to the success of the organization.

IDS will produce seven indicators every week and 13 every month. For population-based indicators, investigators use will projections for the denominator. Of the 38 indicators shown in Table 2.1, IDS produced three last year on a repeated basis. Indicators to be produced by IDS include prevalence in children under five of acute respiratory infection, diarrhea, and malaria (Table 3.2). Although this is a relatively small number of indicators, it is important to note that IDS has the specific mission of tracking infectious disease. Therefore, it would be outside the scope of their mission to produce the majority of indicators listed in Table 2.1.

IDS will have the capability to produce short- and long-term trends for the indicators produced by this information system.

7.3 Implementing agency & funding source

IDS receives support from the Ministry of Health, World Health Organization, USAID, and Centers for Disease Control.

7.4 Sampling strategy, size, and representativeness

Representativeness of the data collect by IDS is currently limited to facilities. The coverage of IDS is proposed to expand beyond facilities, in order to capture information that is necessary to trigger a public health response or a change in current programming. The IDS system plans to cover all twenty-one regions of Tanzania.

7.5 Data collection methods & quality control

The Infectious Disease Week Ending (IDWE) initially began under the WHO notifiable diseases program during the colonial era, even before Tanzania gained independence in 1961. IDWE was a weekly facility-based surveillance system, which is being replaced by IDS. Currently, there are seven IDS-reported diseases (cholera, cerebro-spinal meningitis, plague, bacterial dysentery, measles, yellow fever, and acute flaccid paralysis). In the future IDS will cover 13 priority diseases, with information on seven outbreak-prone diseases collected weekly and the other six diseases reported monthly. IDS is currently in the developmental stages and has begun tracking disease rates in districts throughout the country. Managers funnel IDS data from facilities to the district health management team, who reports to the regional health team, who reports to the central office. Within the new IDS system, data will be analyzed for trends and possible outbreaks at each level.

When asked to explain mechanisms of quality control for reporting and analysis of data, respondents explained that at the beginning of each week directors check the reports for consistency. They compare the results with those from the week before to see if they are feasible.

Interviewers asked if the data collected by IDS have been internally or externally compared with the results of other sources of demographic, health, and poverty information. Respondents indicated that they have crosschecked their data with HMIS data.

Interviewers asked if the accuracy of IDS reports had been internally or externally assessed. Respondents reported that CDC and USAID carried out a review of IDS in 1998 to determine the strengths and weaknesses of the program and to propose a better way of generating data and tracking disease.

7.6 Reporting intervals, dissemination of findings, and utilization

Weekly and monthly reports are written at the facility, district, regional, and national levels. At the central level, monthly reports are sent to WHO. Respondents reported that this year WHO has also requested weekly reports.

Tallies for diseases to be reported weekly are sent from the facility to the district every Wednesday, from the district to the region every Thursday, and from the region to the MOH every Friday. They are also channeled to WHO country office the same day. The monthly IDS report includes all the 13 priority diseases. This report is sent to the district before the tenth day of the following month. The district compiles and sends the report to the region within the second week and from region to ministry in the third week. The IDS focal person who receives the reports from the facilities is the District Health Office at district level, and the Regional Health Officer at the regional level.

7.7 Cost estimates

IDS is a fairly new system, therefore managers provided their financial plan for implementing the system for the next three years rather than providing an expenditure report. Based on this report, investigators calculated the annual cost for 2001. IDS expects to receive reports from most health facilities in Tanzania. Because the system is still in the process of being established, it was not possible to develop coverage estimates. Therefore, we elected to calculate IDS coverage using the same assumptions as for HMIS. Per participant costs were estimated at \$0.26 based on the 49.5% coverage assumption. We estimated annualized per capita costs to be \$0.13.

7.8 Utilization and dissemination

Respondents explained that the primary use of the data collected by IDS is to monitor and respond to trends in the incidence of infectious diseases. This information directs program decisions, allocation of resources, and policies at all levels. Specifically, the data inform health officials of outbreaks and direct interventions. Aside from the Ministry of Health, the Ministry of Water and the Ministry of Agriculture always request the information collected by IDS.

8 NATIONAL SENTINEL SYSTEM OF LINKED DEMOGRAPHIC SURVEILLANCE SITES FOR HEALTH AND POVERTY MONITORING (NSS): IFAKARA DEMOGRAPHIC SURVEILLANCE SYSTEM

8.1 Mission, objectives, and role of health and poverty monitoring

This population-based longitudinal DSS began in 1996, as part of the Ifakara Health and Research Development Centre (IHRDC). Investigators at IHRDC established the DSS in response to a research need for baseline characteristics of their study population. The mission of the DSS is to assist IHRDC by fulfilling the following objectives:

- Document births, deaths, migrations and socio-economic information
- Evaluate interventions, especially for malaria programs
- Identify epidemics when observing outbreaks or excessive mortality
- Promote the use of information by local officials for policy formation and planning purposes
- Provide a framework for innovation in population-based health research in conjunction with other DSS sites
- Promote the use of information for better health at the local, national, and international levels

Although Ifakara DSS was not primarily designed to monitor poverty, researchers do track socio-economic status (SES) of the population and individual households. The purpose of tracking SES stems from the origins of the DSS itself. This information system initially functioned to answer a specific research question—Did mortality due to malaria change after social marketing efforts began to introduce treated bed nets in the community? Several explanatory variables were considered in the analysis, including the effects of SES on bed net acquisition. Researchers hypothesized that those financially better off would obtain bed nets more quickly. However, they found that the increase, if compared to the same level of household income before and after the intervention, was similar among those in the low-income group to those in the high-income group. The DSS data demonstrated that the program benefited both low- and high-income households.

Ifakara DSS has the potential to show smaller changes in parameters of interest than many other study designs. In addition, with the type of data collected by the information system, researchers are able to monitor the same population over time and observe characteristics that are not easily exposed otherwise.

Ifakara DSS measures the degree of poverty at the district, village, and household levels. Investigators determine a relative measure of poverty through information on household assets, wasting and stunting of children, unemployment, and education rates. Respondents explained that in the future they plan to track sources of medications (e.g., anti-malarial drug) with GIS mapping to evaluate distance traveled to services.

With the advent of the Poverty Monitoring Master Plan (PMMP) came a list of indicators intended to measure change in equity throughout Tanzania. Of the 36 PMMP indicators relating to health and human capabilities, Ifakara DSS measured 25 indicators. These indicators include various socio-economic characteristics such as girl/boy ratio for primary education, mortality rates of infants and children, and indicators of health. Those indicators not produced by Ifakara DSS include absolute measures of poverty that place a percentage of the population below or

above the poverty line and indicators of extremely vulnerable populations (e.g., percent of child-headed houses).

8.2 Indicator production & trend assessment

The production of routine indicators plays an essential role in fulfilling the mission of Ifakara DSS. Data are used to evaluate the success of interventions and to influence health policies. The manager at Ifakara DSS noted that since their system primarily researches how programs cause changes in the health of the population (e.g., burden of malaria), valid and reliable estimates for indicators of health and poverty are essential.

Indicators measured on a routine basis comprise an essential element of their information system role in the community. They provide district and village authorities with newsletters covering key indicators useful for planning. For example, district-level authorities receive information on a variety of characteristics including the distribution of and access to health facilities, and village leaders obtain information on the number of households with access to water and toilets. Additionally, population counts by age and gender help communities plan for adequate space for children in schools

Ifakara DSS produces indicators every four months with a census. For population-based indicators, investigators update the denominator each time the census is completed. Of the 38 indicators shown in Table 2.1, Ifakara DSS produced 25 last year. Of those, investigators produced seven indicators once and generate 18 indicators on a repeated basis each year. Respondents noted that, due to the large sample size of their surveillance population, they are able to produce robust estimates for their indicators. Table 3.2 contains a list of the indicators produced by Ifakara DSS. Indicators produced on a repeated basis fall under a wide spectrum of topics from unemployment rates to the percent of TB cases completing treatment. Since one of the primary purposes of the DSS is to support IHRDC, the DSS has been flexible about adding additional questions to their census whenever a research study requires further information. For example, researchers measured infant and child mortality, percent of ARI and diarrhea in under-fives, and the percent of children fully immunized for the Integrated Management of Childhood Illness (IMCI) evaluation of Tanzania.

The system produces repeated measures that can be used for trend analysis. Short-term trend analyses measuring changes in events over the course of one year have also been carried out. For example, researchers analyzed the relationship between food shortage and increased mortality. Similarly, investigators produce long-term trends over multiple years. For example, they tracked respondents for three years to evaluate trends in treated bed net acquisition and malaria.

8.3 Implementing agency & funding source

The National Institute for Medical Research and Swiss Tropical Institute are the implementing and funding agencies for Ifakara DSS. USAID, CDC, and WHO have also provided study-specific support.

8.4 Sampling strategy, size and representativeness

Based on their proximity to IHRDC, researchers sampled Kilombero and Ulanga districts for the DSS population. Investigators then selected a convenience sample of 26 villages along the valley within the selected districts; most people live along the valley and are therefore more accessible. Within these villages, researchers included every household. Each time indicators are produced, the population from which the sample is drawn is the same. The coverage of this information system amounts to a population of 66,000 people under surveillance.

8.5 Data collection methods & quality control

Researchers at Ifakara DSS conduct a census with accompanying survey of their population three times per year and have used verbal autopsy to determine cause of death since 2000. Ifakara DSS uses seven main techniques for quality control. New data collection forms are forward translated from English into the language of the respondents. The forms are then translated back into English. Whenever the original form and the back translated forms do not match up, researchers investigate a clearer way to ask the questions that takes into account the nuances of the languages. Next, the respondent reported that researchers perform internal checks of the data. This includes checks for completeness, consistency, and legibility of the data. Thirdly, inconsistencies in the data are clarified in the field and fourthly, a sample of ten percent of the households originally visited is re-interviewed. At the time of the re-interview researchers do not have access to the original data, but use a copy that contains intentional random errors that they should detect and correct. The fifth quality-control measure performed at Ifakara DSS involves keying the data twice; two data entry staff input the same data into two separate files. A comparison program detects discrepancies between the files, and researchers rectify the differences. Ifakara DSS also uses HRS software to perform logical checks of the feasibility of responses. Examples include ensuring that a male respondent is not recorded as pregnant or that the date of a person's death does not precede the date of her birth. HRS is a software package that performs these checks and rejects forms containing misinformation. Data entry personnel are informed that the value they have entered is invalid and must be addressed before the record can be added to the file. Lastly, the staff attend weekly meetings to discuss the quality of the data and any concerns they have about specific forms.

Ifakara data have been cross-compared with data from the previous national census, and will be cross-compared again when the 2002 census data become available.

A variety of reports produced by the system have been rigorously evaluated. Internally, research projects provide an annual crosscheck of data quality. Internal reviewers select a sample of individuals on the demographic register and re-interview respondents; these reviewers work at IHRDC but do not routinely collect the demographic information.

8.6 Reporting intervals, dissemination of findings, and utilization

Ifakara DSS prepares and submits two annual reports to the central level of the Ministry of Health. The first report contains IHRDC research results, which includes information about the DSS, and the second presents the overall demographic information collected. At the DSS level, investigators write quarterly reports for internal use. For the two districts under surveillance, investigators assimilate quarterly reports of district-level demographic and health information, which are provided to district health and planning officials. Lastly, researchers prepare quarterly and annual reports for the villages under surveillance. Village leaders receive these reports, which contain the demographic information for their village. When asked to identify barriers or constraints when preparing and submitting reports, respondents noted that equipment, supplies, late reporting, and incomplete reports are never a problem. Furthermore, Ifakara is a stand-alone research facility, which does not require reporting compliance from lower levels. The respondent explained that the only possible problem for Ifakara DSS is that the sheer volume of information produced is greater than the demand for the information.

Interviewers asked respondents if the data they collect are always, sometimes, or never used for the following: 1. To direct the allocation of resources, 2. To direct program decisions, 3. To direct policy decisions, 4. To inform other departments or other ministries of their findings, and 5. To

inform non-routine studies. When respondents indicated that the information is always or sometimes used for any of these purposes, they were asked to identify examples of utilization.

8.7 Cost estimates

The study team received budget information for the year July 2001/June 2002 for personnel and capital investments and operating expenses. We did not receive a report on expenditures. Therefore the capital investments are not annualized. The population estimate was taken from the Ifakara DSS census for the year 2001. The resulting estimated cost per participant is \$3.08, and \$0.01 per capita.

Given the comparatively restricted geographic coverage of DSSs and concerns from some quarters about representativeness of indicators derived from such systems (28), it may be argued that it is not appropriate to cost DSS on a per capita basis. The Tanzanian experience, however, suggests that DSS (and the coordination of several DSS activities in particular) can be reasonably thought of as a national information system. First, all DSSs in Tanzania contribute to the NSS, which, in turn, is used for national M&E efforts. Second, much formative, operational, and programmatic research is undertaken in DSS sites. Findings from this research often influences program decisions, if not stated policy. Examples include social marketing of insecticide treated nets, evaluation of the Integrated Management of Childhood Illness, and the proportion of children dying from acute febrile illness/malaria who received treatment at formal health care facilities.

Table 8.1 shows the range and type of utilization of the outputs of Ifakara DSS.

Table 8.1 Utilization of data from Ifakara DSS		
Type of Utilization	Finding/Indicator(s)	Result/Policy Issue
Guide resource allocation	Assets ownership indicator	Provide to health facilities to challenge them to reach the poor with services
Influence policy decisions	Participation in the multi-country evaluation of the integrated management of childhood illness (IMCI). The data provided by ifakara DSS for this study included infant and child mortality, percent of ari and diarrhea in under-fives, and the percent of children fully immunized. Asset ownership and bed net ownership data	Evaluation of innovative measures for managing childhood illness. Discussions with the Vice President of Tanzania about scaling up ITN (treated bed nets) for malaria control
Information to other departments, ministries, non-routine studies	Asset ownership Infant mortality rate, under-five mortality rate, maternal mortality rate, proportion of malaria cases for under 5 years or malaria in-patient case fatalities for children under five, births attended by a skilled health worker, percent of women of child bearing age (15-49) using family planning	Information was requested by the District Development Office in reference to the condition of the roads. Provided to the districts on a routine basis
Direct program decisions	Information on the girl/boy ratios in school, school enrolment rates and literacy rates Only 33% of the poorest people receive Malaria treatment when ill Unemployment rates High mortality during famine	Planning District health and pharmacies alerted of this finding are now selling medications at reduced rates to this population. Establishment of a system for treating the unemployed who lack money to pay for services. Caritas and World Food Program used data to get food to the areas that had a food shortage.
Other uses	Prevalence of malaria	CDC used information for an evaluation of whether malaria combination therapy delays the development of malaria.

9 NSS: RUFJI DEMOGRAPHIC SURVEILLANCE SYSTEM (RUFJI DSS)

9.1 Mission, objectives, and role of health and poverty monitoring

Since 1998, the Rufiji Demographic Surveillance System (Rufiji DSS) has served as a population-based longitudinal DSS. The mission statement of this information system is to provide service, monitoring and evaluation research, and capacity building. Rufiji DSS aims to:

- contribute to the development of the new Tanzania National Sentinel Surveillance (NSS) System
- provide a platform for high-quality household survey data for operational field trials of health and socio-economic interventions in rural populations
- provide a platform for training in applied field research and practical health, socio-economic, and demographic survey methods

Although not contained in its mission statement, poverty monitoring is an implicit aspect of Rufiji DSS's goals and objectives. Given that so many of the poverty monitoring indicators have to do with health and survival outcomes, Rufiji DSS will be able to produce several of them on a routine basis. Poverty status is measured in Rufiji DSS using an "asset list" approach. Assets that are owned by the household are analyzed using principal components analysis and used to generate poverty quintiles for socio-economic status. The technique provides relative, rather than absolute, measures of poverty and socio-economic status. These quintiles are related to various health outcomes and to health service coverage.

Some poverty monitoring questions will be asked during each census, such as how many times people eat and what type of food. The information system will measure the assets index indicator once again, but it will also introduce new questions to better understand the level of food security. Rufiji DSS is also investigating the relationship between acquisition of bed nets and poverty, and the relationship between different diseases and socio-economic status.

The permanent professional staff at Rufiji DSS and the full-time operation approach makes the information system highly flexible to respond quickly to new research questions. Since the basic system is already in place, the marginal costs of adding questions on new topics to subsequent update rounds are low. For example, a full food security section has been added to the questionnaire to be implemented in a future census round. "Piggy-backing" such modules on routine cycles of data collection is much more cost-effective than mounting separate, nested household surveys.

Of the 36 PMMP indicators relating to health and human capabilities, Rufiji DSS measured 17 last year. These indicators included socio-economic characteristics such as households with access to safe and clean water, mortality rates of infants and children, indicators of extremely vulnerable populations (e.g., percent of child-headed houses).

9.2 Indicator production & trend assessment

The production of routine indicators plays an essential role in fulfilling the mission of Rufiji DSS. Investigators need this information for planning and providing data and feedback to the district council health management teams for planning purposes. Rufiji DSS times the production of the annual reports to fit in with annual planning cycles, and it also conducts community feedback sessions at this time of year. This feedback is tailored to local needs and is presented in an easily comprehended format for the community. For example, the community needs information about the age of children for the purpose of knowing how many children are eligible for school. The

community may also request data on other variables, including the number of households that have toilets in the village. Each year investigators meet with key informants (village leaders) in the community to disseminate information. Last year they had a two-day workshop with a large group of teachers, counselors, and other stakeholders in the community to disseminate information and discuss potential uses for the findings. Indicators produced by Rufiji DSS are also used at presentations and workshops.

Rufiji DSS produces indicators every four months, coinciding with the census update rounds. For population-based indicators, investigators update denominators each time an update round is completed. Of the 38 indicators shown in Table 2, Rufiji DSS produced 17 last year; nine additional indicators could be calculated using data that Rufiji DSS routinely collects. Rufiji DSS is planning to do a sample survey of the population three times per year to produce stunting and wasting indicators to assess food security, and will also measure the ratio of reserves to monthly inputs for food security as well.

The Rufiji DSS has been in operation for three years, but long-term trend assessment is envisioned as part of the future output.

9.3 Implementing agency & funding source

Rufiji DSS was established by the Ministry of Health's Adult Morbidity and Mortality and Tanzania Essential Health Interventions Projects (AMMP-2 and TEHIP). AMMP-2 is supported by the UK Department of International Development (DFID) and implemented in partnership with the University of Newcastle upon Tyne. Canada's International Development Research Centre and the UK Department for International Development (DFID) financially and technically supports TEHIP. The Ifakara Health Development and Research Centre (IHDR) plans to assume responsibility for the Rufiji DSS at the conclusion of TEHIP in 2003.

9.4 Sampling strategy, size, and representativeness

Rufiji District was selected by TEHIP through a consultative process that included a number of stakeholders, including the Tanzanian government, WHO, and the World Bank. The DSS was established as part of TEHIP's impact evaluation strategy for monitoring the effects of support to district health system capacity strengthening. Because of its coastal location, it was also felt to represent an important addition to the National Sentinel Surveillance system of linked DSSs that was being established under AMMP. Rufiji district is also an area that has been somewhat neglected by donors. The enumeration area is a sub-section of the district and was selected to include urban, peri-urban, rural, and river delta areas. Investigators included a complete enumeration of 14,000 households within 32 villages, accounting for 82,355 people.

9.5 Data collection methods & quality control

Rufiji DSS operates the "Household Registration System" of DSS that is also used in the DSS operated by the IHDR. Researchers conduct a census three times per year of all people who have resided in the surveillance area for at least four months before each census round. Rufiji DSS has used verbal autopsy to determine cause of death since 1999. Rufiji DSS produces a number of socio-demographic and health indicators.

Rufiji DSS uses several quality-control measures in all areas of work, from questionnaire development to reporting. For example, all new data collection tools are translated and back translated between English and Swahili and rigorously piloted to ensure reliability.

The accuracy of Rufiji DSS outputs has been assessed through cross-comparison to other data sources. A rigorous assessment, including the application of balancing equations and cross-comparison with data from other Tanzanian DSS sites, has been carried out in connection with the evaluation of the impact of the Integrated Management of Childhood Illnesses intervention. Results are also compared with rural point estimates for various indicators from the Demographic and Health Surveys. Like other DSS sites, the Rufiji DSS assumes that it has little sampling and measurement error for the surveillance area given the intensity of the data collection activities.

9.6 Reporting intervals, dissemination of findings, and utilization

Reporting strongly supports the mission of Rufiji DSS to provide valuable information to all levels of government and the local community. In order to inform individuals of progress concerning the burden of disease and the demographics of their community, Rufiji DSS provides semi-annual newsletters to each household on their registry. Additionally, they provide each health post with village-specific data for planning and policy purposes including the allocation of resources and program decisions.

On a monthly basis, Rufiji DSS creates financial and technical reports for their donor. The DSS presents a formal annual report to the district government and sends the same report to the regional administration and Ministry of Health. This report provides pertinent information for the coastal region relating to the burden of disease and socio-demographic characteristics of the population. Table 9.1 shows the utilization of data from the Rufiji DSS system.

9.7 Cost estimates

Rufiji DSS provided a budget that was created by the donor-funded Tanzanian Essential Health Interventions Project (TEHIP) as part of a funding proposal for the INDEPTH Network. INDEPTH is an international network of field sites with continuous demographic evaluation of populations and their health in developing countries. The proposal aimed to acquire more funding for DSS sites in many developing countries. The INDEPTH costing methodology considers both recurrent and capital costs to produce an approximate annual running cost. Capital costs are annualized over an estimated five useful years per item. The population estimate was taken from the Rufiji DSS 2001 census. The resulting cost per participant is \$2.44, and per capita costs of \$0.01.

Table 9.1 Utilization of Data from Rufiji DSS		
Type of Utilization	Finding/Indicator(s)	Result/Policy Issue
Guide Resource Allocation	Burden of disease reporting tool that links the burden of disease to expenditures at the district level	Use district health expenditure mapping. See if they are allocating their money where the burden of disease is the greatest. Use link to plan where to put additional resources in the future. Shows how districts can use DSS data.
Influence Policy Decisions	Malaria infection rates and assets ownership indicators	At the central level influence ITN for malaria control since poor unable to buy nets and shown to have the lowest coverage. Voucher established as a targeted subsidy to the poor.
Information to other departments, ministries, non-routine studies		Health Management Information System asks for 11 indicators annually. Used data for the Global Health Fund for ITN voucher system (non-routine). Sharing tool development for new methods, e.g., equity, food security, rainfall specific data. IMPACT study – value of combination therapy for malaria. Adult IMCI – design intervention package for adults. Presentations including the malaria conference in Durban. Global Health Fund – Tanzania received 19.9 million dollars and the DSS results led to the mobilization of these funds.

10 NSS: DEMOGRAPHIC SURVEILLANCE SITES AT DAR ES SALAAM, HAI, IGUNGA, KIGOMA URBAN, AND MOROGORO, SUPPORTED BY THE ADULT MORBIDITY AND MORTALITY PROJECT

10.1 Mission, objectives, and role of health and poverty monitoring

The Adult Morbidity and Mortality Project, Phase-2 (AMMP-2) is a population-based longitudinal demographic and cause-specific mortality surveillance system established in 1992. The mission of AMMP-2 is to provide demographic, health, and poverty information to the Ministry of Health and other district partners to aid in planning, priority setting, and policy development. The main objectives of AMMP-2 are to:

- Support the aims of health sector reform by assisting the Ministry of Health and District Health Managers to collect, manage, analyze, and use burden of disease and poverty information using demographic and cause-specific mortality surveillance methods
- Enhance the capacity of the Ministry of Health to carry out the co-ordination and management of a “National Sentinel System” of linked demographic surveillance systems for health and poverty monitoring (NSS)
- Disseminate data to key users both in and outside of the health sector
- Ensure Ministry of Health capacity to carry out DSS work using methods, tools, and software developed under the project

Poverty monitoring is carried out using a validated Consumption Expenditure Proxy (CEP) tool developed by the project. By asking a few questions on housing conditions, household size, asset ownership, and consumption patterns, the tool gives an estimate of consumption expenditure per adult equivalent that is highly accurate in distinguishing houses above and below the basic needs and food poverty lines. The tool allows production of common poverty indicators such as the headcount ratio that can be related to mortality and health service use outcomes, which are also collected in the DSS.

The AMMP-2 CEP tool was developed and validated using data from the 2000/2001 National Household Budget Survey. Household Budget Surveys are considered to be the gold standard in measuring income poverty in developing countries. In the 2001 census update rounds, CEP data were collected from all households participating in DSS. In addition, all new households are interviewed using the CEP tool and their data are included in analysis. It is planned to revise the CEP tool and update the CEP data from all households following the next national household budget survey planned for 2005.

With the advent of the PMMP came a list of indicators intended to measure progress in meeting the goals stated in the national Poverty Reduction Strategy Paper. Of the 36 PMMP indicators relating to health and human capabilities, AMMP-2 measured 19 indicators (29). These include various socio-economic characteristics such as the girl/boy ratio in primary education, mortality rates of infants and children, and the “headcount” ratio of the population below and above the poverty line.

10.2 Indicator production & trend assessment

AMMP-2 generally produces the indicators required for monitoring and planning once per year. For population-based indicators, investigators update the denominator each time the census is completed. Of the 38 indicators shown in Table 2.1, AMMP-2 produced 19 last year. Of those, investigators produced three indicators once and generate 16 indicators on a repeated basis. Table 3.2 contains a list of the indicators produced by AMMP-2.

Indicators produced on a repeated basis fall under a wide spectrum of topics from life expectancy to the number of births attended by a skilled health worker. Indicators that have been produced once include headcount ratio for the basic needs poverty line

Because AMMP-2 is intended to serve as a tool for monitoring progress toward the goals of health sector reform and poverty reduction, producing indicators is a central task of the project. Routine annual reports containing indicators include:

- “Annual District Book” digests of demographic and mortality burden information at the village, division, and district level are produced to coincide with annual planning cycles and production of comprehensive district health plans.
- “Burden of Disease Profiles” are presentations of proportional mortality grouped by “intervention addressable shares.” They are produced to coincide with annual planning cycles and production of comprehensive district health plans.
- Reports about the major findings of surveillance work are made to all households annually in the form of newsletters that are distributed shortly in advance of each census update round.
- AMMP-2 contributes routine sections to the production of the Ministry of Health’s annual Health Statistics Abstract and several indicators to the annual Public Health Sector Performance Profile.
- Annual National Mortality Burden Estimates are produced as a complementary report to the district Burden of Disease Profiles.

AMMP-2 also contributes key indicators to reports produced by the Routine and Administrative Data Systems Technical Working Group in the National Poverty Monitoring Master Plan.

Because DSS systems involve longitudinal monitoring of dynamic cohorts, trend analysis for communities and population subgroups can be performed. To date, trends have been analyzed in maternal mortality, AIDS/TB, acute febrile illness, and measures of total mortality and life expectancy.

10.3 Implementing agency & funding source

AMMP-2 is a project of the Tanzanian Ministry of Health, and the local and municipal councils of Hai, Morogoro, Igunga, Ilala, Kigoma Urban, and Temeke. The project is funded by the UK Department for International Development (DFID) and implemented in partnership with the University of Newcastle upon Tyne. The Ministry of Health and local councils have planned to assume primary responsibility for the DSS sites upon the conclusion of AMMP-2 conclusion in 2004.

10.4 Sampling strategy, size, and representativeness

The AMMP-2 DSS was established under the project’s first phase (AMMP-1), which was primarily a research study focused on non-communicable disease transitions in Tanzania. The districts where DSS was established were originally selected because they were felt to represent a diversity of urban and rural poverty and living conditions. These districts were Hai District (Kilimanjaro region), Morogoro District (Morogoro Region), and Temeke and Ilala Municipalities (Dar es Salaam region). Within selected districts, a contiguous set of villages was chosen in order to include approximately 100,000 people in each sample. All residents within these villages are included in a dynamic cohort. In order to increase representativeness of the linked DSS sites in Tanzania, surveillance was extended to two additional sites: Igunga District

(Tabora Region), and Kigoma District (Kigoma Region). By 2003, a population of approximately 500,000 was covered by AMMP-2 demographic and cause-specific mortality surveillance.

10.5 Data collection methods & quality control

District authorities conduct annual census update rounds in Igunga, Hai, Kigoma, and Morogoro districts and a twice-yearly update rounds in Dar es Salaam. A continuous mortality surveillance system operates in parallel to the demographic surveillance work. This system is used to determine probable cause of death through the application of verbal autopsy interviews. Income poverty status in AMMP-2 areas is assessed using a validated poverty proxy tool to estimate consumption expenditure per adult equivalent for each household in the DSS area.

10.6 Reporting intervals, dissemination of findings, and utilization

The AMMP-2 central office compiles reports annually for the central, district, village, and household levels upon collection and entry of annual census round.

The DSS supported by AMMP-2 is fully integrated into District structures and is under the management of local councils through the District Executive Directors and District Medical Officers. Health system staff members are responsible for collecting mortality data and must cover large geographic areas. Those assigned to mortality data collection are sometimes unable to collect and process the verbal autopsy data in a timely manner.

The project supports the production and distribution of annual reports and newsletters to the central, district, village, and household levels for all sites. In addition, for Dar es Salaam, a second household newsletter is disseminated after the mid-year census round.

Data from both phases of AMMP have been used in numerous national and international reports for the Ministry of Health and civil society groups. AMMP Data are also frequently sought by WHO and the US Centers for Disease Control for inclusion in regional burden of disease estimates. Many conference papers, book chapters, working papers, and peer review publications have come out of the project. Table 10.1 summarizes utilization of data from AMMP Phases 1 and 2.

10.7 Cost estimates

AMMP-2 provided costing information in the same format as the Rufiji DSS budget. The costs were broken down by site (Dar es Salaam, Hai, and Morogoro) and AMMP-2 confirmed that the costings were based on average historical expenditures for the system. We combined all of the sites to obtain an overall per participant and per capita cost for AMMP. The average cost per DSS site was \$96,049, with annualized per participant and per capita costs of \$0.83 and \$0.003, respectively.

Table 10.1 Utilization of Data from AMMP		
Type of Utilization	Finding/Indicator(s)	Result/Policy Issue
Allocation of Resources	All indicators produced by AMMP-2	Provided annually to districts for use in the production of annual district plans.
Direct Program Decisions	Percent of households with access to safe and clean drinking water	Morogoro – Water project started partly on information from AMMP, SMITTEN (Social Marketing of Insecticide Treated Nets) and CARE Malaria Project (DAR) requested this information to direct their programs.
Influence Policy Decisions	Percent of ARI in under-fives Prevalence of diarrhoea in under-fives Proportion of Malaria patients to complete treatment Cause of death Infant mortality rate Under-five mortality rate Life expectancy	At the central level, these indicators are always reported on an annual basis to the Public Health Sector Performance Profile. Used to inform the change of treatment for Malaria from Chloroquin to Fansidar. At the central level, it is always reported on an annual basis to the Public Health Sector Performance Profile.
	Births attended by a skilled birth attendant	At the central level, it is always reported on an annual basis to the Public Health Sector Performance Profile
Other Government Departments/Ministries	Percent of ARI in under-fives Prevalence of diarrhea in under-fives Infant mortality rate Under-five mortality rate Life expectancy	PORALG requests the information. At the central, regional, district and village levels always used. At the central level the information is reported to the National Poverty Monitoring Program. At the regional, district, and village levels it is a routine output for the NSS.
	Proportion of orphans Proportion of children in the labor force Proportion of children in the labor force and not going to school	At the central level, the National Poverty Monitoring Program always uses these indicators.
Additional Research	AMMP experience with Verbal autopsy AMMP-1 Report Cause of death data AMMP health data Disease-specific data Infant and child mortality data Headcount ratio for – basic needs poverty line Headcount ratio for – basic needs poverty line (rural)	Expansion of UNICEF districts to 10 for mortality surveillance. Used frequently as reference publication for other studies. The Heat Waves project is looking at the relationship between weather and mortality. Global Burden of Disease book contains AMMP data. Muhumbili hospital staff uses the data to help understand the health problems of youths. The Global Health Forum and WHO request information on specific diseases. Supported the multi-country IMCI evaluation. At the central, regional, district, and village levels always used for poverty monitoring. At the central level the information is reported to the National Poverty Monitoring Program and Technical Working Group (TWG) on routine and administrative data. It will also be reported to the Ministry of Health. At the regional, district, and village levels it will be used in reports for sentinel sites.

Table 10.1 Utilization of Data from AMMP		
Type of Utilization	Finding/Indicator(s)	Result/Policy Issue
	Asset Ownership (as a proxy for income poverty)	Other Specify: At the central, regional, district and village levels always used for poverty monitoring.
	Unemployment rate	At the central level the information is reported to the National Poverty Monitoring Program and Technical Working Group (TWG) on routine and administrative data. It will also be reported to the Ministry of Health. At the regional, district, and village levels it will be included in annual reports from 2002. Working paper (copy available) on feasibility of producing indicators using AMMP/NSS data.
	Girl/boy ratio in primary and secondary education	Working paper (copy available) on feasibility of producing indicators using AMMP/NSS data.
	Percent of HH w/access to safe and clean water	Working paper and publication in progress
	Proportion of elderly living in a HH where no one is economically active	Working paper and publication in progress
	Percent of ARI in under-fives	Working paper and publication in progress
	Prevalence of diarrhea in under-fives	Working paper and publication in progress
	Maternal mortality rate	Working paper and publication in progress
	Proportion of orphaned children	Working paper and publication in progress
	Proportion of children in the labor force	
	Proportion of children in the labor force and not going to school	

11 NSS: DEMOGRAPHIC SURVEILLANCE SYSTEM AT TANZANIA AND NETHERLANDS SUPPORT AIDS RESEARCH CENTER (TANESA)

11.1 Mission, objectives, and role of health and poverty monitoring

Since 1994 this population-based longitudinal DSS site has operated under the larger TANESA (Tanzania and Netherlands Support AIDS) Research Center. The main objective of TANESA is to reduce HIV transmission by contributing to the development of interventions, primarily at the district level. For example, investigators carry out evaluations of HIV/AIDS interventions and assessments of the impact of the epidemic in the community at large. The DSS at TANESA supports the Research Center by providing baseline data on the population and producing both demographic and health-related indicators on a repeated basis.

Of the 36 PMMP indicators relating to health, survival and human capabilities, the DSS at TANESA measured six indicators last year. These indicators included enrollment and dropout rates for primary education, proportion of orphaned children, HIV prevalence, and the percent of women using family planning.

11.2 Indicator production & trend assessment

Producing routine indicators is essential to the DSS at TANESA. The data collected by the DSS are used primarily to provide baseline characteristics of the population, and to evaluate the success of interventions and direct HIV/AIDS programs in the community.

DSS at TANESA uses projections of the population to update the denominator when calculating population-based indicators for most wards. For one ward, the denominator is measured directly. Of the 38 indicators shown in Table 2.1, DSS at TANESA produced five last year on a repeated basis and generated one indicator for the first time. Table 3.2 contains a list of the indicators produced by the DSS at TANESA. Indicators produced on a repeated basis range from primary school enrollment rates to the prevalence of HIV infection among antenatal clinic (ANC) attendees. Since TANESA aims to evaluate the effects of HIV/AIDS on the community, the proportion of orphaned children in the community was recently introduced as an indicator for routine measurement.

Data quality is assured through a series of internal checks and by management overview. These checks include re-testing samples to ensure correctness, data cleaning checks, and verifying data for reports. The data are recognized to be of high quality. In addition to serving as the basis for reports on the status of the HIV epidemic and the evaluation of interventions, the data have been used for numerous peer-review publications and conference papers. Methods for extrapolating district-level HIV prevalence from ANC data used by TANESA have been cross-compared for plausibility with those used in Uganda. Given that repeated measures of the same population are taken over time, TANESA is able to calculate and analyze trends. Investigators produce long-term trends over multiple years of school enrollment, contraceptive use, and HIV prevalence.

11.3 Implementing agency & funding source

TANESA has three local collaborating institutions: the Regional Medical Office, the National Institute for Medical Research (NIMR), and the Bugando Medical Centre. The Royal Netherlands Ministry of Development Cooperation funds TANESA.

11.4 Sampling strategy, size, and representativeness

Cluster sampling was used to select areas within the district for inclusion in the DSS. Villages within the clusters were selected at random. TANESA is interested in obtaining information from

both urban and rural health facilities as well as from the community. They selected a sample of facilities for inclusion based on a series of selection criteria. For household-level indicators, all households within the selected villages are included in the sample. The coverage of this information system includes parts of Mwanza region (Northwest Tanzania), and 23,000 people in Kisesa District participate in surveillance.

11.5 Data collection methods & quality control

The DSS monitors the community through demographic surveillance methods, repeated epidemiological surveys, and multiple socio-behavioral studies. Most studies collect data from individual, community, and health facility levels. In addition, investigators carry out verbal autopsies (VA) for all deaths in participating communities. The DSS at TANESA is the only information system included in this study that generates HIV seroprevalence data, which is collected once every two to three years. This HIV surveillance is part of TANESA's main mission. Certain data collected by this information system are also collected in DHS modules.

11.6 Reporting intervals, dissemination of findings, and utilization

The DSS at TANESA produces quarterly and annual internal reports for the senior management committee of the Research Center. TANESA generates external reports for the National AIDS Control Programme (NACP) and the Ministry of Health. Reports are disseminated through local dissemination workshops and activities, and numerous academic articles have been produced by TANESA researchers using the DSS data. Table 11.1 summarizes utilization of data from TANESA.

11.7 Cost estimates

TANESA reported total expenditures of TSh 21,000,000 over two years for operating demographic surveillance, including the cost of HIV testing for 8,000 blood samples. Therefore, this amount only covers recurrent costs and does not include capital costs. TANESA derives estimates of HIV prevalence from pregnant women using Voluntary Testing and Counseling. The research ethics necessitate the provision of treatment to women who are found to be HIV-positive. This adds another TSh 3,000,000 to operating the information system. The resulting annualized cost estimates are \$0.51 per participant excluding the treatment costs, and \$0.59 when they are included. Per capita costs estimates are \$0.0004, both including and excluding treatment.

Table 11.1 NSS: TANESA		
Type of Utilization	Finding/Indicator(s)	Result/Policy Issue
Allocation of resources	HIV/AIDS was affecting food security Proportion of orphaned children	Budgeting of government food assistance altered Allocation of resources to families in need can be better directed
Direct program decisions	Primary school enrollment	Informs TANESA's program choices for education programs within the schools
Direct policy influence	HIV seropositive rate among ANC attendees Proportion of orphaned children	Extrapolated to the larger community and used to inform national HIV/AIDS monitoring efforts Helps communities make decisions concerning the policies surrounding financial support for the school fees of orphans
Information requested by other departments or ministries	HIV prevalence among ANC women is always requested by the National AIDS Control Programme	
Other uses	School enrollment is always used to assess trends in education Enrollment data were used to assess that drop out rates are linked to poverty, since families who cannot pay primary school fees remove their children from school Prevalence of HIV among ANC attendees	Shown that HIV, poverty, and drop-out rates are linked Working papers and publications

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ANNEX 1. INFORMATION AND INDICATOR QUESTIONNAIRES

Assessment of Information System Results and Effectiveness

Name of information system: _____

We would like to ask you some questions about the results and effectiveness of [information system name]. There are eight sections in this questionnaire: training/retraining, supervision, reporting, indicator production, trends, equity, impact/utilization, and additional comments.

A. Training/retraining

For this section we are interested in knowing about the amount of training and/or retraining that was planned and carried out. We are not asking about the topics that were covered during training/retraining. Retraining includes training workshops.

- Does [information system name] have an established schedule for training/retraining?
Yes No *(If no, skip to section B)*
- During the last year or the last time [information system name] implemented training/retraining, how much time was planned for training/retraining at each level?

Level	Not Applicable	No. of Days	No. of Weeks	No. of Months
Central				
Regional/ Zonal				
District				
DSS/Sentinel site				
Village/ Ward				
Other level Specify: _____				

- During the last year or the last time [information system name] implemented training/retraining, how much time for training/retraining was completed at each level?

Level	Not Applicable	No. of Days	No. of Weeks	No. of Months
Central				
Regional/ Zonal				
District				
DSS/Sentinel site				
Village/ Ward				
Other level				

B. Supervision

- Does [information system name] have an established schedule for supervision?
Yes No *(If no, skip to the section C)*
- During the last year, how often at each level was supervision planned? *(Enter the number of sessions planned for each. For example, if the system has activities in 3 regions on a quarterly basis for supervision than the value entered in the table is 3 X 4 = 12.)*

Level	Not Applicable	Monthly	Quarterly	Biannually	Annually	Other specify
Central						
Regional/ Zonal						
District						

DSS/Sentinel site						
Village/ Ward						
Other level Specify: _____						

3. During the last year, how often at each level was supervision actually completed?

Level	Not Applicable	Monthly	Quarterly	Biannually	Annually	Other specify _____
Central						
Regional/ Zonal						
District						
DSS/Sentinel site						
Village/ Ward						
Other level Specify: _____						

****Please let us see your supervision reports. We are interested in seeing the types of issues that came out in the reports.*

C. Reporting

1. Does **[information system name]** have an established schedule for preparing and submitting reports?
 Yes No *(If no, skip to section D)*

2. During the last year, how often at each level were reports planned to be completed?

Level	Not Applicable	Monthly	Quarterly	Biannually	Annually	Other specify _____
Central						
Regional/ Zonal						
District						
DSS/Sentinel site						
Village/ Ward						
Other level Specify: _____						

3. During the last year, how often at each level were reports actually completed?

Level	Not Applicable	Monthly	Quarterly	Biannually	Annually	Other specify _____
Central						
Regional/ Zonal						
District						
DSS/Sentinel site						
Village/ Ward						
Other level Specify: _____						

4. To what extent have the following been barriers or constraints when preparing and submitting reports for **[information system name]**? *(Equipment includes computers, photocopy machine... Supplies include stationary, pens...)*

Potential barriers	Never	Sometimes	Always
Equipment			
Supplies			
Late reporting from lower levels			
Incomplete reports from lower levels			
Other barrier Specify			

5. Have the accuracy of the reports ever been internally or externally assessed? If so, please let us see the assessment. (*Question of validity –Is the data presented in reports accurate – did you measure what you intended to measure.*)

Quality control of reporting

6. Does **[information system name]** have quality control mechanisms for reporting? (*For example, perform checks to see that reports from lower levels make sense, return reports for clarification when necessary, and recheck the reports at the central level...*)
 Yes No (*If no, skip to section D*)
7. What kind of quality control mechanisms are in place?

D. Indicator production

1. By what method are samples of appropriate populations for **[information system name]** selected at each level? (*Different types of sampling strategies include simple random, complete enumeration, convenience sample, cluster sample, passive or self-selected...*)

Level	Method of Sampling
Central	
Regional/Zonal	
District	
DSS/Sentinel site	
Village/ Ward	
Other level	

**This table will be used to assess the representativeness and generalizability of the sample*

2. Is the population from which the sample is drawn the same each time indicators are produced?
 Yes No
3. For population based indicators, do you use projections of the population denominator to produce the indicator or is the denominator directly measured every time?
 a. If a projection is used, what is the source; if an estimate is used, how is the estimate made?
4. Does **[information system name]** have mechanisms for data quality control?
 Yes No (*If no, skip to D-7*)
5. What kind of data quality control mechanisms are in place? (*Examples: QC at all phases – development of questionnaire/data entry forms, sampling strategy, looking at the same population, developing data instrument, data collection, data inputs, data processing and analysis.*)
6. Have the results of your analysis been validated or cross-checked against the results of any other source of information or other indicators of poverty or health issues in Tanzania? (*For example,*

compared to the gold standard? Compare with another study in the same area or another country or region?)

Yes No (If no, skip to question D-9.)

a. How have the results been validated or cross-checked?

7. Of the indicators shown in Table 1, approximately how many indicators did [information system name] plan to produce last year?
8. Of the indicators shown in Table 1, approximately how many indicators were actually produced last year?

***Please, can we have copy of the list of indicators produced by your system.

Below is a table of indicators of poverty and health issues that are used by Poverty Monitoring Master Plan, Public Health Sector Performance Profile, Local Government Reform Program and/or Comprehensive District Health Plan. Please look at this list and specify which of these indicators are produced by [information system name].

Table 1: Indicators of Health and Poverty Issues

No.	Indicator	Produced by system	Repeated Measure
Income poverty			
1	Headcount ratios for- basic needs poverty line		
2	Headcount ratios for- basic needs poverty line (rural)		
3	Headcount ratios for- food poverty line		
4	Asset ownership (as a proxy for income poverty)		
5	Proportion of working age population not currently employed		
6	Overall GDP growth per annum		
7	GDP growth of agriculture per annum		
8	Percent of rural roads in maintainable condition		
Human capabilities			
9	Girl/boy ratio in primary education		
10	Girl/boy ratio in secondary education		
11	Transition rate from primary to secondary		
12	Literacy rate or literacy rate of population aged 15+		
13	Net primary enrolment		
14	Gross primary enrolment		
15	Drop-out rate in primary school		
16	Percent of students passing Std 7 with grade A,B,C		
17	Percent of ARI in under-fives		
18	Prevalence of diarrhea in under-fives		
19	Percent/proportion of households with access to safe and clean water		
Survival			
20	Infant mortality rate		
21	Under-five mortality rate		
22	Life expectancy		
23	Seropositive rate in pregnant women or prevalence of HIV infection among ANC attendees		
24	Districts covered by active AIDS awareness campaign		
25	Maternal mortality rate or proportion of deaths to women during child bearing age due to maternal causes or maternal mortality ratio		
26	Proportion of malaria cases for under 5 years of all cases presenting at OPD or proportion of malaria cases for under 5 years or malaria in-patient case		

	fatalities for children under five.		
27	Percent of TB cases or proportion of TB cases completed treatment		
28	Proportion of children under one or under two year(s) immunized against Measles, Polio, BCG and DPT or percent of infants completed vaccination per health center		
29	Births attended by a skilled health worker or proportion of clients attending for purpose deliveries(% with skilled birth attendant)		
30	Percent of women of child bearing age (15-49) using family planning or proportion of clients receiving family planning by method		
Social well-being (governance)			
31	Ratio of primary court filed cases decided		
32	Average time taken to settle commercial disputes		
Nutrition			
33	Stunting (height for age) of under-fives		
34	Wasting (weight for age) of under-fives		
35	Proportion of under-five children with a body weight less than 60% or percent of infants with body weight below 60% for age or underweight (weight for age) of under-fives		
Extreme vulnerability			
36	Proportion of orphaned children		
37	Proportion of child-headed houses		
38	Proportion of children in the labour force		
39	Proportion of children in the labour force and not going to school		
40	Proportion of elderly living in a household where no one is economically active		
41	Conducive developmental environment		
42	Ratio of reserves to monthly inputs		

E. Trends

We would like to ask some questions about the extent to which **[information system name]** is used to produce trends over time in key indicators.

1. a. Does your system collect repeated measures of any of the indicators in the list you have been provided? *Please tell us about each indicator*
b. How often are these measurements taken?
Daily__ Weekly__
Monthly__ Quarterly__
Annually__ Other Specify_____
2. Is the data able to assess short-term (<1 year) trends e.g. outbreaks? *(i.e. things that affect local decision making)*
Yes No
3. Is the data able to assess long-term (>1 year) trends e.g. survival? *(i.e. things that affect higher level and policy decision making)*
Yes No *(If no for both questions E-2 and E-3, skip to section F)*
4. Has a trend analysis been done on any of the indicators produced by **[information system name]**?
Yes No *(If no, skip to the section F.)*
5. Have trend reports been produced?
Yes No *(If yes, please let us see a copy of the reports.)*

F. Equity

We would like to know about the ability of **[information system name]** to link poverty and health. For example, linking information you have gathered about education or information about access to services to health. (After the interview, we will also look at the types of indicators produced by **[information system name]**)

1. What method, if any, is used to determine poverty/ socioeconomic status at each applicable level? (For example, is the level measured by assessing assets or looking at unemployment rates?) Do these methods yield relative or absolute measures (i.e. are they capable of placing households or communities above or below a poverty line as measured in TSh?)?

Level	Not Applicable	Method to determine degree of poverty	Absolute (1) or Relative(2)
Central			
Regional/ Zonal			
District			
DSS/Sentinel site			
Village/ Ward			
Household			

G. Impact/Utilization

1. How is the information collected by **[information system name]** used on a routine basis?

Activity	Always Use	Sometimes Use	Never Use	Example(s) of Use
Direct Program Decisions				
Allocation of Resources				
Influence Policy Decisions				
Other government departments/ministries				
Other Specify _____				

2. How is this information produced by **[information system name]** used for non-routine outputs? Please list the ways the information is used. (For example, policy briefings, working papers, secondary analysis of the data collected by **[information system name]**, provision of data or data sets for further analysis by other Ministry departments, agencies, or researchers, and major citations of the work) Please provide specific examples that were especially important/significant and why you thought they were important/significant.

H. Additional Comments

1. Do you have any further comments on strengths of **[information system name]** in terms of the quality of the information and indicators it produces?
2. Do you have any further comments on weaknesses of **[information system name]** in terms of the quality of the information and indicators it produces?

Thank you for your time.

Assessment of Indicators

Following question D-10 from the “Assessment of Information System Results and Effectiveness” questionnaire, these questions will be repeated for every indicator produced by the information system that is included in our list of indicators.

Name of information system: _____

Indicator number: _____

Indicator: _____

- For this indicator are the data collectors and analysts using a standardized definition? (a) *Highly Standardized*: “All data collectors and supervisors use a single, specified definition of the indicator and data for calculating this indicator are collected in an entirely standardized way” (b) *Fairly Standardized*: “Data collectors and supervisors can exercise some discretion in how the indicator is defined, but data for calculating this indicator are collected mainly in a standardized way.” (c) *Locally Interpreted or modified*: “Data collectors and supervisors routinely exercise their judgment in how the indicator is defined, and data for calculating this indicator are collected according to these definitions.”

Highly standardized	Fairly standardized	Locally interpreted or Modified	Unknown

***Work through explanation of how each term is defined. For example, if the indicator is proportion of births attended by a skilled birth attendant - is there a clear definition of “skilled birth attendant” used by all sites.

Impact and Utilization

- How is this indicator used on a routine basis? (For example, to make decisions about resource allocation, direct program decisions, or influence policy.)

Activity	Level	Always Use	Sometimes Use	Never Use	Example(s) of Use
Direct Program Decisions	Central				
	Regional/ Zonal				
	District				
	DSS/ Sentinel site				
	Village/ Ward				
	Other level				
Allocation of Resources	Central				
	Regional/ Zonal				
	District				
	DSS/ Sentinel site				
	Village/ Ward				
	Other level				
Activity	Level	Always Use	Sometimes Use	Never Use	Example(s) of Use
Influence Policy Decisions	Central				
	Regional/ Zonal				
	District				
	DSS/ Sentinel site				

	Village/ Ward				
	Other level				
Other government departments/minis- tries	Central				
	Regional/ Zonal				
	District				
	DSS/ Sentinel site				
	Village/ Ward				
	Other level				
Other Specify _____ _____ _____	Central				
	Regional/ Zonal				
	District				
	DSS/ Sentinel site				
	Village/ Ward				
	Other level				

3. How is this information used for purposes done in a non-routine manner? Please list the ways the information is used. *(For example, policy briefings, working papers, secondary analysis of the data collected by [information system name], and major citations of the work)*

4. After the interview is complete, the systems for which the indicator is required will be checked.

<i>Poverty Monitoring Master Plan</i>	<i>Public Health Sector Performance Profile</i>	<i>Local Government Reform Program</i>	<i>Comprehensive District Health Plan</i>

ANNEX 2. QUALITATIVE QUESTIONS

Following on from the brief survey we conducted last month, we have some more open-ended questions that we would like to ask you. As with the survey, you should feel free to decline participation or to withdraw your participation at any point should you so chose. There are no direct benefits to you for participating in this work. We plan to have a preliminary feedback session at the end of July to which you will be invited.

The following questions concern general aspects of your activities as a manager of an information system. The questions are intended to elicit your views, opinions, and experiences and are for descriptive purposes only; they are not intended to evaluate the quality of your system or your work in any way.

- 1) a) Previously, we have discussed your work in the production of health and/or demographic information in terms of training, supervision, cost, and impact. One issue we would like to hear more about is the main purpose and function of your information system. Do you have a mission statement or a specific set of goals and objectives you can share?

b) How important would you say the production of routine indicators is to these goals and objectives?
- 2) a) When your information system was established, did it have the monitoring of poverty conditions in Tanzania as one of its aims? If so, in what ways?

b) As you may be aware, Tanzania is in the process of implementing a National Poverty Reduction Strategy. Monitoring and evaluation form a key component of this. Within this context, what role do you feel your information system can play?
- 3) We would also like to know how you might go about *increasing* the utilization of the information your system produces?
- 4) Let us say that a major source of funds for producing demographic and health information in Tanzania over the next 20 years became available.

a) Where do you think those resources should be invested?

If you were to make a proposal to the committee in charge of allocating those funds to support your own information system, what would you tell them?

ANNEX 3. TABLE OF DETAILED COST COMPONENTS AND ESTIMATES

	TSh ^a	US\$	Year of cost info	Annual capital costs	Annual recurrent costs	Total annual cost (\$)	Annual cost for 2001 (\$)	Pop of area covered	Year of pop est.	Population estimate for 2001	Annual cost per covered person	Annual cost per capita ^b
National Household and Population Census	36,577,073,097		2000-04	578,808	7,665,306	8,244,114	8,244,114	33,616,801	2001	33,616,801	0.25	0.2500
National Household Budget Survey 2000/2001		2,466,700	1999-01			822,233	822,233	108,672	2000	108,672	7.57	0.0200
DHS Combined		3,269,528	1999-00			817,382	854,164	43,636	1999	43,636	19.57	0.0243
DHS 1991		918,953	2000			918,953	946,522	55,625	1991	55,625	17.02	0.0273
DHS 1994		428,747	2000			428,747	441,609	30,978	1994	30,978	14.26	0.0128
DHS 1996		1,008,828	2000			1,008,828	1,039,093	50,842	1996	50,842	20.44	0.0300
DHS 1999		913,000	1999			913,000	970,519	37,098	1999	37,098	26.16	0.0272
Village Register												
Vital Registration	638,383,127		2001			719,427	719,427	312,636	2001	312,636	0.23	0.02
HMIS (49.5% of the pop consulted a government health provider when ill)		1,994,300	1999	160,000	1,834,300	1,994,300	2,119,941	16,640,316	2001	16,640,316	0.13	0.0631
IDS (49.5% of the pop saw a doctor when ill)							4,270,943	16,640,316	2001	16,640,316	0.26	0.1270
NSS: Ifakara DSS	180,388,100		2001	42,328	160,960	203,289	203,289	66,000	2001	66,000	3.08	0.0060
NSS: Rufiji DSS		200,992	2001	22,571	178,421		200,992	82,355	1999	82,355	2.44	0.0060
NSS: AMMP (Dar, Hai, and Morogoro sites)		288,148	2001	58,598	229,551	288,149	288,149	347,000	2001	347,000	0.83	0.0086
Dar-AMMP		102,017	2001	20,168	81,849	102,017	102,017	65,000	2001	65,000	1.57	0.0030
Hai-AMMP		88,775	2001	18,628	70,147	88,775	88,775	157,000	2001	157,000	0.57	0.0026
Moro-AMMP		97,356	2001	19,802	77,555	97,357	97,357	125,000	2001	125,000	0.78	0.0029
NSS: TANESA DSS (including drug costs for HIV-patients)	24,000,000		2000-01			13,523	13,523	23,000	2001	23,000	0.59	0.0004
NSS: TANESA DSS (excluding drug costs for HIV-patients)	21,000,000		2000-01			11,833	11,833	23,000	2001	23,000	0.51	0.0004
Notes:												
^a exchange rate: US\$1 = TSh 887.35 for 2001												
^b Denominator is the estimated total population of Tanzania in 2001 of 33,616,801												