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Use of administrative data sources for health workforce analysis: multicountry experience in implementation of human resources information systems

PAMELA MCQUIDE, DYKKI SETTLE, WALID ABUBAKER, GHANIM MUSTAFA ALSHEIKH, CÉLIA REGINA PIERANTONI, SHANNON TURLINGTON, DANNY DE VRIES

9.1 Introduction

The most efficient and immediate way to track changes to a health workforce is to use data from a routine administrative information system. Censuses and surveys, both population based and facility based, are key tools to provide an accurate snapshot of a country's health workforce, but must be fully reconducted periodically to look at a changing situation. As these tools are prohibitively expensive to implement on a regular basis, data from such sources should be considered as a basis (albeit an essential one) for complementing the national routine human resources information system (HRIS), which provides a continuous record of changes in the health workforce and serves as the timeliest source of information available. These systems are typically used by administrative organizations in the country, such as ministries of health, professional councils and professional associations, to qualify, manage and plan the health workforce. It is in the interest of these organizations to maintain updated and accurate information in the HRIS.

An HRIS can be as simple as a filing cabinet of paper personnel files or as complex as a multi-database system with the capacity to analyse workforce problems and assist in identifying possible solutions. The strength of an HRIS does not depend on technology but on its ability to be adapted to address current workforce issues and generate accurate and timely information. In most low- or middle-income countries HRIS data are routinely collected in paper form. While such a system can represent a functioning HRIS, there are often serious limitations to the use of these data. Although records representing a single role or individual can be located and accessed (with varying degrees of ease), often these records cannot be used efficiently because of the intensive effort involved in updating or aggregating data, difficulties linking data on an individual level

across various records, and issues of data quality, such as incomplete records, timeliness and inconsistencies. As a result, decision-makers may not have access, in a timely and accurate fashion, to critical pieces of information necessary to developing an effective human resources for health (HRH) strategy. For example:

- How many physicians and nurses are being trained and in what specialties?
- How are health workers distributed across urban and rural areas?
- Why are health professionals leaving the health-care services industry?
- How many health professionals are currently not employed?

Understanding the answers to these and other key policy questions will help decision-makers effectively:

- ensure a steady supply of trained health professionals;
- deploy human resources with the right skills to the right positions and places to meet health-care needs;
- retain health worker skills and experience in the country.

A mature, comprehensive HRIS links all human resources data from the time health professionals enter pre-service training to when they leave the health workforce. Using such a system, decision-makers can quickly find the answers they need to assess HRH problems, plan effective interventions and evaluate those interventions. If well designed, managed and maintained, HRIS data can provide a cost-effective yet extremely useful source of information with which to monitor and evaluate the impacts of changes in social policy at the national and subnational levels.

Country experience indicates that, while often less accurate than census or survey data, particularly in the initial phases, routine health data systems improve in accuracy over time (1). A well-functioning HRIS has an

advantage over a survey because it allows for ongoing monitoring of detailed information in large sample sizes, including subnational geographical analyses. In addition, it is longitudinal in nature with the capability to record health workforce dynamics. Continuous and current information on the same individual can be tracked over long periods of time at less cost per data point. Due to advances in computer technology, linking various administrative databases is easier, less expensive and more reliable than ever before (2).

At the same time, many low-income countries need to build capacity, both human and technical, in order to improve the use of HRIS data, including planning, software design, infrastructure support and management, as well as strategies for data use and strengthening. The implementation of a comprehensive country strategy should include the following underlying principles:

- a participatory approach that involves stakeholders from various ministries and sectors from the outset and increases the ownership of the system;
- an iterative development methodology that incorporates existing systems, tools and processes as much as possible to lower costs and speed up implementation;
- a mature software solution designed for the country context and to answer key HRH policy questions for that country;
- an emphasis on building capacity, ensuring sustainability and continuously improving the system through training and technical support;
- a continuous effort to train decision-makers to analyse and use the data that the HRIS provides to make sound HRH decisions.

In this chapter, an overview is provided of the essential elements and lessons learnt to date in the implementation of a comprehensive HRIS strengthening initiative. A series of critical stages in the development and strengthening of a complete HRIS is first discussed, followed by presentation of a number of case studies drawing on experiences in selected low- and middle-income countries.

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9.2 Recommended first steps to develop a human resources information system

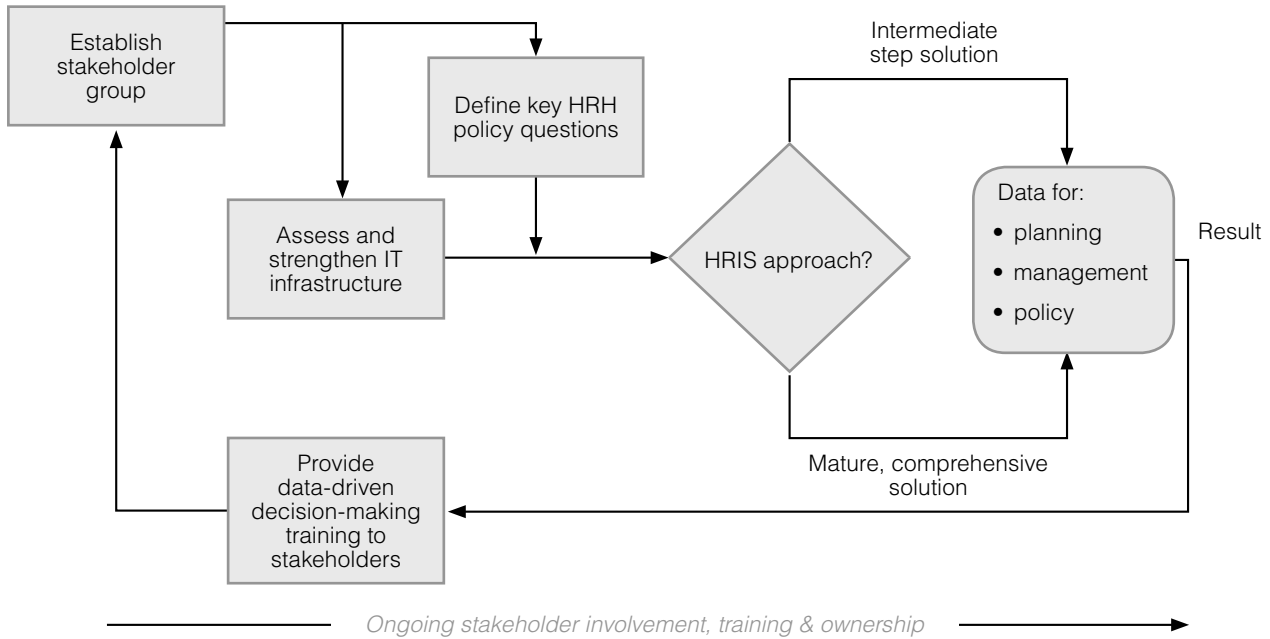
The first and most important thing to keep in mind when developing an HRIS is that just as human resources are a building block of a health system (3), so the HRIS is a part of the comprehensive health information system. And just as every aspect of the health system (including facility- and community-based service delivery, availability of medical products, financing and governance)

contributes to the success of health workers and health workers influence the functionality of the system, there is also a critical interdependence of the HRIS and the other components of the health information system. In a mature and comprehensive health information system, the HRIS will be the authoritative source of HRH data for each of the other building blocks. This underscores the critical nature of the HRIS to the integrity and success of the whole health system.

Ideally, the HRIS development and strengthening process comprises five key stages using a participatory approach (Figure 9.1). First, a stakeholder leadership group is established, or a national task force involving all key stakeholders and led by the ministry of health, and the key HRH policy questions are identified. Next, HRIS technical staff conduct a needs assessment to focus on the current infrastructure (for example existing networks, Internet connectivity, software) and data already being collected by the different ministries, councils and other organizations. After the questions and infrastructure are agreed upon by the stakeholder group, HRIS software solutions should be customized to answer the key health workforce policy and management questions for a respective country. The end result could either be a step solution or a mature (multiple component) system able to support managers and decision-makers in their efforts to effectively use and analyse data for informed and confident decision-making. At the stage of data use, attention is paid to how data are actually used for decision-making. Throughout the process, sustainability and continuous improvement of the HRIS can be ensured through training and building of capacity in the country team to independently support, use and improve the system into the future.

9.2.1 Building a stakeholder leadership group

A key to the success of implementing an HRIS is the ability to respond to in-country needs. Developing a leadership group of all the essential stakeholders that produce and use HRH information assists in developing a country-focused HRIS. This group will initiate, lead and monitor all subsequent activities in HRIS strengthening. The stakeholder leadership group empowers stakeholders to develop an HRIS that meets their needs, ensures ownership of the system and builds the necessary capacity to support, use and improve the HRIS. Another benefit of including the key stakeholders is that it opens communication channels between groups of individuals that typically do not meet together, thereby facilitating collaboration and sharing of data across groups.

Figure 9.1 Framework for institutionalizing a human resources information system

Source: Capacity Project (1).

The stakeholder leadership group should include experts in health workforce planning and production, and in information systems. The outcome of the first meeting should be the terms of reference for the group (such as its leadership, membership, accountability, mission, function and duties) and the principles of operation for the meetings (such as the equality of all members, the need to hear from all participants and the need to reach consensus for decisions to occur).

After deciding on the terms of reference and principles of operations, the group is ready to begin defining the key HRH questions that need to be answered and the indicators that will be used to monitor the status of the health workforce via the HRIS, and considering issues pertaining to data confidentiality, ownership and policies for data sharing. It is critical that the country identifies and owns these questions to ensure the success and usability of their HRIS. Once the stakeholder group identifies these questions, the group will continue to meet regularly to provide direction for the infrastructure development, programming, data inputting, report development and use of data for decision-making. It is particularly important that issues of data confidentiality and data ownership are addressed from the onset since these are not typical considerations with a paper-based system and could have serious consequences if safeguards are not considered and instituted from the very beginning.

Many stakeholders are involved. Ministries, licensing and registration or certification bodies, private sector organizations and other stakeholders must work

together to develop a mature and complete HRIS that tracks health professionals from the time they enter training until they leave the health workforce. Depending upon the scope of the HRIS development, there may be a need for employees of facility-based service delivery points to be included in the stakeholder leadership group to ensure that individual-level data remain accurate and that they have access to necessary information (for example, direct salary deposits into their bank account). At every juncture, the most important outcome is that ownership of the HRIS is being built and capacity is being developed.

9.2.2 Infrastructure development

Despite the momentum that is often generated by the stakeholder leadership group, experience suggests that no country is ever ready to deploy a complete and mature HRIS in the first instance. Strengthening the information system in planned steps provides quick gains without overwhelming the infrastructure needed to support the system. Data collectors and managers, technical support staff and decision-makers should receive training at each step, become comfortable with the new system and then take the next step when they are ready. In particular, training should occur in updating new information at each stage of the workforce life span (for example pre-service training, new deployment, redeployment, migration, retirement, death).

Improvements to existing information technology infrastructure can generally be implemented quickly and often result in increased efficiency and productivity.

Proposed infrastructure improvements should be based on a technical assessment and consider low-cost solutions that can rapidly but significantly enhance existing systems and processes. Recommended improvements might include procuring computers for workers who need to enter or access data in the system, improving software applications and tools that are currently being used, increasing data storage capacity, upgrading network connections for transmitting data or expanding technical support services.

9.2.3 HRIS development steps

Depending on the current form, existing HRH information systems may be strengthened in iterative steps. A step solution is any interim solution for managing HRH data that is deployed while a mature system is being developed. Step solutions can be deployed to enable the ministry or another organization to quickly start entering and managing its HRH data. The data can then easily be migrated to the mature solution when it is available and the end user is ready to implement it.

Where there is only a paper-based system, an electronic register can be implemented. Where an electronic register is already in place, a simple database can be built. Where there is a simple database, that database can be progressively strengthened or expanded. For example, a situation may arise where the routine database system is so out of date and unreliable that policy-makers cannot manage the results. One particularly useful step solution is to develop a short survey form to collect minimal accurate information on health workers at the facility level and enter these data into a register. These data can be used to update databases and make the system operational again. Another important step solution could be the specification of a gender-sensitive HRIS.

The goal of such an iterative strengthening methodology is to ensure that every country or organizational programme can quickly benefit from an HRIS strengthening process regardless of resources. Proceeding in iterative steps also lessens the impact of too much change too quickly, while ensuring that each step progresses towards the goal of a mature and complete solution.

When a country or organization is ready and the appropriate infrastructure and supporting systems are in place, a complete set of mature software solutions can be implemented to fully track skilled health service providers from the time they enter training until they exit the health workforce. Four components are needed to address the most critical health workforce planning, production and management issues:

- **Qualification.** This component is used to collect and aggregate data on skilled health service providers and speeds up the process of generating routine forms, such as registrations and licences or records of professional examination results, that were previously handwritten. It should reside with the licensing or certification authority for a health worker cadre, such as physicians or nurses. In most countries these authorities are boards or councils. These data are critical for hiring authorities throughout the country to ensure that only qualified professional health workers are hired, since forging paper documents is reported in many countries.
- **Management.** This component tracks detailed information about health workers who are employed by the ministry of health, a public sector health-care facility such as a hospital, or a private sector service delivery point within the country. In addition to individual deployment information, other pertinent information may include performance appraisal, disciplinary action, retirement, change of occupation and payroll information.
- **Education and training.** There are two main training components: (i) pre-service education, which tracks the level and field of education leading to qualification for a health occupation; and (ii) continuing education and in-service training, which update the professional knowledge, practice and skills of individual health service providers. Continuing education may be required to maintain an active licence to practise in certain countries. These two components of training may be included in either the qualification or management systems or they may be stand-alone systems, depending on the needs of a country.
- **Planning.** This component uses data from each of the other systems and statistical modelling applications to form a complete picture of the health workforce in the country and allow projections on how that workforce will change in the future (based on known influences such as retirement age, number of trained health workers annually entering the workforce, attrition rates, changes in population, staffing norms, disease patterns and other factors). The planning and modelling component of the HRIS can help decision-makers assess their health workforce needs and make effective policy decisions to meet those needs.

Together, these four components can provide a powerful feedback loop for analysing, planning and managing health workforce resources and needs. If all four components use the same core programming, database architecture and supporting hardware and software systems, once one is fully deployed, the others can be added at a significantly lower cost. Each of the four

systems may be deployed independently or integrated with software products already in place to provide a customized, contextual solution for the country, filling in any gaps that existing systems may have left (1).

9.2.4 Supporting use of data for effective decision-making

The primary aim of any HRIS should be to promote better use of data to drive effective decision-making for addressing daily challenges and positively impacting HRH policies and practice. However, it would be very difficult for a few people poring over data reports to make sound and binding decisions. The ways in which data are used for effective decision-making rely on the active involvement of a broad range of stakeholders working together. Understanding the context in which data are used to make decisions is also essential.

Rather than having an external consultant supply a packaged training programme for using data for decision-making, for instance, all national stakeholders should be engaged in understanding how they use data now, both individually and organizationally, and what factors are important in their context for using data effectively. Examples of approaches that have been employed in countries to improve the use of data for decision-making include:

- mapping how data are used to support a decision, resulting in case studies of practical data use;
- providing opportunities for decision-makers to experience critical decision-making moments so they can develop their skills using real data in real-life situations;
- improving communication among users of data;
- identifying and leveraging opportunities for improved data sharing across different levels of the organization and with other stakeholders.

9.2.5 Methodology for sustainability and continuous improvement

An information system requires ongoing support and improvement to ensure maximum utility and sustainability. Depending on the context and needs of the country, sustainability strategies include continuous collection of feedback from stakeholders about changing data needs and rolling out of improvements that align with those needs. The early involvement of stakeholders with the design and eventual implementation of the HRIS encourages their sense of ownership. As part of this, the HRIS strengthening process should include the training of decision-makers and stakeholders to effectively use and analyse data for informed and confident decision-making. In addition, the training of data collectors, system support staff and system managers helps to improve the technology infrastructure, data

quality and integrity. Data quality is of primary importance and should be emphasized at every step of the process, from initial data collection to data analysis and interpretation.

Data accuracy and completeness are necessary to inform decision-making. Standardization of data collection forms and data coding can facilitate ease of use and internal validity. In addition, procedures to minimize data entry errors when transferring data from paper to electronic forms can result in improved data quality. Dual data entry, in which a record is entered into an electronic database at two separate times by two separate staff, can reduce data entry errors by ensuring that discrepancies in data are compared against the original document. Should dual data entry be prohibitively expensive or time intensive, a system of spot-checking, in which a randomly selected list of electronic records is checked against the original record, can be used. Both dual data entry and spot-checking permit data managers to identify, record and correct data errors. A data error log can also serve as a starting-point for later improvements in training methods, data collection forms or software modifications.

Routine, reliable updates can also improve data quality by ensuring that data remain relevant for planning and decision-making. Data reports at the central level can be sent (either electronically or via paper forms) to provincial or district representatives for review and updating on a regular schedule. Similarly, processes should be put in place to facilitate the flow of data and reports between the central and district levels, and between hospitals, health centres and other service delivery points. This exchange of information allows the HRIS to better account for changes in the workforce, such as new deployments, transfers, specific in-service trainings and workforce exits. Sharing data not only improves accuracy but also enables health planners at all levels to gain access to information valuable for policy and administrative decisions. Furthermore, enabling public access to aggregated HRIS data may facilitate HRH planning and research across sectors, including nongovernmental organizations, academic researchers and policy-makers.

Although sharing data is essential in order to improve data quality and encourage evidence-based decision-making, maintaining data security is equally critical. HRIS data includes personal information that must remain secure in order to build confidence and trust in the system. Implementing and adhering to a data security policy starting from the initial stages of development of the information system can help ensure data confidentiality and integrity (Box 9.1) (4). A system can be built with several levels of access based on

Box 9.1 Confidentiality and security of HRH information

With increasing attention to human resources opportunities and constraints to achieving health systems objectives, greater emphasis is being placed on the collection of information to improve HRH development and monitoring. Having longitudinal data, or information gathered at different points over time, allows individual health workers to be tracked in their labour market activities and other significant events, supporting evidence-based decision-making for policies and programmes at critical junctures along the working lifespan.

Provider-level information becomes even more important when used for human resources development strategies or health services delivery monitoring. This will require information systems, whether paper based or electronic, that ensure health worker confidentiality yet allow relatively easy access to the information at both the individual and aggregate level. Implemented systems must also address issues of system availability.

Using personal data for health systems goals must be balanced against individuals' rights to privacy and confidentiality, and should be based on human rights principles.

When developing approaches to protecting data, a distinction should be made between providing for the physical protection of data to guard against environmental threats, and the protection needed to guard against inappropriate use of sensitive information, whether due to inadvertent or deliberate activities.

Three interrelated concepts, each implemented in a different manner, have an impact on the development and implementation of protection of sensitive data: privacy, confidentiality and security.

Privacy is both a legal and an ethical concept. The legal concept refers to the legal protection that has been accorded to an individual to control both access to and use of personal information and provides the overall framework within which both confidentiality and security are implemented.

Confidentiality relates to the right of individuals to protection of their data during storage, transfer and use, in order to prevent unauthorized disclosure of that information to third parties. Development of confidentiality policies and procedures should include discussion of the appropriate use and dissemination of health worker data with systematic consideration of ethical and legal issues as defined by privacy laws and regulations.

Security is a collection of technical approaches that address issues covering physical, electronic and procedural aspects of protecting information collected as part of the HRIS. It must address both protection of data from inadvertent or malicious inappropriate disclosure, and non-availability of data due to system failure and user errors.

Source: Adapted from UNAIDS (4).

user roles. For example, such a system could enable some users to enter records without accessing reports, other users to see reports without the ability to enter or modify data, and a third group of users to access only aggregate reports, without the ability to view or edit individual records. All HRIS users should be supplied with a password that is regularly changed, and a system should be put in place to back up data on a regular schedule.

The development of skills is necessary for supporting, maintaining and developing computerized information

systems. This part of the strategy could include the development of regional user communities to facilitate problem solving and share system improvements, possibly in collaboration with local educational institutions.

Taking full advantage of HRIS results to improve HRH planning and management in developing countries requires a concerted supportive process. When policy-makers and other key stakeholders obtain access to extensive information about the health workforce, it may be difficult for them to see uses for these data beyond the usual reports that they formerly generated

with paper records. Additionally, the HRIS data are being produced in a policy-making context that is highly political, and appointments to positions may change frequently (5). The data for the decision-making process involves the key stakeholders in a practical, participatory procedure of using, interpreting and applying the new HRIS information while considering what capacity needs to be developed to implement changes on an individual, organizational and policy level. This may involve sharing information and reports that are now available and training on different ways to interpret the information and present evidence effectively to respond to key policy questions. Having the key stakeholders present their own data to their peers helps to build the ownership and confidence in using these data to inform management and policy decisions. The final phase involves developing a plan for disseminating these HRIS data regularly, based upon the reporting cycle within the country.

9.3 Country case studies

Examples are now provided from HRIS development, strengthening and evaluation efforts in three low- and middle-income countries: Uganda, Sudan and Brazil.

9.3.1 Building a health professional licensure information system in Uganda

In Uganda, the Ministry of Health (6) and four health professional regulatory councils, including the Nurses and Midwives Council, needed updated and reliable information on how many health professionals by cadre were licensed to work in the country, what training they had received, if they were leaving the health workforce and if so, why. Until recently, although a complex system of paper forms was in place, there was no way to aggregate or analyse the information, and it was difficult even to track down a given nurse's current address or licensing information.

A stakeholder leadership group was formed, including representatives from several departments in the Ministry of Health, the four professional licensing associations, training institutions and nongovernmental organizations, as well as consultants in health workforce planning and information systems from the Capacity Project (7), a global HRH initiative funded by the United States Agency for International Development. The goal was to develop a registration and licensing information system that would track all health professionals from the time they entered pre-service training until they left the health workforce. One of the first activities of the stakeholder group was to identify the key policy questions that it wanted addressed regarding nursing and midwifery personnel, so that the first HRIS

strengthening step could focus on generating regular reports to answer those questions.

Improvements were made to the network and hardware infrastructure at the Uganda Nurses and Midwives Council, the regulatory body that licenses professional nurses and midwives working in the country. An open source software application was installed: *iHRIS Qualify*, a training, certification and licensure-tracking database (7). "Open source" refers to computer software distributed under a licence that allows anyone to study, copy and modify the source code (the set of instructions that creates a piece of software) and redistribute the software in modified or unmodified form, without restriction and without the need to pay a licensing fee. This means that products can be distributed at minimal cost, and users can continue to use and improve their systems without paying onerous licensing or upgrade fees. Open source software does have some disadvantages, most importantly the potential for poor support for users in countries with a shortage of skilled personnel in new information and communications technologies, and a lack of accountability if software glitches or unauthorized access occurs. However, using open source software has the advantage of encouraging software development in context, and often represents the least-cost alternative where there is a foundation of computer skills in the country, or better yet, the health system. It is also possible to draw on the global open source support community that has developed around these technologies to voluntarily support and improve the systems. This can be quite advantageous in helping users answer questions, fix problems with software and even develop new modules. The result is a completely tailored (but still low-cost) system that can grow and change over time.

In the Ugandan context, implementation teams were formed to programme and deploy the software. Entry of historical registry data from the Uganda Nurses and Midwives Council was completed first, followed by the other three licensing bodies – for medical and dental practitioners, pharmaceutical practitioners and allied health professionals. Quality controls were incorporated into the data entry and processing procedures, notably the assignment of a unique identification number within and across cadres to address potential biases such as double-counting (for example, when a health professional has more than one type of training), and a dual data entry system to ensure accuracy and permit tracking of data entry problems. Another method used for validating the data was to request each individual health worker, upon entry to the appropriate council, to verify the contents and update any information that may have changed based on a printout of their electronic record. This process keeps the database updated and

gives the health professionals an appreciation of the need for data accuracy.

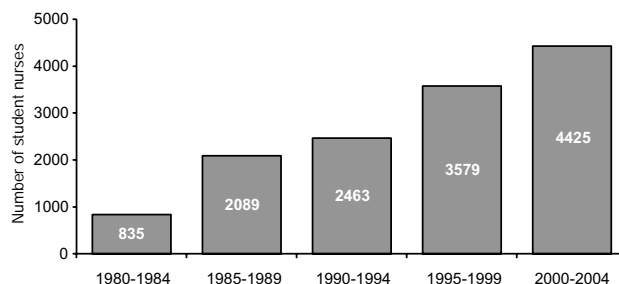
The next three figures offer examples of the type of information that can be examined with the database, drawing on administrative records for all student nurses and midwives that entered training between 1980 and 2004. Figure 9.2 shows the increase in enrolment in nursing and midwifery training programmes during this timeframe.

Figure 9.3 presents findings on completion of training programmes and professional qualification among student nurses and midwives in Uganda. Of the 21 888 student nurses and midwives that entered training from 1980 to 2004, only 17 297 completed the training programme and sat for the exam. Of those who passed the examination, 16 658 qualified to register with the Nurses and Midwives Council and 14 637 eventually registered – approximately two thirds of those who originally entered training. One way in which these data are being used is to ensure that nurses and midwives hired are registered with the Uganda Nurses and Midwives Council by giving central and district authorities restricted access to view the HRIS to see if the applicants for professional positions are in good standing with the Council.

Figure 9.4 identifies the location of nursing schools by district, showing where students are most successful in passing the licensing examination and becoming registered, and where they are having more difficulty. For example, 18% of nurses and midwives who attended school in Kampala District and 11% of those who attended school in Kisoro District passed the exam but did not become registered by the Council. In contrast, all nurses and midwives who attended school and passed the exam in Bushenyi District became registered.

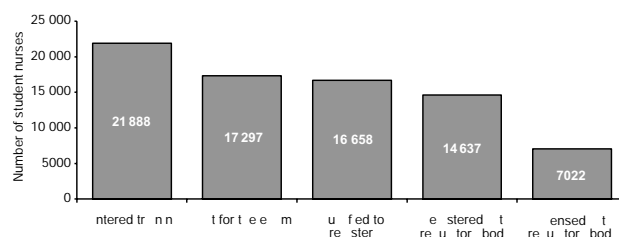
These data have important policy implications about expenditure of scarce national resources for educating health professionals that are wasted if individuals do not complete training and become registered with the appropriate regulatory body. They also raise questions about selection of students and the examination process. Without knowing how many of these students do not complete training, policy-makers and planners do not know how to budget or plan for training or deployment of health workers to meet the needs in the country. Also, these data help educators, professional councils and various ministries to identify potential problems in the early stages, prioritize where to target interventions, offer an indication on where further investigation and monitoring are needed, and point to factors that were

Figure 9.2 Number of students entering nursing training programmes (leading to qualification as registered or enrolled nurses) in Uganda, 1980–2004



Source: Capacity Project (1).

Figure 9.3 Number of student nurses who entered training between 1980 and 2004, passed the professional licensing exam, and qualified, registered and became licensed with the Uganda Nurses and Midwives Council



Source: Capacity Project (1).

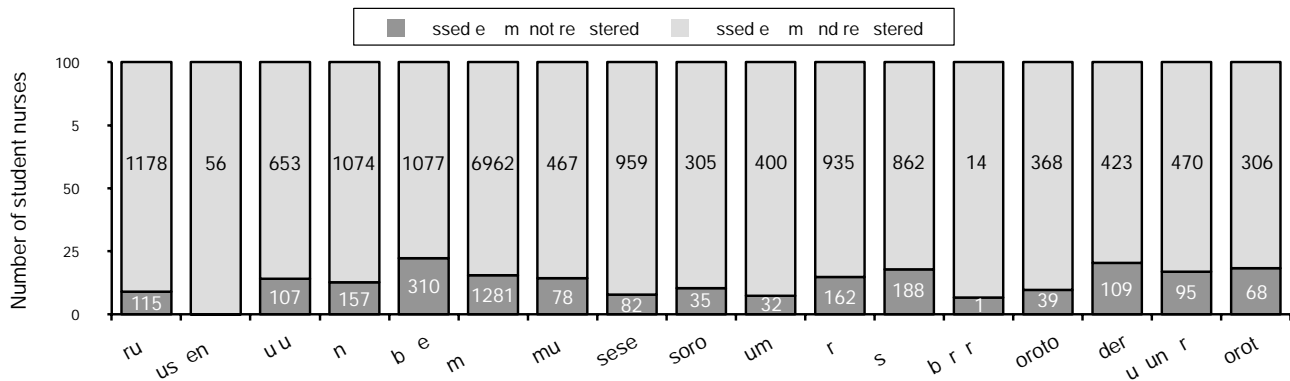
important to observed positive outcomes from which stakeholders can learn.

Based on the results discussed above, in Uganda, a recommendation was developed to further explore the causes for the high failure rates among student nurses and midwives and propose ways to tackle the problem (8). An interministerial stakeholder meeting was set up to address some of the issues about examining nurses for registration with the Nurses and Midwives Council.

9.3.2 Institutionalizing a health workforce monitoring framework in Sudan

A number of strategies and initiatives have been implemented in Sudan in recent years to improve health system performance, including strategies to achieve the Millennium Development Goals and other international, regional and national goals for reducing poverty and improving population health. Accordingly, Sudan’s Federal Ministry of Health made a decision

Figure 9.4 Number and percentage of student nurses who passed the professional licensing exam and registered with the Uganda Nurses and Midwives Council, by school district (entrants between 1980 and 2001)



Source: Capacity Project (1).

to closely monitor the institutional performance of the key departments and programmes at all levels (9, 10). In collaboration with the World Health Organization, the Ministry developed a comprehensive monitoring and evaluation matrix tailored to the national context for health system performance. The matrix drew on baseline information and set periodic targets for each agreed upon indicator, against which the information system would be used to monitor progress over time. Three main sections were included:

- global indicators, including those related to health system coverage and health workforce density;
- disease-specific indicators, such as those pertaining to HIV, malaria and tuberculosis;
- department- or programme-specific indicators.

In order to ensure national ownership, the Ministry of Health assumed the leadership role, particularly during the launching and institutionalization of the information system. In addition to international recognized expertise, a number of other partners and community representatives were asked to participate throughout the development and evaluation process. While the undersecretary of the Ministry of Health served as the champion of the whole process, the Department of Health Planning was commissioned to establish a new institutional monitoring and evaluation unit with full-time professional and support staff. A detailed profile was drafted for the unit, including operational terms of reference for both central and subnational teams.

Each main department and programme selected focal points to assume responsibility of the implementation of their respective monitoring and evaluation plans in accordance with the appropriate indicators, baselines and targets. In particular, the Department of Human Resources Development put in place a specific annual monitoring and evaluation plan to monitor key dynamics

pertaining to HRH variables, including those related to entry, active labour force and exit. The objective was the development of a sustainable information and monitoring system for the timely and continuous updating, verification and analysis of data on health workforce dynamics. The plan drew on the national HRH 10-year strategy and other relevant initiatives. The monitoring and evaluation plan was thoroughly reviewed, discussed and endorsed by a wide range of staff from the Department of Human Resources Development and by the Ministry of Health undersecretary.

Special HRH monitoring and evaluation reports were presented at the monthly departmental performance review meetings, including progress made and transparent identification of areas needing improvement. While the reports did not tackle such global issues as retention and migration, they did monitor recruitment, deployment, transfer, exits, opportunities for pre-service and in-service training and compliance with performance-based incentive schemes. Once cleared after the departmental review, wallcharts were displayed in each unit within the Department with monthly statistical variations. Inputs of monitoring and evaluation activities related to HRH were further used for the annual Ministry-wide statistical report.

A number of practical steps to HRH information and monitoring system development and institutionalization were part of the Sudan experience, including:

- critical mass strategy: advocacy to raise awareness of the crucial value of the HRIS and obtain political commitment;
- institutional ownership and leadership: multidisciplinary team approaches under the guidance of a national leader;

- consensus on a limited set of core indicators adapted to the country context, including explicit baselines and benchmarks;
- going electronic: deployment of user-friendly software for monitoring progress;
- methodology refinement and local adaptation: allowing flexibility for refining and adapting or readapting the information system to the changing local context for the health workforce;
- training in data analysis, dissemination and use, and in basic information technology skills for national human resources development staff and monitoring and evaluation coordinators and focal points;
- transparent dissemination of information generated by the system, including periodic dissemination sessions among key stakeholders aimed at gaining inputs and generating maximum consensus building.

Selected results from the HRH information and monitoring system in Sudan are presented in Table 9.1. Critical to these results is the linking of the monitoring and evaluation analysis to problem solving and HRH strategic enhancement: there is no point in investing in a complex information system if the results are only used to monitor implementation. The system must include mechanisms to identify and rectify areas that need improvement.

9.3.3 Evaluating an HRH information and management system in Brazil

In Brazil, the HRH information and management system (*sistema de informação e gestão de recursos humanos em saúde*, or SIGRHS) was conceived in the context of health systems reform. It was designed as an instrument for the collection, processing and use of primary data relevant to planning and management of the health workforce. The system was developed to inform regional and local health managers to make better decisions related to their personnel. Initiated in 1987 by the Department of Health of the State of Rio de Janeiro and implemented by the University of the State of Rio de Janeiro's Institute of Social Medicine, the HRIS has been continuously updated, modified and evaluated in response to local demands and taking advantage of innovations in information technologies. In particular, the development of new, user-friendly software applications facilitated data entry operations at the decentralized level and allowed inclusion of both quantitative and qualitative variables on HRH management.

The HRIS includes data drawing on administrative records from different levels and types of institutions. Data collection and entry are conducted using standardized templates. The basic elements captured in the system include sociodemographic characteristics of health workers, professional qualifications and work-related variables, such as job position, employment sector and working hours. These items of information enable profiling of the health labour force, for example

Table 9.1 Selected indicators and benchmarks from the health workforce information and monitoring system in Sudan, 2006–2007

Indicator	Period	Target	Result	Gap	Compliance rate	Suggested rectification measures
1. Number of newly graduated physicians entering the service for internship on time	Q1/2007	750	750	0	100%	The deployment system has been substantially improved since utilization of the newly developed electronic system/web application (2006), with a maximum waiting time of three months.
2. Number of internship supervisory visits at three identified hospitals using the quality assurance approved checklist	Q1/2007	10	3	7	30%	Compliance rate is too low, to be discussed in next Department of Human Resources Development staff/performance review meetings. Effort should be given to report qualitative results and not merely quantitative.
3. Number of medical specialists deployed to underserved areas	Q1–Q4, 2006	12	7	5	58%	Revisit newly developed incentive system and recommend modifications to attract more specialists to work outside the capital.

Source: Federal Ministry of Health of the Republic of the Sudan.

the distribution by age, sex and educational attainment. They can be used to assess, among other things, skills mix of the health workforce and the deployment of staff across different types of professional functions, health facilities and regions. Regular updating of the data also allows for estimating worker attrition rates. The main data source is staffing rosters and payroll for public health services. Given the confidential nature of these data, a technical team oversees the level of access, whether partial or total, to the information contained in the system for research purposes.

The use of administrative data offers many advantages over other types of standard statistical sources. Traditionally, information on HRH in Brazil came from large-scale databases, compiled by different national agencies for a range of objectives. They include the decennial population census, household sample surveys including the monthly labour force survey, and health facility surveys carried out by the Central Statistical Office (11). Other sources of information on the formal labour market include various registries on jobs, wages, recruitments and dismissals of the Ministry of Labour, and on specific occupations through the registration systems of professional associations, unions and councils (12). However, these sources tend to be fragmented and are often not readily usable for informing managerial practices and strategies at the local level, particularly in the health sector.

The process of health systems reform and decentralization, and the availability of new information technologies at the level of local health organizations, were a catalyst to the implementation of the HRIS in Brazil. In order to evaluate the success of maintenance and consolidation of the system, and the use of information as a planning and managerial tool, a survey was conducted in collaboration with the University of the State of Rio de Janeiro for appraising the implementation of the HRIS and its performance. An appraisal tool was developed drawing on a framework for evaluation of the implementation process covering three key components of accountability of health policies and programmes: administrative, political and community levels (13, 14). The survey was administered among various stakeholders across the country by means of site visits and semi-structured interviews. The specific objectives of the survey included:

- identification of the different types and degrees of involvement of relevant actors in the implementation and utilization of the HRIS;
- identification of the opportunities and constraints for integrating additional information in the area of HRH management, notably qualitative information;
- assessment of the level of satisfaction among health service managers regarding the utilization of the information contained in the HRIS;
- profile of the utilization of the information generated by the HRIS among other organizations both within and outside the health sector.

Table 9.2 Selected indicators and corresponding criteria used for evaluating the performance of the HRH information and management system in Brazil

Indicator	Response options for performance level		
	High	Average	Low
Coverage of implementation of the HRIS among registered servers in the public health services network	At least 90% of registered servers	Between 70 and 90% of registered servers	Less than 70% of registered servers
Completeness of information sources compiled in the HRIS	Collection of data from primary sources and complete fields	Secondary data sources primarily used with at least one review of primary sources	Incomplete data collection/compilation
Productivity of implementation of the HRIS	Emission of first dissemination report less than three months after data collection	Emission of first dissemination report within three to six months after data collection	Emission of first dissemination report more than six months after data collection or not at all
Regularity of implementation of the HRIS	Data collection routinely updated	Data collection updated occasionally or on demand	Data collection not updated
Regularity of utilization of the HRIS	Dissemination reports issued regularly, up to four in last four months or on demand	Dissemination reports not issued regularly, but at least once in last six months	Dissemination reports not issued

Source: Pierantoni (15).

The performance of the HRIS was evaluated using a number of criteria, including coverage, completeness, quality, timeliness and regularity of utilization (Table 9.2) (15). Forty-five per cent of the surveyed sites were ranked as having a high level of performance of the HRIS, 33% average performance and the remaining 22% insufficient. While an evaluation of the technical characteristics and operation of the information system's computer software programme was not explicitly outlined, the results of the survey did gather information on usability of the instrument that guided future upgrades.

Table 9.3 presents selected findings on the institutional impact of the implementation of the HRIS in Brazil (15). Given the decentralized management of the health system in this context, homogeneity was not expected in the information needs pertaining to HRH, expectations for the HRIS, capacities to implement and use the system, or collected responses to its evaluation. However, the results do indicate an overall positive direction in

utilization of information on the health workforce across different situations. The need for comprehensive information for the management processes of HRH and health systems outweighs conditions of even the lowest performance of the implementation of the information system itself.

More recently, as requested by the Brazilian Ministry of Health (16), the information system has been updated to incorporate more detailed information on education and training for health workers, including numbers of graduates of advanced health education programmes. Both a new software (*sistema de informação sobre a graduação em saúde*, or SIGRAS) and the latest version of the SIGRHS package have been made available on the Internet (17) (see also Box 9.2). The freely accessible, adaptable, web-based or network-based programmes should help facilitate the integration of data from local health facilities with other information on HRH production and management processes, reduce operational costs, strengthen data dissemination and use, and

Table 9.3 Selected indicators and results from the evaluation of the institutional impact of the HRH information and management system in Brazil

Indicator	Expected outcome	Response options for institutional impact		Survey results (n=9 sites)
		Yes	No	
Utilization of the information in the HRIS in the processes of HRH planning and management	Improvements in the processes of planning, management and capacity of HRH	The implementation of the HRIS influenced at least three of the following processes: <ul style="list-style-type: none"> – professional qualification; – workforce planning; – team building; – continuing education; – plans for staffing, career development and remuneration; – decentralization of HRH management. 	The implementation of the HRIS did not alter the HRH management processes.	Yes=100%
Utilization of the information in the HRIS in the processes of health system management at the local level	Induction to innovations/reformulations of management processes in decentralized health systems	The implementation of the HRIS influenced at least one of the following processes: <ul style="list-style-type: none"> – restructuring of local health services; – integration of information on HRH with other health system databases; – implementation of programmes for performance improvement. 	The implementation of the HRIS did not alter the management of the health system.	Yes=78%

Source: Pierantoni (15).

expand the evidence base for informing decision-making for management change within organizations.

9.4 Summary and conclusions

Due to the growing interest in health system strengthening and its critical human resources function in particular, the need for documenting and analysing trends and results pertaining to the health workforce is becoming part of the global and national agenda in monitoring health system performance. Although the instalment and maintenance of a functioning HRIS at the national, regional and global levels is not an easy endeavour, it is doable, given the political commitment and evolving quest in many countries to generate evidence-based policies to make progress in tackling HRH-related challenges. The development and sustainability of a comprehensive HRIS to inform decision-making is a leadership, financial, educational, partnership and management issue (18).

Well-defined indicators and high-quality data to continuously monitor the status of the health workforce and evaluate outcomes are being increasingly sought in many countries, particularly by ministries of health. However, prospective countries are not looking for merely cutting-edge technology and technical assistance with attractive manuals and guidelines, but practical options and easy-to-use methods to

monitor the complex dynamics of the health workforce. A generic and conceptually sound framework for HRIS implementation is neither useful nor sufficient. Field experience shows that a “one framework fits all” recipe is not the solution, given the unique context of the health workforce in each country.

At the same time, this chapter has revealed a number of commonalities across various country-specific experiences and lessons learnt that are crucial for the development of an operational HRIS that is viable, effectively functioning and sustainable within the routine health management system establishment.

Firstly, while other partners and local representatives should participate throughout the process, the ministry of health has to be the owner in establishing and institutionalizing the information system. Moreover, institutional readiness is one of the most crucial conditions to making an HRIS both functional and sustainable. Bringing together all HRIS stakeholders, often for the first time in the same room, ensures that information is shared and helps in identifying the data that do exist and reaching consensus for selection of appropriate indicators and benchmarks. Training and capacity building among stakeholders of the system is critical from the early planning stages, not only in data analysis and basic information technology skills, but also in data dissemination and use to inform decision-making.

Box 9.2 Implementation and use of the SIGRHS information system for HRH management in Guinea Bissau

The SIGRHS HRH information and management system was adopted and implemented by the Ministry of Public Health of Guinea Bissau as part of a partnership between the Brazilian Ministry of Health and the World Health Organization to support the use of information systems for health workforce development in Member States of the PALOP organization (Países Africanos de Língua Oficial Portuguesa).

To implement the SIGRHS software for data collection, storage and analysis in Guinea Bissau, it was necessary to adapt the system to the local specificities. A new configuration was based on the administrative organization of the country's health system, the organizational structure of the Ministry of Public Health, the identification and distribution of health facilities and services at the district level, the positions and location of health workers, and the structure of the education system for producing skilled health service providers.

It was also necessary to upload about 2400 pre-existing facility staffing return records from their previous form in a simple spreadsheet (Excel file). Incorporating these initial data into the adapted SIGRHS system enabled preliminary reports to be run and an initial profile of the health workforce to be drawn. The results showed that the health workforce in the public sector of Guinea Bissau is largely constituted by workers with lower levels of education; only 11% were reported to have university-level education. The majority of health workers (63%) were to be found in primary care facilities, 25% in secondary-level facilities and the remaining 12% in large regional-level facilities.

A number of practicalities also need to be considered. The relevance of the HRIS for review of the national HRH situation critically depends on the quality of the data used to feed it. Dimensions against which to measure data quality include the validity, reliability, integrity, precision, truthfulness and timeliness of the system (19). As an example, data validity can be compromised when individual records are not updated upon retirement, emigration or death. While the development of the HRIS is ongoing, a formal evaluation plan for data quality would include comparing routine administrative data used for continuous monitoring to periodic survey or census data for purposes of validation. Another issue closely related to data quality is that of privacy and confidentiality. No data that can specifically identify individuals should be made accessible for public use. Even aggregate data sharing should only come through the permission of the responsible stakeholder.

While an idealized planned progression towards a complete and mature software solution was identified in this chapter, experience suggests that in some cases less is better, and patience is paramount to leave space and time for understanding, ownership and engagement before a solution is rushed in. In particular, although there are proprietary software solutions for HRIS, the choice of free and open source software offers significant advantages for sustainability at the country level where cost-effective solutions are essential (7). Open source solutions decrease the costs of implementation and ongoing maintenance of the HRIS, and provide a global community for support and continuous improvement. Many governments and health systems have elected to standardize on open source technologies and build the necessary capacity to support them in order to realize the benefits.

Unfortunately, some countries remain reluctant to make data publicly available for further analysis, notably in contexts of severe HRH shortages. It is highly recommended to link results of the information system to problem solving among experts in health workforce planning and management. Sharing consistent information is important so that improved human resources strategies can be compared and used by others. Intercountry knowledge sharing as part of the HRIS strengthening process provides models that help avoid repeating mistakes and standardizes HRH information and evidence across regions and countries. As will be further discussed in Chapter 12 of this Handbook, HRH observatories are one valuable mechanism that can be used for widely disseminating information and evidence for effective practices at the national, regional and global levels.

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