

**An Empirical Investigation of Health  
Information System Failure in Regional  
Sri Lanka**

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## Abstract

Public health decision making is critically dependant on accurate, timely and reliable information. There is a widespread belief that most of the national and sub-national health information systems fail in providing much needed information support for evidence based health planning and interventions. This situation is more acute in developing nations where resources are either stagnant or decreasing, coupled with the situations of demographic transition and double burden of diseases. Literature abounds with publications, which provide information on misguided health interventions in developing nations, leading to failure and waste of resources. Health information system failure is widely blamed for this situation. Nevertheless, there is a dearth of comprehensive evaluations of existing national or sub-national health information systems, especially in the region of South-East Asia. This study makes an attempt to bridge this knowledge gap by evaluating a regional health information system in Sri Lanka. It explores the strengths and weaknesses of the current health information system and related causative factors in a decentralised health system and then proposes strategic recommendations for reform measures. A mix methodological and phased approach was adopted to reach the objectives. An initial self administered questionnaire survey was conducted among health managers to study their perceptions in relation to the regional health information system and its management support. The survey findings were used to establish the presence of health information system failure in the region and also as a precursor to the more in-depth case study which was followed. The sources of data for the case study were literature review, document analysis and key stake holder interviews. Health information system resources, health indicators, data sources, data management, data

quality, and information dissemination were the six major components investigated. The study findings reveal that accurate, timely and reliable health information is unavailable and therefore evidence based health planning is lacking in the studied health region. Strengths and weaknesses of the current health information system were identified and strategic recommendations were formulated accordingly. It is anticipated that this research will make a significant and multi-fold contribution for health information management in developing countries. First, it will attempt to bridge an existing knowledge gap by presenting the findings of a comprehensive case study to reveal the strengths and weaknesses of a decentralised health information system in a developing country. Second, it will enrich the literature by providing an assessment tool and a research method for the evaluation of regional health information systems. Third, it will make a rewarding practical contribution by presenting valuable guidelines for improving health information systems in regional Sri Lanka.

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## List of Abbreviations

AIDS: Acquired Immune Deficiency Syndrome

ANC: Ante-Natal Clinic

DQAF: Data Quality Assessment Framework

DSS: Demographic Surveillance System

DOTS: Direct Observed Treatment Short Course

GGHE: General Government Health Expenditure

*GGHE: General Government Health Expenditure*

GIS; Geographic Information System

GPS: Global Positioning System

HMN: Health Metrics Network

HIS: Health Information System

HIV: Human Immune Deficiency Virus

ICT : Information and Communications Technology

IHR: International Health Regulations

IMF: International Monetary Fund

ICD: International Classification of Diseases

ISCO: International Standard Classification of Occupations

LAN: Local Area network

MIS: Management Information Systems

MDG: Millennium Development Goals

MoH: Ministry of Health

MMR: Maternal Mortality Rate

NHA: National Health Accounts

NSO: National Statistics Office

NGO: Non-Governmental Organisations

NCD: Non-Communicable Diseases

OECD: Organisation for Economic Co-operation and Development

PES: Post Enumeration Survey

PHEIC: Public Health Emergency of International Concern

SRS: Sample Registration System

SARS: Severe Acute Respiratory Distress Syndrome

WHO: World Health Organisation



## Statement of original authorship

The work contained in this thesis has not been previously submitted to meet requirement for an award at this or any other higher education institution. To the best of my knowledge and belief, the thesis contains no material previously published or written by another person except where due reference is made

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Signature

Indika Ranasinghe Kaduruwane

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Date



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## 1. Introduction

From our infancy, we receive information that forms our thinking and problem solving. The method by which a phenomenon is measured shapes societal perceptions of it and collective efforts to manage it. Likewise, the methods we use in the collection and use of information for health will determine the effectiveness in detecting problems, defining priorities, identifying innovative solutions, and allocating resources for improved health outcomes. Despite this fundamental reality, there has been little awareness to date, of the influence of health information on management of health services, especially in developing countries. The research reported in this thesis focuses on management of health information in a decentralised health system of Sri Lanka, one of the developing countries in South-East Asia.

Good management is an essential prerequisite for increasing the efficiency of any organisation. It is especially important with healthcare organisations of developing countries where there is a need to do more with less, due to stagnant or decreasing resources.

Good management is also essential in increasing effectiveness of health services and interventions. There is a great deal of evidence that health interventions lose their theoretical effectiveness (also called efficacy) in poorly organised health services [1]. For example, the effectiveness of polio vaccine could be reduced by interruptions of the cold chain, wrong assessment of the age of the child, failure to follow up on children who default booster doses, and such failures.

The World Health Organisation (WHO) has long emphasised that health information systems are critically important for the good management of healthcare organisations. Literature abounds with publications which clearly link improved management to improved health information systems [2-8]. Thus, the general consensus within the health management domain is that, development of rational health information systems which are closely adapted to the information needs of health services at district, health centre and community levels can potentially contribute to the overall improvement of management of health services.

As the physicist Niels Bohr famously stated in 1930, “Nothing exists until it is measured” [2]. Although he was referring to quantum mechanics, the idea is relevant to health services management as well. Accurate, reliable and timely information is considered vital to measure the needs, demands, output and outcome of healthcare organisations in any country.

An early example of epidemiological investigation and informed health intervention is the work of John Snow during the cholera epidemic that ravaged London in mid 1800 [9]. In his ground breaking work he was able to map the relationship of deaths due to cholera with the places of water pumps. He was able to do so by using information available within the registers of deaths made available by the local health authorities. Without information on numbers of death from cholera and street addresses of each victim, it would not have been possible to map the mortalities and their relationship to distribution of contaminated water.

A century and a half later, it is reported that only 78 countries carry out comprehensive death registrations while only 150 countries are able to estimate child

mortalities based on empirical data [2]. The countries with comprehensive registers are generally developed countries.

It has been widely reported that most countries are lacking reliable health information due to various reasons. Therefore, it could be assumed that their management decisions are not evidence based. This situation is more acute in developing countries where the health services are facing severe constraints due either to stagnant or decreasing resources. The need for accurate health information is aggravated in these countries due to demographic and epidemiological transitions, which have created a double burden of disease. The “epidemiological transition” is brought about by the decreased prevalence of communicable (infective) diseases and increased prevalence of non-communicable (non-infective) diseases. The demographic transition is caused by the decreased birth and death rates leading to an ageing population [10].

Although documentation of health services and counting of demographic events improved in developing nations over the past two decades, much remains unknown in these countries especially about adult mortalities, causes of death and burden of disease due to non-fatal health conditions[2]. As a consequence, these countries fail to meet the basic prerequisites of any health programme, i.e. the number of deaths it will avert and the proportion of burden of disease it will address. For these reasons, many are of the view that lack of information support is the mostly cited obstacle for effective health management in developing nations [2-8, 11-13].

Information is required at various levels of management of health services [2]. For example, at the level of individuals and communities, information is required to assess the extent to which services meet the needs and demands of communities.

At district level, information is useful for health planners and managers to make decisions regarding the effective functioning of health facilities and the local health system as a whole. At higher levels, information is essential for strategic management of national health systems and formulation of policies.

For health information to make a substantial positive influence on management, it has to be used by decision makers at all levels of health management, mentioned above. Undertaking a situational analysis, setting health priorities, and evaluating health programmes are some examples of decision points where information is vital. This means that information is crucial at all level of management from periphery to the centre. Therefore, health information should be used not only by policy makers and managers but also by the care providers such as doctors, nurses, health technicians and community health workers. Unless this occurs it will be difficult to justify the considerable costs involved in setting up and maintenance of health information systems.

Health information system is defined as “ an effort to collect, process, report and use health information and knowledge to influence policy making, programme action and research”[14]. There is a general consensus that Health Information Systems should address following areas in terms of demand [2, 12, 15, 16].

- Health determinants (Socio-economic, environmental, behavioural and genetic factors)
- Inputs to the health system and related processes including health infrastructure facilities, equipment, costs, human resources, financial resources, and health information systems



- The performance or outputs of the health system such as availability, quality and use of health information and services
- Health outcomes such as morbidity, mortality, disability, wellbeing, disease outbreaks, and health status

The usual data generation methods of health information systems include health facility data, administrative returns, household surveys, census, vital registration, financial accounts and health research.

## 1.1 Statement of the problem

How well are the national and regional health information systems of developing nations performing at present? The common response to the above question is that most national and regional health information systems of developing countries are not performing well [2-4, 13, 14, 17-19]. This failure of national health information systems of developing countries was revealed recently in the process of evaluation of the achievement of Millennium Development Goals (MDG) which have strong health related components. For example, only few developing countries are able to calculate cause specific mortalities which are the targets of several MDGs.

The word ‘system’ is defined as a connected whole or organised process. However, most health information systems are said to be lacking such cohesion due to many reasons [2, 14]. They are said to have developed in a piecemeal way and remain fragmented due to many reasons. Following five weaknesses of national and sub national health information systems of developing nations are consistently cited in the literature [1, 2, 4, 13, 17, 18, 20-23].

1. Lack of relevance :

Many of the data recorded and reported by the health staff of these countries is not needed for any purpose. Yet, data that are needed are frequently not collected. For example, appropriate health indicators are rarely included in health information systems. Another observation is that data collected supports disease control objectives and rarely supports the management objectives. A common reason for these two observations could be a lack of a consensus between producers and users of data at each level of the healthcare system regarding the information needed.

## 2. Poor quality of data

The quality of data produced is described to be of poor quality. Several reasons are cited in the literature and investigative reports. In most of the developing countries, required technical skills are lacking among the health information professionals. Another reason is lack of motivation among the health services professional. Lack of incentives and feedback mechanisms are widely believed to be reasons for this situation.

## 3. Duplication and waste among parallel health information systems

Vertically structured health programmes of most developing countries have their own information systems leading to fragmentation of health information systems. This results in duplication of health data and waste of resources.

## 4. Lack of timely reporting and feedback

The process of collecting, transmitting, analysing and compiling data are tedious and troublesome in most of the health systems of the developing countries. As a result of this, by the time most reports are prepared, the statistics are outdated and of no use in the making of management decisions.

## 5. Poor use of information

Despite the evidence that much of the information generated is of poor quality, irrelevant, redundant or obsolete, there are nonetheless some useful information and data sets available within the health information systems of most of the third world countries. Yet, information is poorly used in these health systems at various levels for management of services. Information use is found to be especially weak in district and community levels [2, 4, 14, 17].

As such, the general agreement within the domain of health management and the research community is that, while most advanced countries have well developed health information systems to inform health services planning and delivery, most of the developing countries are yet to establish effective health information systems. While health information system reform is increasingly becoming a priority in developed countries it has not received its deserving attention in health system management in developing countries

Consequently, planning and delivery of health services of these parts of the world are conducted without sufficient information about the population and the communities using the services. Health programme planning and implementation are therefore based not only on expressed sentiments of some groups of the communities but also on estimation and guesswork. It is appropriate to mention that this situation would inevitably result in inefficiency, inequity and waste in the provision of healthcare.

### **2.1.1 The global Significance**

In this era of globalisation, health information system failure in one country inevitably affects other countries. This phenomenon is especially relevant in relation to newly emerging diseases and global pandemic threats. There were enough examples in the recent past which had signified the importance of concerted efforts of health information management and disease notification for successful control of outbreaks of newly emerging disease outbreaks.

To emphasise the global significance of health information system failure in developing countries, two examples of pandemic threats are considered here. The first example is the global epidemic of Severe Acute Respiratory Syndrome (SARS)

which occurred in the year 2003. SARS created a global panic situation in that year with nearly 1000 deaths worldwide. The macro-economic effects were disastrous due to the restrictions of travelling and many other economic ventures. It is widely believed that SARS emerged as an isolated epidemic in a remote province in China in November 2002 with a cluster of deaths. However, it was duly reported as an epidemic with pandemic threats in 2003 February with the death of a foreign traveller in Vietnam after tracing the source of infection to the remote district in China (Guangdong province) where the epidemic has initially emerged [24]. The pandemic was eventually controlled with a worldwide effort.

The second example is the much publicised pandemic of H1N1 influenza (Swine flu) in the year 2009 [25]. Swine Flu was first detected in Mexico City of Mexico and it was developed in to a state of pandemic within a short period of time. However, in this instance, there was a rapid response and disease notification soon after the initial detection of the outbreak. As a result of this quick notification and actions by the local health authorities, WHO was able to launch a concerted worldwide effort to control the pandemic successfully.

Above two examples highlight the global significance of successful health information management in individual health systems. Therefore, it could be safely assumed that no country is safe if a health information system fails in another country.

How do the health systems of third world countries find themselves in this disastrous situation of health information management? Is the problem lack of funds? Is it due to inadequate capacity prevailing in these countries? Is it due to

abdication of responsibilities by health authorities? Is it due to all of the above? Or is it due to something else entirely?

The research reported in this thesis has been conceived and proposed with the objective of finding answers to the above questions in a regional health system of Sri Lanka, one of the third world countries situated in South-East Asia.

The following section of this introductory chapter will explain the planned objectives of the research followed by an overview of strategies adopted to meet the research objectives. It will then present a statement of expected research contribution and its significance.

At this stage it is considered appropriate to introduce three key terms which are widely used in the thesis. Therefore, some space is devoted to define and explain key terminology which is considered critical in the interpretation of research findings. The three terms explained in the next few paragraphs are, “Health Management”, “Health Information Management” and “Health Information System”. The main purpose of this explanation is to avoid any ambiguity. It is also expected that this explanation will assist in identifying the main focus of this research.

### **Health management**

The definition of the term “health management ‘does not deviate from the definition of the general organisational management. Thus health management is the process of effective utilization and coordination of resources such as capital, materials, and labor. Tailored to the management of healthcare organizations, the term could be defined as “ the healthcare organizational process that includes strategic planning, setting objectives, managing resources and deploying the human and financial assets needed to achieve objectives, and measuring results” [26]

## **Health Information Management**

“Health Information Management” is a functional process which encompassed all functions related to the ultimate production and use of health information. The process starts at the level of data collection. It also includes data processing, storage, dissemination and use of information at various levels of health organisation. Lippeveld [14] defines Health Information Management as “the activities dealing with data collection, processing, reporting and use of the information necessary for improving the health services effectiveness.

## **Health Information System**

A “system” is conveniently defined as any collection of components that work together to achieve a common objective [14]. The Health Information System integrates the activities of health information management mentioned above. Smith [27] defines Health Information System as “a set of interrelated components working together to gather, retrieve, process, store and disseminate information to support the activities of health system planning and decision making both in management and service delivery”.

At this stage, it is considered appropriate to mention that the main focus of the research reported in this thesis is “Health Information System”. It makes a substantial attempt to identify the key strengths and weaknesses of a regional Health Information System of a developing country in the South-East Asian region.

## 1.2 Research Questions

The failure of health information systems in the third world countries to meet its objectives has hampered the progress, efficiency and effectiveness of health services in these countries as declared by many sources including world Health Organisation [1, 2, 4, 17, 19, 20, 28-31]. Yet, there is a dearth of research studies which comprehensively investigate the causative factors underpinning such failures, pertaining to specific national or regional health systems. Such studies are extremely valuable to identify the region or nation specific causative factors for health information system failure. Correct identification of causes is fundamentally important for planning and implementation of sustainable reform measures.

The postgraduate research reported in this thesis makes an attempt to find answers to following four fundamental questions related to the management of health information in one of the decentralised health systems of Sri Lanka.

1. What are the ideas, concerns and expectations of the regional health managers of Central province of Sri Lanka in relation to the regional health information system and its management support?
2. What are the existing strengths and weaknesses of regional health information system of Central province, Sri Lanka?
3. What are the causative factors for existing strengths and weaknesses of regional health information system of Central province, Sri Lanka?
4. What are the strategic recommendations for the improvement of regional health information system of Central province, Sri Lanka?



The main objectives of the research are to find and formulate answers to the preceding investigative research questions. The next section of this introductory chapter is dedicated to present a contextual description of the health system of Sri Lanka which is the conveniently selected study setting for the research. It will be followed by an overview of the strategies adopted in this study to achieve the formulated objectives.

### **1.3 Sri Lanka: Country profile**

Sri Lanka is an island in the Indian Ocean with an area of 65610 km. The population of Sri Lanka is approximately 20 million according to the last census conducted in 2000. It has a market oriented economy with manufacturing capacity taking over from former dependence of agriculture. For three decades, it had to face a civil war which has destroyed infrastructure and impeded socio economic development in the north and the eastern provinces. Sri Lanka is prone to natural disasters. Some instances are landslides and floods in 2003, droughts in 2002-04 and the tsunami in December 2004 which devastated the major portion of the coastal belt [32].

World Health Organisation compiled a comprehensive report on Sri Lanka identifying some key constraints in the health sector [33]. These are:

1. Inter-sectoral coordination is poor due to weak horizontal linkages between health-related ministries and the Ministry of Health, as well as lack of appreciation of each other's importance.
2. For sustainable and efficient district health systems, the capacity of health managers and planners as well as instruments such as health information and material procurement, need substantial improvement.

3. The tertiary and secondary level hospitals have bed occupancy in excess of 100% (2 persons on one bed in some cases) whereas the primary care hospitals often have 30% occupancy. This highly cost-ineffective situation arises because many people bypass the lower level facilities even for relatively simple illnesses.
4. The health information system needs further strengthening with IT support, and inclusion of community and private sector information. Data on private sector patient workload and disease profiles are not collected, which makes a comprehensive overview of the entire health sector impossible.
5. Stewardship is required to engage and regulate the private sector, collaborate with the education and other sectors as well as other stakeholders, and providing much needed certainty in the direction of the health sector.
6. Quality control in pharmaceutical production, pricing and prescriptions has been a major issue which is yet to receive adequate attention.

As it is evident from the constraints depicted above, health information system failure is considered as a key issue which needs serious attention. It is also worth noting that all the other issues mentioned above could be properly addressed if there is a strong and efficient information system in place. For example, inter-sectoral coordination, and engagement of private sector could be efficiently handled with the aid of an efficient health information system.

To our knowledge, the existing health information system in Sri Lanka has not been systematically studied at national or regional levels. The PhD research reported in this thesis is the first comprehensive study to make a situational analysis of a regional health information system in Sri Lanka. It is anticipated that the findings of this study will not only provide a baseline for reform

measures to improve the regional health information systems in Sri Lanka and other developing countries of the region but also will enrich the research literature related to health information system failure in developing countries.

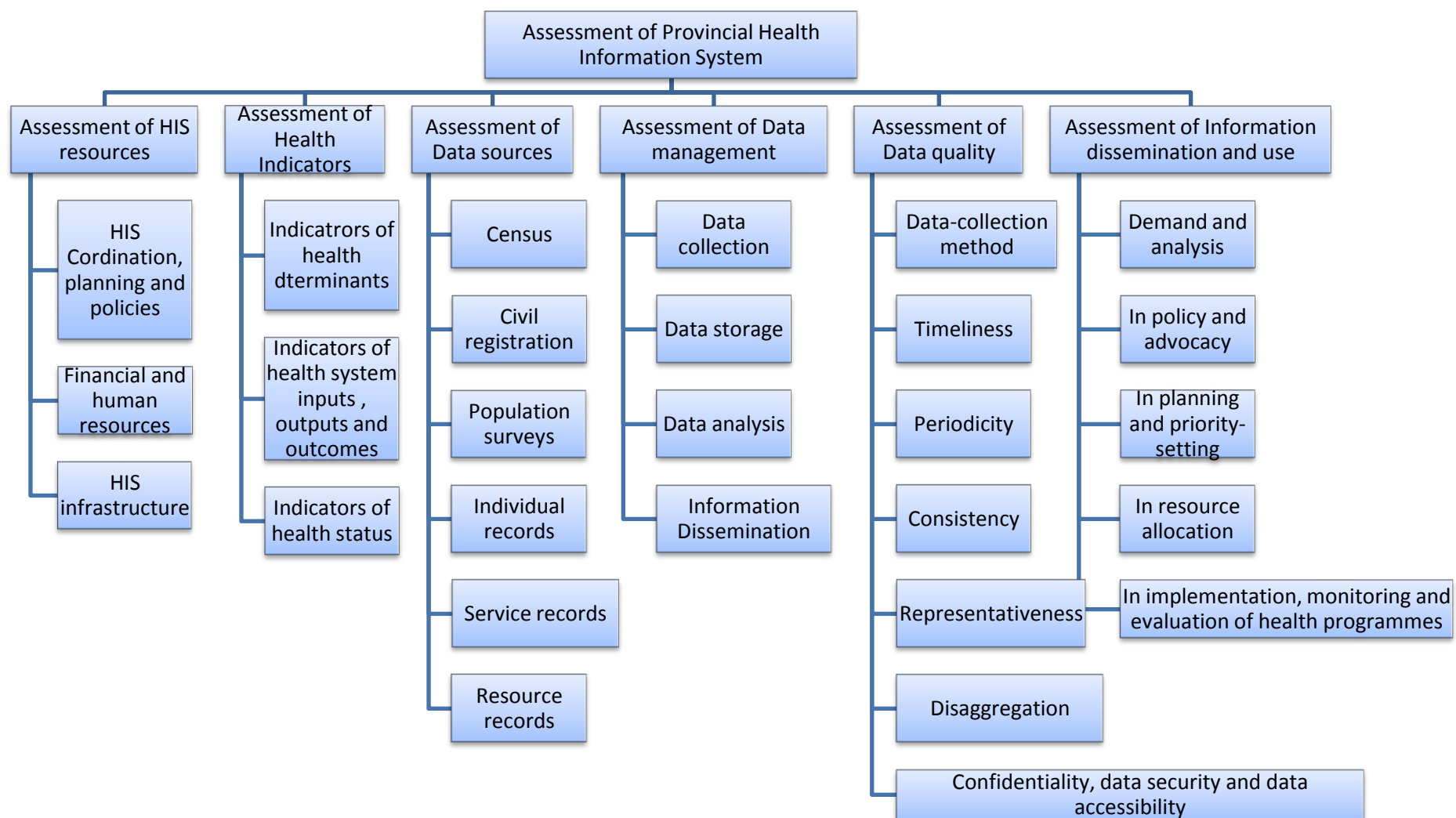
## 1.4 Research Strategies

A mixed methodological approach is adopted in this research to ensure the success in achieving the objectives of answering above research questions via a stepwise research process. First, a quantitative research method has been used to analyse the perceptions of key stakeholders of health planning and management of the studied regional health system. The objective of this initial study is to establish the existence of regional health information system failure to meet the expectations of health planners and managers of the region. The study instrument used was a questionnaire, which was validated and distributed among health planners of the regional health system. Prior to this component of the research, our assumption is that the regional health information system of Central Province, Sri Lanka is in a state of failure and provides no significant support towards health planning and management. This assumption is based on two sources of evidence:

- a. Researcher's personal experience of working in the same health region as a medical practitioner and a medical administrator
- b. Available literature on other developing countries [1, 2, 10, 14, 34]

The second phase of the research process consisted of a comprehensive evaluation of all aspects of the health information system. The conceptual framework for this assessment is based on an assessment tool developed by WHO affiliated Health Metrics Network for the assessment of national health information systems of developing countries [16]. Figure 1 (page 18) illustrates the conceptual framework of the case study component of this research with the major areas assessed. The research method adopted is "case study" research method of the qualitative paradigm. Literature review, document analysis and interview of key stake holders were the main sources of data in this phase of research. The data so

gathered were analysed and interpreted to synthesise an accurate picture of the regional health information system. The strengths and weaknesses of the existing health information system were deduced upon the findings of this evaluative case study. This phase of the study fulfils the requirement of a comprehensive overview of the regional health information system which is useful to gain a full understanding of the situation and the breadth of change required. The recommendations for reforms of the studied health information system for the next decade are based on these findings.



**Figure 1: The conceptual Framework for the evaluation of regional health information system of Central Province, Sri Lanka**

## 1.5 Anticipated Research Contributions

This is the first study which makes a significant attempt to empirically evaluate a regional health information system in Sri Lanka. It could probably be the first such study in the region of South- East Asia. The research contribution anticipated is multi-fold and could be classified in to two categories of practical and theoretical. The anticipated practical contributions are those contributions derived from the study findings that can be directly applied to the regional and national health information systems of Sri Lanka and the other developing countries. The study findings will have a direct impact on the management of health information in the studied health region of Central Province, Sri Lanka. The theoretical contributions anticipated are those contributions which will enrich the existing literature with new knowledge and enhancing existing knowledge in health information management, especially in relation to the health systems of the third world. Thus, the potential contributions arising out of this research include at least the following.

### **Practical contributions:**

- A. Identification of the ideas, concerns and expectations of healthcare managers and planners of the studied health region (Central Province, Sri Lanka) which could justifiably be generalised towards other health regions of the country and also towards peripheral health regions of developing countries of South- East Asian region
- B. A comprehensive annotated bibliography which will serve as a resource document of reported health information management practices and research
- C. Identification of critical success factors and contextual elements related to the regional health information system of the studied health region with categorisation in to various sub-components. These findings could justifiably be

generalised towards the other regional health systems of Sri Lanka and the developing countries of South-East Asian region.

- D. Exposure of existing weaknesses and critical failure factors of the studied regional health information system of Sri Lanka. These findings could justifiably be generalised towards the other regional health systems of Sri Lanka and the developing countries of South-East Asian region
- E. A proposal consisting of recommendations which could be implemented as strategic reform measures for the improvement of the regional health information system of the studied health region specifically and the regional health information systems of entire Sri Lanka in general.
- F. Presentation of two validated study instruments that can be used for comprehensive evaluation of regional health information systems of developing countries

**Theoretical contributions:**

- a) A comprehensive annotated bibliography and synthesised critique of health information management research related to the developing countries
- b) A prototype of how multi-method research design consisting of survey and case study research strategies can be applied in health information systems research
- c) An exemplary description on how to conduct and present case study research with a chain of evidence from research questions to conclusions
- d) An exemplary description on how to design well structured survey and study instruments using past literature in a new domain
- e) Presentation of a sound basis for further research in the research area of health information management of regional Sri Lanka, and regional health systems of third world countries in general



## 1.6 Chapter Conclusion and Thesis Structure

In this introductory chapter, firstly, the link between health information system and overall management of health care organisations has been presented and explained. Second, the existing weaknesses of health information systems of the developing countries were briefly discussed. Next, the importance of evaluation research leading to strategic recommendations for reform measures was emphasised. Subsequently, research questions and objectives were presented, followed by an overview of the research design and strategies. The remaining sections of this thesis is structured and organised as follows.

Chapter 2: Presents a review and synthesis of literature related to prior research on health information management in developing countries. This identifies the current knowledge gaps within this research area and thus positions this research accordingly within the contemporary research literature. In addition, this chapter provides a research agenda for the topic of health information management in developing countries.

Chapter 3: Presents the epistemological and ontological foundation of the research with detailed presentation of multi-method research strategies adopted to achieve the research objectives.

Chapter 4: Presents the results and descriptive statistics of the questionnaire survey conducted among the health planners of the decentralised health region of Central Province, Sri Lanka.

Chapters 5 and 6: Present the results of qualitative strategies used in the evaluative case study of the regional health information system. These chapters

summarise the overall interpretation of the key components of the case study (literature review, document analysis and semi-structured telephone interview of the key stakeholders).The themes and relationships arising from interviews, literature review and documentary examination are illustrated in these chapters.

Chapter 7: Presents the conclusions derived from this study. This chapter includes a narrative description of answers to each of the research questions with justifications for potential follow-up studies.

## 2. Literature Review

This chapter presents a comprehensive review of literature pertinent to the study. The review is structured and organised in to three sections. The first section considers the terminology and definitions related to health information management. This section is especially important to be placed at the beginning of the chapter because many terms related to health information management are found to be having different meanings in different contexts. The second section is a narrative review which considers the writings and observations related to health information management in developing countries and health information system failure in those countries in particular. The third section reviews the empirical research carried out to study the health information systems in low-income countries. This section, while analysing the key issues and themes arising from the existing research literature, positions this study within the contemporary research literature in health information management in developing world.

In summary, following are the main objectives of the literature review reported in this chapter:

- a. To define appropriate terminology used in health information management because there is an ambiguity in certain terms used in contemporary literature
- b. To consider writings and observations related to health information management. This was performed as a narrative review.
- c. To analyse the key issues and themes arising from empirical research literature on health information management pertaining to developing countries

- d. To position the study reported in this thesis within the area of identified knowledge deficiency in the current literature

## **2.1 Definitions and Terminology**

The research literature pertinent to health information management is riddled with confusing terminology which has different meanings in lay terms, and in more specific meanings attributed by researchers. Moreover, even researchers have different terminology for the same concept. Therefore, it is increasingly difficult to find way through the confusion and develop a common understanding of the terminology [35, 36]. Recognising this confusing state of terminology, text books of information management and information systems define their own terms [37, 38]. Thus this section devotes some space to describe and define some of the terms used in this research.

### ***2.1.1 Data and Information***

Information is one of the key resources in any organisation. Therefore it has to be well managed to ensure its efficient and effective use. However, this seemingly obvious concept and the term “information” become more complicated when it is differentiated from data. Wilson [39] is of the view that it is important to use definitions which provide insights to analyse the concept. He believes that information has to be data with the meaning ascribed to it. For example, the number of hours worked by an employee is a piece of data. It will be converted in to one kind of information when it will be used by the salaries clerk in calculating the amount of

pay due to the employee. It becomes completely different kind of information when used by a production scheduler to allocate resources to related tasks.

Wilson [39] further states that information is generated when facts are combined with meaning. This idea is supported by Avison and Fitzgerald [37] who additionally indicate that distinction between data and information is context dependent. Thus, something which is information to one person can be raw input to another because it has not been analysed for their purposes. Therefore information is not of value in itself and its value lies in its use. These comments recognise the fact that information is organisation specific and role or individual specific.

### ***2.1.2 Definition of systems***

The conceptual basis of Information System lies in the idea of systems which are developed to deal with complex situations. This term however, can be used in two different ways which have major implications in the analysis of problem situations and in methods for dealing with them. The “hard Systems” approach is an ontological definition and based on that, the world is composed of such ontologically defined systems and sub systems. (“Thus a university is a system to produce a better qualified workforce”). The soft systems approach defines system as an epistemological device for exploring the world. (“Thus a university might be regarded as a system to produce a better qualified workforce”) [40].

A system is a set of an interrelated components, which is organised together to form an entity, that as a whole, has an emergent properties that belong to no single component or subset of the components for which it is formed [40]. Systems have an organisation and a purpose while aggregates do not. Thus, in a system it is important how the parts are arranged, but in an aggregate it is only important if the parts are

present or not. Systems can be a single entity or it could be formed in to a hierarchy, consisting of components which are known as sub systems. The sub systems each contribute to the overall goals, whilst acting as separate components in many ways. The system has an environment existing outside the system boundary, which will include those things which interact with the system, even though they are not within it. The system interacts with the environment by means of input and output. Input is anything entering the system from the environment. Output is anything leaving the system crossing the boundaries to the environment [41]. Thus, the output is the result of input which has been transformed within the system.

### ***Information Systems***

According to the definition of information systems mentioned above, the “information systems” are processed data systems. It is also to be noted that they only become information systems when someone makes use of the output [39]. Thus, the user also must be a part of an information system. Accordingly, Sen [41] defines an information system as a set of people, data and procedures that work together to provide useful information. The activities undertaken within an information system include accepting data from outside or within the system; processing data to produce information and presenting the information to the users. Hence, Sen sees information system as a term covering a variety of systems which receive data as an input and issue information as an output. However, some others for example, Lyytinen believe that Information System needs a much more complicated definition. According to him, information system “*might be seen as a sophisticated piece of technology, a communication technology, a communication tool, a decision making tool, a control mechanism and so on or an institutional arrangement.*”[42].

The definition used throughout this thesis for health Information System, drawing upon above ideas and others mentioned earlier is “an integrated effort to collect, process, report and use health information and knowledge to influence policy-making, programme action and research” (8).

## **2.2 Problems in health information management in developing countries**

The literature focussing on health information system failure in developing countries is of variable quality. There is a dearth of in-depth case studies which have studied and reported the problems or examined the reasons for the problems. When identifying the problems some authors seem to be drawing conclusions based on their own or other's personal observations rather than a systematic review of a specific situation. This section describes the issues raised in these publications in relation to the situation of health information systems in developing countries.

### ***2.2.2 Data Collection***

Many publications indicate the deficiencies in data collection procedures in health information management in developing countries [13, 14, 21, 23, 28, 43]. Their main concern is that some important data items are missing in the procedure. Some others comment on the fact that data are incomplete or fragmented [20, 44]. Many more publications also comment on the reliability, timeliness and accuracy of health information in developing countries [3, 18, 45]. Many of these deficiencies indicate the need for a set of reliable health indicators. Health indicators would assist health managers' routine tasks of planning, monitoring and evaluation roles. According to these authors' views, mere collection of data contribute to profiling morbidity and mortality status for national use which is the focus for centrally reporting health information systems.

Furthermore, there is a perceived lack of feedback to grass root level data collectors [2, 4, 6, 8]. Several authors suggest that data are collected and recorded by staff when it is not needed for their own work and they are not often involved in



deciding which data should be collected. It is described that excessive time is spent in data collection and processing and that lack of integration in data collection leads to duplication of forms and processing [2, 4, 6, 8, 11-13].

### ***2.2.2 Data processing and analysis***

The identified problems of data processing and analysis are lack of data processing at the level of collection, and lack of analysis and processing of inter-sectoral information. Unattractive presentation format, absence of meaningful analysis, undue influence from aid agencies requesting information for their own interests are also cited as common problems of health information management [3, 5, 6, 46, 47].

Poor dissemination of information is another commonly cited problem [2, 4, 6, 12]. Skill level of data collectors are not compatible with the data collecting tasks as a result of insufficient training and skill development provided to them [2, 21]. Under-utilisation of computers in data analysis and presentation is also a widely reported deficiency in health information management. Consequently, the overall quality of health statistics has become poor. It is also to be noted that as a consequence of this, there are no uniform methodologies for programme monitoring [2, 14, 17, 18, 28]. Existing health information is not always analysed consistently resulting in a situation where health information system often produce internally inconsistent information [2, 13, 14, 17, 18, 28, 48].

The data and information are not being processed to provide a systematic assessment of the quality, or coverage of the services provided. There is a fragmentation of reporting system due to lack of integration among vertical programmes. A dire consequence of this situation is fragmentation of management

tasks leading to management failure as a result of separate presentation of input, process and outcome information. These issues have become more problematical in newly computerised systems with rising cultural issues and with insufficiency of availability of skilled personnel [2, 13, 14, 17, 18, 28, 48].

### ***2.2.3 Use of information***

Utilisation of information at various level of health management is a major concern in health systems of developing nations. Little of the data sent to the national ministry level is analysed and fed back to district levels. Information often fails to arrive at decision making levels [2, 4]. There is a considerable lag between the use and availability of information. Consequently there is an insufficient use of information for local decision making [13, 14, 22]. In order to implement proper use of information there is a need to link targets, objectives, output and outcome of health services and interventions. This is not seen in most of the health systems in developing countries and as a result of this situation, health information is not used to compare health needs, utilisation, performance and equity of public or private healthcare services [1, 13, 14, 19, 22].

Non-utilisation of financial information is another widely apparent feature in these health systems. Only very little attempt is made to present information in the form of comparisons in an understandable format for the managers of district and sub-district levels. Most of the current health information systems are designed without paying attention towards the analysis and utilisation of information. There is a lack of tools which enable health managers to make maximum use of health information. Communities and consumers are not usually using health information

while health managers do not know how to use information in their routine management tasks.

Surprisingly, in some health systems of the third world countries, there are constraints to the simple understanding of “using information”. Health managers rarely exploit “health indicators” for their routine and strategic management tasks. They occasionally use indicators for supervision but not for important tasks like decision making in resource allocations. This situation may have been caused by the fact that, health managers or data collectors do not see the value of information or do not perceive the importance of information for management tasks [13, 49].

#### ***2.2.4 Organisation and Management of health information systems***

Commonly, health information systems of the developing countries are over centralised [2, 4]. This hampers the possibility of estimating, if the health services meet the demands and needs of the population at district and sub-district levels. Information systems are not usually integrated in these health systems. Furthermore, information systems do not reflect the tasks and responsibilities of managers [14].

As a solution to the above situation some authors recommend, individualised health information systems rather than using standardised health information systems. For example, Fenenga [44] believes that health information system designers should relate information needs to intervention possibilities and that health information systems should retrace the steps taken in decision making process. Qazi [49] suggests that there is a need to develop health information systems which support existing health policies in individual health systems of developing countries.

Furthermore, WHO, [50] when reviewing the health information system problems, felt there were only few apparent improvements in services and programmes despite much time spent in data handling and report production. WHO is also of the opinion that efforts to strengthen the health information systems have often produced little improvements and have sometimes made the problem worse.

Rational decision making does not necessarily follow improvements in health information systems. Even when accurate and reliable health information is available, informational approach to management decision making is not automatic. Therefore, Stansfield [13] maintains the view that, while health managers are to be provided with accurate, timely and reliable health information, new informational approach to health planning and management is also to be advocated.

Many researchers and operational managers note that existing health information systems do not always monitor health policies [4, 28, 48, 51-53]. They also argue that these health information systems do not represent the differences in management roles of the health service providers. However, it is unclear if all individual health systems face these problems or whether only certain people of the health system find them problematical. For example, senior managers may have problems with one particular system but operational managers may be quite content as it serves their needs. It would be useful to have a thorough needs assessment of individual health information systems or a diagnosis of problems that indicates at what levels it is adequate and where it is not, including the views of all those involved.

Furthermore, research is needed which not only describes information management problems but also describes the problems experienced when changing

from traditional role of health unit in charge or district coordinator with limited power to an informational approach to management undertaken by managers with control over resources in a decentralised administration.

## 2.3 Research on Health Information Systems in developing countries

This section of the review is dedicated to present an overview of current landscape of health information systems research literature concerned with developing countries.

### 2.3.1 Introduction

In the recent past, there had been some debate as to whether reforms to health information systems were relevant to developing countries. However, this debate has been resolved with a clear “yes” answer [1, 10, 14, 21-23, 44, 54]. The question has become not whether, but how it can be performed and how it can be beneficial. Health information system reforms have high potential value across all health related sectors, in both public and private, and at multiple levels, from health unit management to formulation of national health policies. However, health information system reforms in developing countries have not always been successful to date, and indeed there are many examples of failure or partial failure (see, for example, [21]) , but the challenge remains to tackle these difficulties and to resolve them. A further challenge with respect to these reforms is to address issues of the “digital divide” between those health systems with access to the technologies and the ability to use them effectively, and those without.

The increasing visibility and importance of development and reforms of health information systems in developing countries is mirrored to some extent by a growth in the health information systems research literature addressing the area. There are some specialist journals devoted to the area, and occasionally, articles also appear in the mainstream information systems journals. While it is true that very few related research articles currently appear in premier journals such as *International*

*Journal of Medical Informatics and Bulletin of the World health Organisation*, evidence of increased interest was displayed in publication of a special issue of *Bulletin of the World Health Organisation* in 2005 devoted to the area (Volume 83, No.8).

The purpose of this section of the literature review is first to survey the “landscape” of current research on health information systems in developing countries. An attempt has been made to identify what is currently being reported in the literature, how researchers have carried out their studies, and what their results suggest about particular topics. In addition to this survey of work to date, this review will address the future scope by identifying positive trends which need further development, and by suggesting some important topics, issues or theories which are omitted in the current literature, or where research is sparse. It could be anticipated that reviews of this nature will encourage future research aimed at filling gaps, expand the coverage of important but relatively neglected topics, and stimulate further debate on topics and research approaches of relevance.

The method adopted in this review was as follows. As the first step, 10 recent health information system research articles pertinent to health information systems in low income countries were sampled from health and information system related journals. These were then analysed and an initial classification was generated. The classification thus generated was as follows.

- a) Key challenges for the development and reform of health information systems in developing countries
- b) The role of technology in addressing health information system failure in developing countries

A more widespread investigation of research literature was then carried out using the above classification. The survey was restricted to publications from 1995 onwards to reflect current or recent work. This time period was decided to maintain the recency of the review. For the section entitled “Future prospects” an approach was developed through careful examination of what the survey revealed, from a conceptual view of how to study health information systems in developing countries, and from ideas derived from the candidate’s personal experience as a medical practitioner and health manager in a developing country.

### ***2.3.2 Key challenges for the development and reforms of health information systems in developing countries***

The analysis of the publications showed a variety of challenges which were being addressed by the researchers and, in many cases, these reflected challenges faced by the practitioners in the field situations themselves. In this section, these have been divided in to four categories as follows.

- a) Broad issues faced at national health system level in development and reform of health information systems
- b) Issues related to inter-sectoral coordination
- c) Attempts at local adaptation of health information systems
- d) Efforts to help particular level of health management via informational approach

#### **2.3.2.1 Broad issues faced at national health system level in development and reform of health information systems**

Articles in this category dealt with broad issues of the contribution of health information system reforms and development to improvement of health services at national level, sometimes in the context of a specific country. In some cases, the



meaning of the term *health information system development* was itself discussed. For example, in this latter category, Heeks [21] examined the use of technology in national health information system development. He drew from the health information system development studies literature to define this latter concept of technology infusion. He derived some conclusions for intervention by the key stakeholders, including the importance of minimising the so-called “Design – Reality Gap”.

Braa [18] also problematized the notion of uniform development of health information systems, and in particular questioned the rhetoric that health information system should be a standardised instrument for gains within the context of healthcare services. He drew from a discourse analysis of research literature generated in developing countries, and argued for the crucial role, in his view, of the standardisation and scalability in complex national health information system development.

Cibulskis and Hiawalye [4] dealt with a specific country, Papua New Guinea, and discussed how to promote the increased use of health information in this particular country context, especially among the decision makers at national level. In terms of information use, they emphasized the importance of demand for accurate health information by national health policy formulators, so the entire national health system will be motivated to produce such information. The paper provides an interesting conceptual basis, although, in line with most published studies in this broad category, the data used were largely secondary in nature rather than being derived from the authors’ own empirical research. This is not necessarily an unsatisfactory situation, but contrasts with the more micro-level studies, drawing on primary data, which form the basis in the majority of the research literature surveyed.

Hotchkiss [55] also wrote about a particular country, Uganda, but they looked at the role of each component of health information system in bringing together networks in national interest. These included, in their case study, national health organizations, local health management units, other public sector organisations and aid organizations. They showed how heterogeneous elements of a national health information system are brought together in a specific national–local combination, linked for example, to particular national plans for development. Although they did not state this explicitly in the article, the evaluation is clearly related theoretically to “Design-Reality gap” model proposed by Heeks [21].

### **2.3.2.2 Issues related to inter-sectoral coordination**

In contrast to rather non-specific literature with national interest, whose exemplars were discussed above, a second category of articles dealt with a rather specific issue, namely that of inter-sectoral coordination in health information management.

For example, Gladwin and Dixon [56] discussed the growing phenomena of diffusion of innovation and dynamic equilibrium organizational change models, and the problems related to wider organisational issues in health information management. With data drawn from Uganda, they emphasized the specific difficulty in non face-to-face communication when working across different related sectors. To offset this, they generated a model for sensitizing collaborators in cross-cultural and inter-sectoral development projects to issues and problems which may need to be handled.

Hammond and Baily [57] also dealt with cross-cultural and inter-sectoral issues in health information management both in developed and developing countries, drawing on secondary data. They highlighted the fact that, in most parts of

the world today, health data most likely come from many different and unconnected systems and therefore must be organized into a composite whole. They use the word “interoperability” to capture what is required to accomplish this goal. They present five priority areas for achieving interoperability in health care applications namely, patient identifier, semantic interoperability, data interchange standards, core data sets, and data quality. The output in this study is a model for the way forward with a stepwise approach, namely, definition of a vision, developing a strategy, identifying leadership, assigning responsibilities, and harnessing resources.

Aiga and Kuroiwa [58] took a critical stance on one aspect of inter-sectoral coordination, namely that standardisation may “impose its own logic” when transferred between different sectoral contexts. They addressed the challenge of how to avoid the inappropriate imposition of standardisation, by making an attempt to classify the health information systems into four types according to their data sources. They argue that information requirement by the diseases-specific funds (e.g. Global Fund to Fight AIDS, Tuberculosis and Malaria) and projects implemented by development agencies increase the workloads of health professionals at facility level and subsequently compromise data quality within an environment of improper standardisation.

Boerma and Stansfield [59] in something of a contrast, used international monitoring of Millennium Development Goals (MDG) as an example to argue that multiple forms of rationality exist in any context and that national inter-sectoral coordination and standardisation represent only one aspect of the standardisation of health information systems. Thus, they argue that we need to unpack the notion of international standardisation rather than seeing it as a fixed entity, relevant to each country. Furthermore, they emphasise the fact that it is time to accelerate the

production and use of accurate, complete, and timely health statistics for decision-making by investing in country health information systems that should be based on an efficient and effective mix of standardised methods of data collection and analysis that meet country and international needs.

Hanvoravongchai and Adisasmito [60] examined the value of inter-sectoral and inter-country collaboration in health information management in a broader context. They examined the challenges and constraints in relation to pandemic preparedness in six Asian countries. With the aid of systemic Rapid Assessment Tool Kit, they evaluated priority disease programmes by taking into account the programmes, the general health system, and the wider socio-cultural and political context. They conclude that the interfaces and linkages between health system contexts and pandemic preparedness programmes in these countries differ. While acknowledging the fact that specific disease programme information systems improved the surveillance systems, they are of the opinion that substantial improvement is required in the aspects of national and international collaboration in monitoring disease trends. This represents one study which reveals true situation of health information management and inter-sectoral collaboration in a representative sample of third world countries. While exploring the ground realities, they hint at the dire consequences in the circumstances of a worldwide pandemic if the health information systems fail to report at the correct time.

Macfarlane [7] is of the view that there is an opportunity for the health sector of developing countries to collaborate with other sectors because such efforts are taking place in other sectors too. He proposes a coordinated approach to lever international resources. He argues that it is practically feasible in these countries to rationalize definition and measurement of indicators common to several sectors;

streamline the content, frequency and timing of household surveys; and harmonize national and sub-national databases that store socioeconomic data. The optimism displayed in this paper appears to be highly significant in true practitioner's contexts as the publications with such an optimistic approach to health information system reforms are rare in the contemporary literature.

### **2.3.2.3 Attempts at local adaptation of health information systems**

Although pessimism and complexities may not be present as clearly as in inter-sectoral coordination issues, bringing a reform of health information management to a new local context also involves some implicit elements of cultural transfer and mutual learning. Local adaptation and cultivation in the new context are themes addressed by another group of papers.

The current era has seen the development of global systems and approaches which aim to transfer best practices and procedures between different contexts and countries. This phenomenon is common to health information management as well. However, there is a tension in developing such systems between wishing to standardize for efficiency and comparability purposes, and the difficulty of imposing the same standards on different local contexts. For example, Odhiambo-Otieno [19] and Qazi [49] in two different studies representing Kenya and Pakistan respectively described perceptions of a group of key stake holders in health information management. Through cross sectional attitude surveys they examined the information need and information seeking behaviour of health managers of two decentralised health systems of Kenya and Pakistan. They critiqued globalization theorists who argue that cultural homogeneity is becoming the norm, and instead

emphasized the need to understand, and indeed value, locally meaningful ways of doing things.

Krickeberg made somewhat similar arguments to those above, inspired by work in Vietnam and other places. He concluded that the local context was crucial in the design and implementation process of national and sub-national health information systems, and that it was essential to involve local stakeholders in the entire process. Krickeberg identifies and proposes eleven principles for designing or reforming a health information system in developing countries. Those principles are, explicit description of the underlying units (target population) and variables; no prior listing or fixing of indicators in advance; limiting only one register per target population; technical coordination between registers and reports; correction algorithms; local use of data and indicators; autonomy of health institutions regarding the information that concerns them; and novel use of registers for various studies. The significance of these principles lies on the emphasis of local adaptation through the entire process of system development. While acknowledging the fact that Krickeberg's principles are remarkably important in bringing about reforms of health information systems, it is to be noted that he has not paid attention towards the importance of global standardisation of key areas of health information systems. Completely dissimilar local adaptations of health information management may lead to difficulties in comparison in a globalised context. Therefore, many authors [6, 13, 50] and global health organisations [30] believe that countries should strike a balance between local adaptation and adherence to accepted global standards in vital areas of health information management.

Noor [61] also dealt with participation in terms of the need to bring local participatory practices into geographical information systems' (GIS) design, drawing

from their research in Kenya. Geographical information systems can be regarded as addressing spatial issues in a particular top-down manner, whereas local stakeholders also have relevant knowledge, for example of where various types of traditional health service providers are located which is not captured in the GIS. The authors argued the need to draw from both approaches to inform appropriate health service provision and catchment population.

Braa and Hanseth [18] were also concerned with local adaptation of health information systems. In their article, they addressed the adaptation of health information systems in contexts such as global health standards. They highlight number of paradoxes which are useful as strategies. They argue that integrated independence in each health systems encourages experimentation and heterogeneity to develop and share innovative solutions for health information management while still conforming to simple standards. The authors suggest an approach to implement health information management standards in developing country settings that is sensitive to the local context, allows change to occur through small steps, and provides a mechanism for scaling information systems.

Puri and Sahay [62] address the challenge of developing participatory networks to support the design, development and implementation of Health Information Systems in India. They concentrated their effort in the context of health information management in the public health sector in Kerala, India. They argue that traditional information system design theories have their origin in developed countries and are quite incompatible with what we see in developing world. Based on an ongoing empirical analysis of an action research effort to introduce, scale and sustain Health Information Systems in Kerala, the authors elaborate the need to re-conceptualise traditional information system design theories. Four areas of re-

conceptualization of participation in the context of HIS in developing countries are identified and proposed as creation of participatory networks, increased context sensitivity, focus on outputs of participation (not just inputs and techniques), and, focus on structural aspects of participation (not just behavioural issues).

Rommelmann [63] studied a totally different aspect of local adaption of health information systems. He addressed the issue of cost-effectiveness in spending for generation of information for health services monitoring in the resource constrained health system of Tanzania. In an impressive manner he has calculated the cost of allocations for health information system managers. System coverage, quality assurance and information production were then reviewed to assess the cost-effectiveness of these expenditures. The study revealed that adherence to standardised procedures had incurred high cost in some sectors and produced very few indicators in return. He concludes that designers of health information systems and programme managers should be mindful about associated cost in producing information. Authors propose that formal cost-effectiveness studies should be formulated in the local adaptation procedures of established information management procedures.

A rather different focus is chosen by some researchers and authors in regards to local adaptation of health information management. They focus their attention on the adoption of Information and Communication Technologies in national and sub-national health systems of some low income countries which are outside the margins of so called “digital divide”. Heeks, in his landmark article titled “Health information systems: Failure, success and improvisation” attributes the widespread health information system failure to technology incompatibility. He explains this incompatibility through “Design-Reality gap” which describes the wide conceptual



gap between the designers of information system and the attitude and needs of real users of the information system. He argues that until and unless this gap is minimised most healthy information systems reforms are bound to fail.

It is to be noted that most of the authors mentioned in this sub-section of the review believe that local adaptation is a vital component which should receive due attention in management of health information, health information system development and health information system reforms. In summation, all of these authors and many others support the notion that uniform and homogenous architecture of health information system may not be successful in low income country context. They also strengthen the argument that local information needs and information seeking behaviour coupled with local health service priorities should determine the nature of health information system reforms in developing nations.

#### **2.3.2.4 Efforts to help particular level of health management via informational approach**

A prominent feature of the contemporary research literature related to health information management in developing countries is reporting of empirical research on specific information support at various levels of health management. They not only report the success and failure of such informational approaches but also encourage the attention towards these specific areas which could eventually lead to the overall success of the health information system. This sub-section of the literature review will be devoted to the critical review of some selected work which were undertaken with the purpose of enhancing the informational support at various level of health management in developing countries. At the end of the section, an attempt will be taken to assess the current landscape of empirical research literature related to specific informational support.

##### **A. Disease surveillance system**

Hiyawalyer [64] described some interesting work on this issue, involving the development of a disease surveillance system which was developed and implemented on the national scale. He explained how it was integrated and collaborated with other management information systems and how information has been used to support management decision-making and informed policy decision in the health sector. The work started in Papua New Guinea but the approach has since been used in a number of other developing countries. The author also highlighted the fact that new information systems should revolve around the existing information system components. This paper provides an interesting example of how reforms should be aimed at an isolated health service area.

## **B. Large linked databases: An example**

Mohammad [65] described a case study of the implementation of a large linked database for the monitoring of vaccine-related adverse events in Khanh Hoa province, Vietnam. In this report of rare nature he proves that it is feasible to establish health information sub-systems such as a large linked database which can provide reliable, accurate and timely information in a developing country for a modest increase in use of resources. Although these types of information sub-systems are common in developing countries, such systems are rarely reported in low income countries. This rarity may be attributed to the prevailing notion that complete overhaul of health information systems should be carried out in reform processes rather than isolated sub-system development. This case study addresses the standardization versus localization debate, strengthening the argument that universal solutions are unlikely to be successful in multiple locations spanning different social, organisational, political, institutional, and strategic contexts. It shows that there is a need for a pragmatic balance between global standards and local needs.

## **C. Use of Health Information in addressing inequalities**

A related small area development was described by Nolen and Braveman [8] who went back even further with respect to the health information systems in a specific location, namely inequalities in health among socioeconomic groups and by gender, race or ethnicity, geographical area and other measures associated with social advantage. He reviews main information requirements and potential databases. They then propose short-term and longer term measures for strengthening the capabilities of health information systems for the analysis of health equity and discuss related areas of health information system for supporting a culture of equity-oriented decision-making and policy development.

#### **D. An injury surveillance system**

An important area public health, affected by poor health information management is highlighted in an article presented by Rahman, Andersson and Svanström [66]. They report a study conducted in Bangladesh about the adequacy of current injury surveillance system. They argue that prevention of injuries, which is a major public health problem in many developing countries including Bangladesh, is not receiving due attention from the policy makers because of the lack of accurate information. The present system of hospital records, post-mortem reports and police reports are not well coordinated to provide a true picture of the situation. They believe that development of an injury surveillance system will provide a solution for the present inadequacy of information. They suggest a coordinated system with combination of data obtained from several different sources to compensate for inadequacies in the individual sources and to improve the overall usefulness of the system.

#### **E. Vital civil registrations**

Setel, Sankoh and Rao [67] describe an entirely different aspect of health information management in developing countries. They emphasise that registration of births, recording deaths by age, sex and cause, and calculating mortality levels and differentials are fundamental to evidence-based health policy, monitoring and evaluation. Yet few of the countries with the greatest need for these data have functioning systems to produce them despite legislation providing for the establishment and maintenance of vital registration. They propose that Sample Vital Registration (SVR) should be promoted in these countries as a solution to this predicament. They argue that when applied in conjunction with validated verbal autopsy procedures and implemented in a nationally representative sample of

population clusters, SVR represents an affordable, cost-effective, and sustainable short- and medium-term solution to this problem. This is yet another example where researchers try to promote small area development in health information system reforms to achieve its objectives.

Shaw [11] describes somewhat similar aspect of health information management in developing countries via a case study conducted in South Africa. He evaluates an essential data set developed in a particular health region to assist health managers perform their management tasks in an environment of changing health needs and priorities. While emphasising the fact that health services are increasingly under pressure to develop information systems that are responsive to changing health needs and appropriate to service objectives, he describes how District Health Information System (DHIS) implemented in the studied health region helped to achieve its objectives. His main argument is that sub-national health system should have their own essential data sets to meet the information needs. Shaw describes how the development of essential data set for the district had a significant impact on neighbouring districts and how it resulted in the development of a regional essential data set, which in turn helped to influence the creation of a provincial and then national essential data set. He concludes that developing a unique essential data set provides managers with a clearly defined set of indicators for monitoring and evaluating health services. The process of developing an essential data set itself can strengthen the health services and the health information system because it requires coordination of reporting requirements among different health programme managers, and the creation of a framework for reviewing information needs over time. Shaw's case study could be interpreted in several ways. It could be interpreted as an exaggeration of events proposing individual health information system architecture.

Health information scientists, who hold the view that some uniformity is necessary in developing data sets and indicators, will not consider this as a success story. On the other hand, health services managers of the decentralised health systems of many developing nations will agree with him because of the similar reasons. Accordingly, this dialogue and debate, whether to acquire a whole system approach or to develop essential and unique components for dissimilar health systems in different countries continue in the area of health information system reforms.

#### **F. Health information management at unique levels**

Thieren's work in the area of health information management in humanitarian emergencies provides yet another example of health information management at a unique level of health services management [68]. His paper reviews the various data-collection platforms in emergency situations, looking at their respective contributions to identification of service priorities and needs. Several lessons could be drawn from Thieren's work. One important lesson is that while providing urgent services, humanitarian agencies should pay attention to reporting of accurate numbers so that true picture will be revealed. For this to happen, there should be an established way to integrate such data to the existing national and sub-national health information systems. Poorly integrated emergency data generate fragmented, incomplete and often contradictory statistics, a situation that leads to a misuse of numbers with negative consequences on humanitarian interventions. To avoid confusion regarding humanitarian health statistics Thieren stresses the importance of submitting statistics to a rigorous and coordinated auditing process prior to their publication. Finally, this paper emphasises the ethical obligation of humanitarian agencies to ensure that the necessary safeguards on data are in place to protect the confidentiality of victims and minority groups in politically sensitive contexts.

Thieren's work [68] is important in health information system reforms due to two reasons. First, this work provides an insight as to how complex is the integration of various aspects of health information systems. It clearly describes the social and political implications of handling sensitive areas in health information management. Distortion of true picture of a humanitarian situation could sometimes lead to drastic consequences in addition to service interruptions. Secondly, this paper introduces the important concept of submitting statistics to a rigorous and coordinated auditing process prior to their publication. Thieren emphasises that audit trail should describe the various steps of the data production chains both technically and operationally. He further emphasises that it should indicate the limits and assumptions under which each number can be used.

#### **G. Public health priority setting and interventions: An example**

Tornheim et al, [69] report an impressive study on epidemiology of pneumonia patients in rural western Kenya. Their findings show that hospital-based data can provide useful information for public health priority setting and interventions. They highlighted the fact that deaths due to this cause could be prevented by introduction of new pneumonia vaccines for children and accelerating the introduction of antiretroviral medications based on hospital information. These interventions need accurate, reliable and timely data. This situation is common to almost all health systems of developing nations. Surveillance of common communicable diseases via a hospital information system could not only avert epidemics but also prevent unnecessary deaths due to the causes for which definitive treatment methods are available.

The same authors Tornheim et al, published a similar study [70] three years later with the same objectives. Their study consisted of analysis of diarrhoea cases in

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regional Kenya over a period of 3 years. They once again proved that had the health service managers properly utilised the existing hospital data, many useful health interventions would have been implemented for the benefit of target population.

These two studies points to the fact that even the rudimentary data available in existing health information systems in some developing countries could be used to assist some aspects of health services management. Thought provoking reports of this nature, strengthen the argument that holistic approach with complete overhaul of health information systems in developing countries is not essential in reform attempts. Much can be gained with little improvement of available functional components.

In summary, the nine selected publications analysed above, were used in this review to emphasise the fact that attempts have been made by some researchers to encourage improvement of particular level of health services management via an informational approach. Table 1 (page 53) depicts a broad overview of these publications.



Author, year and the country	Area of the Health Information System studied	Concluding remarks
Hiawalyer, G., ( <i>Papua New Guinea</i> ) 2005	Disease surveillance	Disease surveillance information sub-system could play a significant role in deciding health management priorities
Mohammad, Ali Canh Gia, Do ( <i>Viet Nam</i> ) 2005	Large linked databases related to essential services	Establishing large linked databases of this nature is a cost effective measure in developing countries
Nolen, LB Braveman, P Dachs, JNW ( <i>Developing countries</i> ) 2005	Addressing health inequities	Health information systems can be made use of to support a culture of equity oriented decision making and policy development
Rahman, F. Andersson, R. Svanström, L. ( <i>Bangladesh</i> ) 2000	Health information and measuring disease burden	Existing data sources could be improved to establish an accurate injury information system
Setel, PW Sankoh, O Rao, C ( <i>Developing countries</i> ) 2005	Registration of vital events	Sample Vital registration (SVR) is an affordable, cost-effective, and sustainable short- and medium-term solution to the prevailing problems of vital registration in developing countries
Shaw, V ( <i>South Africa</i> ) 2005	Essential data sets for regional health information systems	The development of an essential data set contributes to strengthening health services
Thieren, M ( <i>Developing countries</i> ) 2005	Health information in humanitarian emergencies	Health information systems require integration and participation in humanitarian emergencies
Tornheim, Jeffrey Manya, Ayub S. Oyando, Norbert ( <i>Kenya</i> ) 2007	Surveillance data from inpatient health facilities	Surveillance data from inpatient health facilities can be useful for prioritization of public health initiatives, but often are not collected or analysed in developing countries
Tornheim, Jeffrey Manya, Ayub S. Oyando, Norbert ( <i>Kenya</i> ) 2010	Morbidity and mortality data from inpatient health facilities	Hospitals provide useful data for public health priority setting and planning, including preventative interventions

**Table 1 : Efforts to help particular level of health management via informational approach: Some representative publications**

### ***2.3.3 The role of technology in addressing health information systems failure in developing countries***

Information and Communication Technology (ICT) plays a highly significant role in organisational information systems. However, its diffusion beyond the margin of digital divide in to the developing nations has often been problematical due to obvious reasons and therefore it has received attention of many contemporary researchers. Both pessimistic and optimistic remarks on diffusion of technology in reforming and developing health information systems in low income countries could be found in current literature. This section of the literature review examines some selected work on the role of technology, especially the Information and Communication Technology in addressing the much debated health information system failure in low income countries, most of which are placed beyond the “digital divide”.

According to many authors, ICT could play a positive role in addressing the root causes of HIS failure in developing countries. A small proportion of authors publish their work based on the notion that caution should be exercised in embracing ICT in resource constrained and donor dependant health systems. Following section of the review will discuss some selected representative work on both these schools of thought, with the purpose of identifying strengths, weaknesses, opportunities and threats in applying ICT beyond the digital divide to address the HIS failure. This narrative review will be followed by a critical assessment of some relevant empirical research studies of ICT application in enhancing health information management.

### **2.3.3.1 Role of technology in health information management in developing countries**

The introduction of Information Technology (IT) to the health services management typically comes with the promise of helping to manage scarce resources, increase efficiencies, reduce workload, and increase work productivity. In the context of developing countries, the lure of these promises is magnified given the existing conditions and inefficiencies. There had been some debate as to whether Information and Communication Technologies (ICTs) were relevant to health information management of developing countries, health systems of which are usually resource poor and donor dependant. However, in the recent past, this debate has been resolved with a positive note that ICT has a definite role in solving health information deficiencies. The question has become not whether, but how ICTs can be beneficial in resource poor circumstances.

Information and communication technologies have high potential values at multiple levels of health information management, from population surveys at grass root community level, for example, to health services monitoring and policy formulation at national level. However, the application of ICT has not always been successful to date, and indeed there are many examples of failure or partial failure, but the challenge remains to tackle these difficulties and to resolve them. A further challenge with respect to ICTs is to address issues of the “digital divide” between those people with access to the technologies and the ability to use them effectively, and those without.

## **A. Introduction of computers to manage routine health information systems: A Malaysian experience**

Bulgiba [71] presents some valuable lessons learnt by Malaysian health system in its attempt to make one of its hospitals a “paperless” organisation. His comments are based on a general review of status of few hospitals in Malaysia, some years after the introduction of computers to manage routine health information systems. He warns that caution should be exercised in introducing technology in health systems in the area of information management in developing countries. He strongly argues that healthcare is a complex industry and this very complexity could be an obstacle in its adoption of Information Technology. Yet, the attraction of Information Technology in healthcare is irresistible because of the fact that healthcare decisions are usually of high- risk. The damage resulting from a wrong decision in healthcare could be irreparable or irreversible.

The Malaysian experience of IT adoption at University of Malaya Medical Centre, a large hospital containing 1200 beds, is a good example of success and failure in applying IT in a resource constrained environment. In his evaluation, Bulgiba predicts following “stumbling blocks” for IT adoption in any healthcare setting in the third world.

1. *Finance* : Introducing new systems and ongoing maintenance of computer systems are expensive and therefore could pose a huge strain on already strained financial resources
2. *Lack of expertise and experience* : Bulgiba attributes this to the high turnover of the staff in computer industry

3. *Lack of home-grown technology*: Developing countries rely heavily on expensive imported technology. This results in outflow of valuable foreign exchange causing a financial burden due to obvious reasons.
4. *Rapid pace of change in systems and hardware*: It is difficult to keep up with rapid changes in IT. Mostly, the client-server systems suffer due to these rapid changes. This situation has aggravated to such an extent that it has been suggested to use web based technology in place of client-server technologies in future attempts.
5. *Change management*: Coping with change is considered as one of the greatest challenge in any organisation. Two challenges are identified in this regard. The first one is changing of documentation from paper based manual system to the electronic system. Secondly, the less obvious but more difficult task is to change the mindset of healthcare personnel.

Bulgiba further elaborates that following factors should be considered in any attempt to computerise existing HIS in developing countries.

1. Adequate and ongoing training of healthcare personnel
2. Development of indigenous technology
3. Establishment of a coordinating body
4. Establishment of standards
5. Process reengineering

Bulgiba's findings and arguments are affirmed by many such studies which evaluate introduction of computers in developing country settings. One such evaluation is provided by Jayasooriya [72] who did a similar kind of evaluation of a computerised field health information system in Philippines. His concerns are similar to the findings reported in Bulgiba's study. However, these two authors elaborate

only the tangible and obvious constraints and factors related to technology infusion. Thorough investigation of situations where developing countries made attempts to introduce technology in health services management is mandatory to identify stumbling blocks so that health managers can take pro-active measures. Detailed case studies of such nature are rare in contemporary research literature.

### **B. Factors leading to failure of technology infusion**

A case study of more investigative nature was again reported by Jayasooriya [73] in Phillipine health system in 1999. He used a contextual framework to analyse the situation. Factors that led to the failure of technology infusion in this case study included ambiguity in organisation and responsibility related to the project. He emphasised that lack of capacity to undertake large information systems development projects and inability to retain appropriate staff are key factors for failure of such projects. However, Jayasooriya reports that, when the historical and contextual issues were revealed and the interplay between the content, process and context of the change was analysed, it was apparent that the content of the HIS was not responsive to the changes in the wider health system. The case study confirms the need to analyse and understand organisational, environmental and cultural issues in adopting information system models and procedures in developing countries.

Kahen and Sayers [74] share the attitudes of above authors. More optimistically, they believe that computer-based technologies such as information systems and expert systems have an undoubted contribution to health-care development in developing countries, especially in managing health information. The purpose of their review article is to discuss the appropriateness of these information technologies for health services of developing countries, the criteria to be used in selection of the technology to be transferred, and the need for a systematic approach

to evaluation. They present a conceptual model for assessing transferability so as to achieve an effective transfer. The model includes the analysis of prior experience in transferring these technologies in similar settings. Following this approach, and using operational research techniques a subjective assessment model has been described by the authors. The subjective assessment model is practically important because it can systematically guide decision-making about introduction and implementation of computer-based health-care technology in the developing countries.

Kimaro and Nhampossa [23] draw attention of health managers towards a different aspect of technology infusion in health information management in the third world setting. They argue that sustainability of such projects should receive more attention and that it is the measures for sustainability that can decide the success or failure of such projects.

Information Technology projects may take a long time to be fully institutionalized and therefore sufficient resources are required to build the local capacity to support and sustain the project after the withdrawal of donors in health systems where donor support is a significant factor. Inadequate donor support often contributes to weakening rather than strengthening human resource capacity and effective system design. Kimaro and Nhampossa argue that these factors contribute to the design and implementation of unsustainable health information systems (HIS) in developing countries.

Through a comparative case analysis of the HIS in Mozambique and Tanzania, the above authors have identified three sets of relationships which they consider as crucial in shaping the sustainability of HIS. These are as follows :

1. The relationships between the Ministry of Health (MoH) and the software development agency

2. The relationship between the Ministry of Health and the donors,
3. The relationship between the donors and the software development agency.

Based on their comparative case study, authors identify the reasons for the lack of alignment between these relationships, and bring forward some specific recommendations to support their alignment. They believe that the sustainability of the system could be maintained if sufficient attention is paid towards maintaining these relationships.

Although, Kimaro and Nhampossa discuss an important crucial point of sustainability, based on some valid empirical evidence through an actual case study, the generalisability of their argument is questionable for two reasons. Firstly, the donor influence especially in health information management tasks may not be so influential in many, if not most of the health systems of developing nations. Therefore, one could argue that they are giving an undue prominence to an insignificant factor related to sustainability. Secondly, there could be so many other factors such as “change management” in making substantial influence and impact in regards to sustainability in adoption of IT. Therefore, more in-depth case studies of IT innovation are required in similar study settings to uncover critical influential factors.

### **C. Potential benefits of ICT innovations**

Lucas [75] does a general discussion on these issues, combining a case study approach. He discusses potential benefits of a diverse range of ICT innovations in health services delivery and some of the constraints. He highlights the importance of improving following four broad areas simultaneously.

1. Improvements in traditional health information systems



2. Computer-aided diagnosis and treatment monitoring
3. A range of applications generally labelled as telemedicine
4. The use of ICT to inform general populations on health and healthcare.

Lucas visualises success, if one attempts a holistic approach rather than isolated attempts in improving a single area such as health information management alone.

#### **D. Opportunities and challenges offered by ICT**

Simba and Mwangi [76] highlight some of the opportunities and challenges offered by ICT in the strengthening of HIS in developing countries in the wake of globalisation. According to their opinion many developing countries have embarked on strategies to utilise Information Communication and Technology (ICT) in generating and communication of data from one level to another. However, many of these countries have managed to modernize the Health Management Information System (HMIS) only at the higher levels (national and provincial). This is because they do not possess technological, political and legal infrastructure to adequately utilise ICT in health information management at all levels. The poor communication infrastructure in these countries has undermined the efforts to spread the technology to the rural areas where majority of the people resides. Simba and Mwangi describe this situation as “internal digital divide”.

Simba and Mwangi also state that the present situation of health information system failure itself is a challenge in adopting IT in health information management of developing nations. Data collected in developing countries have been reported to be incomplete, inaccurate and not timely; as a result it is usually not used for various reasons including that of poor quality and unreliable nature. Therefore, the potential for ICT to improve data quality may not be realised especially in the presence of other contributing factors, because many of these problems cannot be solved by mere

computerisation of the HIS. Therefore, they argue that, as the initial step of adopting technology, developing countries need to make deliberate efforts to address constraints, threatening to increase technology gap between urban minority and rural majority by setting up favourable policies and appropriate strategies. Concurrently, strategies to improve data quality and utilisation should be instituted to ensure that HIS has positive impact on health services management.

One of the important arguments put forward by the above authors is the possibility of presenting raw data even to the highest level of health information management at national level. The introduction and adoption of ICT in routine data system widen the scope of analyses thus reducing bulkiness of data reported. It enables data to reach its destination much faster to the users such as senior health managers. Computerisation of the routine data, even at its simplest level, has been reported to facilitate detection of errors if the health information system is programmed in such a way. In addition, computerisation allows transmission of disaggregated data to the national level. This easy transmission at various levels makes data validation an easy exercise at each level.

The purpose of this subsection of the review is to identify some selected work which review challenges and opportunities in introducing IT in improving health information management in developing countries. Although literature abounds with general review articles, detailed and in-depth case studies of IT innovation in health information management in developing countries are rare. Such studies are vital to identify real-life difficulties and strengths. The small number of such studies is mainly confined to the African continent. It may be due to the attention of donor community. However, several important conclusions could be drawn from the studies reviewed so far in this sub section of the literature review. Firstly, the

external and internal “digital divide” prevalent in the third world should be addressed individually or as a holistic approach, with the purpose of minimising the divide. More research, intervention studies and actual implementation of large and medium scale projects will create a background where most needy countries have the capacity to embrace the capabilities of recent advances in IT. Secondly, the existing routine health information systems of these countries should be revised and basic components should be restructured before embarking on large scale projects to computerise the system. Lastly, sustainability should be considered in a proactive manner before investing in computerised information system.

### ***2.3.3.2 ICT applications in enhancing health information management in developing countries: Some empirical studies***

This section of this review has been devoted to analyse some empirical studies where IT systems in health information management in developing countries are evaluated and reported. The purpose of this review is to synthesise these findings with the objective of revealing common experiences and issues arising out of them. It is anticipated that such a consolidated and systematic review will also reveal knowledge deficiencies, which in turn will enable positioning the research reported in this thesis in current literature, related to health information management in the third world settings.

The development of regional information exchange among health care organizations and various health systems or among health programmes is viewed as an important step in the development of health information systems. Operational health information exchange promises substantial financial and societal benefits and suggests that health care delivery costs can be reduced by making health related data available at the time of care or health planning in all departments.

Information exchange using recent advances and capabilities of IT is the key to the many initiatives underway, including the improvement of health information systems in low income countries. This has been discussed in detail in the previous section of this review. According to Mars [77], there is an increasing level of maturity in the functionality of these health information exchange efforts—the most common related to the efforts related to coordination of health planning activities among various health programmes.

Many developing countries are now making efforts to build a local, regional or national health information infrastructure or strategies to provide secure and

ubiquitous access to complete healthcare information and to improve health care through the quality, completeness, and timeliness of health data reporting from health care settings [78]. These will improve the ability to monitor better-quality information through timely disease reporting, improve case management, and care coordination.

These strategies have improved the analysis of patterns of care, and gaps in delivery of preventive services, and have improved the ability to plan, and allocate resources for healthcare services. These regional health information infrastructure or strategies provide the capability to move from a traditional paper-based retrospective data collection and review mode of operation, to real-time, interactive electronic data exchange and action response practice. They also are known to reduce health care cost, prevent medical errors, improve administrative efficiency, reduce paperwork, and increase access to affordable health care [75].

Nevertheless there is little experience or data about the factors that contribute to the successful formation and sustainability of these exchanges. The most difficult challenge is to assess the cost effectiveness of efforts of improving the health information exchange by using ICT.

Some authors are of the opinion that most of the ICT interventions in HIS reforms developing countries ended as failures and that there is a negative bias in publishing failure stories. However, detailed assessments which substantiate this argument is rare in the literature.

The purpose of this review is to find out how health information systems reforms or developmental efforts with IT interventions have been investigated, what has been investigated and what are the effects that have been achieved. The following research questions were addressed:

1. What is the research method used?
2. What types of IT interventions have been studied?
3. What are the outcomes of studied health information systems reform efforts?

This systematic review concerns healthcare information technology and its application in health information management, focusing only on empirical research on organisational, regional or national health information systems.

An extensive literature search was conducted on four electronic databases. These databases were Medline (from 1995 to 2010), Science Direct (from 1995 to 2010), Ebsco (from 1995 to 2010). The search strategies were specific to the databases with key words that reflected health information systems in developing countries and ICT applications. The search was performed using the following keywords: ‘health informatics’, ‘health information system reforms’, ‘health information systems failure’, ‘health information management’, ‘medical records systems’, ‘electronic health records’, ‘health technology’, ‘integrated electronic health records’, ‘health management information systems’ and ‘healthcare information technology’. These keywords were combined using the Boolean operator AND or OR with the keyword developing countries. Additional keywords were: ‘regional health information systems’, ‘integrated electronic health records’, ‘integrated health information’, and ‘information exchange’. A complementary search was conducted using the keywords: ‘medical records systems’, ‘computerized’, ‘public health informatics’, ‘information systems’, ‘medical informatics’, combined using the Boolean operator AND or OR with the keyword “developing countries”.

A search using the main keywords yielded a large number of articles on national or sub national health information systems from many developing countries.

However, when the search was limited to empirical studies, the number was significantly reduced. A total of 521 studies were identified through the initial search. After checking abstracts and a further review of 51 full-text articles, a total of 28 studies that met the inclusion criteria were identified. A summary of the main study characteristics is shown in Table 2 (page 71).

This systematic review comprises empirical research articles concerning all kinds of health information systems developments or reforms in developing countries. The following inclusion criteria were used: firstly, the search was limited to articles published in English. Secondly, only empirical research articles concerning health information systems or networks were included. Studies made with a technological and architectural approach were excluded.

The references were retrieved and handled as follows. Firstly, the article titles were read and the titles that matched the research questions and the keywords were retrieved. Only English text papers published in peer-reviewed journals were selected for further review. Editorials, letters, conceptual papers, and duplicate texts were excluded. Secondly, the abstracts were checked against the inclusion criteria concerning health information systems in developing countries and outcomes. Therefore, all abstracts that addressed the research question were retrieved, regardless of their study design. Abstracts of all papers identified from the search strategy were read and assessed. Abstracts that were found to be relevant to the research question were isolated and the full-text papers were retrieved for further review. Thirdly, after proper examination of the full texts, a list of the studies included and excluded was compiled.

Utilisation of healthcare information technology in the implementation of health information exchanges and reforms to the regional or national health

information systems or organizations have been investigated in many different ways, and with many different study designs. The most common type of study design was “constructive evaluation” and the second was “case study”.

In these 28 studies, the data collection was carried out by means of different methodologies. Interviews, questionnaires, observatories, comparisons or other collections were the main methods. There were no studies using only one data collection method. The studies used interviews or semi structured interviews, group interviews and workshops. The studies also included structured or semi structured questionnaires, an open-ended group teleconference questionnaire and open-ended questions. Observations, patient scenarios, comparisons and document analysis were also used in some studies reviewed. Cost–benefit analysis, usability studies, before–after activity analysis, and literature-based surveys were some other notable study methods.

There were various types of IT interventions in this selected group of empirical studies. Almost all of them were small scale sub-systems of organisational information systems. There were no studies of complete or comprehensive evaluation of regional or national level health information systems where IT interventions were applied.

The outcome of most of the studies, except one, is a success. However, these study findings should be interpreted with caution due to two reasons. First, the constructive evaluation which is the commonest study mode may not be considered as a true assessment of the product. Independent practical evaluation of the application, preferably by a third party may yield entirely different conclusions. According to Heeks [21] there could be a negative bias against publication of failures in IT applications in health information systems.



<b>Author, year and the country or region</b>	<b>Study design</b>	<b>Type of IT intervention investigated</b>	<b>Outcome</b>
Blaya et al [79] , 2010 Developing countries	Systematic review	Personal digital assistants and mobile devices in data collection procedures	Such devices can be very effective in improving data collection time and quality
Borzekowski et al [80], 2006, Ghana	Survey	Use of the internet as a source of health information	Internet has high potential to deliver health information to in developing countries
Boyom et al [81], 1997, Sub-Saharan Africa	Constructive evaluation	An information-oriented tool for acquiring, processing and disseminating medical knowledge, data and decisions	The system is successful in daily micro-management of various components of the health system
Bulgiba, A. M. [71], 2004, Malaysia	Case study	A tailor made hospital information system in a tertiary care hospital	Problems and challenges in implementation identified
Chan et al [82], 2010, Developing countries in general	Constructive evaluation	A framework for selecting patient-oriented Information Technologies in developing countries	The framework can be applied to health interventions across all health domains
Diero et al [83] , 2006, Kenya	Constructive evaluation and survey	Electronic Medical Records (EMR) and (personal Data Assistant) PDA in rural health information management	EMRs and PDA are useful tools for performing health information management
Dongmo et al [84] , 2006, Cameroon	Case study	Obstetric health information system	Obstetric health information systems can provide a relatively accurate assessment of the maternal health situation
Douglas et al [85], 2003, Malawi	Constructive evaluation	Computer-based order entry system	Such systems can be successfully deployed and adopted in resource-poor settings
El Hattab, O. Dayhoff, R. E. [86], 1995, Egypt	Constructive evaluation	An integrated hospital information system	Benefits, cultural issues and other technology related issues identified
Fraser et al [87], 2007, Africa and Latin America	Systematic review	HIS in tracking patients with specific diseases	HIS need to play an increasing role in disease tracking

<b>Author, year and the country or region</b>	<b>Study design</b>	<b>Type of IT intervention investigated</b>	<b>Outcome</b>
Fraser et al [88], 2002, Peru	Constructive evaluation	Web based medical record system	Successful implementation in resource poor countries is possible
Geissbuhler et al [89], 2007, Mali	Constructive evaluation	E health network and a telemedicine tool	Improvement in clinical data access Improvement in clinical data exchange Complexity of clinical data exchange
Hannan et al [90], 2000, Kenya	Constructive evaluation	Electronic Medical Record System	Decisions, trade-offs and the process involved in introducing technology in a developing country
Idowu et al [91], 2006, Nigeria	Survey	IT infusion model	Proposal for development of a successful IT innovation model
Jayasuriya [72], 1995, Philippines	Case study	Field Health Information System	Challenges and opportunities in implementation of IT systems in a developing country
Jayasuriya [73], 1999, Philippines	Case study	Computerised regional HIS	Factors that led to the failure of the system identified
Kijsanayotin et al [92], 2009, Thailand	Survey	IT system of a healthcare programme	Factors related to IT acceptance identified
Kohli et al [93], 2006, Kenya	Constructive evaluation	Radiology information system	Identified as a low-cost system
Lim et al [94], 2009, Kenya	Constructive evaluation	Nutritional Information System	Collaboration between engineering and medical communities is highlighted as a success factor
Ma et al [95], 2008, Developing countries in general	Constructive evaluation	An application framework for programming practices : structured application framework for Epi Info (SAFE)	SAFE and Epi Info are both cost-free and have low system requirements Beneficial for low income countries
Massimo [96], 1998, Developing countries in general	Constructive evaluation	Common architecture for an organisational HIS	Effectiveness and validity of a common architecture for HIS discussed
Mohammad et al [65],	Case study	A large linked database	Feasibility to

<b>Author, year and the country or region</b>	<b>Study design</b>	<b>Type of IT intervention investigated</b>	<b>Outcome</b>
2005, Viet Nam		for the monitoring of vaccine-related adverse events	establish health information systems such as a large linked database
Ndira et al [97], 2008, Uganda	Case study Survey	Electronic Health Record System	Only some aspects of Information management was improved with the system
Noor et al [61] , 2004, Kenya	Case study	Framework for resource allocation based on a Geographic Information System I(GIS)	Success of GIS application in health information management demonstrated
Scott et al [98], 2002, South Africa	Case study	Application of GIS to improve an existing HIS	Potential of GIS to improve His demonstrated
Shih et al, 2009[99], Taiwan	Case study	An integrated HIS of a specific health programme	Success of a fully integrated electronic HIS demonstrated
Syed-Mohamad et al [100], 2010, Malaysia	Constructive evaluation	An open-source web-based electronic patient record system (EPR)	Improved coordination and data integrity demonstrated
Ali et al [101], 2005, Viet Nam	Case study Survey	large linked database for the monitoring of vaccine-related adverse events	Feasibility to establish health information systems such as a large linked database demonstrated

**Table 2 : Review of empirical research studies of IT applications in health information systems in developing countries**

The HIS outcomes focused on four main areas: flow of information, collaboration, process redesign, and system usability. Studies have also examined organizational behaviour in more broad terms but there is a sense of a mixture of outcomes and the organizational social contexts.

The information flow of the HIS studied focused on three main categories: access to clinical data, timely information, and clinical data exchange. The HIS improved access to clinical data and provided real-time patient information and the

timely and appropriate provision of patient information as well as the timely monitoring of disease-specific measures, and the opportunity to discuss patient care online. The HIS improved the timeliness of patient information exchange between professionals and entities. However, the HIS studied also created an impression that there is a complexity in clinical data exchange.

Collaboration in the studied HIS focused on two categories: communication and coordination. The HIS improved communication and coordination within a region or an organisation in an appropriate time and situation-specific format, improved case management and consultation with colleagues, and enabled empowerment and multidisciplinary teamwork for the better understanding of the situation of healthcare organisation. Another finding is that HIS increased patient safety, and satisfaction, and also the self-care behaviours of patient and their families, leading to better health outcomes.

The studied HIS redesigned the process and improved clinical effectiveness. Effectiveness mentioned therein focused on six categories: improved effectiveness, time saved, supported workflow, supported patient health care plan process, improved decision making, and quality of life. These systems also decreased the duplication of services, improved patient documentation, and enabled subsequent electronic data processing. There was a lot of evidence that these systems saved time, coordinated and supported the healthcare workflow. Time saved benefits health managers, planners and healthcare recipients. The electronic data transmission paved the way for improved quality of care with better decision making.

System usability focused on two categories: usefulness and reliability. There was found to be good usability and interoperability of the HIS components studied.

There were some issues of the complexity and user-friendliness of HIS. Some HIS also raised concerns over security and confidentiality.

Work morale including commitment and attitudes was the most important issues of organizational behaviour concerning the HIS. There was a sense of commitment to the HIS, with the acceptance and a feeling of participation by staff concerned. However, differences in organizational culture, vision and expectations of leadership, the non-existence of common rules and policies to share health data and the non-existence of a consistent strategic plan, and limited understanding of the system was found to be affecting the HIS. Nevertheless, there was widespread participation by both providers and patients. In addition, previous negative experiences with computerised HIS and resistance to change were pointed out.

This systematic review has some limitations. The first is related to the quality and scope of the analysed literature. The investigated phenomenon (outcome of IT interventions in HIS reforms in developing countries) was unwieldy and complicated to approach. The reported methodologies in the systematic review appear to be heterogeneous, which limits their comparability. The regional health information systems or organizations have thus been investigated in many different forms, and with many different study designs. As noted earlier, the quality of the studies included could not be determined. There were different types of integrated health information systems although the boundaries between the types are not exact. Secondly, the papers were reviewed by just one researcher. Finding the right key words for the database search was challenging.

In conclusion, it could be safely assumed that integration is a proper way of developing and reforming health information systems and new organizational models of collaboration that meet the needs of the healthcare providers and the recipients of

developing countries. The centrepiece of a HIS reform measure is the implementation of health information exchanges via integration [102]. As a result, HIS development or reforms through IT innovation are expected to have effects and impacts on health care procedures, work practices and overall management of the organisation. Rigorous evaluation of such exercises is necessary in developing country contexts to develop required standards and norms before these countries embark on widespread implementation of such expensive and time consuming projects.

#### **2.3.3.2.1 Future scope of IT innovation**

To address the question of what type of research is needed in the future, there is a necessity for conceptual view of the role of ICTs in health information systems reforms in developing country contexts. Necessity also arises to classify existing work, identify gaps, and suggest future opportunities.

It is suggested here that the following conceptual framework of three questions should receive attention in future research studies on ICTs in health information systems of developing countries.

- What is the “improvement” of health information management to which ICTs aim to contribute?
- What are the key issues of health information management which can be resolved by applying recent advances in IT?
- What are the levels of health information management where IT could be adopted?

## 2.4 Summary of the Literature Review

This chapter of the thesis has been devoted to review prior research, to identify gaps in the existing literature and to propose future directions in research area of health information management in developing countries. The first section of the review consisted of a critical review of the use of some common terminology of this particular domain and how the researchers have their own versions of some confusing technical terms was discussed. The second section of the review discussed some selected review articles which describe the current situation of health information management in developing nations. The purpose of this sub-section is to present an overview of current scenario of health information system failure so that the significance of the research reported in this thesis could be emphasised.

Thirdly, a critical analysis was performed of the research literature published in peer reviewed journals. Before this critical review, a classification of the published work was made to ease the categorisation. Two main categories presented were “key challenges for the development and reform of health information systems in developing countries” and “the role of technology in addressing health information system failure in developing countries”. These main categories were again subdivided with the purpose of paying special attention to the empirical research studies and also with the purpose of suggesting future scope of research in some categories.

At the end of the review it was clear that some deficiencies exist in the research area of health information management in third world countries. Following deficiencies were clearly visible.

1. Comprehensive case study research involving entire national or sub-national health information system was rare. Only two studies of this nature [19, 103] representing the region of Sub-Saharan Africa could be isolated. There were no such studies reported from the region of South-East Asia, where the study setting of the research reported in this thesis is based.
2. Specific studies which identify strengths and weaknesses of particular sub-components of national and sub-national health information systems of developing countries were scanty. The few studies reported were confined to the region of Sub-Saharan Africa (for example [23, 28] ).
3. Studies which examine the information seeking behaviour of health services managers and decision makers at certain levels also were rare to find. There were two survey based studies from the South-east Asia region and from the region of Africa [22, 49] .

This review shed some insight in to the need of research studies in the third world to address the existing gaps mentioned above. It is anticipated that the research reported in this thesis will address some issues described above, and also will add new knowledge in relation to strengths and weaknesses of existing health information systems in developing countries. It will also create awareness of the possible strategic reforms to address the existing deficiencies of these information systems.

The researcher hopes to position this study within this area of specific knowledge deficiency in the current literature. It is expected that this study would



address the above mentioned three deficiencies in the area of health information management in developing countries.



### 3. Methodology

The research process and the strategies applied to achieve the objectives are described in this chapter. A description of the study setting and the sampling methods are also included.

The objectives of this research, as described in the introductory chapter are to assess the strengths and weaknesses of a regional health information system in Sri Lanka, the causative factors for the weaknesses detected and to propose strategic recommendations to improve the information system. The regional health information system of Central Province, Sri Lanka is thus evaluated here in relation to its influence on following aspects of health services management.

- a) Institutional structures
- b) Networks and relationships of various stakeholders and sectors
- c) Data collection and analysis
- d) The quality, accessibility and timeliness of information
- e) Accuracy of data and information generated
- f) The use of information to support health planning and decision making

Systematic review of an organisational information system requires a multi-disciplinary approach. This is because the procedure of systematic review or evaluation involves various disciplines of information management which are mentioned below [104].

- a. The policies and legislative background,
- b. The distribution of roles and responsibilities,

- c. The structure and arrangement of the studied organisation,
- d. The implementation processes and the coordination mechanisms

Three approaches for the assessment of information systems are described in the literature. The most widely used approach is assessment by using various economic methods. It originated as a cost-benefit analysis. It later evolved in to the discipline of information economics. However, there is a significant shortcoming in this approach in terms of its inability to assess intangible and indirect benefits of information systems [105]. The second method of assessment adopts an experimental strategy, the major study tools of which are prototyping and simulation [106]. The third approach includes multi-objective and multi-criteria-methods which focus on a wide number of stakeholders in the evaluation process in an effort to make an informed judgement on the expected value and benefits of the information system [107]. The immense popularity of this method of assessment may be due to the fact that it emphasises better information and better decision making as the primary benefits of an information system. It also seeks to explore the value added by improving the information system. This third approach is widely believed to be the most suitable for evaluation of health information systems. Therefore, the third approach with a qualitative perspective is considered as most appropriate for this study which evaluates a health information system with the purpose of generating ideas as to how to improve the system.

The objectives of this study justify the use of third approach (multi-objective and multi-criteria method) as its research strategy. Firstly, the study has multiple objectives of answering three research questions of revealing strengths and weaknesses, finding the causative factors and formulating strategic recommendations. The study also had to investigate multiple criteria such as HIS

resources, indicators, data management, data quality and information use. For these reasons the study preferred the third approach to the first and second which have several limitations. Table 3 depicts the multiple objectives of the research and the assessed multiple criteria.

Multiple objectives of the study	Multiple criteria assessed
To find the key weaknesses of the studied regional HIS	Health Information system resources Health Indicators
To find they key strengths of the studies regional HIS	Data Sources Data Management
To formulate strategic recommendations to improve the studied regional HIS	Data Quality Information dissemination and use

**Table 3 : Multiple objectives of the study and the relevant multiple criteria used in the assessment**

From the perspective of Management Information Systems (MIS), there is another classification for information system research. The first method involves the evaluation of collection, and processing of data followed by the analysis of utilisation of information. The second method in this perspective is evaluation of overall management of the organisation with particular attention to the information support. The first method of assessment focus on almost all aspect of information management such as how effectively data are collected analysed and transformed in to useful information. It then focuses its attention towards the efficiency and effectiveness of maintenance of information system including information storage, retrieval, presentation and use.

The second method described in the above paragraph focuses on the efficiency and effectiveness of the management of organisation in terms of planning, financing, staffing, controlling and evaluating in order to satisfy the objectives of the information system.

Forrester's industrial dynamic model [108] can be applied to analyse most of the information products. This particular model of analysis traces the paths of information flow from one point to another and then locates any key weak points in the system and the pathway affecting information production. The research studies involving information management commonly applies system management theories for the purpose of evaluation and improvement of system performance. The concepts of principles of Human resource Management (HRM), strategic planning and change management are also frequently used in information management research. The research reported in this thesis which evaluates a regional health information system, explores both these dimensions, the technical and the managerial.

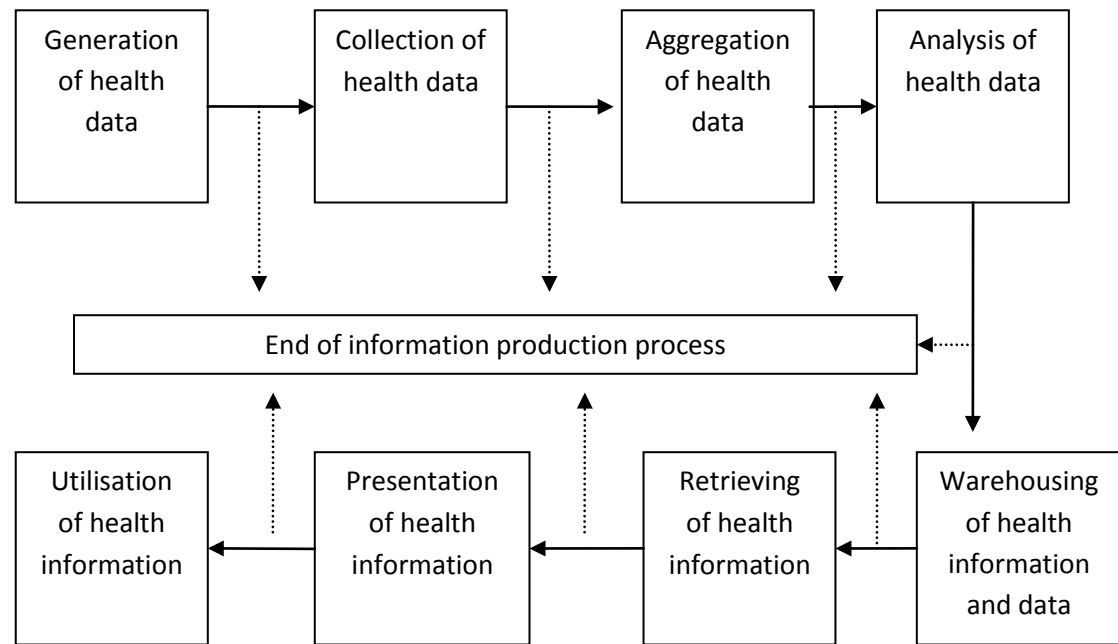
In comparison to many disciplines in business and social sciences, management information systems (MIS) research is relatively young, having been in existence for approximately about 35 years. At the same time, many believe that MIS research is unique in many respects [109] The uniqueness of MIS research lies in many respects. On the one hand, researchers and practitioners expect more maturity in research built upon various theories and practical experiences. On the other hand, Information Technology (IT), which is one of the primary drivers of MIS research and practice, continues to leapfrog at a breathtaking pace. Changes in IT and its application are so vast and rampant that researchers barely get to study one particular phenomenon with any level of rigor before moving on to new areas. These opposing forces have a significant impact on the research methods employed by researchers[109].

Many methodologies for MIS research are described in the literature [109-113]. The choice of a single or multiple methodologies depends on several factors including the topic area, the research question, the researcher's background, and the intended audience. The use of multiple methodologies is gaining wider acceptance. It

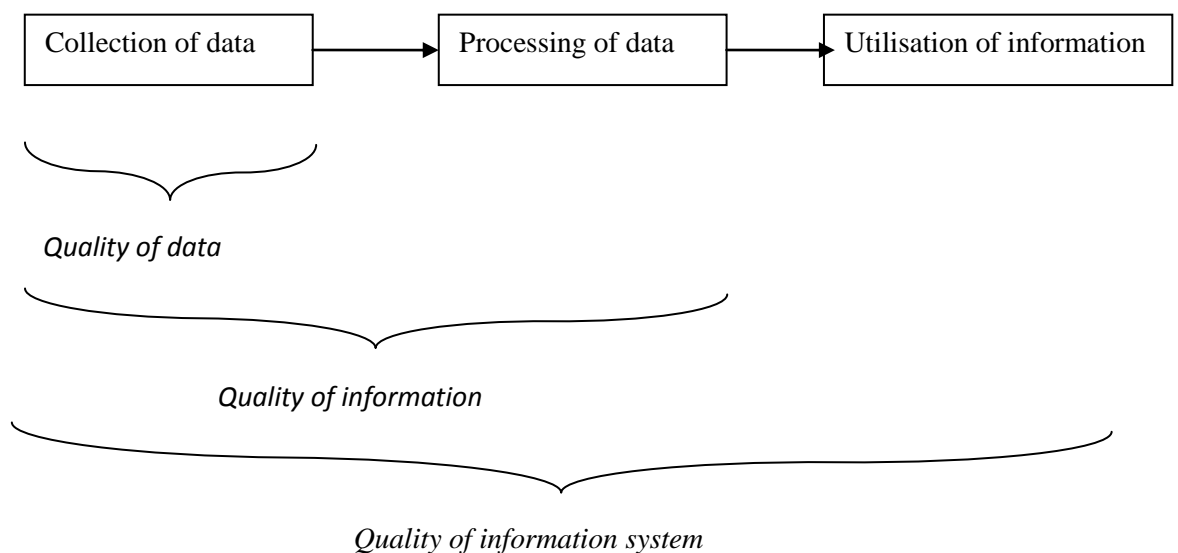
allows triangulation leading to greater confidence in the research findings. Table 4 (page 86) represents a compilation of the methodologies in use and applicable to MIS research. The list of methodologies depicted in Table 4 is not exhaustive. However, it possibly represents the essence of methodologies currently in use in Information Systems research.

An important dimension of the information production cycle evaluated in this research is the quality of information and data produced in the studied regional information system. In this research, data quality is meant by quality at every stage of information production from collection to storage. Quality of information refers to the status of quality at the later stage of the process including information retrieval and distribution. Quality of HIS refers to the system perspective. In this research an attempt is made to assess the quality in all aspects of information management in the studied regional information system. Figure 2 and 3 illustrate this framework of quality dimensions of information.





**Figure 2: The cycle and phases of health information production (based on Forrester's industrial dynamic model)**



**Figure 3: Quality dimensions of data, information and information system**

Methodology	Definition
<b>Speculation/commentary</b>	Research that derives from thinly supported arguments or opinions with little or no empirical evidence.
<b>Frameworks and Conceptual Models</b>	Research that intends to develop a framework or a conceptual model.
<b>Library Research</b>	Research that is based mainly on the review of existing literature.
<b>Literature Analysis</b>	Research that critiques, analyses, and extends existing literature and attempts to build new groundwork, e.g., meta analysis.
<b>Case Study</b>	Study of a single phenomenon (e.g., an application, a technology, a decision) in an organization over a logical time frame.
<b>Survey</b>	Research that uses predefined and structured questionnaires to capture data from individuals. Normally, the questionnaires are mailed (fax and electronic means are also used).
<b>Field Study</b>	Study of single or multiple and related processes/ phenomena in single or multiple organizations .
<b>Field Experiment</b>	Research in organizational setting that manipulates and controls the various experimental variables and subjects.
<b>Laboratory Experiment</b>	Research in a simulated laboratory environment that manipulates and controls the various experimental variables and subjects.
<b>Interview</b>	Research in which information is obtained by asking respondents questions directly. The questions may be loosely defined, and the responses may be open-ended.
<b>Secondary Data</b>	A study that utilizes existing organizational and business data, e.g., financial and accounting reports, archival data, published statistics, etc.
<b>Qualitative Research</b>	Qualitative research methods are designed to help understand people and the social and cultural contexts within which they live. These methods include ethnography, action research, case research, interpretive studies, and examination of documents and texts.

**Table 4 : Classification of methodologies used in Information System research**

### 3.1 Strategies to reach study objectives

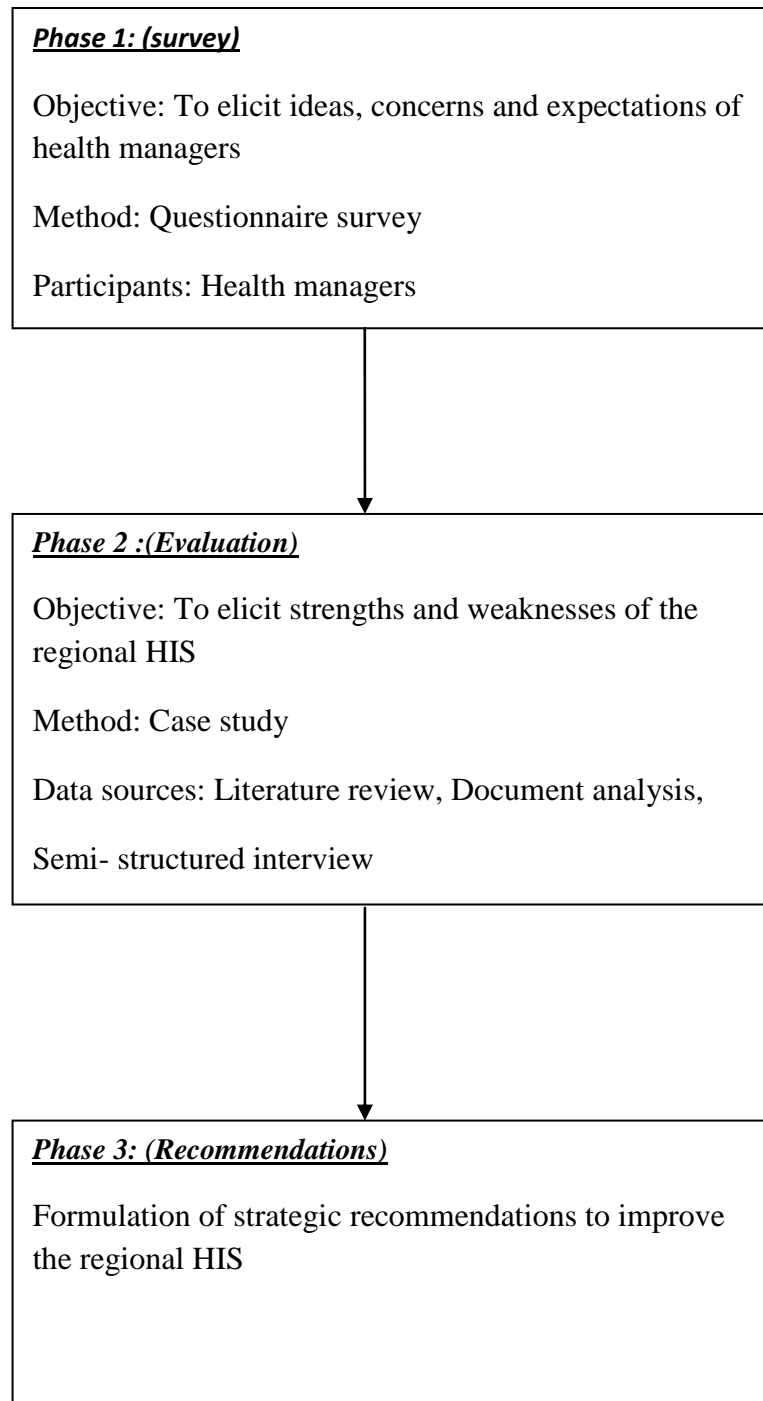
As depicted in chapter 1 of this report, this study attempts to answer four research questions in relation to the management of health information in a decentralised health system in Sri Lanka. Following research questions were formulated with the purpose of bridging the existing knowledge deficiency in the area of health information management in regional Sri Lanka and in developing countries in general:

1. What are the ideas, concerns and expectations of the regional health managers of Central province of Sri Lanka in relation to the regional health information system and its management support?
2. What are the existing strengths and weaknesses of regional health information system of Central province, Sri Lanka?
3. What are the causative factors for existing weaknesses of regional health information system of Central province, Sri Lanka?
4. What are the strategic recommendations for the improvement of regional health information system of Central province, Sri Lanka?

A mixed methodological approach is adopted in this research to ensure the success in achieving the objectives of answering above research questions via a stepwise research process. First, a quantitative research method has been used to analyse the perceptions of key stakeholders of health planning and management of the regional health system studied. The objective of this initial study is to establish the existence of regional health information system failure to meet the expectations of health planners and managers of the region. The study instrument used was a questionnaire, which was validated and distributed among health planners of the

regional health system. The principles adopted and the methods used to conduct the questionnaire survey are described in detail in the following sections of this chapter.

The second phase of the research process consisted of a comprehensive evaluation of all aspects of the health information system. The conceptual framework for this assessment is based on an assessment tool developed by WHO affiliated Health Metrics Network for the assessment of national health information systems of developing countries [16]. The research method adopted is “case study” research method of the qualitative paradigm. Literature review, document analysis and interview of key stake holders were the main sources of data in this phase of research. The data so gathered were analysed and interpreted to synthesise an accurate picture of the regional health information system. The strengths and weaknesses of the existing health information system were deduced upon the findings of this evaluative case study. The recommendations for reforms of the studied health information system for the next decade are based on these findings. A detailed explanation of this qualitative component of the study will follow. Figure 4 illustrates the stepwise research process adopted in this study.



**Figure 4: The research process**

### 3.2 Phase 1: Questionnaire survey

Survey methods are widely used in healthcare and information systems research. It can be of three main types [114]. Those are, ad-hoc surveys, cross sectional surveys and longitudinal surveys. Ad-hoc surveys are usually conducted to study a phenomenon in a short time frame for a specific requirement of knowledge. An example is a short and a rapid population survey of a catchment area of a health institution to survey the satisfaction of health consumers. The cross sectional survey consists of a broader context and a time frame involving more participants with the purpose of obtaining a broad overview of a phenomenon. An example includes a survey of an entire catchment population of a health system to find out coverage by a certain vaccine. The longitudinal survey methods are employed to study a phenomenon in relation to a selected population over a period of time [115]. An example of a longitudinal survey is study of a selected cohort of population over a stipulated period of time to find the influence of certain food habits in developing cardio-vascular diseases.

As in this research, survey methods are often associated with the use of a questionnaire. A questionnaire could be administered by various methods such as face to face, by telephone or self completed through postal or other means. It is to be noted that although survey methods tend to address questions that are both descriptive and analytical, they have limitations in relation to exposing causative influences [114].

Sake and Allsop [114] believe that questionnaire survey is probably the most widely used and well tested method for obtaining data from a selected population. If correct sampling techniques are used and executed with careful planning, the

findings can be generalised to large populations. As has been argued, the questionnaire surveys are particularly effective when used to compare changes over time.

Some inherent weaknesses also are reported in relation to questionnaire surveys based on postal methods [114]. Some of these are, difficulties in avoiding response bias, difficulties in using open ended questions, inability to control question sequence and difficulties in motivating respondents to answer “boring” questions.

The broad objective of using a questionnaire survey within the first phase of this research is to elicit the ideas, concerns and expectations of health managers of the studied health region in relation to the existing health information system and its planning support. It was a cross sectional survey administered over a time period of two months. The questionnaire was designed to address the main areas of health information system and its influence on health planning.

The questionnaire for the study was developed by reviewing the current literature on health information systems in developing countries [15, 16, 19, 113, 116-118].

The questionnaire (Appendix 2) consisted of 3 categories and 13 questions. The three categories were named as follows.

1. Information generation, acquisition and use

The purpose of this section of the questionnaire is to assess the rate of satisfaction with regards to the current status of regional health information system and to find out the information seeking behaviour of the health managers. Eight questions were formulated under this category considering various factors associated with information seeking behaviour and health managers’ attitude towards health information management.

## 2. Reforms for the health information system

The main objective of this section of the questionnaire is to evaluate the ideas and expectations of the health managers in relation to possible reforms to overcome the present weaknesses of the existing regional health information system. There are two questions in this category to inquire whether reforms are necessary and also to inquire about the nature of reforms from the perspective of health managers.

## 3. Application of Information Technology (IT) in health information management in the region

As mentioned earlier in this report, IT plays a key role in management of health information in both developed and developing countries. Accordingly, the three questions in this section of the questionnaire inquire about the status of IT literacy among the participants as well as their attitude towards success or failure of IT based future reform processes in the regional HIS.

### ***3.2.1 The study setting and the sampling procedure***

The studied health system, Central Province, is one of the nine regional health systems of Sri Lanka. It has three administrative districts with a population of 2.5 million according to the last census in 2001 [119]. There are 201 health care institutions of various categories in the region including hospitals, preventive care institutions and administrative offices. The health workforce is approximately 6500.

Health managers are scattered around the province in a hierarchical manner. After studying the hierarchical structure of health management, the key management positions which are directly related to the strategic management were identified. The study used the purposeful and judgemental sampling procedure and thus all 65 health

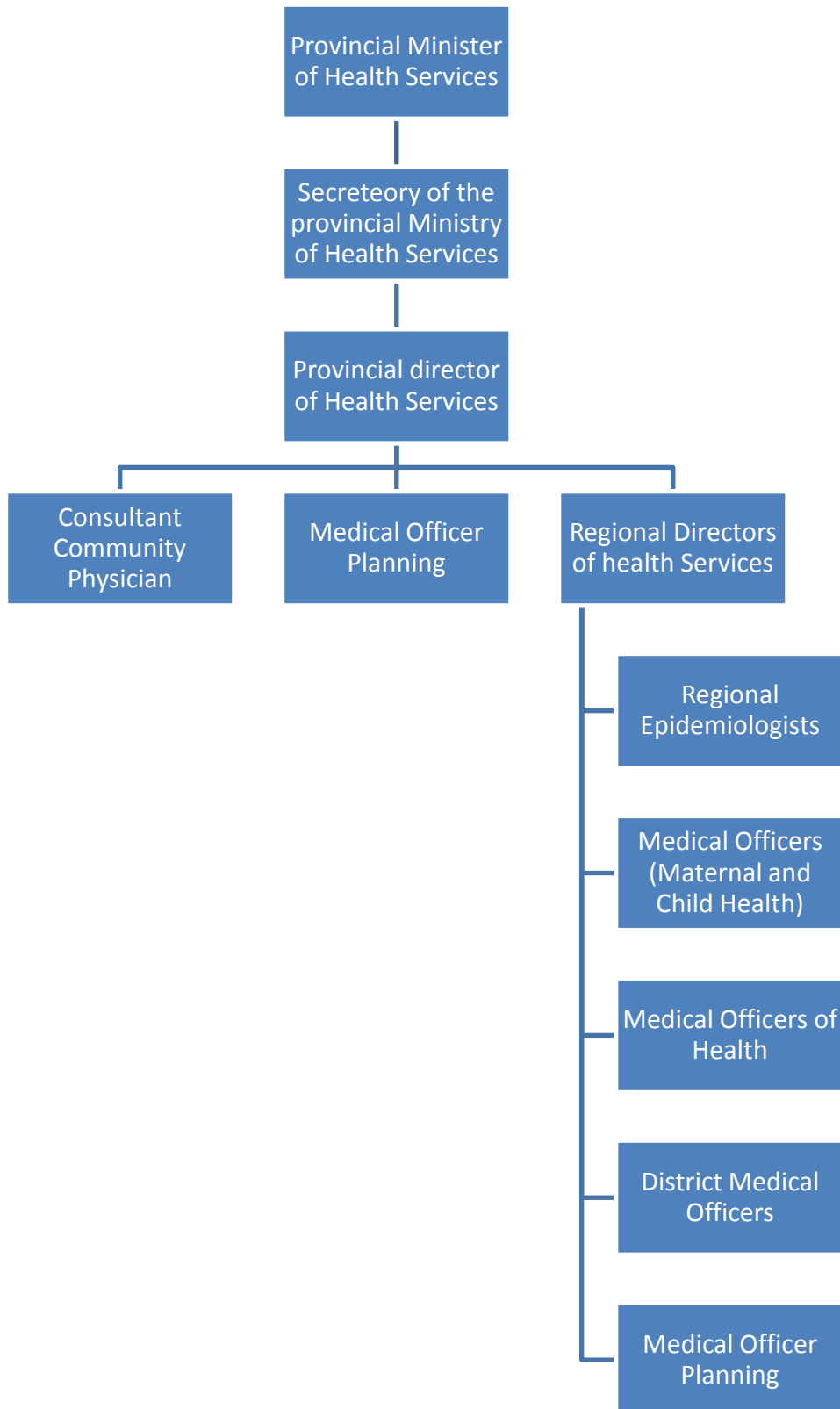


managers of the province were purposively selected and enrolled. The enrolled health managers are directly involved in planning and management of health services of the studied health region. The designations and key management tasks of the selected group of health managers are depicted in Table 5 (page 95). For the easy understanding of the management structure of the studied health region, a hierarchical diagram is presented in page 94 (Figure 5).

To check the ease of completion and to address any ambiguity of questions, the questionnaire was pre-tested within the actual study setting by conducting a pilot study. For the pilot study, it was distributed among five senior health managers in the office of the Provincial Director of Health Services, Kandy, Sri Lanka. The questionnaire was then modified accordingly considering some difficulties in providing answers to certain questions.

The method of distribution was postal. The postal survey method was used as it was considered to be the most efficient in eliciting unidentified sensitive information [114]. The self-administered postal questionnaire was posted to 65 selected participants.

To provide the opportunity of free expression of their perceptions participants were advised not to reveal their identities. Ethical clearance was received for this component of the research only for unidentifiable data as the respondents could be critical of the present health administration of the studied regional health system



**Figure 5 : Hierarchical management structure of the studied health system (Central Province, Sri Lanka)**

<b>Designation</b>	<b>Key management tasks</b>	<b>Number participated</b>
Secretary to the provincial ministry of health	Formulation of policies and supervision of management tasks	1
Senior Assistant Secretary	Formulation of health policies and supervision of management tasks	1
Provincial Director of Health Services	Overall supervision and decision making in planning and management tasks in the province	1
Regional Director of Health Services	Overall decision making ,planning and management tasks at district levels	4
Consultant Community Physician	Planning and management of preventive healthcare services in the province	2
Medical Superintendents	Planning and management of services at secondary care hospitals	5
Medical Officer (Planning)	Identification of needs and prioritisation at the provincial and district levels	4
Regional Epidemiologist	Planning and management of preventive healthcare services at district level	3
Medical Officer (Maternal and Child health)	Planning and management of maternal and child health services at district level	4
Divisional Director of Health Services	Planning and management of healthcare services at divisional level	40
	Total	65

**Table 5 : Designations and key management tasks of the selected health managers**

Three reminders were made by way of letters and announcements in official meetings before declaring non-response. These reminders each elicited about 10% response rate. The total response rate was 55%. After the receipt of completed questionnaires a coding frame was developed and operationalised. Data were then transferred to a database and aggregate data were analysed. Responses to open ended questions were manually collapsed in to categories.

### **3.3 Phase 2: Evaluation of the regional health information system of the Central Province, Sri Lanka: The case study component**

This particular phase represents the qualitative component of this evaluative study. Yin [120] describes case study research as “*conducting an empirical investigation of a contemporary phenomenon within its natural contexts using multiple sources of evidence*”. Case study research method was chosen to be the appropriate research strategy to find answers to the research questions of this study due to its following inherent characteristics [121].

1. Case study research more often address a phenomenon e.g. a particular event, situation, programme, activity
2. The phenomenon being researched is studied in its natural contexts, bounded by space and time
3. Case study research is richly descriptive because it is grounded in varied sources of information
4. It defines what is in existence or what is known based on careful analysis of multiple sources of information about the case
5. The research process includes systematic series of steps designed to provide careful analysis of the case
6. The reports of outcomes of the case study research process are generally narrative in nature. They consist of series of illustrative descriptions of key aspects of the “case” in question.

Hancock [121] further describes that there are three types of research designs in case study research. These include exploratory, explanatory and descriptive. Exploratory designs are applied to design research questions or to determine

feasibility of research procedures. Explanatory procedures are mainly applied to establish cause and effect relationships. The primary purpose of this type is to determine how events occur and how they influence particular outcomes. The descriptive case study designs attempt to present a complete description of a phenomenon within its contexts. The design adopted in the research reported in this thesis belongs to the category of explanatory design as it makes an attempt to study the context of health information management in a particular organisation and then to find causative factors for its strengths and weaknesses.

Benbasat [110] is of the opinion that there has been a growing interest in the use of qualitative techniques in investigations of information systems. Researchers' dissatisfaction towards the use of quantitative techniques are probably due to the complexity of multivariate nature of quantitative research methods, the distribution restrictions associated with the use of these methods (e.g., multivariate normality), the large sample sizes required in these methods, and the difficulty of understanding and interpreting the results of studies in which complex quantitative methods are used. He suggests that Case Study research is particularly appropriate for complex practice based problems where the experiences of the stakeholders are important and the context of action is critical for an appropriate solution.

In his authoritative and landmark article on case study method in information system research, Benbasat [110] describes 11 key characteristics of case study research as follows.

1. Phenomenon is examined in a natural setting.
2. Data are collected by multiple means.
3. One or few entities (person, group, or organization) are examined.
4. The complexity of the unit is studied intensively.

5. Case studies are more suitable for the exploration, classification and hypothesis development stages of the knowledge building process; the investigator should have a receptive attitude towards exploration.
6. No experimental controls or manipulation are involved.
7. The investigator may not specify the set of independent and dependent variables in advance.
8. The results derived depend heavily on the integrative powers of the investigator.
9. Changes in site selection and data collection methods could take place as the investigator develops new hypotheses.
10. Case research is useful in the study of "why" and "how" questions because these deal with operational links to be traced over time rather than with frequency or incidence.
11. The focus is on contemporary events.

Multiple data collection methods are typically employed in case research studies. Ideally, evidence from two or more data sources should converge to support the research findings, Yin [120] identifies several sources of data appropriate for case study research.

- 1, Documentation: This written material could range from memoranda, government policy documents to newspaper clippings, formal reports and many others.
- 2, Archival records: Organization charts; service, personnel or financial records
- 3, Interviews: These may be open-ended or focused
- 4, Direct observation: Absorbing and noting details, actions, or subtleties of the field environment and organisational context
- 5, Physical artefacts—Devices, outputs, tools.

The goal of accessing these data sources is to obtain a rich set of data surrounding the specific research issue, as well as capturing the contextual complexity.

The case study component of this research employed three sources of data to evaluate the present health information system of the health region studied. The three sources of data are literature review, document analysis and a semi-structured telephone interview of a selected group of key stake holders involved in health information management. A detailed explanation of these sources follows.

### ***3.3.1 Literature review***

The literature pertinent to health information management in national and regional health systems of Sri Lanka was reviewed to collect as much information as possible to understand health management and information support. The sources included both peer-reviewed and gray literature, and scholarly commentaries. The international literature review focused on both the developed and developing world. The domestic literature review focused on policy discussions, reports of progress and evaluations of national and regional HIS. The articles published in Sri Lankan journals, post graduate theses, and international journals were systematically reviewed to synthesise a broad overview of current status of the health information system in various aspects.

### ***3.3.2 Documentary Reviews***

The documents related to health policies, health programme activities, and health information management itself are useful sources to generate ideas which can later be pursued through the questionnaire survey and the semi-structured interview. The

objective of the documentary review was to understand the national and provincial health information management policies in Sri Lanka and their impact on the planning and management of health services and management of health information itself.

Documents were collected during the field visit to organise the questionnaire survey and from web sites. It is understood that any documentary review could be affected by selective deposit and selective survival bias. Ongoing document collection with multi-channel approach was applied to address this limitation as much as possible.

### ***3.3.3 Key stake holder interviews***

Key stake holder interviews are considered as an important and traditional approach to collection of data in case study research [114, 120]. Interviews are mainly used to uncover the subjective judgements about problems and solutions. Interviews could provide useful insights into the HIS phenomena based on social and emotional factors created by the experience of the participants. The researcher is able to attain rich and personalised information through this method.

This phase of the research process was organised in five steps as follows.

- 1) Development of the interview guide
- 2) Selection of participants for the interview
- 3) Selection of interview method and location
- 4) Ethical requirements
- 5) Recording of interview data



### 3.3.3.1 Selection of participants for the interviews

In this research, key participants, whose knowledge and opinions may provide important insights regarding the research questions, were identified. Accordingly, three groups of key stake-holders of health information management in the regional HIS was identified as follows.

1. *Health data manufacturers:* This group of participants included healthcare staff members who are involved in the first step of health information management. Within the studied health system, they are usually designated as Medical Record Officers. A purposive and judgemental sample of five Medical Record Officers was selected for the interview. The reason for selecting Medical Record Officers is to obtain detailed view of the first step of health information management.
2. *System managers:* This group included staff officers who are involved in management tasks of the regional health information system. They are system managers located at administrative units of each districts and the provincial health directorate. A purposive sample of five participants was selected from this group. The justification for selecting this particular group of participants is that they are in a position to give detailed information regarding overall management of current HIS in the regional health system.
3. *Health Managers:* This group represents the actual users of health information for health management activities. A purposive and judgemental sample of five senior health managers who are involved in planning and management of healthcare services in the region was recruited.

In addition to the 15 participants selected as above, it was decided to recruit more participants if necessary, based on the interview responses of the initial participants. The purpose of utilising this “snowball” technique is to collect as much information as possible to find answers to the research questions.

### **3.3.3.2 Development of the Interview Guide**

An interview guide, also called interview protocol, was prepared for the purpose of convenience and smooth coverage of all aspects of health information management. First, a framework was developed based on Health Information Assessment Tool, (Version 4) of Health Metrics Network. This assessment tool was especially developed by World Health Organisation (WHO) affiliated Health Metrics Network (HMN) for the purpose of assessing national health information systems of developing countries. Certain sections of the tool were modified to suit the assessment of a decentralised regional health information system, which is the study setting of this research.

Open ended questions were initially developed to cover all aspects of health information management. Anticipated responses and follow-up questions were then developed. The key sections of health information management covered in the interview protocol were as follows.

- 6) HIS resources
- 7) Health Indicators
- 8) Data sources
- 9) Data management
- 10) Data quality
- 11) Assessment of information dissemination and use

The main sections depicted above were again subdivided appropriately to cover all related areas. The complete interview protocol is attached as Appendix B in this report. The main sections and sub-sections of health information management assessed in this interview are also illustrated in Figure 1 (page 18).

### **3.3.3.3 Interview method and location**

The interviews were conducted over the telephone at a location in Queensland University of Technology. After obtaining the contact details of participants through their respective healthcare institutions, prior arrangements have been made for the interviews, in consultation with the participant. The approximate duration of the interview for a participant was one hour.

The interviews were of semi-structured type, guided by the interview protocol. Using the interview protocol, predetermined and flexibly worded questions were posed to the interviewees. Follow-up questions were then used to probe issues deeply. The researcher personally conducted all the interviews.

### **3.3.3.4 Recording interview data**

Interview data were hand written at the time of the interview and later transcribed and consolidated in to especially constructed tables during the phase of data analysis.

### **3.3.3.5 Ethical requirements**

Ethical clearance for this phase of the research was obtained from the university Research Ethics Committee. A participant information sheet was prepared and verbally presented to each participant before the interview. Informed consent was

thus obtained before proceeding to complete the interview. The responses were recorded and stored in an anonymous and confidential manner.

### **3.4 Analysis and interpretation of data**

A case study researcher has to synthesize many disparate pieces of data and information, acquired during the research process in order to identify and report meaningful findings. There are several strategies for accomplishing this task. Hancock [121] presents three examples of such strategic analytical methods. Those are thematic analysis, categorical analysis and narrative analysis. The method of analysis and interpretation is largely related to the disciplinary orientation and case study design.

Although each strategy mentioned above, has their own unique characteristics, there is a basic process common to all strategies. This basic process of analysis consists of repetitive ongoing review of accumulated information in order to identify recurrent patterns, themes or categories.

This research used thematic analysis to interpret the accumulated data through all means of data collection mentioned above. By using this strategy, each new piece of information obtained was examined in light of a particular research question to construct a tentative answer to the question. These tentative answers were then categorised in to themes. This process continued until themes emerged which are well supported by all available information.

An important final step in case study research is confirmation of research findings. As depicted below, several strategies exist through which a case study researcher could confirm his findings [120-122].

1. Sharing the results with the key stakeholders
2. Review of the report by fellow case study researchers
3. Scrutiny of the final report by experts on the topic under investigation
4. Articulation of researcher's personal biases and efforts made to mitigate the potential effects of those biases
5. Triangulation : Confirmation of findings based on multiple sources

In this research multiple methods were used to confirm findings except sharing with key stake holders for ethical reasons. Triangulation was mainly used to confirm the findings. Following chapters of this report which are devoted for the presentation of research findings will provide an ongoing explanation of strategies used to confirm the research findings.



#### **4. Results and Discussion: The Questionnaire survey**

This chapter presents the results of the first phase of the study. The first phase of the study consists of the questionnaire survey which was carried out among the health planners of the studied health region of Sri Lanka to find answers to the first two research questions of the study (page 8). As depicted in the first chapter of this report, the first research question is about the perceptions of regional health planners on information support they receive via the existing regional health information system. It was worded as “What are the ideas, concerns and expectations of the regional health managers of Central province of Sri Lanka in relation to the regional health information system and its management support?”. The second research question is about the existing strengths and weaknesses of regional health information system of Central province, Sri Lanka.

Space has been devoted in this chapter to present the key revelations of the survey and to critically evaluate the findings. It will lay the foundation for critical evaluation of the case study findings in subsequent chapters (Chapters 5 and 6). The concluding remarks based on this survey will be revisited in the final chapter of the thesis (conclusions and recommendations).

The objectives of the questionnaire survey were twofold. The first objective was to establish the fact that the studied regional health information system has failed in providing much needed informational support to the healthcare planners and managers in the region. Accordingly, the researcher hypothesised that regional health information system is in a state of failure from the view point of actual end users of health information ( regional health managers) and thus went on to test this hypothesis through this survey. It was also expected that the survey findings would

pave the way and provide appropriate foundation for more comprehensive qualitative study (second phase of the research) to study the existing HIS failure in depth.

The second objective of the questionnaire survey was to examine the perceptions of healthcare managers in regard to various critical aspects of the regional health information system. The ideas, concerns and expectations thus revealed were considered when making the strategic recommendations for the improvement of regional HIS.

Health managers are scattered around the province in a hierarchical manner and are directly involved in routine and strategic planning of healthcare services of the province. The study used the purposeful and judgemental sampling procedure and thus 65 health managers who are directly involved in planning and management of health services of the studied health region were purposively selected and enrolled.

This study was approved by the Research Ethics Committees of Queensland University of Technology, Australia and the Central Provincial health department of Sri Lanka. A participant information sheet attached to the questionnaire assisted participants to express informed consent before the participation. No incentives were offered for completing the questionnaire. Participants were informed that the participation is voluntary.

The questionnaire was organised in to three major sections to capture the perceptions of the participants in three critical areas of health information management and use of health information for their routine and strategic management tasks. The three major sections of the questionnaire were formulated as follows:



1. Information generation and use
2. Possible reforms to overcome the deficiencies
3. Application of Information and Communication Technology in utilisation and management of health information

The questionnaire comprised of 14 key questions grouped under the above three categories. Some questions were made open ended for free and independent expression of participants' ideas.

It was decided to use the postal survey method to distribute the questionnaire among the participants because of the fact that it is considered to be the most efficient in eliciting unidentified sensitive information [114]. Before the distribution of the instrument, the questionnaire was pilot tested among few participants, numbering five, at the office of the provincial health director. The purpose of this pilot test is to check the ease of completion and also to detect any ambiguity of questions. The pilot test revealed few difficulties and ambiguities which were corrected before mailing the questionnaire.

The questionnaire was then mailed to 65 participants who were purposively selected for the survey. It was planned to be self-administered. Non-response was declared after three reminders each of which elicited about 10% response rate. The total response rate was 55%. After the receipt of completed questionnaires a coding frame was developed and operationalised. Data were then transferred to a database and aggregate data were analysed. Responses to open ended questions were manually collapsed in to categories. Statistical analysis presented in the next section is primarily of descriptive nature.

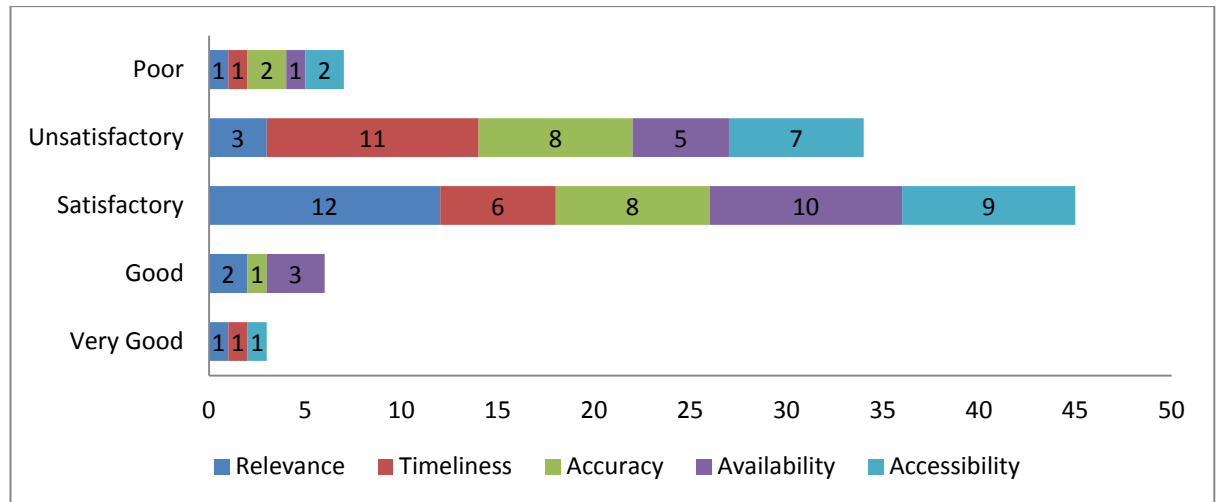
Out of the total of 65 questionnaires posted, 33 completed questionnaires were received with a response rate of 55%. Following sections of the chapter will detail the descriptive statistics of this survey as the percentage of respondents in relation to the questionnaire items. These results are described and organised in order of the main sections and sub sections of the questionnaire.

#### **4.1 Information generation, acquisition and use**

There were eight questions under this category. Each question attempted to capture at least one important aspect of health information generation, acquisition and use. Responses received for each questionnaire item is analysed and presented below.

##### ***4.1.1 Level of satisfaction on information support received through the current regional HIS***

The first questionnaire item under this category was formulated to capture the level of satisfaction of the participants in regards to the planning support they receive from the existing health information system as against five major quality criteria. Eighty four percent of the respondents indicated that the management support they receive through the current HIS is either unsatisfactory or poor in terms of relevance, timeliness, accuracy, availability and accessibility. Their ratings were consistent as against all five criteria. Figure 6 depicts these findings.



**Figure 6 : Participants' level of satisfaction on planning support received through the current health information system as against five major quality criteria**

#### 4.1.2 Importance of information resources made available by regional HIS in making managerial decisions

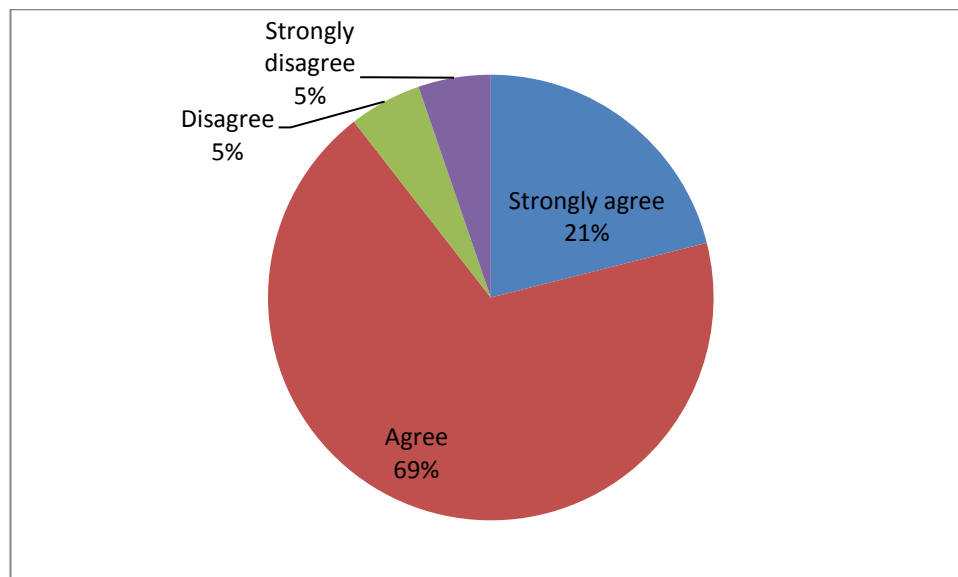
When asked to rate the importance of various types of data sources in making decisions related to health planning and management, it was revealed that community requests, political interests, and donor requests were the three highly rated factors (Table 6).

Type of data or resources	Percentage of respondents according to the rate of importance			
	Not used	Provides minor support	Provides significant support	Critically important
Political interests		12%		88%
Community requests		6%		94%
Donor requests		17%		83%
Inpatient data		84%	8%	4%
Out patient data	6%	88%		
Clinic data	10%	90%		
Notifiable disease data	4%	96%		
Financial data	98%	2%		
Epidemiological data	10%	90%		
Demographic information	12%	88%		
Health indicators	98%	2%		
National Health policies	2%	44%		
Biomedical supplies and distribution data	5%	95%		

**Table 6 : Most influential factors affecting management decisions of regional health managers in Sri Lanka**

#### 4.1.3 Necessity of reforms to the existing national and regional HIS

Majority of the respondents (90%) agreed with the statement that “National and regional HIS of Sri Lanka are poorly organised and need urgent reforms”. Twenty one percent of the respondents expressed strong agreement to this statement while 10% of the respondents disagreed with it. Figure 7 represents a graphical illustration of the perceptions of respondents to the above statement.



**Figure 7: Necessity of urgent reforms to the national and regional HIS as perceived by the participants**

#### ***4.1.4 Application of Information Technology in various stages of information generation, acquisition and use***

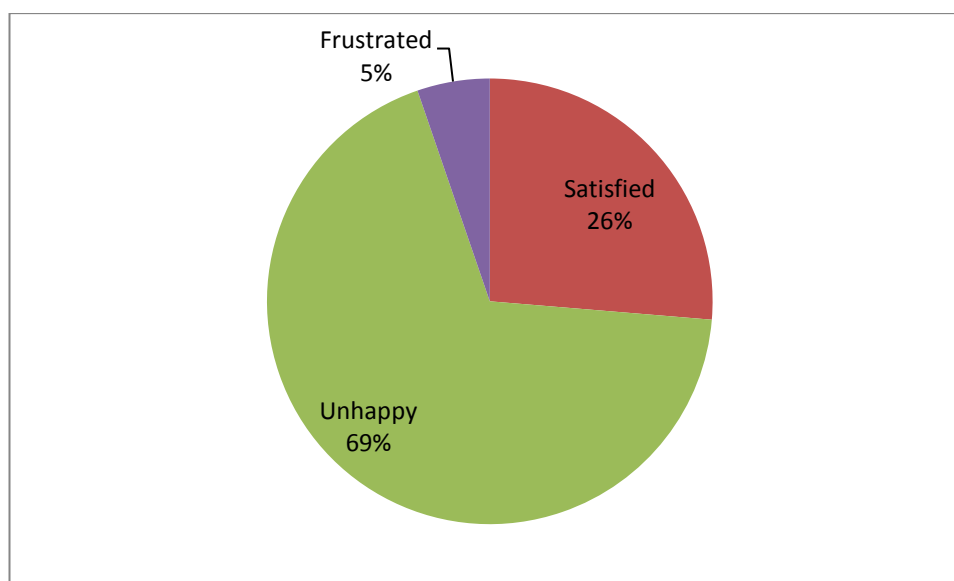
Most of the participants are of the view that application of Information and Communication Technology in health information management in the studied health region is unsatisfactory. Table 7 shows the status of application of ICT in provincial health system as perceived by the local health planners.

<b>Component of the health information system</b>	<b>Percentage of respondents describing the situation</b>				
	Very good	Good	Satisfactory	Unsatisfactory	Poor
Data Collection				4%	96%
Data Transmission				4%	96%
Data Processing			48%	52%	
Data storage			17%	83%	
Information retrieval			16%	84%	

**Table 7: Application of IT in various stages of health information management in the studied health region: Health Manager's perceptions**

#### ***4.1.5 Overall status of satisfaction towards the planning support rendered by existing regional health information system***

This item of the questionnaire asked the participants to express their overall satisfaction towards the planning support provided by the existing regional health information system. The difference between this item and the item 4.1.1 mentioned above is that this question ask the participants to opionate their overall satisfaction whereas item 4.1.1 inquires about the state of satisfaction in regard to some individual quality criteria. Figure 8 depicts the degree of satisfaction and percentage of respondents.



**Figure 8: Degree of overall satisfaction towards the planning support provided by the regional health information system**

#### ***4.1.6 Prominent strengths of the existing regional HIS as perceived by the health managers***

Participants were then asked to mention the positive and useful characteristics of the current regional health system as perceived by them. As an open ended question in the questionnaire, it asked each participant to indicate three most prominent strengths according to their opinion. Table 8 depicts the most prominent four positive features of the existing regional HIS as mentioned by the participants.

<b>Strengths of the regional Health Information System</b>	<b>Percentage of respondents</b>
User friendly paper based system	45%
Availability of a centralised planning system	45%
An efficient disease notification system	40%
Meaningful utilisation of some data	30%

**Table 8 : Most prominent strengths of the regional health information system as perceived by the participants**

It is interesting to note that 45% of the participants are happy about the user-friendliness of the existing paper formats. This fact should receive proper attention in future reform attempts. Any introduction of sophisticated electronic components to the system will become unpopular if the user friendliness will not be ensured.

#### ***4.1.7 Prominent weaknesses of the existing regional HIS as perceived by the health managers***

As an open ended question, participants were inquired about the most prominent weaknesses of the existing regional HIS as perceived by them. Table 9 presents the responses to this question with percentage of respondents.

<b>Weaknesses of the regional Health Information System</b>	<b>Percentage of respondents</b>
Lack of comprehensive coverage of the system	45%
Doubtful accuracy in data and information	45%
Delay or lack of feedback	40%
Records are often misplaced	40%
Minimal application of ICT capabilities	40%
Lack of a common database	38%
Non-utilisation of health information for management activities	35%
Lack of timeliness	35%
Low priority for health information system development	34%

**Table 9: Weaknesses of the regional Health Information System as perceived by the health managers**



In addition to the major weaknesses depicted in Table 10 following weaknesses also were reported by some participants.

- a) Repeated collection of same data
- b) Inadequate time for data transmission
- c) Lack of a mechanism to check the accuracy of data
- d) Excessive number of forms
- e) Lack of mechanisms for monitoring and evaluation
- f) Lack of user friendliness
- g) Lack of motivation among staff members

## **4.2 Appropriate reforms to the existing Health Information System**

The second part of the questionnaire under this heading was designed with the purpose of exploring the health managers' attitude pertaining to the possible reform exercises to the existing regional health information system aimed at addressing the current weaknesses. There were two questions under this heading. One question inquired whether reforms to the existing HIS are actually needed or not while the other question inquired about the nature of such reforms as perceived by the participants.

### ***4.2.1 Need for reforms to the existing Health Information System***

Participants were asked to express their opinion as to whether they believe that reforms to the current health information system of the region are actually needed or not. Ninety five percent of the respondents affirmed the statement that "The existing Health Information System in the province is in need of significant reforms". Five

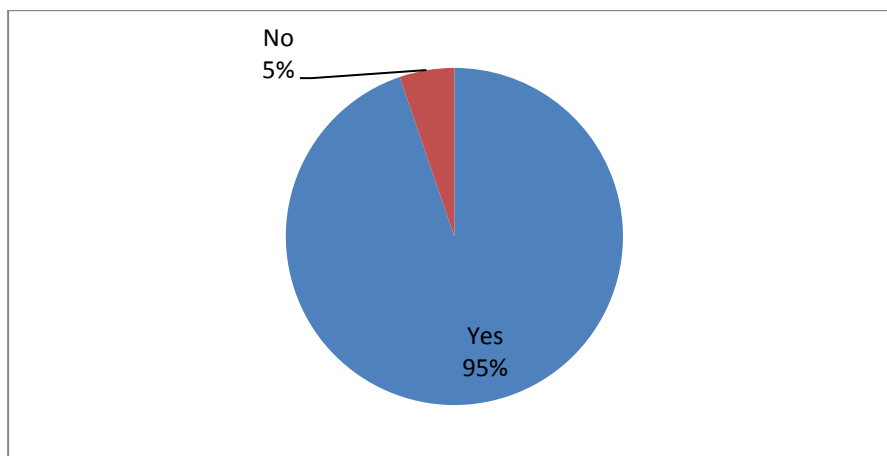
per cent of the respondents indicated that reform measures are not required. Figure 9 illustrates the participants' response to this question.

#### 4.2.2 *The nature of reform measures to the existing Health Information System*

The second question of this section asked the participants to choose one of the three types of reform measures suggested in the question itself. The three types of reform measures suggested were:

- a) Complete overhaul of the system
- b) Development of a framework based on regional requirement
- c) Adoption of a generally and internationally accepted framework
- d) Development of specific functional tools with minor reforms to the existing structure

Reforms to the existing health information system through adoption of an internationally accepted framework are found to be the most popular reform measure among the respondents (40%). Complete overhaul of the system and development of functional tools to address the specific issues are the other two reform types that are of interest to the respondents (Table 10).



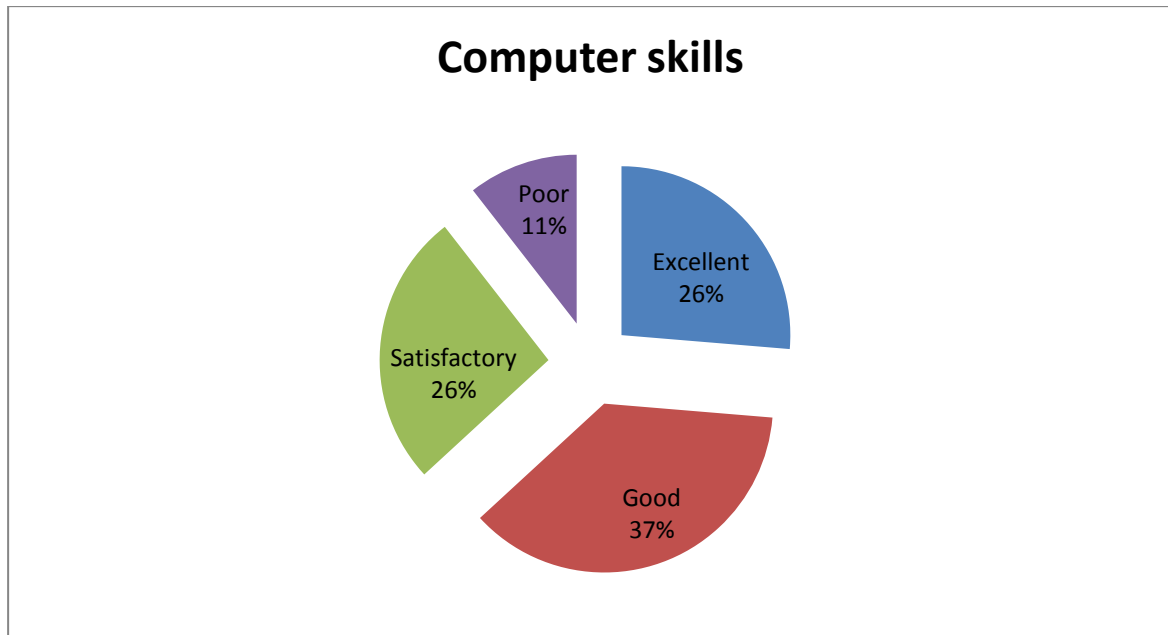
**Figure 9 : Participants' response to the question whether significant reform measures are required for the current regional health information system**

<b>Preferred type of reform</b>	<b>Percentage of respondents</b>
Adoption of an internationally accepted framework	40%
Development of specific functional tools with minor reforms to the existing system	25%
Complete overhaul of the system	20%

**Table 10: Preferred types of reforms to the Health Information System as perceived by the health managers**

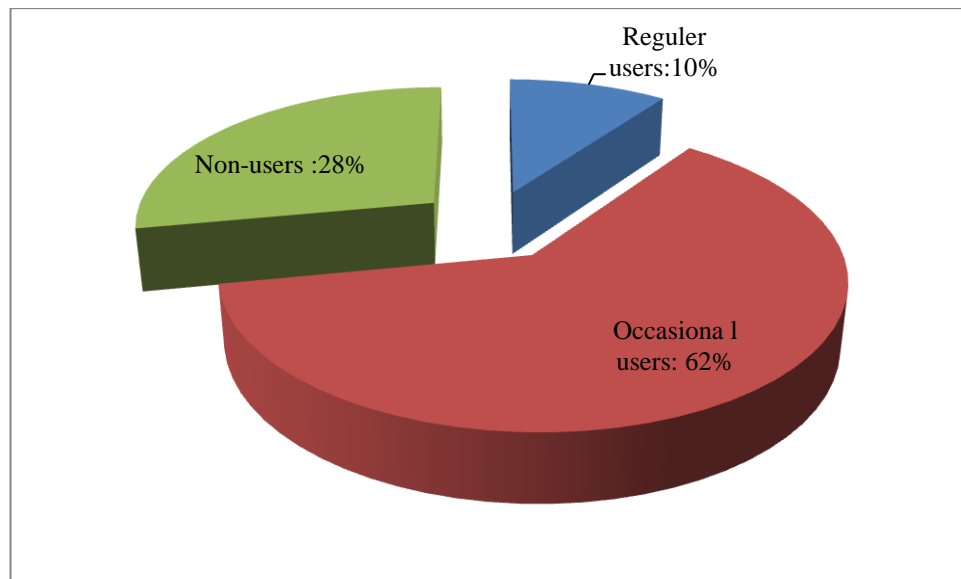
### **4.3 Information Technology in utilisation and management of health information in the province**

The first question of this section was formulated to explore the computer skills of the participants. It asked the participants to rate their general skills of using routine computer applications such as “Office 2007”. Participants were advised to use the scale of excellent, good, satisfactory or poor as they decide on their own related skills. Based on their responses, the general computer skills of the participants are graphically illustrated in Figure 10. Eighty four percent of the respondents are found to be satisfactorily skilled in routine computer applications required of a health manager.



**Figure 10 : Participants skills of using routine computer packages such as "Office 2007"**

The second question of this section of the questionnaire was designed to check the frequency of utilisation of Information Technology by the participants (regional health planners) in routine and strategic planning tasks. It asked the participants to indicate whether they are regular or occasional users of IT in their planning tasks. Ten percent of them were regular users of computers in their routine health management tasks. A majority of them (62%) use computers only occasionally in their routine works. Some of the respondents (18%) never use computers in their routine work. Figure 11 graphically illustrates the responses received for this question.



**Figure 11 : Use of Information Technology in routine planning and management tasks by the regional health managers of the studied health region**

Participants were then asked to indicate their opinion as to whether the application of recent advances in IT would improve the efficiency and effectiveness of health information management in the province. All respondents agreed with the statement that ICT would improve health information management in their health region. However, in response to the next question, majority of the respondents believe that the process of introduction of ICT may not be successful in their health region due to various reasons such as poor computer literacy among the staff (83%), administrative bureaucracies (87%), high initial cost (16%), and lack of a well structured health information system in place (73%).

#### 4.4 Discussion and conclusions

The findings of this region wide questionnaire survey confirms the initial hypothesis that information support for evidence based health management is unavailable in the local health region of Central Province, Sri Lanka. Although these findings appear to be intuitively deductible, this survey is the first to show that routine health information system does not meet the expectations of health managers of regional Sri Lanka. Furthermore, findings of this study reflect a dramatic and widespread lack of evidence based health planning and interventions in a regional health system of this under-resourced country. Although our study does not shed light on the reasons for absence of information based health management and planning, the failure of health information system could be considered at least partly responsible.

Alarmingly, most of the health managers who participated in the survey do not use vital health information in planning and management of health interventions. This clearly shows that the health information system of the studied health region does not meet its objectives, as perceived by the local health managers.

Contrary to the expectations of the researcher and to the results of studies from low income countries [4, 28, 51-53, 56, 123, 124], most of the health managers are appear to be satisfactorily skilled in routine computer applications as appropriate and required of a health manager. While this may be a subjective interpretation of one's own skills, this could also reflect that, there will be minimal practical hindrances in motivating ICT based reforms to health information system in future reform attempts.

These findings may not be generalisable for all provinces in Sri Lanka since the study was done only in one specific health region. However, much of Sri Lanka is homogenous with respect to health administration and health information management. Therefore, these findings give a fair idea about the information support for health management in other areas as well.

The findings of this survey are consistent with findings of other similar studies. Similar lack of information support for health management has been reported from other middle and low income countries [17, 19, 23, 28, 49, 55, 125]. All these studies were conducted in developing country settings by adopting different methodologies. Some were case studies and some were surveys of various nature. Such findings and those of the present survey suggest that failure of health information system is a significant hindrance to the management of healthcare services of these countries and that further research and immediate intervention are required to rectify the situation. The situation is particularly devastating considering the unique features of double burden of diseases, demographic transition and stagnant or decreasing resources that are prevalent in these countries [54]. Although no conclusions on cause and effect can be drawn from these results, health information system failure is in all likelihood, contributing adversely to the identification and prioritisation of health needs and monitoring and evaluation of health interventions in the studied health region and probably in entire Sri Lankan health system.

This survey has several limitations. First, although the questionnaire has undergone pilot testing it has not been assessed for test-retest reliability. This limits the validity of the survey results. Second, response bias, inability to motivate answering less interesting questions and inability to control question sequence may

have prevented producing high-quality responses. These are inherent limitations of postal surveys [114]. Nevertheless, these limitations could no way undermine the valuable insight and overview that could be elicited over the analysis of the data of this unique survey which was the first of its kind, conducted in the studied health region.

As mentioned earlier questionnaire survey was formulated to establish the presence of HIS failure in the province from the view point of strategic management decision makers. This served as the precursor for the more in-depth qualitative study which was followed. As such, the total number of strategic decision makers was recruited (65). Thirty six of the participants responded to the questionnaire making it response rate of 55%.

Certain questions of the questionnaire received low response. This is a recognised inherent weakness of any self administered questionnaire survey. However, apart from establishment of existence of lack of information support in its broader sense, no important specific conclusions were drawn upon the findings of the questionnaire survey. This research relied upon the findings of more in-depth qualitative component of the study, to draw important specific conclusions regarding the major aspects of the provincial health information system.

In conclusion, this self reported, region wide questionnaire survey assists in answering the first two research questions (page 12) of the PhD research reported in this thesis. It strongly suggests that the routine health information system in the studied regional health system has failed in providing much needed information support for health planning and management. Further studies with wide stakeholder involvement are required to elicit the causes of this failure and to propose strategic



responses. This survey is a precursor to a more comprehensive qualitative study which is reported in the next chapter of this thesis.



## **5. Results and Discussion: The case study (Part 1)**

This chapter has been devoted for the presentation of the findings of the case study research carried out to meet the second objective of the research. As depicted in previous chapters, the second objective is to find the strengths and weaknesses of the studied regional health information system. The sources of data for this component of the research are, interviews of key stake holders, document analysis and literature review.

The regional health information system of Central Province of Sri Lanka was studied under 6 subject headings. These criteria were extracted from the Health Information System Assessment Tool (Version 4) of WHO affiliated Health Metrics Network. Data were collected in relation to these subject components and an attempt has been made later to construct a broad overview of the regional health information system particularly in relation to its management support. During the phase of data analysis, data from various sources were coded according to these main subject components and their related subcomponents. What is presented in this chapter of the thesis is the synthesis of wide array of revelations in to a summarised version of strengths and weaknesses of the studied regional health information system. The framework utilised to study the regional health information system in this qualitative component of the research is depicted below with its main subject headings and related subheadings.

1. Assessment of HIS resources
  - a. HIS Coordination, planning and policies
  - b. Financial and human resources
  - c. HIS infrastructure

2. Assessment of Health Indicators
  - a. Indicators of health determinants
  - b. Indicators of health system inputs , outputs and outcomes
  - c. Indicators of health status
3. Assessment of Data sources
  - a. Census
  - b. Civil registration
  - c. Population surveys
  - d. Individual records
  - e. Service records
4. Assessment of Data management
  - a. Data collection
  - b. Data storage
  - c. Data analysis
  - d. Information Dissemination
5. Assessment of Data quality
  - a. Data-collection method
  - b. Timeliness
  - c. Periodicity
  - d. Consistency
  - e. Representativeness
  - f. Disaggregation
  - g. Confidentiality, data security and data accessibility
6. Assessment of Information dissemination and use
  - a. In policy and advocacy

- b. Demand and analysis
- c. In planning and priority-setting
- d. In resource allocation
- e. In implementation, monitoring and evaluation of health programmes

In compliance to the objectives of this research, the unit of analysis of this case study component was identified as the regional health information system of Central Province, Sri Lanka. Thus the main purpose of this component of the study is to gather as much information as possible to identify the strengths and weaknesses of the defined health information system. As mentioned in chapter 3 of this report, there were three sources of data namely, literature review, document analysis and interviewing key stake holders.

This chapter of the thesis, which provides the results of the case study component is organised as follows. First, it will provide a concise description of each source of data indicating how each source of data was organised, accessed and to what extent each source has been useful in achieving the research objectives. Second, it will present a comprehensive description organised according to a framework mentioned above. This narrative description was constructed synthesizing all relevant information gathered in the case study by using above sources of data. Third and finally, it will present a concise report which will depict the key strengths and weaknesses of the studied regional health information system in summarised, easily readable and in a tabulated form.

## 5.1 Sources of data

### 5.1.1 Literature review

The literature review in this case study component was carried out specifically to gather information and knowledge in relation to the studied regional health information system. A thorough search yielded no results in peer reviewed journals and conference proceedings. This could be due to two reasons. First, it may be due to the fact that no rigorous investigation has been carried out in the region to study the health information system. Second, any investigation which may have been carried out has not been documented and published in a proper manner.

There was one published study which provided insight in to the diffusion of information technologies in to the public sector in Sri Lanka and the Central province in general [126]. This was based on general principles of applications of IT in the public sector of a developing country and was not specifically related to health sector.

There was one published study on assessing national health information system in Sri Lanka in a non-peer reviewed journal which is being published in Sri Lanka[127]. This article reports a study carried out within Sri Lanka by using the same Health Metrics Network Assessment Tool, which was extensively used in this study. However, the researchers of this study have used the Delphi method instead of the case study strategy used in the research reported in this thesis. The information and knowledge generated in this particular research article was of minimum assistance in this research because of two reasons. First, the journal was neither listed in any established database nor ranked. Second, it provides only a brief overview of the national health information system of Sri Lanka.

For the reasons mentioned above, review of literature did not assist in a considerable extent in seeking information for the case study component. Therefore, the researcher had to depend heavily on document analysis and interviews of key stakeholders in finding information for the case study.

### ***5.1.2 Document analysis***

The accessible documents related to national and regional health information management of Sri Lanka were carefully selected for the purpose of obtaining a broad overview of current state of health information management in regional Sri Lanka. The documents perused included, websites, government documents, periodicals, government circulars and various formats used in health information management activities in Sri Lanka.

Some examples of the document referred for this purpose are listed below.

- a) Annual Health Bulletin of Sri Lanka
- b) Annual health Bulletin of Central province Sri Lanka
- c) Official web site of the Ministry of Health Sri Lanka

### ***5.1.3 Interview of key stake holders***

Interview of key stake holders involved in health information management in Central Province Sri Lanka was the main source of data in this case study. The researcher identified three groups of key stake holders in the studied health region. They are health data collectors (Medical Record Officers), health information system managers and users of health information (health managers). A purposive sample of 5 was selected from each category making the total of 15 stakeholders. Seven more informants were later selected based on the information received during the process

of interviewing initial 15 informants. Accordingly, 22 key informants were interviewed in total.

The interviews were conducted over the telephone, based on an “interview guide” prepared beforehand. The interview guide covered the entire framework of the case study mentioned above with specific questions designed under each subject headings (Appendix 2). The interview guide was semi-structured and the interviewees were encouraged to express their opinion freely.

The responses to the interview questions and further comments were recorded accordingly during the process of interviews. These data were later coded and a scoring system was used to analyse the situation in relation to each subject heading. In addition to that, non-specific responses and comments were coded and tabulated separately. An attempt has then been made to synthesise an accurate picture of the existing regional health information system under the six broad subject headings in the framework utilised. What is presented in this chapter is a narrative description of the current scenario of health information management based on interpretation of qualitative data gathered from all three sources of data.

Triangulation has been used as the method of validation in this qualitative study. The reason for using triangulation to validate the research data was the availability of three sources of data. All important findings obtained through one source of data were verified using at least one other source of data. All the findings and interpretations were verified with multiple sources of data. Unusual and extraordinary information were isolated and discarded if they were not authenticated by at least one other source of data.



## ***5.2 Results and discussion***

### ***5.2.1 Assessment of HIS resources in the studied health region***

Resources for health information system could be sub-divided in to three groups as follows.

- a) HIS Coordination, planning and policies
- b) Financial and human resources
- c) HIS infrastructure

Each of these three groups of resources was assessed separately by using the key-stake holder interviews and other sources of data. The assessment details and findings are described in detail under each heading.

#### **5.2.1.1 HIS Coordination, planning and policies**

The situation in the studied regional information system with regards to coordination, planning and policies is not satisfactory. The province has up-to-date legislation providing the framework for health information covering vital registration and notifiable diseases. However, the provincial health system has no legislation covering private sector data, confidentiality, and fundamental principles of official statistics. Although the legislations available for notifiable diseases are not fully enforced in the region, the legislation covering the vital registration appears to be satisfactorily enforced.

There is no written HIS strategic plan in the provincial health system addressing all the major data sources (censuses, civil registration, population surveys, individual records, service records and resource records). This has not been discussed or received attention from the health managers of the province in the recent past. The

province also does not have a representative and functioning provincial committee in charge of HIS coordination. Usually, the management of health information is being coordinated by the health planning unit situated at the office of the provincial director of health services. This may be due to the fact that health information system per se has not been recognised as an important component in the provincial health system by the managers.

It was revealed that there are no established coordination mechanisms between national statistics office and the provincial ministry of health. National statistics office is situated in the capital city of Colombo which is situated at a distance of about 150 kilometres from city of Kandy. National statistics office is entrusted with the task of managing demographic data, census data and other nationally important statistics including health sector data. However, it appears that the provincial health information system has not established a regular communication mechanism with the national statistics office.

The Central provincial health system has no routine system or policy in place for monitoring or reviewing the performance of the HIS and its various subsystems. Although, regular reports are sent from the grass root level health institutions to the district and provincial level administrative offices, no feedback mechanisms or monitoring and evaluation of the performance of these primary level health information management is being carried out at present.

This study could not elicit any specific reasons for weaknesses noted above. Most interviewees are of the opinion that this is due to the inconsiderate approach of all stake holders in health information management. A general statement will be made at the end of chapter 6 in relation to the reasons of most of the weaknesses detected in this study. Interaction among key units and various health and non-health sections

are important in proper functioning of a health information system. Some examples of various health units include individual healthcare institutions including hospitals, the ministry of health's central health information unit, disease surveillance and control units, and the central statistics office. Analysis of the coordinating mechanism can therefore be useful in identifying constraints that undermine policy or hamper the implementation of key strategies for developing the information system. Constraints include those related to reporting hierarchies or relationships between different units responsible for monitoring and evaluation.

Another important aspect of a health information system is the legal and regulatory mechanisms within which health information is generated and used. They are also highly important as they enable mechanisms to be established to ensure data availability, exchange, quality and sharing among different sectors and the users. Legal and policy guidance is also needed, for example, to elaborate the specifications for electronic access and to protect confidentiality.

Legislation and regulation are particularly significant in relation to the ability of the provincial HIS to draw upon data from both the private and public health services, as well as non-health sectors. Particular attention to legal and regulatory issues could be important to ensure that private health-care providers are integral to the national HIS, by using accreditation where appropriate. The existence of a legal and policy framework consistent with international standards enhances confidence in the integrity of results.

A legal framework can also be useful to define the ethical parameters for data collection, and information dissemination and use. The existence of a properly constructed health information policy framework will be of immense benefit for a regional health information system to identify the main actors and coordinating

mechanisms, ensure links to programme monitoring, and also to identify accountability mechanisms.

Table 11 (page 137) depicts the results of assessment the studied regional HIS in relation to coordination, planning and policies. It presents the item assessed, expected standards and the level of adequacy in the studied information system. The expected standards were derived from His assessment tool, Version 4 of Health Metrics Network [16].

Item	Expected standards	Level of adequacy and the situation in the provincial health system
Up-to-date legislation covering vital registration; notifiable diseases; private sector data; confidentiality; and fundamental principles of official statistics	Legislation covering all aspects exists and is enforced	No such legislation except for notifiable diseases
Implementation and active use of written HIS strategic plan addressing all the major data sources (censuses, civil registration, population surveys, individual records, service records and resource records)	Comprehensive HIS strategic plan exists and is implemented	No written HIS strategic plan
Presence of a representative and functioning provincial committee in charge of HIS coordination	A functional provincial HIS committee exists	No provincial HIS committee
Presence of established coordinating mechanisms between national statistics office and the provincial ministry of health	Coordination mechanisms are fully operational	No such coordinating mechanism
Presence of a routine system in place for monitoring the performance of the HIS and its various subsystems	Routine monitoring system exists and is used regularly	No such system
Presence of an official policy to conduct regular meetings at health-care facilities and health-administration offices (e.g. provincial or district level) to review information	An official policy exists and is being implemented	No such policy

**Table 11: Regional HIS assessment: Central Province, Sri Lanka (Coordination, planning and policies)**

### 5.2.1.2 Financial and human resources

According to all sources of evidence, it was revealed that the Central provincial department of health has the adequate capacity in core health information sciences (epidemiology, demography, statistics, information and ICT). This is one of the strengths which should be noted in future reform processes. Availability of adequate human resources will make it easier to introduce novel components to the system with minimum training and capacity developments activities.

There is a functional central HIS administrative unit in the department of health to design, develop and support health-information collection, management, analysis, dissemination and use for planning and management. This does not function as a separate entity. It functions within the provincial health planning unit. There are three officers who collect and analyse incoming data before the preparation of consolidated reports and statistics. However, this central unit has very limited functional capacity and usually undertakes only few HIS-strengthening activities such as occasional training programmes. This particular unit or any other unit in the provincial health department is not responsible for the design and development of household surveys. Therefore, household surveys are not usually performed within the province.

There are designated fulltime health information officer positions in some offices and healthcare institutions in the region. However, these positions are available in less than 50% of the healthcare institutions and offices. Capacity building activities for these health information officers are limited within the province. These are confined to occasional training programmes usually conducted once a year by the national ministry of health. It was also revealed that assistance is

not available to the HIS staff in designing, managing and supporting databases and software. The turnover rate of these health information staff is satisfactory and manageable within the province.

In regards to financial resources, the provincial department of health does not have separate budget line for health information management activities. These activities are usually considered under health planning activities and not as a separate entity. This is one of the factors which should receive attention in future reform processes as the financial resources are vital for the improvement of various components of the health information system. Table 12 (page141) presents a summarised version of these findings.

The training, deployment, remuneration and career development of human resources at all levels of a health information system is vital for its proper functioning and improvement [16]. At national and provincial levels, skilled epidemiologists, statisticians and demographers are required to oversee data quality and standards for collection, and to ensure the appropriate analysis and utilization of information. At peripheral healthcare institutional levels, health information staff should be accountable for data collection, reporting and analysis. Deploying health information officers within large facilities and districts (as well as at higher levels of the health-care system) results in significant improvements in the quality of data reported and in the understanding of its importance by health-care workers [16].

Another important aspect of human resource management of all disciplines is appropriate remuneration which is essential to ensure the availability of high-quality staff and to limit the staff turnover. This means, for example, that health information positions in health systems should be graded at a level equivalent to those of major disease programmes. Within statistics offices, measures should be taken to retain

well-trained staff. Health Metrics Network suggests that establishing an independent or semi-independent statistics office should allow for better remuneration and subsequent retention of high-level staff [16].



<b>Item</b>	<b>Expected standards</b>	<b>Level of adequacy and the situation in the provincial health system</b>
Presence of adequate capacity in core health information sciences (epidemiology, demography, statistics, information and IT)	Highly adequate	Partially adequate
Presence of a functional central HIS administrative unit in the department of health to design, develop and support health-information collection, management, analysis, dissemination and use for planning and management	HIS central unit is functional with adequate resources	Absent
Presence of a functional unit in the provincial health department which is responsible for the design and development of household surveys	HIS central unit is functional with adequate resources	Absent
Availability of designated full-time health information officer positions at healthcare facility, district and provincial levels	All of the health offices have a designated and filled full-time health information officer positions	Present in less than 50% of health offices
Capacity building activities for the HIS staff take place regularly	Sufficient capacity-building has taken place	Limited capacity-building
Availability of assistance to health and HIS staff in designing, managing and supporting databases and software	Assistance is freely available	Not available
Rate of health-information staff turnover at provincial level	Low turnover	Problematic turnover rate
Presence of a specific budget line in provincial budget to provide adequately for the provincial HIS.	There are specific budget-line items within the provincial budget for HIS	No provincial HIS budget-line

**Table 12: Regional HIS assessment: Central Province, Sri Lanka (Financial and Human resources)**

### 5.2.1.3 HIS infrastructure

In the studied health region of Central province, Sri Lanka, there is an adequate supply of materials for reporting disease and other information. According to many interviewees there can be occasional stock outs but that does not affect recording of information. Computers are available for health information management activities only in provincial and district offices. Some regional preventive care institutions are equipped with micro computers. However it is not clear whether these computers are being utilised for the health information activities to a satisfactory extent.

IT infrastructure for rapid compilation of data (computers, telephone, and internet access) is adequately available at district and provincial level for rapid compilation of data. It was also found that the Medical Officers and Medical Record Officers who are working at the district and provincial levels are adequately trained and thus have the capacity to use this IT infrastructure to a satisfactory extent. The support for ICT equipment maintenance at all levels on regular basis is highly adequate in the region.

The above findings reveal that the Central province has adequate HIS infrastructure at the provincial and district levels. However, the healthcare institutions and hospitals at primary care level have no adequate HIS infrastructure. This could adversely affect the initial steps in health information management namely, recording and timely transmission of data. The paper based formats used in initial steps of health information management could lead to inaccuracies and inefficient data transmission. Table 13 (page 145) presents a summary of this information.

The infrastructural needs of a HIS can be as simple as pencils and paper or as complex as fully integrated, web-connected, ICT. Most basic record keeping, requires facilities to store, file, abstract and retrieve records. However, ICT can radically improve the availability, dissemination and use of health-related data to the real users of health information such as operational health managers and policy makers. Information technologies can improve the amount and quality of the data collected. Communications technology can enhance the timeliness, analysis and use of information. A communications infrastructure is therefore vital to fully realize the potential benefits of information that may already be available.

In ideal circumstances health managers at both national and regional levels should have access to an information infrastructure that includes computers, e-mail and Internet access. Similarly, national and regional statistics offices should be equipped with transport and communications equipment to enable the timely collection and compilation of data at the sub national level.

### ***5.2.2 Assessment of Health Indicators***

The availability and utilisation of a set of core health indicators in Central province, Sri Lanka was assessed in this study by all three means (literature review, document analysis and key stake holder interviews). Surprisingly, there is no identified set of minimum core indicators covering all categories (determinants of health; health system inputs, outputs and outcomes; and health status) in the region. So far, a process has not been initiated to identify a core set of indicators.

The region has no clear strategy for measuring health related Millennium Development Goal (MDG) indicators. Three of the primary healthcare level medical practitioners interviewed, had no clear understanding of the objectives of Millennium Development Goals. It was found that even the health system managers are not adequately aware of the importance of MDG.

Another weakness detected in the regional health information management is that, each health programme manages data and information according to their own specific requirements. There is no collaboration among key stakeholders such as ministry of health (MoH), national statistics office (NSO), other relevant ministries, professional organizations, sub national experts and major disease-focused programmes.

The studied health region has no guidelines or explicit criteria for the selection or preparation of indicators. Interviewees are not aware of any such initiatives in the near future. As such, there is no reporting of information and data related to a minimum set of core health indicators in the health region. This unsatisfactory situation requires immediate remedies. Some strategic recommendations to rectify this situation will be made in the final chapter of this thesis. Table 14 (page 149) summarises the situation with regards to the core health indicators in the studied health information system. The expected standards depicted in Table 14 are based upon the HIS Assessment Tool currently used by Health Metrics Network [16]

Health managers require health data for various needs, including information for improving the provision of services to individual clients, statistics for planning and managing health services, and also for formulating and assessing health policy. This

information requirement cannot be met with health sector data alone and information related to other sectors is also required in routine and strategic health management activities. Therefore, health indicators are a vital component of any regional or national health information system as a way of presenting consolidated information. They are important to track progress and to assess changes. WHO affiliated Health Metrics Network identifies three domains of health indicators [16]. The three domains of health indicators are as follows.

<b>Item</b>	<b>Level of adequacy and the situation in the provincial health system</b>
Adequate supply of materials needed for recording and reporting of disease and other information	Adequate
Availability of computers at all levels for Health Information management	Only at provincial and district level offices
Presence of basic ICT infrastructure (computers, telephone, and internet access) at health facility, district and provincial level for rapid compilation of data.	Present at provincial level; more than 50% at district level; but less than 50% at institutional level
Support for ICT equipment maintenance at all levels on regular basis	Support available for ICT equipment maintenance at all levels

**Table 13 : Regional HIS assessment: Central Province, Sri Lanka (HIS infrastructure)**

1. Health determinant indicators: Indicators of this domain include socioeconomic, environmental, behavioural, demographic and genetic determinants or risk factors. Such indicators characterize the environments in which a particular

health system operates. Some of the information for these indicators are generated through other sectors, such as agriculture, environment and labour.

2. Health system indicators: This group of indicators consists of three sub groups namely, health system input indicators, health system output indicators and health system outcome indicators. The health system input indicators include inputs to the health system and related processes such as policy, organization, human and financial resources, health infrastructure, equipment and supplies. The output indicators represent health service availability and quality, as well as information availability and quality. Finally, the health system outcome indicators represent service coverage and utilization.
3. Health status indicators: Indicators of this domain include levels of mortality, morbidity, disability and well-being of a society. Health status of a society depends upon the efficacy and coverage of interventions and determinants of health that may influence health outcomes independently of health service coverage. Ideally, health status indicators should be stratified or disaggregated by variables such as sex, socioeconomic status, ethnic group and geographical location in order to capture the patterns of health in the population and to permit analysis of inequities in health.

The core indicators of a health system (national or sub-national) should be able to reflect changes over time in each of the three domains. As with any indicator, health indicators should be valid, reliable, specific, sensitive, feasible and affordable to measure. They must also be relevant and useful for decision-making in health services management. The precise indicators used and their number vary according to the epidemiological profile and health development needs of individual countries and health regions within a country.

Carefully selected and regularly reviewed, set of core indicators are a vital part of national or sub-national HIS. It can be viewed as the backbone of the health system, providing the minimum information package needed to support macro and micro health system functions. All countries therefore need a nationally and regionally defined minimum set of health indicators used regularly in programme planning, monitoring and evaluation.

Health indicator definitions must also meet international technical standards for ease of global comparisons. Furthermore, national and regional indicators should be consistently linked and harmonized with key indicators in major international and global initiatives, such as the Millennium Development Goals (MDG).

### ***5.2.3 Assessment of Data sources***

A national or sub-national HIS should have a set of key data sources. The role and contribution of each of data source vary according to the type of information collected by each source. The optimal choice of data sources usually depend upon a range of factors including epidemiology, specific characteristics of the measurement instrument, cost and capacity considerations, and programme needs. In addition, each source may generate data on a range of indicators. The frequency and mode of data collection will depend upon the likelihood of change and the ability of the indicator to detect this change over time. In all settings an appropriate combination of data sources should be used to provide the priority information required.

Feasibility, periodicity, cost-effectiveness and sustainability should be considered in selection of data sources of a national or sub-national HIS. Periodicity of measurement depends on the likely speed of change of the indicator and the costs of generating it. Determining which items of information are most appropriately

generated through routine health information systems – and which require special surveys – should be a central feature of the HIS strategic plan. HIS data are usually generated either directly from populations or from the operations of health and other institutions.

Population-based health data sources generate data on all individuals within defined populations. Common population based data sources are census, civil registration, household surveys and other population surveys. Such data sources can either be continuous and generated from administrative records (such as civil registers) or periodic (such as cross-sectional household surveys).



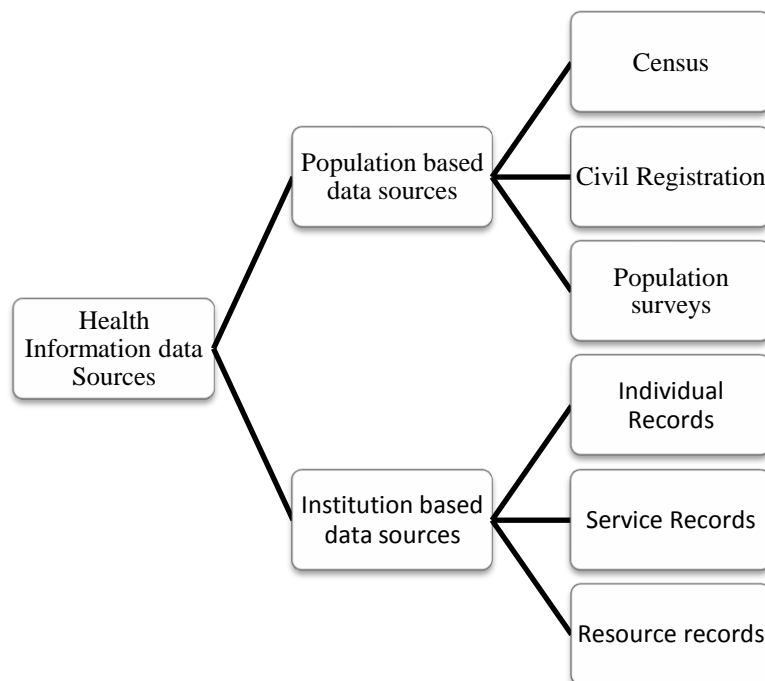
Item	Expected standards	Level of adequacy and the situation in the provincial health system
Presence of an identified set of minimum core indicators covering all categories (determinants of health; health system inputs, outputs and outcomes; and health status)	Minimum core indicators are identified at provincial level and cover all categories	Process not initiated No minimum indicators nor data set identified
Presence of a clear and explicit strategy for measuring health related Millennium Development Goal (MDG) indicators	All the appropriate health-related MDG indicators are included in the minimum core indicator set	At least one but less than 50% of the appropriate MDG indicators are included in the minimum core indicator set
Collaboration with all key stakeholders in defining core indicators (e.g., ministry of health (MoH), national statistics office (NSO), other relevant ministries, professional organizations, sub national experts and major disease-focused programmes)	All the relevant stakeholders collaborated in the selection of the core indicators	Minimum or no collaboration. Each programme requests data according to own requirements
Selection of core indicators according to explicit criteria including usefulness, scientific soundness, reliability, representativeness, feasibility and accessibility	The core indicators have been selected according to explicit criteria including usefulness, scientific soundness, reliability representativeness, feasibility, and accessibility	There are no guidelines or explicit criteria for the selection of indicators
Reporting on the minimum set of core indicators on a regular basis	Reporting is regular (e.g., annual or biannual)	Very limited reporting

**Table 14: Regional HIS assessment: Central Province, Sri Lanka (Health Indicators)**

Institution-based health data sources generate data as a result of administrative and operational activities of various institutions. These activities are

not confined to the health sector alone and could include police records (such as reports of accidents or violent deaths), occupational reports (such as work-related injuries), and food and agricultural records (such as levels of food production and distribution). Within the health sector, the wide variety of health service data includes morbidity and mortality data among people using services; services delivered; drugs and commodities provided; information on the availability and quality of services; case reporting; and resource ( human, financial and logistics) information

Six categories of data sources in the studied health region were assessed in this study. Figure 12 depicts these six categories of data sources. This assessment and selection of categories were based on HIS assessment tool formulated and currently used by the Health Metrics Network [16].



**Figure 12: Health Information Data Sources**

A brief description of each of these main categories of health data sources follow.

#### **A. Censuses**

Censuses are ideally carried out at least once in every 10 years. In ideal circumstances, the census results are made available within 2 years of the data being collected. Unfortunately, only a small number of questions could be included on a census questionnaire, and the data are often of variable quality. To assess census-data quality, it is a standard practice to conduct a post enumeration survey (PES) during which the census questionnaire is re-administered to a small sample of the population.

#### **B. Civil registration**

This refers to the comprehensive ongoing monitoring of births and deaths by age and sex, with attribution of the cause of death. The gold standard is a system that provides a complete record of all births and deaths with medically certified causes of death. Achieving the gold standard is difficult in many developing countries within the foreseeable future due to many reasons [16]. The use of a Sample Registration System (SRS) has been shown to be effective as a short term solution.

#### **C. Population surveys**

Well-integrated demand-driven household survey programme is an important part of well organised HIS. It generates regular essential high-quality information on populations, health and socioeconomic status. International standards and norms must be followed in population surveys. More recently, in some countries, population-based surveys have been used to collect biological and clinical data collection (health examination surveys), providing much more accurate and reliable data on health outcomes than self-reports.

**D. Individual Records**

These include individual health records (for example, growth monitoring, antenatal, delivery outcome) and disease records (consultation, discharge) routinely produced by health workers as well as by special disease registries. One of the most important functions of these records is to support the quality and continuity of care of individual patients.

**E. Service Records**

These records capture information on the various services and on the commodities used. Ideally HIS should capture service statistics from the private sector as well. Integrating reports of disease surveillance and public health programmes reduces the burden on those reviewing reports and increases the likelihood that information will be utilised and acted on.

**F. Resource Records**

These records are concerned with the quality, availability and logistics of key health services. This includes information on the density and distribution of health facilities, human resources for health, drugs and other core commodities and key services. The minimum requirement is a database of health facilities and the key services they are providing. The next level of development of this aspect of the national HIS involves the mapping of facilities, human resources, core commodities and key services at national and district levels. Mapping the availability of resources and specific interventions can provide important information from an equity perspective, and also it can help promote efforts to ensure that needed interventions reach peripheral areas and do not remain concentrated in urban centres.

A qualitative assessment of all six categories of data sources mentioned above was performed in detail. Each data source was assessed against the following areas of information management.

1. Contents
2. Capacity and practices
3. Dissemination
4. Integration and use.

#### **5.2.3.1 Census**

In Sri Lanka, population census is conducted every ten years. During the past few decades it was successfully conducted in all provinces except northern and eastern provinces which were affected due to the civil war prevailing at that time.

It was revealed the all provincial regional and intermediate offices have access to the census reports. This is a satisfactory situation when compared with the same in other developing countries. The time lag between the census and publishing of reports within the country is usually between 2-3 years. These reports are usually available for the public without restrictions. One of the weaknesses in this process of population census in Sri Lanka is the lack of accurate population projections by age and sex for the small areas and districts. Therefore, population projections are never being used for planning of health services.

Most of the interviewees were of the opinion that, although census data are available they are rarely considered in planning of healthcare activities. They believe that lack of inter-departmental coordination, lack of awareness among the senior

managers and overwhelming political and community pressure may have caused this situation of non-utilisation of census data.

Table 15 (page 155) presents major assessment findings in relation to census as a data source in the studied health region.

<b>Assessed item</b>	<b>Expected standards</b>	<b>Situation in the studied health region</b>
Wide distribution of a report including descriptive statistics (age, sex, residence by smallest administrative level) from the most recent census	All districts (lowest administrative health offices) have immediate access	All regions/provinces (intermediate administrative health offices) have immediate access
Lag between the time that data were collected and the time that descriptive statistics were published	Less than 2 years	2 or 3 years
Availability of accurate population projections by age and sex for small areas (districts or below) for the current year	Accurate projections are available for the smallest administrative level	No projections for current year
Public access to micro data	Available on request	Available on request
Use of population projections for the estimation of coverage and planning of health services	Projections used by most institutions	Population projections are not used

**Table 15 : Regional HIS assessment: Central Province, Sri Lanka (Census as a data source)**

### **5.2.3.2 Civil registration**

Civil registration system in Sri Lanka has been at a satisfactory level for decades. Therefore, it could be expected that in peripheral health regions also these registration procedures takes place successfully. However, most of the health administrators interviewed were not aware of this fact.

In the studied health region it was found from all sources that a reliable source of vital statistics exists with 90% coverage of all deaths. The cause of death information is satisfactorily recorded in registration forms in the region. Medical records Officers

in the region use the International Statistical Classification of Diseases and Related Health Problems (ICD) for cause-of-death registration. However, a considerable proportion of recorded causes of death (more than 20%) are found to be ill defined.

A positive feature detected in the civil registration in the Sri Lankan national health system and in the studied regional health system is that published statistics from civil registration are disaggregated by sex, age, geographical or administrative region. However, the lag between the time that data were collected and the time that statistics from civil registration were published is 4-5 years. This is not considered adequate according to HMN standards. A significant finding is that the province does not use information from civil registration on mortality rates and causes of death for provincial health planning and monitoring of ongoing health programmes. Most of the interviewees believed that this situation could have arisen due to prevailing unnecessary political and community interference in all health planning and managerial activities. Table 16 (page 157 ) summarises these findings.

### **5.2.3.3 Population surveys**

The situation in the province in relation to population surveys is found to be highly unsatisfactory. The researcher was able to find that there has not been a single population survey carried out in the last five years. All the interviewees agreed that the province has the adequate capacity to conduct such surveys. They believe that absence of population surveys in the province is due to two reasons. First, the health managers of the province are not aware of the importance of population surveys in planning and management of health services. Secondly, population survey methods are ignored due to the presence of a successful civil registration system. It



was also revealed that there are no long or short term plans to organise population surveys.

<b>Assessed item</b>	<b>Expected standards</b>	<b>Situation in the studied health region</b>
Presence of a reliable source of nationwide vital statistics: civil registration; Sample Registration System (SRS); or Demographic Surveillance System (DSS)	Nationwide civil registration is in operation	Nationwide civil registration is in operation
Coverage of deaths registered through civil registration	90% or more	90% or more
Recording of cause-of-death information on the death registration form if civil registration is in place	90% or more	90% or more
Use of the International Statistical Classification of Diseases and Related Health Problems (ICD) for cause-of-death registration	Use of ICD-10 detailed	Tabulation List ICD-10 is in use ( considered adequate)
Proportion of all deaths coded to ill-defined causes (%)	Less than 5%	20% or more
Disaggregation of published statistics from civil registration by: Sex, age and geographical or administrative region	Disaggregated by all 3	Disaggregated by all 3
Lag between the time that data were collected and the time that statistics from civil registration were published	Less than 3 years	4-5 years
Utilisation of information from civil registration on mortality rates and causes of death are used for provincial analysis	Both mortality rates and cause-of-death information are in health planning	Vital statistics are not utilised or considered minimum in provincial health planning

**Table 16 : Regional HIS assessment: Central Province, Sri Lanka (Civil registration as a data source)**

Following are the expected standards of population surveys in health information management in developing countries [16].

- A. Conduct of a representative survey during the last five years
- B. Conduct of a provincially representative survey in the past five years, which provided sufficient and precise estimates of infant and under five mortality
- C. Conduct of a provincially representative survey during the last five years measuring the prevalence of priority non-communicable diseases (NCD) / health problems and leading risk factors
- D. Presence of adequate capacity in the province to conduct household surveys, to process and to analyse the data
- E. Adherence to international standards of consent, confidentiality, and access to personal data in all population surveys
- F. Disaggregation of population survey data by age, sex, locality, income and education
- G. Availability of metadata and micro data for the department officials and the public
- H. Presence of long-term plans and coordinating mechanisms for population surveys in the province

Organisation of periodical population surveys to verify civil registration and other institutional data should be a priority in future reform attempts in the provincial health information system. It is also important to adhere in to the international standards of population surveys mentioned above.

#### 5.2.3.4 Individual records

The studied provincial health information system has many positive features in regards to individual records. The provincial HIS has appropriate case definitions for all key epidemic prone diseases (e.g. Cholera, Bacillary dysentery, SARS, Avian Flu, Whooping cough etc.) and for diseases targeted for eradication (e.g. Poliomyelitis, Leprosy etc.). It also has a good surveillance strategy for leading causes of morbidities and mortalities which are not covered as epidemic prone. However, there is no mapping of public health risks in either provincial or district administrative offices. It was agreed by all the interviewees and also later proven by document analysis that the province has adequate capacity to diagnose report and act upon any key epidemic prone disease in the event of an outbreak. However, most of the interviewees expressed doubts about capacity for appropriate public health intervention based on these data.

A considerable proportion (75%-89%) of medical officers of the province has the skills to diagnose notifiable diseases. In contrast to this, the proportion of healthcare institutions which submit notifiable disease reports on time are less than 25%. However, the district offices were found to be more efficient in this regard and thus, more than 90% of the district offices submit notifiable disease reports on time.

Another strong feature noted within the studied provincial health system is that 90% or more outbreaks are investigated with laboratory results. It was also found that the use of facility retained records for continuity of clinical care is adequate by HMN standards [16]. All the interviewees engaged in patient care agreed that these records are usually completed adequately and can be retrieved for the majority of patients in time to promptly inform clinical decision-making.

The province has a good communication system regarding occurrence of epidemic prone diseases. It was noted that these data are disseminated among all relevant health workers through weekly bulletins. However, these bulletins are prepared by the national epidemiological unit and not by the provincial health authorities.

The integration of these reports among various health programmes is not entirely satisfactory. Therefore, health workers and the managers face a huge burden in reviewing separate reports. In spite of this weakness, it was found that at least 90% of epidemics noted at provincial or national levels are first detected at the district level. The strengths and weaknesses of the individual records mentioned in this section will again be reviewed when making strategic recommendations for improvement in the next chapter. The findings described above, are summarised in Table 17 (page 162).

#### **5.2.3.5 Service Records**

One remarkable finding in the assessment of this category is that the regional HIS covers only the public health system. It does not report data from the private health system. Most of the interviewees are of the opinion that there is no systematic evaluation of reported service records.

Around 60% of the institutions of the province have a trained cadre of health information officers. They are designated as Medical Record Officers. These officers are graduates of Sri Lankan universities and are especially recruited for this purpose. They are given an initial training of about three months before appointing as Medical Record Officers. However, regular in-service training programmes are not conducted

for their continuous professional development. It was also noted that there is no adequate supervisory mechanism for them.

<b>Assessed item</b>	<b>Expected standards</b>	<b>Situation in the studied health region</b>
Presence of appropriate case definitions for key epidemic prone diseases (e.g. Cholera, Bacillary dysentery, SARS, Avian Flu, Whooping cough etc.) and for diseases targeted for eradication (e.g. Poliomyelitis, Leprosy etc.)	Case definitions present for all key epidemic-prone diseases and diseases targeted for eradication and/or elimination	Case definitions present for all key epidemic-prone diseases and diseases targeted for eradication and/or elimination
Presence of a surveillance strategy for health conditions of substantial public health importance other than those listed above	Present for all leading causes of morbidity, mortality and disability	Present for most leading causes of morbidity, mortality and disability
Mapping of specific at risk populations in place (e.g. populations with high levels of malnutrition and poverty) and of general population exposed to specific risk ( e.g. vectors and environmental and industrial pollution)/	Maps are up to date and comprehensive and there is capacity to promptly add new features	No mapping of public health risks
Presence of adequate capacity to 1) diagnose and record notifiable diseases, 2) report and transmit timely and complete data on these diseases, 3)analyse and act upon these data for outbreak response and planning public health interventions	Adequate capacity for all 3 activities	Adequate capacity to carry out activities (1) and (2)

<b>Assessed item</b>	<b>Expected standards</b>	<b>Situation in the studied health region</b>
The percentage of health workers who can diagnose notifiable diseases	90% or more	75% - 89%
The percentage of health facilities who submit weekly and monthly reports on time	90% or more	<25%
The percentage of districts which submit weekly and monthly reports on time	90% or more	90% or more
Proportion of investigated outbreaks with laboratory results	90% or more	75% - 89%
Use of facility-retained patient medical records to support quality and continuity of care	90% or more of patient records are completed adequately and can be retrieved for 90% or more of patients in time to promptly inform clinical decision-making	Records are usually completed adequately and can be retrieved for the majority of patients in time to promptly inform clinical decision-making
Surveillance data on epidemic-prone diseases are disseminated and fed back through regularly published weekly, monthly or quarterly bulletins	Bulletin produced regularly during past year and available at all district health offices	Bulletin produced regularly during past year and available at all district health offices
Integration of reporting of disease surveillance and other disease focussed public health programmes (e.g. maternal care, family planning and growth monitoring)	A single form is used for notification of key diseases. Reporting of other public health programmes is also well integrated	Health workers and managers face a heavy burden completing and reviewing separate reports for numerous public health programmes
Proportion of epidemics first detected at district level	At least 90% of epidemics noted at regional/provincial or national levels are first detected at district level	At least 90% of epidemics, noted at regional/provincial or national levels are first detected at district level

**Table 17: Regional HIS assessment: Central Province, Sri Lanka (Individual records as a data source)**

The national ministry of health has a separate division of health information management headed by a director who is usually an administrative qualified medical or dental graduate. However, in spite of the presence of this arrangement, the provincial HIS does not come under the proper supervision of national HIS.

The dissemination of annual health statistics came under heavy criticism by most of the interviewees. National health information department publishes national health statistics 3-4 years later than the year of concern. As a result of this, provincial health managers usually receive out dated and irrelevant health statistics which may not be of any use in provincial health management.

The communication between provincial HIS and other vertical health programmes (e.g. Tuberculosis, Malaria) is found to be adequate. There are no surveys in the province to validate data from the institutional records or vital registration system. Most of the respondents who participated in this qualitative study agreed with the fact that data derived from health service records are used to an adequate extent to estimate the coverage of key services (e.g., antenatal care, delivery with a skilled attendant and immunization).

Following three key issues were noted arising from the non-specific responses of the interviewees.

1. Reliability of service records: Most of the service records are not reliable. They are usually prepared in a hurry, at last moment when they are requested from the provincial or district offices.
2. Skills of the officers who prepare the records: Most of the rural and divisional hospitals do not have skilled and trained health information officers. Some hospitals use medical assistants to do the statistical work

3. Accuracy of the service records: The accuracy of diagnosis of most of the diseases especially at the rural and divisional hospitals is doubtful. Most of them are unconfirmed provisional diagnoses.

These are very important issues in management of health information in any national or sub-national health information system. Therefore, these issues should be considered in making recommendations for the improvement of current HIS.

#### **5.2.3.6 Resource records**

Under this part of assessment following types of resources were assessed in relation to the availability and adequacy. These criteria were compared against the expected WHO standards. Health information management pertaining to following four types of resources was considered in this assessment

1. Infrastructure and health services
2. Human resources
3. Financing and expenditure for health
4. Equipment supplies and commodities.

A narrative description of results of this assessment follows.

Although there are human resources and equipments for maintaining and updating databases and maps in the province to an adequate extent, the provincial HIS does not have a database of public and private health facilities with unique identifying numbers. The small database of the public sector institutions which was available with the planning unit (not in a separate health information unit) was updated only three years ago. The required standard is that these databases should be updated at least once a year.

Mapping is not used in the province to demonstrate the location of health infrastructure, health staff, and key health services. Managers and health planners



link information on location of health facilities to the distribution of population to a certain extent. However, based on interviewee responses and other sources of data, the researcher thinks that this is not taking place to an adequate extent.

The provincial HIS maintains a human resource database and tracks numbers by professional category. However, a major weakness is that it is applicable only for those working in the public sector. It is widely believed that this database is not updated within last 4 years.

Financial records are available on general government expenditure on health and its components by ministry of health only. The provincial HIS has no details of health expenditure by other ministries (e.g., social security, regional and local governments, and extra budgetary entities) or on private expenditure on health and its components (e.g., household out-of-pocket expenditure, private health insurance, Non-Governmental Organisations, firms and corporations). The province has system for tracking budgets and expenditure disaggregated only by district level and not by institutional level. However, it was noted that the province has an adequate capacity and human resources to manage financial information. The periodicity of making proper financial estimates was revealed as “once in every 3 years”. In spite of these deficiencies, it was found that the provincial financial health information system provides information on following four classifications of financial flow.

a) Financial resources b) Financial agents c) Providers d) Functions

There is no system for tracking budgets and expenditure disaggregated by major diseases, health programmes and target populations. Health financing details are not widely accessible. These documents are considered as confidential in the provincial health system.

The use of financial information for planning and policy formulation in the province is found to be unsatisfactory. Most of the interviewees agreed that policy-makers and other stakeholders are aware of the health financing details but there is no evidence that these have shaped policy and planning of health services.

The studied health region has adequate human resources for management of infrastructure and logistics in the public sector of health services. Yet, there is no mandatory requirement for reporting on the inventory and status of equipment and physical infrastructure (e.g. construction, maintenance, water supply, electricity and sewage system). Whatever the reports received by the provincial health office are usually incomplete in many aspects. The periodicity and completeness of reporting on level of supplies and commodities (e.g. drugs and vaccines) in the province are also found to be incomplete. There is no integration of reporting of different supplies and commodities in the public sector. Usually, all supplies and commodities are separately reported. Health managers at provincial level do not attempt to reconcile data on the consumption of commodities with data on cases of diseases reported in the public sector.

In general, it appears that the studied health region has more weaknesses in key areas of health resource data than strengths. These findings are summarised in Table 18.

<b>Assessed item</b>	<b>Expected standards</b>	<b>Situation in the studied health region</b>
Presence of a provincial database of public and private health facilities with unique identifying numbers	A data base is available covering both public and private sectors	A data base is available and it covers only the public sector
Availability of human resources and equipments for maintaining and updating databases and maps in the province	Available and highly adequate	Available and adequate
Period since the provincial database of facilities was updated	Less than two years	More than 3 years
Presence of maps in all three district offices and in the provincial office, showing the location of health infrastructure, health staff, and key health services	Present at all levels	Absent at all levels
Linking of information on location of health facilities to the distribution of population by Managers and health planners	Highly adequate	Present but not adequate
Presence of a provincial human resource (HR) database that tracks the number of health professionals by major professional category	The provincial HR database tracks numbers of health professionals by professional category in both the public and private sectors	The provincial HR database tracks numbers by professional category but only those working in the public sector
Period since provincial HR database statistics were last updated	0-1 year	2-3 years
Availability of financial records on general government expenditure on health and its components (e.g., by ministry of health, other ministries, social security, regional and local governments, and extra budgetary entities) and on private expenditure on health and its components (e.g., household out-of-pocket expenditure, private health	Available on all components of public and private sectors	Available only for public expenditure

<b>Assessed item</b>	<b>Expected standards</b>	<b>Situation in the studied health region</b>
insurance, NGOs, firms and corporations)		
Availability of a system for tracking budgets and expenditure disaggregated by district and institutional levels	All sources of finance are disaggregated by district or institutional level	All sources of finance are disaggregated only by provincial level
Availability of an adequate number of qualified and skilled staff to work on health financing and expenditure	Adequate numbers of qualified, long-term staff are regularly deployed	Adequate numbers of qualified, long-term staff are regularly deployed
Periodicity and timeliness of routine financial estimates	Estimates every year with 1-year lag between year reported and publication year	Estimates every 2-5 years
Provincial health accounts provide information on following four classifications of financial flow a) Financial resources b) Financial agents c) Providers d) Functions	Provide information on all 4	Provide information on all 4
Availability of a system for tracking budgets and expenditure disaggregated by major diseases, health programmes and target populations	Health expenditure information is available for at least 2 major disease programmes and another area of policy concern	Not available
Accessibility of health financing details	Health financing details are widely disseminated	Written reports on health financing details are not available
Use provincial financial details for policy formulation and resource allocation	There is at least one major policy document that has been substantially influenced by health financing details	Policy-makers and other stakeholders are aware of the health financing details but there is no evidence that these have shaped policy and planning
Presence of a requirement to report at least annually by each health facility on the inventory and status of equipment and physical infrastructure (e.g. construction, maintenance, water supply, electricity and	Present	Not present

Assessed item	Expected standards	Situation in the studied health region
sewage system)		
Presence of a sufficient and adequately skilled human resources to manage the physical infrastructure and the logistics of equipment supplies and commodities in the public sector	Highly adequate	Highly adequate
Periodicity and completeness of reporting on physical infrastructure and equipments in the public sector	Complete quarterly reporting	No reporting
Periodicity and completeness of reporting on level of supplies and commodities (e.g. drugs and vaccines)	Complete quarterly reporting	Incomplete reporting
Degree to which reporting systems for different supplies and commodities are integrated in the public sector	Fully integrated	All supplies and commodities are separately reported
Managers at provincial levels routinely attempt to reconcile data on the consumption of commodities with data on cases of disease reported in the public sector	Routine reconciliation at monthly intervals	No reconciliation

**Table 18 : Regional HIS assessment: Central Province, Sri Lanka (Resource records as a data source)**

There were two issues arising from non specific responses from the interviewees. These are non-utilisation of resource information in provincial health planning and non- availability of private sector data. Most of the interviewees are of the opinion that real resources information are overshadowed by the political agenda and community pressure in the process of health planning. They are also of the opinion that private sector resources are entirely ignored in the province not because

of the lack of capacity. They attribute this situation to the lack of understanding of the importance of private sector data.

### **5.3 Chapter Summery**

This chapter of the thesis presented key findings of the assessment of the regional HIS in relation to first 3 components (HIS resources, Health indicators and Data sources).Strengths and weaknesses of each component were discussed. The findings indicate that most of the sub components do not meet the expected standards. These weaknesses were highlighted under each sub component. Further elaboration of these features and overall conclusions and recommendations will be presented in Chapter 7.

## **6. Results and discussion: The Case Study: Part 2**

In the part 1 of this presentation (Chapter 5) assessment findings of first three components were presented and discussed. This chapter presents the assessment findings of the other three components. The components presented and discussed in this chapter are:

1. Data management
2. Data quality
3. Information dissemination and use

A description of the findings of each component will be followed by tabulated version similar to the presentation in the previous chapter. Similar to the assessment of previous 3 components, it is expected that this will provide answers to one of the research questions (strengths and weaknesses of the studied regional HIS).

### **6.1 Assessment of Data Management**

In this qualitative study, an attempt was made to assess the state of data management in the regional health information system of Central province via the three sources of data mentioned above. However, as mentioned above, document analysis and literature review were of little use in this component. Therefore, the findings reported below were based mainly on the analysis of interviewee responses.

The regional health system of Central province has a written set of procedures of data management (data collection, storage, cleaning, quality control, analysis and presentation for target audiences) [128]. All aspects of data management are not fully covered in this written set of procedures. Although a set of procedures are available to some extent there is no regular implementation.

There is no integrated and user-friendly data warehouse at provincial level containing data from all sources. There is no such arrangement where there is an identifying code for each healthcare institution of the province. Appropriate integration of health information could never take place with the absence of such a data warehouse, accessible to all stakeholders. This is one of the major weaknesses of the regional health information system of the Central province, detected in this study.

Another major weakness is that the provincial HIS does not have a metadata dictionary. No interviewee was aware of the meaning of the term metadata. However, all are of the opinion that availability of such a dictionary will be highly useful in integration and appropriate standardisation of health information. These findings related to health data management within the studied health region are summarised in Table 19 (page 174 ).

A key issue arising from non-specific responses was the availability of consolidated data in paper format at the provincial director's office. Although it is not an electronic data warehouse, certain amount of consolidated data exists at the central level. This existence of a central database will be beneficial in future reform attempts.

Data management consists of a set of procedures [16]. These procedures include collection, storage, processing and compilation of data. In ideal circumstances, national and sub-national health information systems should have a centralized (preferably electronic) data depository that brings together all information for the HIS. This data depository should be made available to all – ideally via the Internet. The availability of such a data depository to all stake holders facilitates the dissemination and cross-referencing of data among programmes. In addition to that,



it promotes adherence to standard definitions and methods, and helps to reduce redundant and overlapping data collection. Additional advantages are provision of a forum to examine and understand data inconsistencies and facilitation of reconciliation of data reported through different systems.

Regardless of the source of a data item, it is essential to pay special attention to the activities concerned with data collection, storage, analysis and dissemination. The aim should be to carefully assemble data from different sources and to ensure its quality before dissemination.

Another important aspect of data management is providing accurate definitions for common data-element. These definitions of data usually include time periods, geographical designations and other dimensions. This definition of data is termed as “meta data”. Metadata or data about data is highly useful in interpreting and handling data from multiple sources. Therefore, in health information management, it is essential to develop common definitions and to understand the characteristics of each data element.

Data management also has a number of other requirements. Some of these are ensuring that relevant and appropriate information is made easily accessible, understandable, and protecting the information assets of the system. For example, health information system should pay special attention in protecting confidential information.

Assessed item	Expected standards	Situation in the studied health region
Availability of a written set of procedures of data management (data collection, storage, cleaning, quality control, analysis and presentation for target audiences) with implementation throughout the province	A written set of procedures exists including all the steps in data management and these are implemented throughout the province	A written set of data-management procedures exists to some extent but these are not implemented.
Availability of an integrated and user-friendly data warehouse at provincial level containing data from all sources (including data from key health programmes)	There is a data warehouse at the provincial level with a user-friendly reporting utility accessible to users at all levels, including users at the district	No provincial data warehouse exists
Availability of a metadata dictionary which provides comprehensive definitions about the data including use in indicators, specification of collection methods used, periodicity, geographical designations (urban/rural), analysis techniques used and possible biases	There is a metadata dictionary which provides definitions for all 6 of the areas	No metadata dictionary exists
Availability of unique identifier codes for administrative geographical units to facilitate the merging of multiple databases from different sources	Unique identifier codes are used in different databases or a complete relational table is available to merge them	Not available

**Table 19 : Regional HIS assessment: Central Province, Sri Lanka (Data management)**

## 6.2 Assessment of Data quality

A wide range of policies and processes are required to ensure quality of information. Reducing the necessary amount of information to a “minimum dataset” is one such guiding principle [1, 13]. This improves data quality by reducing the burden of data collection. Regular local quality control and data-use checks, the use of clear definitions of data elements, up-to-date training, and frequent feedback to data collectors and users are some other management actions to improve data quality.

International Monetary Fund (IMF) describes five dimensions of data quality in general [129]. These are:

1. Assurances of integrity,
2. Methodological soundness,
3. Accuracy and reliability,
4. Serviceability
5. Accessibility

Health Metrics Network uses following seven criteria for the assessment of quality of health related data [16].

- 1. Data-collection method** –There is usually one accepted data-collection method from different data sources for a given indicator.
- 2. Timeliness** – The period between data collection and its availability to a higher level, or its publication
- 3. Periodicity** – The frequency with which an indicator is measured
- 4. Consistency** – The internal consistency of data within a dataset as well as consistency between datasets and over time; and the extent to which revisions follow a regular, well established and transparent schedule and process;

5. **Representativeness** – The extent to which data adequately represent the population and relevant subpopulations;
6. **Disaggregation** – The availability of statistics stratified by sex, age, socioeconomic status, major geographical or administrative region and ethnicity, as appropriate.
7. **Confidentiality, data security and data accessibility** – The extent to which practices are in accordance with established standards for storage, backup, transport of information (especially over the Internet) and retrieval.
8. **Adjustment methods** – The extent to which raw data are adjusted in order to consider bias and missing values. This specifically refers to adjustments, data transformation and analysis methods performed by using sound and transparent statistical procedures

The assessment of health data quality of the studied regional HIS was done by assessing 10 health indicators representing the three main health domains. The above assessment criteria depicted in Health Metrics Network Assessment Tool [16] were used in the assessment. The health indicators assessed are as follows.

1. **Health Status domain**

- a. Under five mortality
- b. Maternal mortality
- c. HIV prevalence

2. **Health Systems domain**

- a. Measles vaccination coverage
- b. Attended deliveries
- c. Tuberculosis treatment

- d. General government health expenditure per capita
- e. Private expenditure
- f. Workforce density

### **3. Health Determinants domain**

- a. Smoking prevalence

The following section of this chapter is devoted to present the assessment findings of each of the above indicators in the studied health region.

#### ***6.2.1 Assessing regional HIS data quality: “Under five mortality rate”***

Under five mortality rate is not separately calculated within the province. What is available is the rate calculated by national statistics department based on census data and civil registration. Therefore quality of this indicator depends on the quality of national census data and civil registration. As depicted in the previous section on census and civil registration, Sri Lanka has an effective system in place for census and civil registration. Therefore, the assessment findings mentioned here are representative of the quality of the same national indicator. Table 20 (page 183) presents the assessment findings related to under five mortality rate. It was revealed that the province has no mechanism to verify the accuracy of these data.

#### ***6.2.2 Assessing regional HIS data quality: “Maternal mortality rate”***

As depicted above, the province does not calculate its Maternal Mortality Rate (MMR). Here again, it depends on national data. However, the province is capable of calculating MMR, because it has all required data components at the central administrative unit. Sri Lanka is famous for efficient and cost effective maternal care. In all probability, as a result of this efficient national maternal health programme, the quality of maternal statistics and indicators are at a satisfactory state.

It is to be noted here that although the numbers are correct, the causes of maternal mortality may not be accurate because most of the autopsies are conducted by non-specialist medical officers. This issue was raised by several interviewees during the process of interviews. Table 21 (page 184 ) depicts the assessment findings related to data quality of MMR in the studied health region.

### ***6.2.3 Assessing regional HIS data quality “HIV prevalence”***

Human Immune Deficiency Virus (HIV) is the causative agent of Acquired Immune Deficiency Syndrome (AIDS) which is a global public health problem at present. HIV prevalence indicates the number of people infected with the virus at a given time. It was found that Sri Lanka maintains accurate data with regards to this indicator nationally and sub- nationally, thanks to its national health programme which is dealing with HIV disease. This assessment reveals that the quality of this data is satisfactory except for one criterion. Table 22 (page 185 ) presents the findings of this assessment.

### ***6.2.4 Assessing regional HIS data quality: “Measles vaccination coverage by 12 months of age”***

Sri Lanka has been described as a country with a successful immunisation programme [130]. The national epidemiology unit supervises the immunisation programme with an efficient monitoring mechanism. As a result of this campaign, both the national and sub-national health information systems are able to maintain accurate and timely information related to all aspects of immunisation. For these reasons, most of the interviewees are of the opinion that the provincial HIS has a good quality information pertaining to all aspects of immunisation including Measles

vaccination. Table 23 (page 186) presents the assessment findings related to this indicator.

#### ***6.2.5 Assessing regional HIS data quality: Deliveries attended by skilled health professionals***

Number of deliveries (child births) attended by skilled health workers is a good indicator of health services delivery in health system domains of developing countries. The larger the number of unattended deliveries, the poorer the health service delivery of a particular geographical locality. In this study it was assessed whether the provincial HIS is capable of revealing such statistics accurately and reliably. Except for one criterion (household surveys) the central province is capable of providing accurate details of deliveries within the province. Most of the interviewees are of the opinion that this criterion is not applicable to the Central province as it has a well organised documentation system for maternal health statistics, making it unnecessary to conduct household surveys. This situation is not specific to the Central province. This is largely due to the properly organised maternal health care and related documentation in the entire country. This has been discussed previously in the section which presented the assessment findings of Maternal Mortality Rate as an indicator. Table 24 (page 187) presents the study findings related to the quality of “number of deliveries attended by skilled health workers” as an indicator.

#### ***6.2.6 Assessing regional HIS data quality: Tuberculosis (TB) treatment success rate under DOTS***

“Direct Observed Treatment Short Course (DOTS)” is an important component of “STOP TB “strategy launched by World Health Organisation in the recent years in

developing countries. This is an enhanced effort to detect and treat cases of Tuberculosis. Success rate of this strategy is an indicator of successful health services delivery. Therefore it is considered vital for a properly organised HIS to effectively monitor the success rate of DOTS programme. This study assessed the situation of monitoring, recording and reporting of DOTS success rate in the Central province.

The situation in regards to this indicator is highly satisfactory in the province due the efficient vertical health programme conducted by anti-Tuberculosis campaign of the national ministry of health. This programme is not decentralised as yet and is being successfully managed by the national ministry. The provincial planning unit receives a copy of all monthly reports addressed by the local chest clinic to the national programme. Therefore, it has up-to-date information regarding incidence, prevalence and treatment success rate of Tuberculosis. All quality criteria assessed yielded highly satisfactory results. Table 25 (page 188 ) presents the assessment findings related to these criteria.

#### ***6.2.7 Assessing regional HIS data quality: General government health***

***expenditure (GGHE) per capita (ministry of health, other ministries and social security, regional and local governments, extra budgetary entities)***

Eight quality criteria were used to assess whether the provincial HIS is in possession of accurate and reliable information regarding health expenditure of the province in general and per capita. The assessment findings revealed that the provincial HIS is not capable of providing accurate and reliable information with regards to health expenditure. Consistency, representativeness and disaggregation of these data are found to be inadequate in the province. A major weakness is that there



is no mechanism to account for the private sector expenditure of health services. Sixty percent of the outpatient care and 5 % of the inpatient care are said to be provided by the private sector in Sri Lanka[128]. Therefore, it could be safely assumed that a large and important segment of health expenditure in the Central province is unaccounted at present. This could be considered as a major weakness in the provincial HIS requiring immediate attention. Table 26 (page 189) presents the findings of the quality assessment of this indicator.

**6.2.8 Assessing regional HIS data quality: Private expenditure on health per capita (households' out-of-pocket, private health insurance, NGOs, firms and corporations)**

In this component of quality assessment of data, an attempt has been made to assess the quality of private sector expenditure information which are in possession of the provincial HIS. The quality of information is found to be poor and highly inadequate except for two criteria. As depicted in the previous section, the province has up-to-date information only on donor funding. It does not have any information on private sector or out of pocket expenditure. Table 27 (page 190) depicts the findings of this assessment.

**6.2.9 Assessing regional HIS data quality: Density of health workforce (total and by professional category) by 1,000 population**

The quality of information on health work force density within the province was assessed using the six quality criteria. It represents the health system domain. Assessment findings of this section are not satisfactory as most of the quality criteria

were just present in the province to an inadequate extent. Data collection methods, timeliness, consistency and some parts of disaggregation barely met the required quality criteria. However, the periodicity and some parts of quality assessment criteria met the required standards. This area of the regional HIS needs to be improved as early as possible because this could adversely affect the distribution of health workforce in the province. Table 28 (page 191) presents these findings in detail. A key issue raised as a non-specific response was the lack of workforce data of the private sector.

#### ***6.2.10 Assessing regional HIS data quality: Smoking prevalence (15 years and older)***

Smoking prevalence in the age group 15 years and older is accepted as a good indicator of health determinants of any national or sub-national health system. It was found that the Central province has never conducted a survey to determine the smoking prevalence of the region. This is a significant deficiency of the regional HIS. Regular household surveys, not only to collect data for this indicator but also to determine the accuracy of information based on other sources should be an important part in the recommendations for future reforms of the regional HIS. Table 29 (page 192) presents the required quality standards for this indicator with the details of the situation within the provincial HIS.

<b>Assessed criteria</b>	<b>Expected standards</b>	<b>Situation in the studied health region</b>
<u>Data-collection method</u> Whether the data-collection method used to estimate, published most recently or to be published	Vital registration of at least 90% of under-5 deaths	Vital registration of at least 90% of under-5 deaths
<u>Timeliness</u> Number of years since the data were collected, for the most recently published estimate	0-2 years	3-5 years
<u>Periodicity</u> Number of times measured in past 10 years	3 or more	1
<u>Consistency</u> Datasets from major data sources consistent during past 10 years	No major discrepancies	No major discrepancies
<u>Representativeness</u> Coverage of data upon which the most recently reported estimate is based	All deaths (>90%)	All deaths (>90%)
<u>Disaggregation</u> Whether most recent estimate disaggregated by demographic characteristics (e.g. sex, age) socioeconomic status (e.g. income, occupation, education of their parent) and locality (e.g. urban/rural, major geographical or administrative region)	All 3	2
<u>Adjustment method</u> Whether adjustments methods used were transparent and well-established	Yes	Yes

**Table 20 : Regional HIS assessment: Central Province, Sri Lanka (Data quality: Under five mortality rate)**

<b>Assessed criteria</b>	<b>Expected standards</b>	<b>Situation in the studied health region</b>
<u>Data-collection method</u> Whether data-collection method used to estimate published most recently or to be published	Data-collection method used to estimate were published recently or will be published	Data-collection method used to estimate were published recently or will be published
<u>Timeliness</u> Number of years since the data were collected for the most recently published estimate,	0-2 years	0-2 years
<u>Periodicity</u> Number of times measured in past 10 years	3 or more	3 or more
<u>Consistency</u> Datasets from major data sources consistent during past 10 years	No major discrepancies	No major discrepancies
<u>Representativeness</u> Coverage of data upon which the most recently reported estimate is based	All deaths (>90%)	All deaths (>90%)
<u>Disaggregation</u> Most recent estimate disaggregated by demographic characteristics (e.g. sex, age) socioeconomic status (e.g. income, occupation, education of their parent) and locality (e.g. urban/rural, major geographical or administrative region)	All 3	All 3
<u>Adjustment method</u> In-country adjustments use transparent, well-established methods	Yes	Yes

**Table 21 : Regional HIS assessment: Central Province, Sri Lanka (Data quality: Maternal Mortality Rate)**

<b>Assessed criteria</b>	<b>Expected standards</b>	<b>Situation in the studied health region</b>
<u>Data-collection method</u> Whether data-collection method used for estimate published most recently or to be published 1. If generalized epidemic 2. If concentrated or low-level epidemic	1. General population survey + Ante-Natal Clinic (ANC) surveillance 2. Surveillance among population at high risk with random sampling	1. HIV case-reporting 2. HIV case-reporting
<u>Timeliness</u> For the most recently published estimate, number of years since the data were collected	2 years	2 years
<u>Periodicity</u> Number of times measured in past 5 years	5	5
<u>Consistency</u> Data consistency over time during past 5 years	No major discrepancies	No major discrepancies
<u>Representativeness</u> Coverage of data upon which the most recent estimate is based 1. If generalized epidemic 2. If concentrated or low-level epidemic	1. Nationally representative survey + both urban and rural ANC clinics 2. All major populations at high risk with random sampling	1. Other method 2. Other method
<u>Disaggregation</u> Estimate that was published most recently (or will be published) is disaggregated by: (1) demographic characteristics (e.g., sex, age); (2) socioeconomic status (e.g., income, occupation, education); and (3) locality (e.g., urban/rural, major geographical or administrative region)	Disaggregation available for 3 elements – specifically, prevalence among 15–24 year olds is estimated with an adequate sample size	Disaggregation available for 3 elements – specifically, prevalence among 15–24 year olds is estimated with an adequate sample size

**Table 22 : Regional HIS assessment: Central Province, Sri Lanka (Data quality: HIV prevalence)**

<b>Assessed criteria</b>	<b>Expected standards</b>	<b>Situation in the studied health region</b>
<u>Data-collection method – administrative statistics</u> Coverage can be estimated from routine administrative statistics .These are reviewed and investigated.	Administrative statistics are complete (>90%) and quality control is good; population denominators are based upon full (>90%) birth registration	Administrative statistics are complete (>90%) and quality control is good; population denominators are based upon full (>90%) birth registration
<u>Data-collection method - household survey statistics</u> Coverage has been measured by at least 2 provincially representative household surveys in the past 5 years	In the past 5 years there have been at least 2 provincially representative household surveys measuring measles vaccination coverage,	No coverage estimate
<u>Timeliness</u> For the most recently published estimate, number of months since the data were collected	0-11 months	0-11 months
<u>Periodicity</u> Number of times in the past 5 years that an annual estimate was published based on administrative statistics	5 times	5 times
<u>Consistency</u> Data consistent between recent surveys and reports	No major discrepancies	No major discrepancies
<u>Representativeness</u> Coverage of data upon which the most recent estimate is based	Data from at least 90% of health facilities and outreach sites that immunize children including all major hospitals and both public and private sector; or (2) nationally representative household sample	Data from at least 90% of health facilities and outreach sites that immunize children including all major hospitals and both public and private sector; or (2) nationally representative household sample
<u>Disaggregation</u> Estimate that was published most recently (or will be published) is disaggregated by: demographic characteristics, socioeconomic status and locality	Disaggregation available for all 3 elements	Disaggregation available for 1 element (locality)

**Table 23 : Regional HIS assessment: Central Province, Sri Lanka (Data quality: Measles vaccination coverage by 12 months of age)**

<b>Assessed criteria</b>	<b>Expected standards</b>	<b>Situation in the studied health region</b>
<u>Data-collection method - administrative statistics</u> The percentage of deliveries attended by a skilled health professional can be estimated from routine administrative statistics. These statistics are systematically reviewed at each level for investigation and correction.	Administrative statistics are complete (>90%) and quality control is good; population denominators are based upon full (>90%) birth registration	Administrative statistics are complete (>90%) and quality control is good; population denominators are based upon full (>90%) birth registration
<u>Data collection method - household survey statistics</u> Data collected by at least 2 provincially representative household surveys in the past 5 years	In the past 5 years at least 2 nationally representative household surveys have measured coverage	No coverage estimate
<u>Timeliness</u> For the most recently published estimate, number of months since the data were collected	0-11 months	0-11 months
<u>Periodicity</u> Number of times measured in past 10 years	3 or more	3 or more
<u>Consistency</u> Datasets consistent between recent surveys and reports	No major discrepancies	No major discrepancies
<u>Representativeness</u> Coverage of data upon which the most recent estimate is based	Data from at least 90% of professionally supervised deliveries and from complete (>90%) registration of births	Data from at least 90% of professionally supervised deliveries and from complete (>90%) registration of births
<u>Disaggregation</u> Most recent estimate disaggregated by: (1) demographic characteristics (2) socioeconomic status (3) locality	Disaggregation available for all 3 elements	Disaggregation available for all 3 elements

**Table 24: Regional HIS assessment: Central Province, Sri Lanka (Data quality: Deliveries attended by skilled health professionals)**

<b>Assessed criteria</b>	<b>Expected standards</b>	<b>Situation in the studied health region</b>
<u>Data-collection method</u> Source of data and method used for most recent data	Clinic reports with evaluation of reporting rate	Clinic reports with evaluation of reporting rate
<u>Timeliness</u> For the most recently published estimate, number of years since the data were collected	1 year	1 year
<u>Periodicity</u> Number of times measured in the past year	4	4
<u>Consistency</u> Consistency of treatment success rates during past 10 years (fluctuation due to non-standardized data collection procedure, definitions, etc.)	No major discrepancies	No major discrepancies
<u>Representativeness</u> Coverage of data upon which the most recent estimate is based -- % of sub-national DOTS quarterly reports received by national TB programme in most recent year	Over 90%	Over 90%
<u>Disaggregation – 1</u> Estimate that was published most recently or will be published is disaggregated by demographic characteristics (e.g. age), socioeconomic status (e.g. income, occupation, education) and locality (e.g. urban/rural, major geographical or administrative region)	Disaggregation available for 3 elements	Disaggregation available for 3 elements
<u>Disaggregation – 2</u> Most recent estimate disaggregated by HIV status and by drug resistance	Disaggregated by both	Disaggregated by both

**Table 25: Regional HIS assessment: Central Province, Sri Lanka (Data quality: Tuberculosis (TB) treatment success rate under DOTS)**



<b>Assessed criteria</b>	<b>Expected standards</b>	<b>Situation in the studied health region</b>
<u>Data-collection method</u> Data-collection method used for most recent data	Data compiled using National Health Accounts (NHA) methodology	Data compiled from administrative sources (i.e. primary sources of each component)
<u>Timeliness</u> For the most recently published estimate, number of years since the data were collected	0-1 years	0-1 years
<u>Periodicity</u>	Yearly	Yearly
<u>Consistency</u> Consistency of definitions of expenditure on health across components (ministry of health, other ministries and social security, regional and local governments, extra budgetary entities) and over time	Single source with no break in series	Various sources that are not harmonized
<u>Representativeness</u> Components represented	All components: ministry of health, other ministries and social security, regional and local governments, extra budgetary entities	Only ministry of health
<u>Disaggregation – 1</u> Availability of disaggregated estimates of general government expenditure (all components: ministry of health, other ministries and social security, regional and local governments, extra budgetary entities) by provincial or district level	All components: ministry of health, other ministries and social security, regional and local governments, extra budgetary entities	Only ministry of health
<u>Disaggregation – 2</u> Availability of disaggregated estimates of externally funded government expenditure by source of funding (i.e. multilateral, bilateral, private foundations, NGOs, others)	Disbursed external resources from multilateral, bilateral, private foundations, NGOs, others	By committed external resources
<u>Adjustment methods</u> Availability of detailed information on sources and statistical methodologies, and recording of any departures from international guidelines, for all adjustments carried out and their resulting estimates	Resulting estimates are completely replicable through data audit trail	Resulting estimates are completely replicable through data audit trail

**Table 26: Regional HIS assessment: Central Province, Sri Lanka (Data quality: General government health expenditure (GGHE) per capita (ministry of health, other ministries and social security, regional and local governments, extra budgetary entities))**

<b>Assessed criteria</b>	<b>Expected standards</b>	<b>Situation in the studied health region</b>
<u>Data-collection method</u> Data-collection method used for most recent data	Data compiled using National Health Accounts (NHA) methodology	No data
<u>Timeliness</u> For the most recently published estimate, number of years since the data were collected	0-1 years	No data
<u>Periodicity</u>	Data for all components available yearly	No data
<u>Consistency</u> Consistency of definitions of expenditure on health across components (ministry of health, other ministries and social security, regional and local governments, extra budgetary entities) and over time	Single source with no break in series	No data
<u>Representativeness</u> Components represented	Provincially-representative including all components: households' out-of-pocket, private insurance, NGOs, firms and corporations	No data
<u>Disaggregation – 1</u> Availability of disaggregated estimates of general government expenditure (all components: ministry of health, other ministries and social security, regional and local governments, extra budgetary entities) by provincial or district level	All components: households' out-of-pocket, private insurance, NGOs, firms and corporations	No data
<u>Disaggregation – 2</u> Availability of disaggregated estimates of externally funded government expenditure by source of funding (i.e. multilateral, bilateral, private foundations, NGOs, others)	Disbursed external resources from multilateral, bilateral, private foundations, NGOs, others	Committed external resources from multilateral and bilateral agencies
<u>Adjustment methods</u> Availability of detailed information on sources and statistical methodologies, and recording of any departures from international guidelines, for all adjustments carried out and their resulting estimates	Resulting estimates are completely replicable through data audit trail	Resulting estimates are completely replicable through data audit trail

**Table 27: Regional HIS assessment: Central Province, Sri Lanka (Data quality: Private expenditure on health per capita (households' out-of-pocket, private health insurance, NGOs, firms and corporations))**

<b>Assessed criteria</b>	<b>Expected standards</b>	<b>Situation in the studied health region</b>
<u>Data-collection method</u> Routine administrative records are validated with findings from a regularly conducted health facility survey/census, labour-force survey and the population census	Routine administrative records validated with population census, labour-force surveys, health facility census/surveys and administrative records	Only administrative records without validation by any census or survey
<u>Timeliness</u> For the most recently published estimate, number of months since the data were collected	0-5 months	12 or more months
<u>Periodicity</u> Number of times measured in past 5 years	5 or more	5 or more
<u>Consistency</u> Variables and data definitions and classifications consistent over time and across different sources	All sources are consistent. The variables have the same definitions/ classification in all sources	Only some of the main sources are consistent
<u>Disaggregation- 1</u> Categorisation of health workers according to ISCO: International Standard Classification of Occupations	15 or more occupations with ISCO 4 digits or national equivalent	15 or more occupations with ISCO 4 digits or national equivalent
<u>Disaggregation – 2</u> Estimate that was published most recently or will be published is disaggregated by (1) gender, (2) urban/rural, (3) major geographical or administrative region and (4) public/private sector	The data allow disaggregation by all 4 variables	The data allow disaggregation by 2 variables (excluding public/private and urban/rural)

**Table 28: Regional HIS assessment: Central Province, Sri Lanka (Density of health workforce (total and by professional category) by 1,000 population**

<b>Assessed criteria</b>	<b>Expected standards</b>	<b>Situation in the studied health region</b>
<u>Data-collection method</u> Data-collection method used for most recent data	Population-based survey with self-report, daily smokers over previous month	No data
<u>Timeliness</u> For the most recently published estimate, number of years since the data were collected	0-2 years	None
<u>Periodicity</u> Number of times measured in past 10 years	3 or more	None
<u>Consistency</u> Data consistent over time	No major discrepancies	Not applicable
<u>Representativeness</u> Type of sample upon which most recent estimate is based	Provincially representative sample	Any other method apart from those already mentioned
<u>Disaggregation</u> Estimate that was published most recently (or will be published) is disaggregated by: (1) demographic characteristics (e.g., sex, age); (2) socioeconomic status (e.g., income, occupation, education of parents); and (3) locality (e.g., urban/rural, major geographical or administrative region)	Disaggregation available for all 3 elements	Disaggregation not possible

**Table 29: Regional HIS assessment: Central Province, Sri Lanka: Smoking prevalence (15 years and older)**

### 6.3 Assessment of information dissemination and use

Data have little intrinsic value in themselves. They produce information only after compilation, analysis and management. The value of health information is increased when it is integrated with other information and evaluated in terms of the issues confronting the health system. When properly synthesised, information becomes evidence that can be used by decision-makers. This synthesis of evidence becomes even more powerful when it is formatted for presentation, communication or dissemination to decision-makers in a form that changes their understanding of health issues and needs. This process is called transforming evidence into knowledge, and once applied can result in decisions which will directly impact upon health and health equity. HIS then hold the responsibility to monitor this impact by measuring changes in health indicators. This process of transforming evidence in to knowledge through proper management of health information is graphically illustrated in Figure 13 (page 195 ).

In healthcare organisations, the link between data and decision-making is more complex and many factors come into play when strategic decisions on resource allocation are made. In a large and complex organisation, policy-making is fragmented and decisions are difficult to make due to the competing interests of different stakeholders. Thus, many factors (behavioural, organizational and environmental) greatly influence the extent to which information is used.

An important function of the national or sub-national HIS is to connect information production with its use. Users of information are comprised of those delivering, managing and planning health programmes. More broadly, users include those financing health-care programmes, both within countries (health and finance

ministries) and externally (donors, development banks and technical support agencies). Users of health data are not confined to health-care professionals, managers or statisticians. Decision-making around country health priorities necessarily involves the wider community (including civil society) as well as policy-makers at senior levels of government. Among the many advantages of developing a culture of evidence-based decision-making is that many diverse types of users can all benefit from the HIS in line with their own needs and requirements.

Health-care planners and managers responsible for tracking epidemiological trends and the response of the health-care system generally require more detailed data than policy-makers who need data for broader strategic decision-making and investment. Thus, the national or regional HIS should present and disseminate data in appropriate formats for all its different audiences.

This study assessed the current situation of information dissemination and use in the Central province by evaluating information use in following areas.

1. Demand and analysis
2. Policy and advocacy
3. Planning and priority setting
4. Resource allocation
5. Implementation and action

The assessment findings are presented in detail in Table 30 (page 196 ). These findings are considered in formulating strategic recommendations in improving the studied regional health information system. This section thus concludes the presentation of assessment findings of the regional Health Information System of Central Province, Sri Lanka.

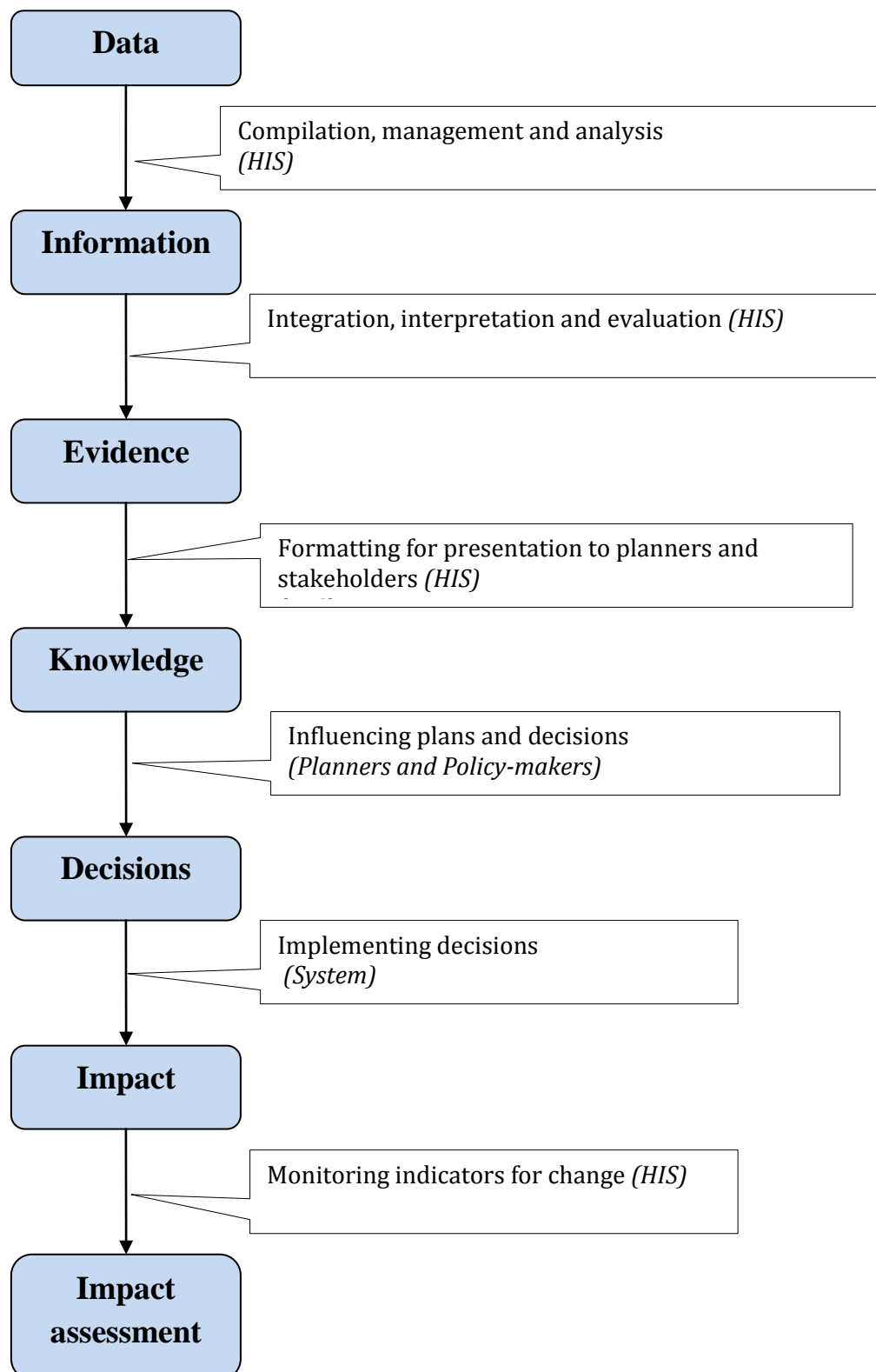


Figure 13 : Transforming data into information and evidence

Assessed criteria	Expected standards	Situation in the studied health region
Demand from senior managers and policy makers for accurate and timely information	A regular demand exists	Demand from managers is ad-hoc, usually as a result of external pressure (e.g., questions from politicians or the media)
Wide display of graphs with up-to-date and clearly understood information, in provincial and district administrative offices and health facilities	Present at all levels (provincial, district health offices, health facilities)	No graphs used
Distribution of integrated HIS summary reports to all relevant parties regularly	Regular integrated reports at least annually to provincial and regional relevant partners	Regular integrated reports at least annually, but distributed only to the provincial ministry of health
Demonstrable use of health information in the planning and in the resource allocation processes	Systematically used with methods and targets aligned between different planning frameworks	Health information is occasionally used
Use of health information by district and provincial management teams to set resource allocations in the annual budget processes	The majority of targets/budget proposals are backed up by HIS information	Few targets/budget proposals are backed up by HIS information
Use of health information to advocate for equity and increased resources to disadvantaged groups and communities	HIS information is systematically used to promote equity	HIS information is used for equity purposes only on an ad hoc basis
Use of health information for health service delivery management, continuous monitoring and periodic evaluation by managers at health administrative offices at all levels (provincial, district, institutional)	Health information is used by managers at all levels for health service delivery management, continuous monitoring and periodic evaluation	All key decisions are centralized to the provincial level
Systematic use of health information on health risk factors to advocate for the adoption of lower-risk behaviours by the general public and by targeted vulnerable groups	Such indicators are systematically used and tailored to fit the risk profile and situation facing each vulnerable group	Only used on an ad hoc basis

**Table 30: Regional HIS assessment: Central Province, Sri Lanka: Information dissemination and use**



## **6.8 The reasons for detected weaknesses of health information management in the studied health region**

The third research question in this study addresses the causative factors of existing weaknesses of health information management in the studied health region. An attempt was made to answer this question throughout the study by using the methods adopted (document analysis, literature survey and key stakeholder interviews).

Although, a special attention was paid regarding this objective, it was difficult to extract information as to why specific components of the system are in failure. No documentary evidence was noted in this regard. For example, the absence of population surveys in the region was easily detected through the available data and information. However, the reasons for such absence could not be detected.

All key stake holders were invited to express their opinion as to reasons of failure in specific components. These responses were later analysed to workout possible causative factors. Accordingly, study findings reveal that inconsiderate approach to the management of health information was the major reason. The studied health system was found to be having adequate resources and capacities to establish a proper health information system. Therefore, this study concludes that inconsiderate approach by the health managers towards health information management in the province predominantly contribute to the current state of HIS failure.

This study also made an attempt to find the reason for this inconsiderate attitude of health managers. Following reasons were repeatedly cited by the interviewees:

- A. Lack of knowledge about basic principles of health information management among all stake holders including key decision makers
- B. Relative lack of understanding of the importance of proper health information management and its relationship to the evidence based health management
- C. Overriding political demands and community pressure making utilisation of health information a low priority

There is a generalised assumption that these three reasons directly affect health information management and proper functioning of the health information system in the region. The researcher believes that any future reform measures should include strategic measurers to address these issues. This will again be reflected in chapter 7 which depicts the conclusions and recommendations.

## 7. Conclusions and recommendations

This chapter presents the overall conclusions derived from the research findings. It also contains strategic recommendations for the improvement of studied regional health information system. These conclusions were drawn upon analysis of study findings of both phases of the research which were described in previous three chapters. The chapter is organised as follows. First, there will be a brief presentation of the context of health information management in health systems of developing countries. It is a revisit of certain background information depicted in the introductory chapter of this report. Secondly, overall study conclusions in relevance to the research questions will be presented. It will be presented by using the same standard framework with six major components of a health information system. This framework has been used in previous two chapters, for the presentation of study results. The strategic recommendations for the improvement of health information management in the studied health system will also be presented and discussed in this section of the chapter. The six major components included in the framework are:

- a. HIS resources
- b. Health indicators
- c. Data sources
- d. Data management
- e. Data quality
- f. Information dissemination and use

Secondly, a description of potential limitations of the study and their impact on study findings will be presented. Thirdly, the outcome of the study will be discussed. An agenda for future research also will be presented in this sub section.

Table 31 depicts the interrelationship among the research questions and the strategies adopted. It also presents an impression of overall findings.

<b>Research Question</b>	<b>Research strategy used</b>	<b>Overall findings</b>
What are the ideas, concerns and expectations of the regional health managers of Central province of Sri Lanka in relation to the regional health information system and its management support?	Self administered postal questionnaire survey	Unmet expectations of health managers Lack of timely and reliable information for health planning  <i>(Page 119)</i>
What are the existing strengths and weaknesses of regional health information system of Central province, Sri Lanka?	Case study research method	Failure of current HIS in number of key areas  Few areas of strengths identified  <i>(Pages 193-219)</i>
What are the causative factors for existing strengths and weaknesses of regional health information system of Central province, Sri Lanka?	Case study research method	Lack of awareness and inconsiderate approach by health managers  <i>(Page 223)</i>
What are the strategic recommendations for the improvement of regional health information system of Central province, Sri Lanka?	Formulated according to the answers for research questions 2 and 3	Key strategic recommendations made according to the WHO standards  <i>(Pages 193-219)</i>

**Table 31 : Interrelationship among the research questions, strategies adopted and the overall findings**

## 7.1 Health information management in the third world: The context

It is widely believed that, since the 1990s, understanding of the global public health scenario has improved because of important investments in data collection. In spite of this, it is also accepted that a huge gap exists between what public health professionals and health care decision makers actually know and what they need to know.

Accurate, reliable and timely health information is a vital foundation of public health action and health systems strengthening, sub-nationally, nationally and internationally. This is particularly important in resource limited settings. The need for sound information becomes, urgent and globally important in the case of emergent diseases and other acute health threats, where rapid awareness, investigation and response can save lives and prevent broader national outbreaks and even global pandemics. Furthermore, the requirements of the 2005 *International Health Regulations* (IHR) [131] impose additional demands for the accurate and timely notification of any public health emergency of international concern (PHEIC).

In spite of all this emphasis on the importance of availability of sound health information, it is reported that only few developing countries have sufficiently strong and effective health information systems [132]. Actually, it is often in developing countries which have the greatest need that reliable and timely information is not available. It is widely believed that this situation is caused by chronic under-investment and inconsiderate attitude for data collection, analysis, dissemination and use. Even when data are available, they are often out of date, rendering the challenge of assessing trends even more difficult. Thus, decision-makers of these health systems do not have the information required to identify problems and needs, make evidence-based decisions on health policy and allocate scarce resources optimally.

Difficulties in collecting good public health data are tied not only to financial, administrative, political or other constraints. Measuring health is conceptually and technically complex. Statistical, public health and biomedical knowledge and expertise unique to specific diseases or programme areas are also required in systematic health information management. Accurate measurement depends upon the availability of disease-specific biometric tests, clinical diagnoses, and the feasibility of measuring behaviours and population-based indicators. Thus, health statistics may vary greatly in terms of their reliability and validity, usability and timeliness.

It is in this context that one has to evaluate an existing health information system. This study made an attempt to evaluate an existing regional health information system in Sri Lanka by using case study research method. Following section of this chapter presents a narrative description, which enlightens the existing strengths and weaknesses of the health information system in the health region of Central Province, Sri Lanka. It is also supplemented by recommendations to be considered as strategic responses to the existing weaknesses in short and medium term reform measures.

## **7.2 Health Information System resources**

Health information system resources pertinent to any health system could be further sub-divided in to three sub-components as follows.

- i. HIS coordination, planning and policies
- ii. Financial and human resources
- iii. HIS infrastructure

A description of overall conclusions regarding strengths and weaknesses of these sub components will follow with appropriate recommendations. These recommendations are based on the research findings and also on guidelines laid down in “Framework and Standards for Country Health Information Systems” published by WHO affiliated Health Metrics Network [132].

### ***7.2.1 HIS coordination planning and policies***

This study concludes that coordination and planning in regards to health information management is inadequate and unsatisfactory in the studied health region. The research findings reveal that following deficiencies have significantly contributed towards this failure.

1. Lack of enforced legislations covering all aspects of health information management.
2. Absence of a written HIS strategic plan
3. Lack of representative and functional HIS committee in charge of HIS coordination
4. Weaknesses in multi-sectoral coordination
5. Absence of a proper monitoring mechanism

It is important to realise that health information systems depend heavily upon how key units and institutions function and interact. The relevant key institutions include the ministry of health central health information unit, disease surveillance and control units, and the central statistics office. Usually, in a sub-national HIS, these are responsible for designing, strengthening and supporting data collection, data transmission, analysis, reporting and information dissemination.



Central province needs a representative provincial committee comprising key stakeholders from health and statistics constituencies to guide the development and maintenance of a health information system. It is recommended that this committee should ensure that data is shared across programmes and institutions. This committee should ideally include representatives of key programmes within the provincial ministry of health, statistics offices, academia, NGOs and international, multilateral and bilateral agencies.

The provincial health information committee should agree upon and sanction national and international demands and requirements for reporting data from health programmes, donors and other provincial stakeholders. It is important that the provincial health information system environment encourages local innovation and entrepreneurship among stakeholders.

The provincial health authorities need to establish a coordinating mechanism for health information management. This can guide health information system investments, with indications of the timeline and anticipated activities. The strategic plan should provide for the maintenance, strengthening and coordination of key health information system components – vital statistics, household surveys/censuses, health service records, reporting and response to health risks and events, and resource tracking. It will also be important to emphasize the integration of data from different sources at national and sub national levels.

It is important to establish legal and regulatory contexts in which health information is generated and used. They enable mechanisms to ensure data availability, exchange, quality and sharing. Legislations and regulations are particularly significant in relation to the generation of data from the private and public health services, as well as non-health sectors. Presence of a legal and policy

framework compatible with international standards, such as the *Fundamental principles of official statistics* [133], enhances the integrity of results. A legal framework can also establish ethical parameters for data collection, and information dissemination and use.

It is also recommended that Central Province formulate a policy framework to identify the main actors and coordinating mechanisms, to ensure links to programme monitoring, and also to identify accountability mechanisms. It is also advisable to have an institutional policy defining the respective roles of health and statistics institutions to ensure the independence of data from external influences, and also to facilitate accountability.

In summary, this study recommends that any reform measures in relation to the studied regional HIS should make stronger emphasis on following strategic responses.

1. Establishment of a representative and functioning provincial committee in charge of HIS coordination. This committee should be empowered with appropriate legislative powers to steer the HIS reform process.
2. Formulation and enforcement of legislations covering all aspects of health information management within the province
3. Formulation and implementation of a comprehensive HIS strategic plan covering all sources of data (censuses, civil registration, population surveys, individual records, service records and resource records)
4. Establishment of coordination mechanisms between the national statistics office and the provincial ministry of health

5. Establishment and maintenance of a routine system for monitoring the performance of the HIS and its various subsystems
6. Formulation and operationalisation of an official policy to conduct regular meetings at health-care facilities and health-administration offices (e.g. provincial or district level) to review information on the HIS and take action based upon such information

### 7.2.2 *Financial and human resources*

Findings of this research indicate that the financial and human resources for health information management in the studied health region are inadequate and unsatisfactory, mainly due to following basic deficiencies.

1. There is no functional HIS administrative unit
2. Functional unit responsible for design and implementation of population surveys is absent
3. Regular capacity building activities for HIS staff are unavailable
4. Unacceptable turnover of HIS staff
5. No specific budget line for the provision of regional HIS

However, it was pleasing to note that the province has adequate capacity in core health information sciences (epidemiology, demography, statistics, information and ICT). The study also reveals that the assistance is available for designing, managing and supporting databases and software when needed.

There is a scarcity of research undertaken into the investment levels needed to ensure a sound health information system – which can vary according to a country's overall level of development. According to some estimates, annual cost of a comprehensive health information system could vary from US\$ 0.53 to US\$ 2.99 per capita [13].

Improvements to health information systems include training, deployment, remuneration and career development of human resources at all levels. It is suggested that at provincial level, skilled epidemiologists, statisticians and demographers are needed to oversee data quality and standards for collection, and to ensure the appropriate analysis and utilization of information [132]. Health information staff at

peripheral levels should be accountable for data collection, reporting and analysis. In the studied health region, such tasks are sometimes allocated to overburdened care providers who see this as an unwelcome additional task that detracts them from their primary role.

The solution to this problem would be to deploy health information officers within large institutions and districts. This will result in significant improvements in the quality of data reported.

Among other factors, adequate remuneration is necessary to ensure the constant availability of high-quality health information staff and to limit turn over. Measures should be taken to retain well-trained staff within all healthcare facilities in the province.

Appropriate and targeted capacity development is required for the health information staff within the province. Training and educational schemes should be established to address human resource development in all areas of health information management. Such training should be organised for all levels of competency. It could range from the pre-service training of health staff and continuous education, to graduate education at the Masters and PhD levels.

In summation, this study recommends that following strategic measures will be of benefit for the improvement of the studied regional HIS in conformity with the accepted standards.

1. Establishment of a functional HIS administrative unit
2. Establishment of a functional unit in provincial health department which is responsible for the design and development of household surveys
3. Deployment of full time health information officers at all levels of healthcare services

4. Regular capacity building activities for the HIS staff
5. Maximum use of the available assistance to health and HIS staff in designing, managing and supporting databases and software
6. Making the HIS staff turnover low and manageable
7. Establishment of a specific budget line to address the requirement of provincial HIS

### **7.2.3 Health information system infrastructure**

This study concludes that the Central province has adequate infrastructure for health information management. Nevertheless, it was found that this could be improved so that the existing infrastructure could be utilised to the maximum extent. Following study findings contributed towards this conclusion.

1. There is an adequate supply of materials needed for health information management
2. Computers are available at provisional and district levels
3. Basic ICT infrastructure is available for satisfactory compilation of data
4. Support for ICT equipment maintenance is available at regular basis

At the level of the most basic record keeping, the health information system needs the ability to store, file, abstract and retrieve records. The infrastructural needs of the health information system can be as simple as pencils and paper or as complex as fully integrated, web-connected, ICT. Many interviewees described the presence of overflowing storerooms filled with mouldering patient records, facility logbooks and paperwork that is never sorted or analysed.

Utilisation of ICT and its recent advances in information management applications should be able to increase the storage and performance capacities within

the province. It will also accelerate the processing timeframes. As a result, the availability, quality, dissemination and use of health-related data can be radically improved. While information technologies can improve the amount and quality of the data collected, communications technology can enhance the timeliness, analysis and use of information. A communications infrastructure is therefore needed to fully realize the potential benefits of information and information infrastructure that is already available.

At provincial, district and institutional levels, health managers should have access to an information infrastructure that includes computers, e-mail and internet access. Although access to the Internet is increasingly essential, basic telephone (landline or mobile) facilities will be highly useful. Provincial and district information units should be adequately equipped with transport and communications equipment to enable the timely collection and compilation of data at all levels. All institutions need appropriate levels of connectivity, but this has to be a medium term objective because of the fact that implementing new technology is complex and requires careful planning and training. Capacity building in electronic and human resources throughout the provincial health system at all levels will be essential for the sustainability of technology deployment. This transition should be supported by clear data-management policies that protect privacy and confidentiality

### **7.3 Indicators**

Health information system is not confined to the health sector alone and overlap with information systems in other fields. Health information systems should offer information for various needs, including information for the provision of services to individual clients, statistics for planning and managing health services,

and measurements for formulating and assessing health policy. Key indicators are required to provide assistance in all these areas. As elaborated in chapter 5, there are three types of indicators representative of three domains of health.

- 1. Determinants of health** –These include socioeconomic, environmental, behavioural, demographic and genetic determinants or risk factors. Such indicators characterize the contextual environments in which the health system operates. A considerable proportion of information for these indicators is generated through other sectors, such as agriculture, environment and labour.
- 2. Health system** – These include inputs to a health system and related processes such as policy, organization, human resources, financial resources, health infrastructure, equipment and supplies. There are also output indicators such as health service availability and quality, as well as information availability and quality. Finally, there are immediate health system outcome indicators such as service coverage and utilization.
- 3. Health status** – Indicators of this domain include levels of mortality, morbidity, disability and wellbeing. Health status variables depend upon the efficacy and coverage of interventions and determinants of health that may influence health outcomes independently of health service coverage. Health status indicators should be available stratified or disaggregated by variables such as sex, socioeconomic status, ethnic group and geographical location in order to capture the patterns of health in the population.

This study concludes that, the situation in the Central province in relation to the formulation and utilisation of a core set of indicators is entirely unsatisfactory and highly inadequate. Virtually, a core set of indicators are nonexistent and not



considered in planning health interventions. It is recommended that provincial health authorities should take immediate steps to formulate and operationalise a core set of health indicators, representative of the three health domains mentioned above.

Indicators of a health system should reflect changes over time in each of the three health information domains mentioned above. Health indicators should be valid, reliable, specific, sensitive, feasible and affordable to measure. They must also be relevant and useful for decision-making at all levels of health information and health system management. If carefully selected and regularly reviewed, core indicators will be vital for health system management. It could be considered as the backbone of the system, providing the minimum information package needed to support macro and micro health system functions.

The main challenge for the provincial health authorities will be to identify a small set of key indicators. Individual health programmes usually have a defined set of indicators, often prepared by external partners and donors. If combined with these indicators it can create a huge burden in terms of data collection, analysis and interpretation. Therefore, a rational selection of a minimum set of core health indicators is essential.

Provincial health authorities will require an accepted framework for selecting core indicators. This will ensure that the indicators will make the comprehensive monitoring and evaluation of health and health systems possible. This framework should be able to identify key management functions and strategic decisions, and then classify them depending on whether they involve inputs, processes, outputs and results. When choosing an indicator and its attributes (such as frequency of measurement and level of disaggregation) consideration must be given to

measurement capacities because indicators for which no statistic can be generated will be of little use.

The provincial set of core indicators may not necessarily be the same as national set of indicators. However, for some national indicators, provincial data collection (for example, through health service provision records) provides the basis statistics.

It is important that indicator definitions must also meet international technical standards. Moreover, provincial indicators should be consistently linked and harmonized with key indicators in major international and global initiatives, such as the Millennium Development Goals (MDG). Therefore it is advisable that national and international stakeholders take part in defining the core indicators.

The study recommends that provincial health authorities need to make some strategic responses to address this failure in health indicators. To conform to the required international standards, it is proposed that following strategic measures need to be adopted.

1. Identification and generation of a set of minimum core indicators covering all categories (determinants of health; health system inputs, outputs and outcomes; and health status). It will be appropriate that these core indicators are defined in collaboration with all key stakeholders (e.g., ministry of health (MoH), national statistics office (NSO), other relevant ministries, professional organizations, sub national experts and major disease-focused programmes). These indicators should be selected according to explicit criteria including usefulness, scientific soundness, reliability, representativeness, feasibility and accessibility

2. Formulation and operationalisation of a clear and explicit strategy for measuring health related Millennium Development Goal (MDG) indicators
3. Reporting on the minimum set of core indicators on a regular basis

#### **7.4 Data Sources**

As described in Chapter 6, health information system data are usually generated either directly from populations or from the operations of health and other institutions [16].

1. Population based: These sources generate data on all individuals within defined populations. Common population based data sources in relevance to health information management are Census, Civil registration and population surveys.
2. Institution based: These sources generate data as a result of administrative and operational activities. Common health data sources in this category could be listed as individual records, service records and resource records.

Although some positive features exist in relation to the presence and operations of certain data sources within the studied region, the overall conclusion of this study is that the data sources of the studied regional HIS do not meet the required standards.

Central province has a properly functioning system for data arising from census and civil registration. However, it has failed to exploit this advantage due to non-utilisation of available data. Censuses are conducted regularly in every ten years in Sri Lanka. Lack of population projection information could be considered as the greatest weakness in census data. Civil registration data are considered highly adequate in Sri Lanka according to the WHO standards. Here again, non-utilisation

of vital statistics in health planning and management process in the province is widely apparent. The province has failed to conduct a single population survey during the last decade.

With regards to institution based data sources, the situation is highly inadequate and unsatisfactory. Several weaknesses were noted. Lack of authenticity, irregular transmission of data from institutional level to the provincial administrative level and non-utilisation of available institutional data were major weaknesses. However, it has to be noted that Central province has fairly reasonable set of paper based formats and recording system. If reviewed and properly implemented with adequate supervision, these will provide considerable proportion of information required for routine and strategic health management activities in the province.

Institution-based data sources generate data as a result of administrative and operational activities. These activities are not confined to the health sector. It could include police records (such as reports of accidents or violent deaths), occupational reports (such as work related injuries), and food and agricultural records (such as levels of food production and distribution). Wide varieties of health service data include morbidity and mortality data among people using services; services delivered; drugs and commodities provided; information on the availability and quality of services; case reporting; and resource information (human, financial and logistics).

Data on the health services provision are generated “routinely” during the recording and reporting of services delivered. Central province needs regular health facility surveys. It could provide another important methodology for collecting data on health services and for validating routine health service data by observing service delivery, inspecting facilities, interviewing staff and clients, and reviewing archives.

Central province does not have a satisfactory system of random health facility surveys.

Provincial authorities should recognise health research as an essential source of information for health decision-making. Currently, health research receives minimum attention in the studied health region. As listed in a joint publication of the Council on Health Research for Development and the Global Forum for Health Research, health research typically covers the following broad spectrum [134].

1. Biomedical;
2. Public health
3. Health policy and systems
4. Environmental health
5. Social and behavioural sciences
6. Operational research in to science and technology

No single data-collection or research method can provide the broad range of information required by national or sub-national health systems. Therefore, health information system managers should consider the information required, the cost-effectiveness and the feasibility of individual methods. The provincial health information system should draw on a set of core data sources.

It is accepted that, using a combination of sources will lead to better quality information while maintaining efficiency [132]. It is also advisable to avoid duplication. The optimal choice of data sources will depend upon a range of factors, including epidemiology, specific characteristics of the measurement instrument, programme needs, cost and the human and technical capacities required to collect, manage and disseminate data. The provincial authorities should consider these factors in selecting appropriate data sources.

#### **7.4.1 *The value of population surveys as a data source***

According to the information gathered in this research the studied health region has never conducted a population survey as a source of data. This may be partly attributable to the fact that it has strong civil registration system. Nevertheless, provincial authorities need to realise the value of population surveys as a reliable source of health data in numerous aspects of health information management.

Population surveys could be used as a source to generate data on following aspects.

1. Child health, maternal mortality and health, nutrition, service use, and knowledge and practices related to health care;
2. Knowledge, beliefs and practices related to disease prevention and transmission
3. Household expenditures on health
4. Inequalities in health outcomes and access to health services

House hold surveys can provide accurate and reliable data on health outcomes than self-reports [132]. Numerous countries, especially in Asia and Latin America, conduct national household surveys on health or include health questions in economic and demographic surveys. By linking surveys focused on health to those directed towards other issues, it is possible to generate important data on the links between health and socioeconomic determinants. Surveys are the prime data sources on risk factors such as unsafe sex, smoking, substance abuse and poor nutritional status. They are less efficient when it comes to measuring relatively rare events such as adult deaths.

Population surveys conducted by other sectors to assess non-health issues (such as incomes and expenditures, the labour force, agriculture or education) may also generate data of major importance to human health. While some of these data

can be derived from institute-based sources, population-based sources could be less subject to bias and more representative of the population. It is recommended that provincial health authorities should consider these positive features of population surveys in health information management within the province.

Population surveys have recently included the use of data on household assets as a proxy of wealth that can be used to disaggregate survey results into wealth quintiles [132]. This provides an important and often unique insight into the equity of the health system.

The success of the household-survey for generating data on key health indicators has created some problems. It is common knowledge that donors now request household surveys in order to measure progress. This has resulted in a multitude of overlapping surveys, and overburdening the capacities of health systems in some countries. For this reason, WHO affiliated Health Metrics Network (HMN) suggests that population surveys should be a well-integrated and a demand-driven exercise.

Well organised, population survey programmes should be a part of provincial health information system. If organised and conducted properly, it could generate regular and essential high-quality data on population, health and socioeconomic status. Provincial surveys could also become major health planning and evaluation instruments. It is therefore important that provincial population surveys adhere to international standards and norms.

Several dimensions should be considered in integrating population surveys into the provincial health information system.

1. Careful consideration of type of health data that can be collected through health and non-health surveys (such as economic surveys)

2. Recognition of surveys as essential sources of validation of routine data sources
3. Recognition that provincial household surveys are costly and complex undertakings.
4. Household survey data are also subject to margins of uncertainty owing to sampling and other errors, illustrating the importance of triangulating data sources.

It is important that provincial population surveys follow internationally agreed standards with regard to sampling, questionnaire design, field supervision, consent and confidentiality, data processing, body fluid collection and analysis, and reporting. Also the data should be publicly disseminated for the interested parties within a reasonable timeframe. To deliver these standards, the provincial health system needs adequate human resources and other capacities.

#### **7.4.2 Individual records**

The overall conclusion of this study is that the studied regional HIS maintains individual health record as a source of data to an adequate and satisfactory extent. It has much strength in this regard. The study conclusion was based on the following research findings.

1. Availability of appropriate case definitions for key epidemic prone diseases (e.g. Cholera, Bacillary dysentery, SARS, Avian Flu, Whooping cough etc.) and for diseases targeted for eradication (e.g. Poliomyelitis, Leprosy etc.)
2. Existence of a surveillance strategy for most leading causes of morbidity, mortality and disability
3. Availability of adequate capacity to
  - a. Diagnose and record notifiable diseases



- b. Report and transmit timely and complete data on these diseases
  - c. Analyse and act upon these data for outbreak response and planning public health interventions
4. Availability of an adequate percentage of health workers who can diagnose notifiable disease
5. Adequate and satisfactory percentage of health facilities who submit weekly and monthly reports on time
6. Investigation of outbreaks with laboratory results to a satisfactory extent
7. Use of facility-retained patient medical records to support quality and continuity of care to a satisfactory extent
8. Dissemination of surveillance data on epidemic-prone diseases through regularly published weekly, monthly or quarterly bulletins
9. Adequate proportion of epidemics first detected at district level

This study also noted following weaknesses in individual records maintained by the provincial HIS.

1. There is no mapping of specific at risk populations in place (e.g. populations with high levels of malnutrition and poverty) and of general population exposed to specific risk ( e.g. vectors and environmental and industrial pollution)
2. The percentage of health facilities who submit weekly and monthly reports on time is between 25-75%

It is to be noted that within the provincial HIS, paper forms will play a key role in recording individual health service information for the foreseeable future. Therefore, the design and production of such forms is an important consideration in

health information system strengthening activities in the province. Paper formats should be organised in an action-oriented manner.

Using electronic database can greatly facilitate the storage, retrieval, transfer and analysis of individual information. This will be especially important where large numbers of patients receive long-term care, for example in common non-communicable diseases. The proper combination of paper-based and electronic medical records will depend upon the human and financial resources and ICT capacities available within the provincial health system.

### **7.4.3 Service Records**

The conclusion of this study with regards to the situation of service record within the province is that it is inadequate and unsatisfactory. The study was able to reveal following major weaknesses in the service record component.

1. There is no health service based information system that covers both public and private facilities
2. There is no systematic approach to evaluate and report the quality of service provided by health facilities
3. Health information staff and other health workers in health facilities receive no regular in-service training in health information
4. There is no supervisory mechanism on information practice in the province
5. There are no mechanisms by which national HIS supervises the provincial HIS
6. Findings from surveys and civil registration system are not used to validate hospital based data

The study also reveals following key strengths of the service record component.

1. A satisfactory level of communication with other vertical reporting systems (e.g. Tuberculosis, Malaria)
2. Satisfactory use of data derived from health service records to estimate the coverage of key services (e.g., antenatal care, delivery with a skilled attendant and immunization)

Service records should include not only the records of health service providers but also the records of events with important health consequences produced in other sectors. Some examples are records made by the police, veterinary services, environmental health authorities, insurance companies and occupational health agencies. Therefore, provincial health system should take steps to capture the service statistics from the private sector, community and civil society organizations and all relevant public sector institutions.

Usually the focus of health service records is management of health services. These records are based on service-generated data derived from health facilities. A major advantage and strength of health service statistics is their usefulness in facility management. In all possible occasions, such service statistics should be used to develop estimates of service coverage, such as immunization coverage, maternity care, etc.

Assessment of service quality should be a part of the health information system. Such surveys should consider different aspects of service quality, such as the availability of drugs, commodities and trained staff. Accepted techniques, such as record review, observing client-provider interaction and using mystery clients, will enhance the value of the assessment. Properly collected service data can be used to validate routine administrative statistics and the availability and geographical distribution of health services and resources.

To overcome these deficiencies and to achieve a satisfactory standard of service records at the regional HIS, this study recommends that provincial health authorities should make stronger emphasis on following measurers.

1. Establishment of health service based information system that covers both public and private facilities
2. Evaluation of the quality of service provided by health facilities based on service records
3. Regular in-service training for health information staff and other health workers
4. Establishment of a supervisory mechanism on information practice in the province
5. Use of findings from surveys and civil registration system to validate hospital based data

#### **7.4.4 Resource records**

The study concludes that the situation in regards to resource records at the studied regional HIS is inadequate and unsatisfactory. Study findings reveal that, the Central province does not have a proper methodology for collection, transmission and analysis of resource records. Although legislations exist, they are rarely implemented and the information available at the central level are not analysed or utilised for planning of health services within the province. Therefore, this component of health information management is entirely unsatisfactory in the province.

This category of health records focuses on the quality, availability and logistics of health service inputs. This includes data on the density and distribution of

health facilities, human resources for health, budgets and expenditures, drugs and other core commodities, and key services.

A database of health facilities and the key services they provide could be considered as the minimum requirement of resource records. Mapping of facilities, human resources, budgets and expenditures, core commodities and key services at district and institutional levels are considered as further developments. The provincial health authorities should consider the use of Global Positioning System (GPS) equipment and Geographic Information System (GIS) software to determine the location of service delivery sites and administrative boundaries and placing these on a computerized map. Introduction of such technology for the mapping of availability of resources, specific interventions, and disease patterns can provide important data from an equity perspective, and promote efforts to ensure that needed interventions reach peripheral areas and do not remain concentrated in urban centres.

Provincial HIS should make sure that information on human-resource levels and distributions of key staff is an essential component and should be monitored at central, district and facility levels. Such data on doctors, para- medical staff, midwives, nurses, nurse auxiliaries and laboratory technicians should be complemented by further information on staff turnover through mortality, resignation and possibly migration.

Budget and expenditure data are usually provided by financial management information systems. This system provides information on the amount of financial resources available for health and their flows across the health system. The breakdown of data into private and public sector categories is an important requirement in the studied health region.

The disaggregation of financial information by major disease or health programme area should be made an essential component of resource records. Information on actual expenditure is more difficult to obtain but is crucial in understanding the performance of the health system. The availability of information on core commodities and drugs should be streamlined through facility reports or administrative records within the provincial health system.

## 7.5 Data management

This study sought to investigate whether data management component of the regional HIS is functioning efficiently and accurately, conforming to the expected standards formulated by the World Health Organisation. The overall conclusion is that this is highly inadequate and unsatisfactory at present. This conclusion is based upon following study findings.

1. The regional HIS does not have a written set of procedures for proper data management (data collection, storage, cleaning, quality control, analysis and presentation)
2. An integrated and user-friendly data warehouse is unavailable at the provincial level
3. Clear definitions does not exist in following critical areas
  - a. Use of data in indicators
  - b. Specification of data collection methods used
  - c. Periodicity
  - d. Geographical designations (urban/rural),
  - e. Analysis techniques used and
  - f. Possible biases

Any reform measures will be counterproductive in the short term, if these deficiencies will not be addressed by the authorities. However, considering the strengths shown in the areas of human resources and ICT capabilities in the studied health region, rectifying these deficiencies will be feasible in the medium term. What is required is a coordinated approach with measures to ensure sustainability of the appropriate data management reforms. Sustenance of HIS reform measures in

developing nations is a hotly debated topic in the contemporary literature [4, 51, 56, 124]. Most are of the view that sustainability of data management measures in resource poor settings could be adversely affected by over reliance on external and donor support. Therefore, it is recommended that health authorities of Central province should avoid this common mistake which has led to continued failure of reform measures in some countries, for example in Tanzania and Mozambique [52].

Findings are also indicative of the fact that data recorded in paper format and collected through registers, cards and forms are likely to remain as the dominant format for the foreseeable future in the Central province. Provincial HIS should therefore ensure the proper storage and accessibility of such data. Patient medical records provide one of the best examples of the importance of data storage. These are vital in managing disease trajectory and for clinical decision-making in individual cases. Hospital and health-facility archives should always be organised as follows:

1. Restricting access to authorized staff to protect the confidentiality and privacy of the patient
2. Coding the system to make records retrievable
3. Following clear procedures for record distribution and re-filing
4. Observing mandatory rules for the minimum period of maintenance and dispatch times at ward, hospital and facility level, and in national archives.

Considering the ICT infrastructure variations, multiple communication models should be encouraged within the province. Cities and developed areas with permanent access can use Internet (and Intranet) technologies, while less-equipped remote areas can use LAN and/or standalone personal computers. Nevertheless, in all cases, transforming paper-based data into digitized data is easier when it is performed as early as possible in the data-to-information cycle (recording, reporting,



aggregating, storing, analysing and using). When a sustainable ICT environment is available at peripheral, hospital and district levels, staff should be encouraged to promptly move routine data from paper to digital format for aggregation, dissemination and reporting.

In addition to the above improvements in data storage, this study also makes following recommendations to overcome the deficiencies in this component of health information management.

1. Formulation and implementation of a written set of procedures of data management (data collection, storage, cleaning, quality control, analysis and presentation for target audiences)
2. Establishment of an integrated and user-friendly data warehouse at provincial level containing data from all sources (including data from key health programmes)
3. Formulation of a metadata dictionary which provides comprehensive definitions about the data. Definitions should include information in the following areas: (1) use of data in indicators, (2) specification of collection methods used, (3) periodicity, (4) geographical designations (urban/rural), (5) analysis techniques used (6) possible biases

## 7.6 Data quality

This study sought to investigate the quality of health information by evaluating ten health indicators against seven quality criteria. The ten indicators evaluated were:

1. Under five mortality ( all causes)
2. Maternal Mortality Rate (MMR)
3. HIV Prevalence
4. Measles Vaccination Coverage by 12 months of age
5. Deliveries attended by skilled health professionals
6. Tuberculosis treatment success rate under DOTS
7. General Government Health Expenditure (GGHE) per capita
8. Private Health Expenditure per capita
9. Density of health workforce (total and professional category) by 10000 population
10. Smoking prevalence ( 15 years and older)

These indicators were evaluated against the following quality criteria:

- |                           |                       |
|---------------------------|-----------------------|
| a. Data collection method | e. Representativeness |
| b. Timeliness             | f. Disaggregation     |
| c. Periodicity            | g. Adjustment method  |
| d. Consistency            |                       |

The study results indicate that out of the ten indicators evaluated six, are of good quality as of the assessed quality criteria. The six indicators which are found to be accurate, reliable and of good quality are listed below.

- |   |  |
|---|--|
| 1. Under five mortality ( all causes)               | 5. Deliveries attended by skilled health professionals |
| 2. Maternal Mortality Rate                          | 6. Tuberculosis treatment success rate under DOTS      |
| 3. HIV Prevalence                                   |  |
| 4. Measles Vaccination Coverage by 12 months of age |  |

The four indicators which were found to be of poor quality according to the assessed criteria were:

1. General Government Health Expenditure (GGHE) per capita
2. Private Health Expenditure per capita
3. Density of health workforce (total and professional category) by 10000 population
4. Smoking prevalence ( 15 years and older)

It is worth noting why the above six indicators are of satisfactory quality in spite of the failure of the regional health information system in most of the other areas. All these good quality indicators are being managed by the vertical health programmes

or line ministry institutions. The vertical health programmes are separate programmes which are established and run by disease control programmes. They are said to have sufficient resources mainly because of the WHO funding programmes and donor support. In the above list, “Tuberculosis treatment success rate under DOTS” is being managed by Anti-Tuberculosis campaign while “HIV prevalence” is being managed by Sexually Transmitted Disease Control campaign. The other remaining good quality indicators are being managed by line ministry institutions namely, Epidemiology unit and Maternal and Child Health unit.

Most of the respondents participated in this study is of the opinion that the line ministry institutions mentioned above, have sufficient resources and capacity to develop their own information systems. They usually follow the internationally acclaimed guidelines, monitored by the WHO. This study recommends that provincial health information unit should make use of the capacity and skills of these campaigns to strengthen the provincial health information system, especially in regards to the quality of indicators.

Provincial HIS should adhere to a wide range of policies and procedures to ensure data quality. Reducing the necessary amount of information to a “minimum dataset” is one guiding principle. By reducing the burden of data collection and this will improve data quality to a considerable extent. Regular local quality control, the use of clear definitions of data elements, appropriate training, and frequent feedback to data collectors are some other measures for ensuring data quality. Electronic communication facilities could be used to enter data at decentralized locations to provide immediate reporting to all levels.

Based on the International Monetary Fund Data Quality Assessment Framework (DQAF) [135] this study recommends that the studied regional HIS

should make stronger emphasis on following quality criteria to overcome the problem of poor quality in certain health indicators mentioned above.

1. **Timeliness** : The period between data collection and its availability to a higher level, or its publication
2. **Periodicity** : The frequency with which an indicator is measured
3. **Consistency** : The internal consistency of data within a dataset as well as consistency between datasets and over time
4. **Representativeness** : The extent to which data adequately represent the population and relevant subpopulations;
5. **Disaggregation** : The availability of statistics stratified by sex, age, socioeconomic status, major geographical or administrative region and ethnicity, as appropriate
6. **Confidentiality, data security and data accessibility** : The extent to which practices are in accordance with standard guidelines such as Organisation for Economic Co-operation and Development (OECD)[136] and other established standards for storage, backup, transport of information (especially over the internet) and retrieval.

## 7.7 Information dissemination and use

This study concludes that the dissemination and use of health information in the studied health region of Central province of Sri Lanka is inadequate and has failed to meet the accepted standards. The study was able to reveal following deficiencies and weaknesses in this component of the regional health information system.

1. Demand from health managers for accurate and timely health information is ad-hoc. This also is usually as a result of external pressure (e.g., questions from politicians or the media)
2. Wide display of relevant health information in graphical form with up-to-date and clearly understood information, in provincial and district administrative offices and health facilities is unavailable
3. Regular integrated reports are published annually, but distributed only among the officers of provincial ministry of health
4. Health information is used only occasionally in the planning and in the resource allocation processes (e.g. for annual integrated development plans, medium-term expenditure frameworks, long-term strategic plans, and annual health sector reviews)
5. Only few targets and budget proposals are backed up by HIS information
6. HIS information is used to advocate for equity and increased resources to disadvantaged groups and communities (e.g., by documenting their disease burden and poor access to services) only on ad hoc basis
7. Managers at various levels of health administrative offices (provincial, district, institutional) do not equally use health information for health services

management, continuous monitoring and periodic evaluation. All key decisions are centralized to the provincial level.

8. Information on health risk factors is used only on ad hoc basis to advocate for the adoption of lower-risk behaviours by the general public and by targeted vulnerable groups

The researcher believes that, this situation of non-reliance on available health information could have been caused by the actual lack of timely information and also by the managers' perception that available data are not reliable. Therefore, any future reform measures for the improvement of information and dissemination should first enhance the timeliness, accuracy and reliability of available information.

Health Information is meant to be used at various levels of the health system for health service and system management, planning, advocacy and policy development. Each level has a broad range of users from different technical disciplines and vocations with associated vocabularies and communication methods. It is important to address the dynamic links between demand, supply and quality of information by encouraging a culture in which information is demanded and used. In reality, this needs the establishment of institutional mechanisms and incentives to create a culture of evidence-based decision-making. Experience has shown that the most effective mechanisms involve linking data and information to actual resource allocation (budgets) and developing indicator-driven planning [132].

One of the major functions of a health information system is to connect data production with its use. Those responsible for collecting data should also benefit from its use. Users are usually comprised of those delivering healthcare and managing and planning health programmes. In broad terms, information users include those financing health-care programmes both within the health systems (for

example health and finance ministries) and external to the health system (donors, development banks and technical support agencies). Therefore, users of health data are not confined to health-care professionals, managers or statisticians. This indicates that decision-making around health priorities essentially involves the wider community (including civil society) as well as policy-makers at senior levels of national or sub national administration. Therefore, the provincial health authorities need to adopt a broad strategy to involve wider stake holders in promoting health information dissemination and use.

Healthcare organisations like the studied provincial health system in the Central Province of Sri Lanka are large and complex. In such a situation, policy-making is fragmented and decisions are sometimes difficult to make because of the competing interests of different players and agencies. The Health Metrics Network has hypothesised that the scarcity of evidence-based decision-making is not due to issues related to data generation but due to institutional and behavioural barriers [132]. Evaluation tools exist, for example “PRISM framework and tools” [137] to allow health systems to assess such factors prior to intervention(s) to improve use of information, and to evaluate the change brought about by such intervention(s).

Following are some recommendations made by Health Metrics Network as organizational and behavioural interventions for improving the use of information in decision-making and planning healthcare interventions [132]. It is recommended that Central provincial health authorities need to place strong emphasis on these recommendations in its future reform exercises.

1. Establishment of transparent mechanisms linking data and information to actual resource allocation (budgets and expenditure)
2. Creating indicator-driven, short- (1 year) and medium-term (3–5 years) planning;



3. Creating organizational routines where managers are held accountable for performance through the use of results-based indicators at all levels of the health system
4. Establishment of a specific programme to address behavioural constraints to data use, for example through applying incentives for data use
5. Creating a supportive organizational environment that places emphasis on the availability and use of well-packaged and well-communicated information and evidence for decision-making

This section concludes the presentation of individual recommendations in relation to the various components of the provincial health information system. It is important to sustain any reform exercises with implementation of above recommendations. To ensure the sustainability of HIS reform exercises with implementation of the above recommendations, following integrated initiatives are recommended. It is expected that these seven initiatives will provide a cost-effective way of implementing the recommendations made in this study. These recommendations for the early initiatives are based on the overall knowledge derived from the case study component of the research in regards to the administrative structure of the studied health region.

1. Establishment of a separate health information unit with its own budget line, entrusted with overall coordination of health information management
2. Establishment of an action committee to provide the leadership in HIS reform measures and change management

3. Consultation of key stake holders in view of further improving the above recommendations.
4. Establishment with an action plan with a stepwise approach to the reform measurers with a feasible time frame.
5. Continuous monitoring and evaluation of the reform process with reorganisation of the action plan and the time frame
6. An intervention study similar in nature to this PhD research to evaluate the effectiveness of the reform process.

### **6.8 Causative factors for the existing failure of regional health information system**

This study concludes that following three factors predominantly contribute to the existing failure of health information system in the region. These conclusions are derived upon the synthesis of non-specific responses received from the interviewees in response to leading questions in this regard. It could be safely assumed that all these factors directly or indirectly contribute to the weaknesses of all major components assessed in this study.

- A. Lack of knowledge about basic principles of health information management among all stake holders including key decision makers
- B. Relative lack of understanding of the importance of proper health information management and its relationship to the evidence based health management
- C. Overriding political demands and community pressure making utilisation of health information a low priority

It is recommended here that all these three factors should be carefully addressed in any future reform measures. First two factors could easily be addressed through proper training programmes with involvement of all stake holders. A stepwise approach is recommended here with following steps.

1. A regional assessment to realise training needs of stake holders at various levels
2. Formulation of training programmes based on the initial assessment
3. Effective conduction of training programmes with proven educational techniques
4. Evaluation of the training programme through post training assessment
5. Continuous professional development programmes

The third factor is concerned with the community pressure and overriding political influence. It is a sensitive social issue in Sri Lanka and probably in all developing countries. It is difficult to propose any recommendations here, to address this sensitive issue which is of social and cultural importance. However, it could be assumed that if the healthcare decision makers will be armed with accurate, reliable and timely health information with fundamental knowledge and understanding of health information management, they will be in a strong position to face these adverse political and community influences.

This subsection of the final chapter of the thesis concludes the presentation of overall conclusions of the research. Next section will present the potential limitations of the study followed by study outcome and scope of further research.

## 7.9 Potential limitations of the research

Every attempt has been made to address the potential limitations of this research by paying careful attention to research rigor. However, some limitations possibly remain and these could be described as follows.

- 1) In the phase of questionnaire survey only one group of stakeholders (health planners) were surveyed to detect the ideas concerns and expectations in regards to the existing health information system. This limits the study interpretations to only one stakeholder perspective.
- 2) Sampling bias could have been introduced because of the sampling techniques used (convenient, judgemental and snow ball) to extract as much information as possible within a limited time frame, addressing the resource constraints at the same time.

However, every possible attempt has been made throughout the research process to apply rigorous scientific measures to minimise the potential impact arising out of these limitations. For example, during the phases of interpretation of study findings and drawing conclusions, these two potential limitations were carefully considered. Because of these reasons, it is to be noted that these potential limitations could no way undermine the overall contribution of this research project which is practically rewarding in the area of health information management of regional health systems of developing countries.

## 7.10 Study outcome and an agenda for future research

The research reported in this thesis made a significant attempt to identify major strengths and weaknesses of the regional HIS of Central Province of Sri Lanka. It has succeeded in identifying strengths and also areas of weaknesses that are to be improved. It has shown that the studied regional HIS is a failure by all accepted norms and means.

It also was able to make some startling revelation as to the major causative factors behind the failure of certain segments of the regional health information system. Based on these strengths and weaknesses the researcher was able to formulate some strategic recommendations for the improvement of regional health information system. Therefore, the research reported in this thesis brought comprehensive answers to the research questions designed and presented in chapter one.

It is anticipated that the findings of this study will bridge the knowledge gaps highlighted in previous sections of this thesis (chapter one and two). This specifically addresses the scarcity of knowledge in in-depth case analysis pertaining to health information management in developing countries.

This is the first study which makes a significant attempt to empirically evaluate a regional health information system in Sri Lanka. It could probably be the first such study in the region of South- East Asia. The research contribution anticipated is multi-fold and could be classified in to two categories of practical and theoretical. The anticipated practical contributions are those contributions derived from the study findings that can be directly applied to the regional and national health information systems of Sri Lanka and the other developing countries. The study findings will

have a direct impact on the management of health information in the studied health region of Central Province, Sri Lanka. The theoretical contributions anticipated are those contributions which will enrich the existing literature with new knowledge and enhancing existing knowledge in health information management, especially in relation to the health systems of the third world. The potential contributions arising out of this research include at least the following.

#### ***7.10.1 Practical contributions:***

- A. Identification of the ideas, concerns and expectations of healthcare managers and planners of the studied health region (Central Province, Sri Lanka) which could justifiably be generalised towards other health regions of the country and also towards peripheral health regions of developing countries of South- East Asian region
- B. A comprehensive annotated bibliography which will serve as a resource document of reported health information management practices and research
- C. Identification of critical success factors and contextual elements related to the regional health information system of the studied health region with categorisation in to various sub-components. These findings could justifiably be generalised towards the other regional health systems of Sri Lanka and the developing countries of South-East Asian region.
- D. Exposure of existing weaknesses and critical failure factors of the studied regional health information system of Sri Lanka. These findings could justifiably be generalised towards the other regional health systems of Sri Lanka and the developing countries of South-East Asian region

- E. A proposal consisting of recommendations which could be implemented as strategic reform measures for the improvement of the regional health information system of the studied health region specifically and the regional health information systems of entire Sri Lanka in general.
- F. Presentation of two validated study instruments that can be used for comprehensive evaluation of regional health information systems of developing countries

#### ***7.10.2 Theoretical contributions:***

- a) A comprehensive annotated bibliography and synthesised critique of health information management research related to the developing countries
- b) A prototype of how multi-method research design consisting of survey and case study research strategies that can be applied in health information systems research
- c) An exemplary description on how to conduct and present case study research with a chain of evidence from research questions to conclusions
- d) An exemplary description on how to design well structured survey and study instruments using past literature in a new domain
- e) Presentation of a sound basis for further research in the research area of health information management of regional Sri Lanka, and regional health systems of third world countries in general

The assessment tool used in this study is a modified version of Health Metrics Networks (HMN) Assessment Tool [16]. This was originally designed for the investigation of national HIS of developing nations by using Delphi technique. This study used a different approach. It used a more comprehensive methodology of a

case study nature, with access to more data sources. Therefore, it could be assumed that this evaluation method would be more productive and would yield more information for easy formulation of future reform processes.

While providing answers to certain questions regarding health information management in developing countries, this research also raises an important question of how authentic is the published health information in these countries. It will be a challenging task to investigate the authenticity of regular publications containing information and health statistics derived from health information systems which are either assumed or proven to be failures.

The findings of this study are consistent with the findings of two similar studies in developing countries of other regions [19, 138]. Odhiambo-Otieno conducted a similar study in a regional health system in Kenya in the year 2005 by using different evaluation criteria [19]. He concludes that the studied regional health information system does not provide adequate management support. However, in comparison the scope of his study is narrower than the study reported in this thesis. Evaluation of two fundamentally important components (HIS resources and information dissemination) appears to be inadequate in his report. This deficiency has probably been caused by the evaluating criteria used in the study. The research reported here was able to overcome similar limitations by using a different assessment tool with comprehensive coverage of all important components of a health information system. Besides, the case study approach used in this study, allowed the use of multiple sources of data with triangulation as a method of verification of study findings.



Yang conducted a similar study in China in 2004 to find out how provincial health systems support health planning in regional China [138]. Overall conclusions of his study are similar in nature. He adopted an unconventional research strategy in qualitative paradigm to evaluate health information management. Although the findings of his study provided significant contribution towards the HIS reform measures in China, his main objective was to study how regional HIS in China could be changed and reformed in accordance with economic transition of China during the period of study (2004). The researcher believes that the findings derived from the research reported in this thesis provide a wider scope of benefits in a generalisable context.

Based on overall conclusions of this study, it is proposed that the following research agenda will be appropriate to strengthen the deprived knowledge in this practically important area of health information management, within the studied health region and also within the health information systems of developing countries in general.

1. In-depth studies of similar nature to investigate the informational approach to management decision making in other sectors (non-health) of provincial administration: This will provide an insight in to the information behaviour of state sector organisations in the decentralised administrative area of Central Province of Sri Lanka. The findings will be helpful in future concerted efforts in promoting evidence based state sector administration. This study has addressed the information management issues in health sector only. However, as discussed in previous chapters, health information system cannot function in isolation because of its relationship to non-health data.

2. Studies to investigate the organisational barriers for information culture and evidence based health management in the studied health region of Central province: This will provide much needed information as to what approach to be taken in promoting information dissemination and utilisation in key stakeholder groups. This study does not reveal much information in this context. One of the causative factors for the existing failure of the studied regional HIS is inconsiderate approach by health managers, which may have been caused by undue political and community influences. Therefore, studies of this nature may provide vital clues to overcome these barriers in future reform process not only in the studied regional HIS, but also in similar settings in all developing countries.
3. An investigative and comparative study to determine the authenticity of current health information produced in the region: This will provide an insight in to the seriousness of inaccuracies committed by poor quality information so far in the region and also a glimpse in to what extent it has misguided the health interventions in the region. The importance of this type of studies became prominent because of the fact that findings of this study cast serious doubts on the authenticity of regional information. Any discrepancies revealed will be helpful to avert misguided health interventions in the future.
4. Productivity of HIS reforms: The deficiencies revealed in this study need immediate attention with a well calculated approach to rectify the situation. It is proposed that the regional health system needs an intervention case study using the same evaluation tool to study the impact of such reform measures.

The evaluation of the same reform process could be guided by the same assessment tool.

5. Studies based on principles of health economics to determine the cost and cost effectiveness of national and sub-national health information reforms in developing countries: This study affirms the need for urgent reforms to the regional HIS studied. As mentioned above, in all probabilities this situation exists in similar health systems in developing countries. These health systems are usually resource strained and therefore any reform measures should be economical and cost effective. Therefore, studies of proposed nature will shed insight as to what amount of financial resources to be diverted in such exercises. This will in turn help to prioritise the required reform measures.

As a concluding remark, the researcher wish to acknowledge the fact that success or failure of health interventions, especially in developing countries depends on many factors. However, health information plays a significant role and it has been proved that health information system failure is at least partly responsible for the dire state of affairs in those health systems. Mere existence of accurate, timely and reliable health information will not be effective in delivering evidence based healthcare interventions. What is actually important is the dissemination of those information and actual use in decision making without any hindrance.

It is simplistic to assume that a linear relation exists between evidence and policy – that good data will automatically lead to better decisions that will in turn result in enhanced health [139]. In practice, it has been found that no linear sequence necessarily exists from good data to better health [140] .

It is to be admitted that availability of good-quality information does not necessarily lead to good health management in developing countries. What are

actually required are evidence-based decision-making culture and practice. For this to happen, the health information system must be able to transform information into valid evidence. To achieve this difficult objective, significant capacity building and reform efforts are needed, supported by sound research.

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## **Appendix I: The Questionnaire used in the first phase of the research**

### **Questionnaire for the health planners of Central Province, Sri Lanka on optimum utilisation of Health Information**

Dear Health administrator/ Health Planner,

The objective of this questionnaire is to collect information related to the current Health Information System and its planning support in Central Province, Sri Lanka. This is a part of a PhD research, currently in progress at Queensland University of Technology, Australia. The objectives of the research are firstly to investigate the failure of Health Information Systems of developing countries and secondly to design a Decision Support System as a reform measure. The researcher is Dr. Indika Ranasinghe, former Regional Director of Health Services (Actg), District of Mathale. The specific objective of this survey is to assess the accessibility, timeliness, availability, accuracy and degree of utilisation of health information from the point of view of the health planners and administrators.

Any knowledge and information gained through this questionnaire are deemed confidential and sensitive and will be accessible only to the researcher. These information and knowledge will not be disclosed, shared, reproduced or used for any other purpose except for the research cited above. Thank you for participating in this survey. If you have any queries regarding the completion of this questionnaire you may contact the research team. Names and contact details of the research team are indicated in the “Participant Information Sheet”.

### 1. Current Information generation, acquisition and use

*(Your responses to these questions will provide information related to the types of information that you use to perform your tasks. It will also provide information that will enable the mapping of information flows within the organization and between the organization and external environment.)*

A. How do you describe the existing Health Information System in your province in terms of planning support?

	Very Good	Good	Satisfactory	Unsatisfactory	Poor
Relevance					
Timeliness					
Accuracy					
Availability					
Accessibility					

E. Please rate the importance of the following characteristics when choosing/using

Information resources.

	1	2	3
	Unimportant		Important

Accessibility/availability/convenience	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Accuracy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Adequacy / relevance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Comprehensiveness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cost	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Delivery method	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Technical accuracy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Timeliness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



B. Please rate the importance of the following resources that are made available by the Provincial or Regional Planning/Information Unit.

1 - don't use

2 - provides indirect or minor support to planning tasks

3 - contributes directly to planning tasks but not essential

4 - provides significant benefits or added value to planning tasks

5 - critical

	Don't use				Critical	
	1	2	3	4	5	
Inpatient data	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Out patient data	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Clinic data	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Notifiable disease data		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Provincial inventory data	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Provincial financial data		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Provincial Epidemiological data		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
National Epidemiological data		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Provincial Demographic data	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
National Demographic data	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Provincial health indicators	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
National Health indicators	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Provincial archives/ Databases		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Political manifestos	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Community requests	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Donor requests		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
National Health Policies		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Human resource data	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

Biomedical supplies and distribution data

G. How do you respond to the statement that “National and regional Health Information Systems in Sri Lanka are poorly organised and need urgent reform measures”

Strongly agree   e  Disagr  Strongly   
disagree

H. How do you describe the current application of Information Technology in various steps in Health Information Management in your province:

	Very Good	Good	Satisfactory	Unsatisfactory	Poor
Data collection					
Data transmission					
Data processing					
Data storage					
Information retrieval					

I. How do you describe your overall satisfaction/dissatisfaction towards the planning support rendered by the existing Health Information System?

Highly satisfied   Satisf  d  Unha    
Frustrated

J. In your opinion, what are the three most prominent strengths if any, in the existing Health Information System of your province?

1.	_____
	_____
2.	_____
	_____
3.	_____
	_____

K. In your opinion, what are the three most prominent weaknesses if any, in the existing Health Information System of your province?

1.	_____
	_____
2.	_____
	_____
3.	_____
	_____

## 2. Health Information System reforms

A. Do you think that the existing Health Information System in your province is in need of significant reforms?

Yes

No

(If “yes” please respond to question B)

B. In your opinion, what is the nature of the reforms required? (*Please tic in appropriate box*)

Complete overhaul of the system	
Development of a framework based on regional requirement	
Adoption of a generally and internationally accepted framework	
Development of specific functional tools with minor reforms to the existing structure	



### 3. Application of Information Technology (IT) in Health Information Management

- A. How do you explain your computer skills in relation to the knowledge of using routine applications such as “Office 2007”?

Excellent	
Good	
Satisfactory	
Poor	

- B. How often do you apply Information Technology and its tools in your routine and strategic planning tasks?

I am a regular user	
I am an occasional user	
I never use	

- C. Do you think that application of recent advances in IT in Health Information System reforms will improve its efficiency and effectiveness in your province?

Yes  No

(If “No” please respond to question D.)

- D. Why do you think that application of IT in Health Information System reforms will not be useful?

It will not be cost effective	
Poor computer literacy will create practical difficulties	
Bureaucracy and “red tapes” will delay the progress	
Not sustainable due to the skill shortage	
Other (Please specify below)	

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## Appendix II: The Interview guide used in key stake holder interviews

### 1. Assessment of HIS resources

#### A. Coordination, Planning and policies

1. Does the province have up-to-date legislations covering the following areas of the information system?
  1. Vital registration
  2. Notifiable diseases
  3. Private sector data
  4. Confidentiality
  5. Fundamental principles of official statistics

#### Anticipated responses and follow-up questions:

##### Yes:

- Are there legislations covering all aspects? If not could you please explain?

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##### Yes, but they are not enforced:

- According to your opinion what are the reasons for not enforcing these legislations?

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##### There are no such legislations:

- According to your opinion what are the reasons for lack of such legislations?

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2. Is there a written strategic plan addressing the following key data sources?
  - a. Census
  - b. Civil registration
  - c. Population surveys
  - d. Service records
  - e. Individual records
  - f. Resource records

Anticipated responses and follow-up questions:

Yes:

Is it fully implemented?  
Do you have adequate resources to implement it?  
Does it emphasise integration of various data sources?

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No:

According to your opinion what are the reasons for lack of such a strategic plan in the province?

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3. Is there a functional provincial committee in charge of HIS coordination?

Anticipated responses and follow-up questions:

Yes

- Does it have adequate resources to be fully functional?

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No

- Was it functional in the past?
- Are there plans to establish such a committee in the future?

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4. Is there a mechanism for multi-sectoral coordination among provincial ministry of health, national statistics office and other related sectors?

Anticipated responses and follow-up questions:

Yes

Is it fully operational with regular meetings?

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No

Have you ever had such mechanisms in the past?

Are there plans to develop such mechanism in the future?

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5. Is there a routine system in place for monitoring HIS and its various sub-systems?

Anticipated responses and follow-up questions:

Yes

- Is it being used regularly?

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No

- Was there such a mechanism that you know of in the recent past?

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- According to your opinion is it practical to establish such a monitoring system in your province?

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6. Is there an official policy to conduct regular meetings at healthcare facilities and health administration facilities to review the HIS? If so is it being implemented as expected?

Anticipated responses and follow-up questions:

Yes

- Is it fully implemented with conduct of regular meetings?

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No

- Are there plans to establish such a policy in the future?

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Financial and Human Resources

1. Are there adequate capacity and staff in key areas of HIS (epidemiology, demography, statistics, information and ICT)?

Anticipated responses and follow-up questions:

Yes

- Could you please rate it according to the adequacy (highly adequate, adequate or partially adequate)?

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No

- Can you identify specific areas which do not have adequate capacity?

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2. Not included because this item is applicable only at national level
3. Is there a functional central administrative unit for HIS?

Anticipated responses and follow-up questions:

Yes

Does that unit have adequate resources?

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Does it undertake HIS strengthening activities regularly?

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No

Have you had such a functional unit in the past?

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Are there plans to establish such a unit in the future?

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4. Is there a functional unit in your provincial health ministry which is responsible for the design and development of household surveys?

Anticipated responses and follow-up questions:

Yes

- Is it fully functional?
- 
- 

- Does it have adequate resources?
- 
- 

No

- Was it functional in the past?
- 
- 

- Why do you think it is not functional at present?
- 
- 
- 
- 

5. Are there full-time Health Information Officers at healthcare facility, district and provincial levels?

Anticipated responses and follow-up questions:

Yes

- Do you think there are an adequate number of these positions in the province?
- 
- 

No

- Have you had such officers in your province in the past?
- 
- 

- According to your opinion, what are the reasons for not appointing such officers?
- 
- 
- 
- 
- 

6. Are capacity building activities for the HIS staff taking place regularly?

Anticipated responses and follow-up questions:



Yes

- Is it being implemented as a long-term plan?
- 
- 

- Are they dependent upon external or donor support?
- 
- 

No

- Could you think of any reasons for lack of these activities in the province?
- 
- 

7. Do you receive assistance in designing, managing and supporting databases and software?

Anticipated responses and follow-up questions:

Yes

Could you please rate the degree of assistance as excellent, adequate or limited?

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No

Could you share with me your opinion as to why such assistance is not available?

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8. Is there an acceptable rate of HIS staff turnover in your province?

Yes

Could you please describe? Is it low turnover with no problems or is it moderate but manageable?

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No

Is it just problematic or unacceptably high? Could you please describe?

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9. Is there specific budget line in provincial budget to provide adequately for the provincial HIS?

Anticipated responses and follow-up questions:

Yes

- Are these budget line items are adequate or limited?

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No

- According to your opinion what are the reasons for non availability of a specific budget line?

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### C. Infrastructure

1. Is there an adequate supply of materials needed for recording and reporting of disease and other information?

Anticipated responses and follow-up questions:

Yes

- Is the supply adequate throughout the year?

No

- Does it affect the reporting of data and information considerably?

2. Not included. This function belongs to a different department
3. Are computers available at all levels for Health Information management?

Anticipated responses and follow-up questions:

Yes

- Do you think that the computers are sufficiently available?

No

- According to your opinion what are the reasons for the lack of computers in the province for health information management?

4. Is there a basic ICT infrastructure (computers, telephone, and internet access) at health facility, district and provincial level for rapid compilation of data?

Anticipated responses and follow-up questions:

Yes

- Do you think that these facilities are sufficiently available?

No

- Could you share with me your opinion as to why these facilities are not available in the province?

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5. Is there support for ICT equipment maintenance at all levels on regular basis?

Anticipated responses and follow-up questions:

Yes

- Do you receive regular support so that interruption to the work is minimised?

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No

- Could you please explain the reasons for non-availability of support for the maintenance of ICT equipments?

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## 2. Assessment of HIS Indicators

1. Is there an identified set of minimum core indicators covering all categories (determinants of health; health system inputs, outputs and outcomes; and health status)?

Anticipated responses and follow-up questions:

Yes

- Does this set of indicators cover all categories?

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- If not what categories are covered at present and to what extent?

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No

- According to your knowledge and opinion, are there plans underway at present to identify an essential set of core indicators?

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2. Is there a clear and explicit strategy for measuring health related Millennium Development Goal (MDG) indicators?

Anticipated responses and follow-up questions:

Yes

- Are all appropriate MDG indicators are included?

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- If not could you please explain the related MDG indicators which are covered?

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No

- Are there plans to identify and include MDG related indicators?

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3. Did the provincial HIS collaborate with all the key stakeholders in defining core indicators?

Anticipated responses and follow-up questions:

Yes

- Could you name the key stakeholders consulted during the process of defining core indicators?

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No

- Can you explain why the provincial HIS did not collaborate with other stakeholders?

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4. Did the provincial HIS use explicit criteria including usefulness, scientific soundness, reliability, representativeness, feasibility and accessibility in selecting core indicators?

Anticipated responses and follow-up questions:

Yes

- Could you explain as to what extent did the provincial HIS use these criteria?

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No

- Are there at least guidelines to use these criteria?

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5. Is there reporting of minimum set of core indicators on regular basis?

Anticipated responses and follow-up questions:

Yes

- Could you please explain? Is it annual, Bi-annual or monthly?
- 
-

No

- Could you identify any reasons for not reporting core indicators regularly?

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### 3. Assessing HIS data sources

#### A. Census

##### 1. Dissemination

1. Is there a report including descriptive statistics of the last census (age, sex, residence) available?

Anticipated responses and follow-up questions:

Yes

- Is it accessible to all levels at the province?

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No

- According to your opinion what are the reasons for lack of accessibility to such a report?

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2. Is there a significant lag between the time that census were conducted and the time that descriptive data were available?

Anticipated responses and follow-up questions:

Yes

Could you specify the period of lag by years?

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No

- Could you explain? How many months does it take to receive the report after the census?

- 
3. Do you have accurate population projections by age, sex and residence by small areas of the province?

Anticipated responses and follow-up questions:

Yes

- What is the smallest administrative area at which these projections are available?

---

No

- According to your opinion what are the reasons for the lack of population projections in your province?

- 
4. Are micro data available for public access?

Anticipated responses and follow-up questions:

Yes

- Are micro data available freely on request or are there any restrictions?

---

No

- Can you tell me why there is no access to micro data?

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## 2. *Integration and use*

1. Do you use population projections for the estimation of coverage and health services planning?

Anticipated responses and follow-up questions:

Yes

- Do you use population projection for planning at all levels (e.g. Provincial, District or sub-district)?

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No

- Are there plans to use population projections for coverage and planning in the future?

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## **B. Civil Registration**

### ***I. Contents***

1. Is there a reliable source of nationwide vital statistics (civil registration, sample registration or demographic surveillance system)?

Anticipated responses and follow-up questions:

Yes

- Please explain. Is it via nationwide civil registration, sample registration or via demographic surveillance system?

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No

- Are there any plans to establish a reliable civil registration system?

- 
2. Is there a full coverage of deaths registered through civil registration?

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Anticipated responses and follow-up questions:

Yes

- Could you explain the coverage as a percentage?

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No

- Could you specify any reasons?
- 
- 
- 
- 
- 

3. Is cause of death information registered on death registration form?

Anticipated responses and follow-up questions:

Yes

- At what percentage?
- 
- 

No

- Could you specify any reasons?
- 
- 
- 
- 
- 

## 2. *Capacity and Practices*

1. Is the latest version of “International statistical classification of deaths and related health problems” (ICD-10) in use for cause-of-death registration?

Anticipated responses and follow-up questions:

Yes

- What version ICD is being used at present (ICD10 detailed, Tabulation list of ICD-10, ICD-9)?
- 
- 

No

- What are the reasons for not using current version of ICD-10?
- 
- 
- 
-

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2. What is the percentage of deaths coded to ill defined causes?

Anticipated responses and follow-up questions:

Less than 20%

- Is this the situation in all hospitals?
- 

More than 20%

- Is this the situation in all hospitals?
- 

- According to your opinion what factors may have contributed to this situation?
- 
- 
- 
- 
- 
- 

3. Are published statistics disaggregated by age, sex and administrative region?

Anticipated responses and follow-up questions:

Yes

- Please explain. Is it complete disaggregation or partial disaggregation?
- 

No

- According to your opinion what are the contributory factors for this unsatisfactory situation?
- 
- 
- 
- 
- 
-



**3. Dissemination**

1. How often the statistics from the Civil Registration System are published?

Anticipated responses and follow-up questions:

Less than 3 years

- This is usually considered as highly adequate. What do you think are the contributory factors for this situation?

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More than 4 years

- This is considered as unsatisfactory. What do you think are the contributory factors?

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**4. Integration and use**

1. Does the provincial HIS analyse information on mortality rates and causes of death?

Anticipated responses and follow-up questions:

Yes

- Is it a regular occurrence?

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No

- Please describe. Is it absent or takes place occasionally?

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**C. Population surveys**

**1. Contents**

1. Has there been a provincially representative survey during the last five years?

Anticipated responses and follow-up questions:

Yes

- Could you please explain the frequency of these surveys?
- 
- 

No

- Could you please explain the reasons?
- 
- 
- 
- 
- 

2. Has there been a provincially representative survey in the past five years, which provided sufficient and precise estimates of infant and under five mortality?

Anticipated responses and follow-up questions:

Yes

- Could you briefly explain how did it take place?
- 
- 
- 
- 
- 

No

- According to your opinion what are the reasons?
- 
- 
- 
- 
- 

3. Has there been a provincially representative survey during the last five years measuring the prevalence of priority non-communicable diseases (NCD) / health problems and leading risk factors?

Anticipated responses and follow-up questions:

Yes

- Did the survey measure at least 3 primary NCD?
- 
- 

- If not, how many priority NCD did it measure?





No

- According to your opinion what are the reasons for the lack of this type of surveys in your province?

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**2. Capacity and practices**

1. Have you got adequate capacity to conduct a) household surveys and b) to process and c) analyse the data?

Anticipated responses and follow-up questions:

Yes

- Please explain. Have you got the capacity for all three?

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No

- What are the deficient areas of capacity?

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2. Do the surveys follow international standards of consent, confidentiality, and access to personal data?

Anticipated responses and follow-up questions:

Yes

- Could you please name the guidelines that are being followed (e.g. OECD guidelines)

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No

- Could you please explain the reasons for not following the international guidelines?

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3. Do you disaggregate survey findings by age, sex, locality income and education?

Anticipated responses and follow-up questions:

Yes

- To what degree? Is it complete disaggregation or partial disaggregation?
- 
- 

No

- Could you please explain the reasons for not disaggregating the survey findings?
- 
- 
- 
- 
- 

4. Not included. Contents of the question are similar to question number 3 at the provincial level.

**3. Dissemination**

1. Are metadata and micro data (design, sample implementation, questionnaires) available for the department officials and the public?

Anticipated responses and follow-up questions:

Yes

- Please explain. Are they freely available to the officials, public and the media?
- 
- 
- 
- 
- 

No

- What are the reasons for the non-availability of metadata and micro data?
- 
- 
- 
-



#### 4. *Integration and use*

1. Are there long-term plans and coordinating mechanisms for population surveys in the province?

Anticipated responses and follow-up questions:

Yes

- Could you please explain? Does this mechanism coordinate all types of surveys conducted?

No

- Could you please explain the reasons for lack of such a mechanism?

#### D. Individual Records

##### 1. *Contents*

1. Does the provincial HIS has appropriate case definitions for key epidemic prone diseases (e.g. Cholera, Bacillary dysentery, SARS, Avian Flu, Whooping cough etc.) and for diseases targeted for eradication (e.g. Poliomyelitis, Leprosy etc.)?

Anticipated responses and follow-up questions:

Yes

- Is this true for all epidemic prone diseases or only for some of the diseases?

No

- What are the reasons for the lack of key definition for these diseases?

- Are there plans to define these key diseases in the near future?



2. Do you have an existing surveillance strategy for health conditions of substantial public health importance other than those listed above in D.1 (e.g. leading causes of morbidity, mortality and disability such as pneumonia and diarrhoea with dehydration in children less than five years of age, Malaria, Tuberculosis, HIV/AIDS, sexually transmitted diseases and non-communicable diseases)?

Anticipated responses and follow-up questions:

Yes

- Is it true for all causes of morbidity, mortality and disabilities or only for some of the conditions?

No

- What are the reasons for the absence of a surveillance strategy for these causes?

- Are there plans to establish surveillance system for these causes in the future?

3. Is there mapping of specific at risk populations in place (e.g. populations with high levels of malnutrition and poverty) and of general population exposed to specific risk ( e.g. vectors and environmental and industrial pollution)/

Anticipated responses and follow-up questions:

Yes

- Are these maps up-to-date and complete?

No

- Are there plans to create these maps in the future?

## 2. *Capacity and practices*

1. Does the province have adequate capacity for the following? a) To diagnose and record notifiable diseases b) To report and transmit timely and complete data on these diseases

c) To analyse and act upon these data for outbreak response and planning public health interventions?

Anticipated responses and follow-up questions:

Yes

- Is the capacity adequate for all three activities?
- 
-

No

- Could you please explain the reasons?

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2. Do you think that the percentage of health workers who can diagnose notifiable disease is satisfactory?

Anticipated responses and follow-up questions:

Yes

- Please specify. Is it more than 90%?

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No

- Are there plans to rectify the situation in the near future?

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3. What is the percentage of health facilities who submit weekly and monthly reports on time?

90% or more

- Do they regularly submit in time?

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Less than 25%

- Are there any measures to rectify the situation?

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4. Do all three districts submit weekly and monthly reports on time?

Anticipated responses and follow-up questions:

Yes

- Do they regularly submit in time?

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No

- According to your opinion what are the reasons for this delay?



- 
- 
- 
- 
- 
- 
- Are there plans to rectify the situation in the near future?
- 

- 
- 
5. What is the proportion of investigated outbreaks with laboratory results?

90% or more

- Is this a regular occurrence?
- 

Less than 25%

- According to your opinion what are the reasons for this situation?
- 
- 
- 
- 
- 
- 

6. Could you please share with me your opinion about the use of facility retained patient medical records to support quality and continuity of care?

90% completed adequately and can be retrieved easily

- Is this the case in all hospitals of the province?
- 

Less than 25% completed adequately and can be retrieved easily

- According to your opinion what are the reasons for this situation?
- 
- 

### 3. **Dissemination**

1. Do you have a mechanism to disseminate data on epidemic prone diseases through regularly published bulletins?

Anticipated responses and follow-up questions:

Yes

- Is this a regular occurrence?

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No

- Could you please explain the reasons?

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**4. Integration and use**

1. Is there integration of reporting of disease surveillance and other disease focussed public health programmes (e.g. maternal care, family planning and growth monitoring)?

Anticipated responses and follow-up questions:

Yes

- Could you please explain how this integration is being carried out?

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No

- Do health workers and managers face a heavy burden in completing and reviewing separate reports?

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2. According to your opinion, what proportion of epidemics was first noted at district level?

More than 90%

- This is a satisfactory situation. What factors contributed towards this situation?

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Less than 75%

- Could you please explain the possible contributory factors for this unsatisfactory situation?

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**E. Service Records**

**I. Contents**

1. Is there a health service based information system that covers both public and private facilities?

Yes

- Does it cover both for profit and non profit facilities?
- 
- 

No

- Could you please explain the reasons for the lack of coverage?
- 
- 
- 
- 
- 

2. Is there a systematic approach to evaluate and report the quality of service provided by health facilities?

Anticipated responses and follow-up questions:

Yes

- Could you please explain the method of evaluation? Is it through a representative health facility survey or through a convenience sample?
- 
- 

No

- Could you please explain the reasons for not evaluating the quality of health service in your province?
- 
- 
- 
- 
-

2. *Capacity and Practices*

1. Does the provincial HIS have a cadre of trained health information staff who are placed at all levels (provincial, district and institutional)?

Anticipated responses and follow-up questions:

Yes

- What type of training have they received?

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- Do you think that at least 75% of the health information staff has been trained?

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No

- According to your opinion what are the reasons for shortage of trained staff?

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2. Do health information staff and other health workers in health facilities receive regular in-service training in health information?

Anticipated responses and follow-up questions:

Yes

- What percentage of health workers has received such training?

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- Can you explain the type of training provided?

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No

- Can you explain the reasons for lack of regular training programmes?

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3. Is there a supervisory mechanism on information practice in the province?

Anticipated responses and follow-up questions:

Yes

- Do you think that the present supervisory arrangements are adequate and satisfactory?

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No

- Can you please explain the reasons for lack of a supervisory mechanism?

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4. Are there mechanisms by which national HIS supervises the provincial HIS?

Anticipated responses and follow-up questions:

Yes

- Do you think that the provincial HIS is adequately and satisfactorily supervised by this way?

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No

- Do you think it will be useful to have such a supervisory arrangement?

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- What are the reasons for non availability of such an arrangement?

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**3. Dissemination**

1. Do you have a system of disseminating annual health statistics with disaggregation regularly?

Anticipated responses and follow-up questions:

Yes

- How often the provincial HIS publish disaggregated statistics?

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No

- Could you identify any reasons for not publishing the disaggregated statistics?

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#### 4. *Integration and Use*

1. Does the provincial HIS communicate with other vertical reporting systems (e.g. Tuberculosis, Malaria)?

Anticipated responses and follow-up questions:

Yes

- Do you think this is at a satisfactory level?

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No

- According to your opinion what are the reasons for lack of integration with vertical health programmes?

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2. Do you use findings from surveys and civil registration system to validate hospital based data?

Anticipated responses and follow-up questions:

Yes

- Do you think that these findings are being adequately used?

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No

- What are the reasons for lack of such an arrangement?

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3. Could you share with me your opinion regarding the degree to which data derived from health service records are utilised to estimate the coverage of key services (e.g. Antenatal care, Immunisation)?

Anticipated responses and follow-up questions:At a satisfactory level

- Is this at a satisfactory level?
- 
- 

No

- According to your opinion what are the reasons for not utilising these data to estimate the coverage of key services?
- 
- 
- 
- 
- 

**F. Resource Records****2.1.1 Infrastructure and health services****1. Contents**

1. Is there a provincial database of public and private health facilities with unique identifying numbers?

Anticipated responses and follow-up questions:Yes

- How long you are using such a database?
- 
- 

- Is it being managed properly and is it up-to-date?
- 
- 

No

- Are there plans to develop such a system in the future?
- 
- 

**2. Capacity and practices**

1. Do you have human resources and equipments for maintaining and updating databases and maps in the province?

Anticipated responses and follow-up questions:Yes

Do you think that these resources are adequate?





No

According to your opinion what are the reasons for lack of these resources?

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2. How often do you update the provincial database related to health facilities?

Less than 2 years ago

- This could be considered as a satisfactory situation. Do you think this is occurring regularly?

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More than three years ago

- According to your opinion what are the reasons for this situation?

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**3. Dissemination**

1. Are maps available in all three district offices and in the provincial office, showing the location of health infrastructure, health staff, and key health services?

Anticipated responses and follow-up questions:

Yes

- Do you think that these details are adequately displayed and up-to-date?

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No

What are the reasons for lack of this type of detailed maps?

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- Are there plans to prepare this type of maps in the near future?

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#### 4. *Integration and Use*

1. Do managers and health planners link information on location of health facilities to the distribution of population?

Anticipated responses and follow-up questions:

Yes

- Do you think that this linkage is adequately coordinated?
- 
- 

- Does it need improvement?
- 
- 

No

- What are the reasons for lack of this type of linkage and coordination?
- 
- 
- 
- 
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#### 2.1.1 Human Resources

##### 1. *Contents*

1. Is there a provincial human resource database that tracks the number of health professionals by major professional category?

Anticipated responses and follow-up questions:

Yes

- Does it cover both private and public sector?
- 
- 

- Has it been properly organised according to the professional and staff categories?
- 
- 

No

- According to your opinion what are the reasons for lack of a proper human resource database?

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- Are there plans to develop a human resource database in the near future?

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**2. Capacity and Practices**

1. Not included. This issue was addressed previously.
2. How often do you update the provincial human resource database?

Anticipated responses and follow-up questions:

0-1 year ago

- This is a satisfactory situation. Do you think that this takes place regularly?

More than two years

- What are the reasons for this unsatisfactory situation?

**2.1.1 Financing and Expenditure for health services**

**1. Contents**

1. Do you have financial records of general government expenditure on health and its components?

Anticipated responses and follow-up questions:

Yes

- Is the breakdown of expenditure available on following categories?
  - a) Public Expenditure : By ministry of health, other ministries, social security, regional and local governments, extra budgetary entities
  - b) Private expenditure: Household out of pocket expenditure, private health insurance, non- governmental organisations, firms and corporations)

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No

Could you please explain me the absence of details of expenditure by above categories?

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2. Is there a system for tracking budgets and expenditure disaggregated by district and institutional level?

Anticipated responses and follow-up questions:

Yes

Is this disaggregation is by all the categories mentioned in 7.1 or limited only to some categories?

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No

According to your opinion what are the reasons for absence of this disaggregation?

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**2. Capacity and practices**

1. Is there an adequate number of qualified and skilled staff to work on health financing and expenditure?

Anticipated responses and follow-up questions:

Yes

- Are they available on long-term and regular basis?

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No

- Could you please explain the reasons for non-availability of these staff categories?

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2. How often the provincial finance reports are made available?

Anticipated responses and follow-up questions:

Every year

This is a satisfactory situation. How long do you experience this situation?

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There are two years or more between estimations

According to your opinion what are the reasons for this situation?

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3. Do provincial health accounts provide information on following four classifications of financial flow?

- a) Financial resources b) Financial agents c) Providers d) Functions

Anticipated responses and follow-up questions:

Yes

- What do you think of the accuracy of these data?

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- Are all these details available regularly?

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No

- If all are not available, what categories are available regularly?

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- According to your opinion what are the reasons for non-availability of these details?

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4. Is there a system for tracking budgets and expenditure disaggregated by major diseases, health programmes and target populations?

Anticipated responses and follow-up questions:

Yes

- Is the system for tracking is comprehensive and complete?

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No

- According to your opinion what are the reasons for lack of such a tracking system?

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- Is there a plan to develop such a tracking system in the future?

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**3. Dissemination**

1. Are these health financing details widely accessible?

Anticipated responses and follow-up questions:

Yes

Are these details available regularly or on demand?

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Are these details available to the public?

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No

According to your opinion what are the reasons for not disseminating these findings?

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**4. Integration and Use**

1. Do health planners use provincial financial details for policy formulation and resource allocation?

Anticipated responses and follow-up questions:

Yes

- Can you mention an example (a policy document) that has been influenced by health financing details?



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No

- Could you share with me your opinion as to why policy makers and health planners do not use finance details for policy formulation and health planning?
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## 2.1.1 Equipment supplies and commodities

### 1. Contents

1. Is there a requirement to report at least annually by each health facility on the inventory and status of equipment and physical infrastructure (e.g. construction, maintenance, water supply, electricity and sewage system)?

Anticipated responses and follow-up questions:

Yes

- Is this requirement well documented?
- 
- 

- Are all health facilities aware of this requirement?
- 
- 

No

- According to your opinion what are the reasons for absence of such regulations?
- 
- 
- 
- 
- 

### 2. Capacity and practices

1. Do you think that there are sufficient and adequately skilled human resources to manage the physical infrastructure and the logistics of equipment supplies and commodities in the public sector?

Anticipated responses and follow-up questions:

Yes

- Is this regular and sustainable?

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No

- According to your opinion what are the reasons for absence of skilled human resources for these tasks?

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2. Could you share with me your opinion on periodicity and completeness of reporting on physical infrastructure and equipments?

Quarterly and annual reporting in complete manner

- Is this regular and common to all healthcare institutions of the province?

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Incomplete or no reporting

- According to your opinion what are the reasons for lack of regular and complete reporting?

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3. Could you share with me your opinion on periodicity and completeness of reporting on level of supplies and commodities (e.g. drugs and vaccines)?

Anticipated responses and follow-up questions:

Complete monthly or quarterly reporting

- Is this regular and common to all healthcare institutions of the province?

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Incomplete or no reporting

- According to your opinion what are the reasons for lack of regular and complete reporting?

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### 3. *Integration and use*

1. Is there a satisfactory level of integration of reporting systems of different supplies and commodities?

Anticipated responses and follow-up questions:

Yes

- Could you please explain? Is it fully integrated or partially integrated?

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No

- Could you please identify any reason for not integrating these reporting systems?

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2. Do health planners at the provincial level routinely attempt to reconcile data on consumption of commodities with data on distribution of diseases?

Anticipated responses and follow-up questions:

Yes

- Does it take place routinely or occasionally?

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No

- Could you share your opinion with me as to why his does not happen?

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### 4. **Assessing Data Management**

1. Is there a written set of procedures of data management (data collection, storage, cleaning, quality control, analysis and presentation for target audiences) with implementation throughout the province?

Anticipated responses and follow-up questions:

Yes

Do you think that this set of procedures is being fully implemented?

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No

Are there plans to prepare a written set of procedures in the future?

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- 
2. Not included. Applicable only at national level
  3. Is there an integrated and user-friendly data warehouse at provincial level containing data from all sources (including data from key health programmes)?

Anticipated responses and follow-up questions:

Yes

- Is it fully functional with the reporting utility?
-

No

- According to your opinion what are the reasons for lack of an integrated and user-friendly data warehouse at the provincial level?

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- Are there plans to develop such a data warehouse in the near future?

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4. Is there a dictionary of metadata, which provides comprehensive definition about data including information in following areas?

1. Use of data in indicators
2. Specification of collection methods
3. Periodicity
4. Geographical designations (urban/rural)
5. Analysis techniques used
6. Possible biases

Anticipated responses and follow-up questions:

Yes

- Does it contain details of all six areas?

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No

- Are there plans to develop a meta- data dictionary in the near future?

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5. Are there unique identifier codes available for administrative geographical units to facilitate the merging of multiple databases from different sources?

Anticipated responses and follow-up questions:

Yes

- How long are you in possession of such a database?

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No

- Are there plans underway to develop such a database?

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## 5. Assessment of Data Quality

1. Could you share with me your opinion regarding quality assessment criteria on following indicators? Please rate your assessment as follows:
  - a) Highly adequate
  - b) Adequate
  - c) Present but not adequate
  - d) Not adequate at all

Indicator	Quality assessment criteria						
	A. Data collection method	B. Timeliness	C. Periodicity	D. Consistency	E. Representativeness	F. Disaggregation	G. Adjustment Method
1. Under five mortality (all causes)							
2. Maternal mortality rate							
3. HIV prevalence							
4. Measles vaccination coverage by 12 months of age							
5. Deliveries attended by skilled health professionals							
6. Tuberculosis treatment success rate under DOTS							
7. General government health expenditure per capita							
8. Private expenditure on health per capita							
9. Density of health workforce (total and by professional category) by 1000 population							
10. Smoking prevalence (15 years and older)							

Anticipated responses and follow-up questions:

Highly adequate and adequate

- Could you please share with me your opinion as to how did you achieve this satisfactory situation?

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Present but not adequate

- What are the reasons for this situation?

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- Are there plans to rectify this situation?

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Not adequate at all

- What are the reasons for this situation?

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- Are there plans to rectify this situation?

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## 6. Assessing Information Dissemination and Use

### A. Demand and Analysis

1. Is there a demand from senior managers and policy makers for accurate and timely information?

Anticipated responses and follow-up questions:

Yes

- Do they (senior managers) have the skills to judge the health information received?

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No

- According to your opinion what are the reasons for this situation?

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2. Is there a wide display of graphs with up-to-date and clearly understood information, in provincial and district administrative offices and health facilities?

Anticipated responses and follow-up questions:

Yes

- Are these graphs and figures displayed at all levels?

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- Are they displayed regularly with continuous updates or just displayed in an ad hoc manner?

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No

- According to your opinion what are the reasons for this situation?

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**B. Policy and Advocacy**

1. Is there a regular distribution of HIS summery reports to all relevant parties?

Anticipated responses and follow-up questions:

Yes

- How often these summery reports are distributed?

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No

- What are the reasons for non distribution of these summery reports?

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**C. Planning and priority setting**

1. Is there a demonstrable use of HIS in the planning and resource allocation process?

Anticipated responses and follow-up questions:

Yes

- Is there a complete synchronisation between health information and planning framework or is it just an occasional use?

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No

- Could you please describe any reasons for not using health information in planning and priority setting?

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**D. Resource allocation**

1. Is HIS information widely used by provincial health managers to set resource allocation in annual budget process?

Anticipated responses and follow-up questions:

Yes

- Could you please describe? To what extent the targets and the budget proposals are backed by health information?

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No

- Could you please identify any reasons for not using health information in preparing targets and budget proposals?

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2. Is HIS information used to advocate for equity and to allocate increased resources to disadvantaged groups and communities?

Anticipated responses and follow-up questions:

Yes

- Do you think that health information is being regularly used for this purpose?

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No

- According to your opinion what are the reasons for not using health information for this purpose?

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#### **E. Implementation and Action**

1. Do managers and care providers at all levels use HIS information for health service delivery management, continuous monitoring and periodic evaluation?

Anticipated responses and follow-up questions:

Yes

- This is a highly satisfactory situation. How long are you experiencing this situation?



No

- Could you identify any reasons for not using this information to advocate for vulnerable groups?

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2. Is there a systematic use of information on health risk factors to advocate for the adoption of lower risk behaviours by the public and by targeted vulnerable groups?

Anticipated responses and follow-up questions:

Yes

- Do you use such indicators regularly or on ad hoc basis?

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No

- According to your opinion what are the reasons for not using these information to advocate for vulnerable groups?

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