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**Exploring routine data collection systems in Iran, focussing
on maternal mortality and using the
city of Bam as a case study**

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ABSTRACT

Introduction:

Health information systems provide information obtained from data for decision making in order to improve the performance of a health system. Although health information systems can be very influential, it can not be exit on its own. It is discussed that the flaw and inefficiency of health information system is rooted to the powerlessness of health system and lack of incorporation in the overall health system [1]. The benefits of using data in planning and implementation go beyond the normal everyday functions of a heath system and include catastrophic situations.

Iran is a developing country which experiences a large number of natural disasters each year with a significant number of casualties. Owing to the importance of data for planning, implementation and evaluation, the necessity for sound data is even more pronounced in a country with such conditions.

The main aim of this project is to use the city of Bam as a case study to explore the routinely collected data systems in Iran. This investigated the collection of mortality data from all causes, and maternal mortality specifically, in order to determine the usefulness and application of these data systems to monitor the immediate and ongoing health effects of a natural disaster, and to plan for future disasters.

Methods:

A mixed qualitative and quantitative method used to provide better understanding of the problem at two main data sources, the Medical University and the Civil Registry. This research has commenced with numeric results of maternal ratios and then has employed a qualitative method to gain better understanding of data collection system. The sampling methods are purposive and probability sampling. Interviews, review of documents, and personal observation are the main data collection methods. The data are analysed using qualitative and quantitative methods. They are presented in four sub –chapters , three sub-chapters for non numeric results and one for numeric results.

Results:

The results show that there are dramatic differences on data collection and data processing between the Civil Registry and the Medical Sciences University. Also it is found that there are some sorts of shortcomings in different stages of data collection system in each organisation. This includes incomplete data coverage, shortcoming in academic staff, insufficient technology infrastructures, lack of training for staff, inadequate data quality checking. Moreover, there are many limitations affecting data collection after the earthquake. These limitations are rooted in basic problems within the existing data collection system and a lack of co-ordination between the groups collecting the data, including national and international aid groups that provided help after the earthquake.

Regarding maternal mortality data collection it is found that there was no consistent definition of maternal deaths among interviewees. All data sources are not aware of urgently reporting of maternal deaths as it should be.

The results of the estimation of maternal mortality ratios from different sources present inconsistent pictures. This inconsistency is found in both of the denominators and nominators. Also, the results of case matching show that the data collected from two different sources authorised commonly by the Medical Sciences University are not consistent. Additional exploring on the mortality data in disaster and non disaster cities reveal that the inconsistency is not limited to the maternal mortality data. Indeed, there is considerable difference on the total mortality data reported by these two organisations in target cities.

Discussion:

There are some requirements before setting the systems including introducing appropriate rules and regulation to oblige different data sources to send the data. Also allocating enough resources including human resources and providing appropriate training before commencing the job are of important factor to improve the system. Having good and strong enough communication infrastructures can increase the speed and accuracy of data.

In addition, some supervisory activities should be in place to ensure that the data collection procedures are on the right track and data checking is undertaken by related staff. Using consistent software in different organisations provides not only more complete data by data transferring they can also improve the quality of data through data cross checking.

Finally the data usage culture should be encouraged by the government in all levels including national, provincial and districts levels. This can be achieved through introducing a system of incentives for use the data in decision making and allocating budget via the data.

Regarding disaster and data collection it is very important to have the collaboration of international organisation to send the data to the host country. Low collaboration might be due to this fact that there is little awareness about the importance of having the flow of data collection after a disaster for planning for disaster stricken country. Therefore appropriate strategies might be needed to increase this awareness in the national and global level. This can be achieved through international organisations such as World Health Organisations or Red Cross Organisations.

Conclusion:

The main aim of data collection is to use the data in planning and evaluation. Incomplete and inaccurate data must be misleading and useless. In order to strengthen the data collection system it should be established based on certain standards to ensure that the data is complete and accurate. This would be of importance in non disaster and disaster situation.

Declaration form

I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person. No material has been accepted for the award of any other degree or diploma of the university or other institute of higher learning. I have done all procedures including data collection, data analysis on my own. I also declare that the intellectual content of this thesis is the product of my own work except to the extent that assistance from others in project's design or in style and linguistic expression is acknowledged.

Signature

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Chapter 1 General Introduction

A health information system is defined as a structure which provides information for decision-making in order to improve the function of health system performance [1]. This information is obtained from health data. The domains and the utility of health data vary. They not only provide information for policy makers but can also be used for policy implementation and epidemiological research [2], [3]. The data can be collected routinely or non-routinely. Routine data are data that are collected routinely from different units. These data have many advantages such as time efficiency, capturing large samples, and being economical [4]. The need for availability of health data is increasing among many countries and developing countries in particular. The reason for this is that a country needs the data for its own aims and the data are necessary to compare countries internationally and globally [5].

There has been growing attention to strengthen health information systems worldwide. The surging need to improve health information systems can be traced back to the increasing awareness of the necessity of evidence-based decision-making and donors' needs to track the improvement on issues funded. The health data also can be used to compare different areas and to measure the achievement of the Millennium Development goals [5]. Health data are also a very useful source of data for epidemiologic studies [3] which, ultimately, aim to improve the health system. However, developing countries are discussed to have weak and unreliable data collection systems [6]. In these countries evidence-based decisions are inadequate [6].

The benefits of using data in planning and implementation go beyond the normal conditions and include catastrophic situations. A catastrophic event is defined as “any occurrence that causes damage, ecological disruption, loss of human life or deterioration of health and health services on a scale sufficient to warrant an extraordinary response from outside the affected community or area” [7].

in the aftermath of a disaster, health care services and normal social life can be interrupted [8]. In some type of disasters, such as a sever earthquake, people might have to reside in camps. Also, economical infrastructures might be destroyed [9]. Therefore a massive disaster might create huge social, economical and health effects

on the society. These changes provoke the necessity of anticipating needs and problems after a disaster. This has a vital role in planning activities for helping the society return to normal life and to reduce the consequences of catastrophic events to a minimum level. It can also be helpful to identify appropriate opportunities to prepare for the disaster and which might result in a quicker and more effective response to the disaster. The information required to achieve the above goals is elicited from the data.

Iran as a developing country has experienced a large number of natural disasters each year with huge numbers of casualties. Owing to the importance of data for planning, implementation and evaluation, it is obvious that the necessity for sound data is even more pronounced in a country with such conditions. This is because the data can enhance the knowledge of policy makers about the effects of a disaster on the society and on health care quality and quantity. The data can also help the authorities to identify high risk groups after a disaster. Therefore, it can lead to an appropriate strategy to tackle the problems occurred by a disaster. However, this imperative will not be achieved if there is an inefficient system of data collection in non-disaster situations. Hence, studying the system in non-disaster situations is a priority and can help to identify the problems that exist within the system which can eventually help to solve the problems. Despite the necessity of having the knowledge of the health information system, there are few documents about the Iranian health system.

Having mentioned the importance of health data in planning disaster response and in non-disaster situations, I would like to clarify the reason for choosing maternal mortality ratios for this study. Maternal mortalities are defined as deaths of mothers during pregnancy or in the 42 days after delivery [10]. Maternal deaths which happen mostly in developing countries are useful indicators of health care quantity and quality [11] and socio-economic [12] development [13].

On the other hand, the number of maternal mortalities can be affected by the occurrence of a disaster. Conditions after a disaster such as living in camps with low access to antenatal care [14], poor socio-economic conditions, and disruption of health care services are factors which might affect maternal deaths. Also, a disaster such as an earthquake might cause preterm delivery which could put the mother at risk [15].

Moreover, the results could be generalised to data collection systems, thus saving time and resources by avoiding studying the whole data that are routinely collected. The introduction chapter includes four areas: an outline of the research, the contemporary context, some background on Iran and an outline of the remainder of this thesis. The aim of the outline the research is to provide information on the aims, the strategy and the design of the study. The section on the contemporary context includes some information on the main areas of the study such as health information, disaster, disaster & safe motherhood, natural disaster & Iran. The next section focuses on Iran, highlighting some information on Iran in general, Iranian health system and Iranian data collection. The last section outlines the remainder of the thesis.

1.1 Outline of Research

This section highlights the research proposal, aims and objectives, research questions, and the strategy and design of the study.

1.1.1 Research proposal

Because of my country's need and the high occurrence of disaster, I was encouraged by my sponsor (Health Ministry in Iran) to do a study on disaster epidemiology. I decided to work on the Bam earthquake due to some important aspects: it was a massive earthquake with high fatality and many devastating effects on the health system and the Iranian society. In addition, my familiarity with the Bam region and its culture was expected to be an advantage. I decided to study the long term effects of the Bam earthquake which occurred in 2003. Maternal and child mortality were chosen as indicators of the status of the current health system.

1.1.2 Research aim and objectives

The primary aim of this project was to use the Bam earthquake as a case study to explore the usefulness of routinely collected data on maternal mortality and child mortality, and on maternity and primary health services and facilities, to monitor the ongoing health and health service effects of a natural disaster in Iran, and to plan for future disasters.

In my first year review meeting, I was advised by the panel to include a study of death and live birth registration as part of my research, including the use of the WHO framework health metric as a standard structure for a data collection system. The primary objectives that will be discussed are the following:

- Describing and characterising the Iranian health system and data collection on maternal and child mortality, which was updated after first-year review also to include deaths and live births.
- Determining and monitoring the ongoing health and health service effects of a natural disaster in Iran with a focus on maternal and child mortality.
- Critiquing the maternal and child mortality data collection in Iran with respect to its suitability and usefulness for planning for future disasters and for ongoing monitoring of any effects that occur.

However, during my fieldwork, I discovered a lack of data on some aspects of my target areas, which required some of my aims and objectives to be changed slightly. There was/is little data available on women experiencing certain problems, such as eclampsia, high blood pressure and haemorrhage, even though they are treated in the health care facilities. This was initially planned to be included in calculating process indicators of maternal deaths, to have a better insight of the causes of maternal mortalities. The other objectives were mostly achievable. However, the low number of reported maternal deaths provides limited opportunities for undertaking sophisticated statistical or epidemiological analysis techniques. The aim and objectives are as follows:

Main aim:

The main aim of this project is to use the mortality data from all causes, and maternal mortality specifically and using the city of Bam as a case study to explore the routinely collected data systems.

Objectives:

- 1) To explore maternal mortality data collection, and mortality data collection as whole, from different sources using the WHO framework;
- 2) To examine different aspect of data usage;
- 3) To illustrate and compare maternal mortality ratios from different sources; and
- 4) To explore the data collection after the earthquake.

Therefore, I had to explore and understand the system as a first step to recognise the problems existing within the system. This has the crucial role to resolve the problems.

In this research I selected Bam as my study setting. Bam city is located on the old Silk Route in the South East of Iran and was destroyed by a destructive earthquake in 2003. Due to the hierarchical system, my study went beyond Bam city and included Kerman as the centre of the province and Tehran, the capital of Iran. Although this study is not conducted across the country the results can be applied to other cities as the data are collected in a similar way across the country. Therefore, the problems

observed in this study might be found in other cities and might eventually help to resolve the problems at the national level. The WHO health information framework is used as the framework to organise my study and develop my interview topic guide. The data are collected through interviews, documents and observation.

1.1.3 Research questions

The initial primary research questions underpinning the study were as follows:

- 1) What are the characteristics of the Iranian Civil Registry system?
- 2) What are the characteristics of the data collection system in Iran?
- 3) What are the changes on maternal mortality and child mortality within the health care facilities after the 2003 earthquake?

However, the research questions had to be changed as a result of a few considerations. Since the focus of this study is on the death and live registry, the results of the study can not be generalised to the whole data collection system. Therefore, question 2 had to be amended to reflect this. Because of the lack of data on child mortality, question 3 had to focus on maternal mortality ratios only. An evaluation of the Civil Registry system based on the WHO health metric information lead me to include another research question, outlined in the next paragraph. Furthermore, information on the data collection methods in Iran gained during my fieldwork led me to narrow the research question to the effects that the earthquake had on data collection. The amended questions are:

- 1) How are mortality data collected and processed?
- 2) How are data analysed, published and used?
- 3) How have maternal mortality ratios changed over time, from two years before the earthquake to three years after the earthquake?
- 4) What was the effect of the earthquake on the vital data collection?

1.1.4 Research strategy and design

A mixed qualitative and quantitative method was a suitable approach for this study and provided a better understanding of the problem. A qualitative method was employed to understand data collection systems and the numeric results of estimation of maternal mortality ratios from different sources are presented to show the usefulness of routine data in monitoring the effects of a disaster. This study used an explanatory method, using qualitative methods to explain the results of the quantitative study. Purposive and probability methods are used for sampling which is explained explicitly in the methods chapter. The data are collected through interviews, documents and observation, on which more detail is provided in the methods chapter (chapter 3).

1.2 Contemporary context

The main aim of this chapter is to provide information on the major areas of research and also to draw connections between different elements of this study including health data, maternal mortality, and the Bam earthquake. This chapter comprises four main sections: on the health information system, disasters, disasters & safe motherhood, and disasters & Iran. The first section on health information is going to give an overview to the readers about the necessity of data collection. It covers three themes; health data, civil registration and maternal mortality data. These themes outline the necessity of health information in the health care system. It includes vital registry and maternal deaths recording as the focus of the study.

The next section, disasters, deals with the general information about disasters and their outcomes. This section highlights the problems emerging in the aftermath of a disaster such as socio-economic factors and health care disruption which also can affect maternal deaths. On the other hand, in the last section of this chapter, Iran is introduced as a country with high frequency of disaster. Putting all themes together is useful to understand the reasons why maternal deaths were chosen to be in the focus of this research.

1.2.1 Health information system

A health information system is defined as a system that provides information for decision-making at different levels [16]. In a more comprehensive definition it is defined as “a set of components and procedures with the objective of generating information which improves health care management decisions at all levels of the health system” [1]. This system has different subsystems such as a management information system, an epidemiological surveillance system and an administrative information system [1]. Although a health information system is a very influential system, it can not exist on its own. It is discussed that the flaws and inefficiency of a health information system are rooted in the powerlessness of the health system it provides information on and in a lack of its incorporation in the overall health system [1]. Despite the critical role of a health information system in improving the health

system, most developing countries have a poor health information system. To tackle this problem some of developing countries have launched several parallel systems to their national health information system to gain better information[2]. It is suggested that these types of systems might gain better quality information on specific topics. However, they are not only unlikely to help the system due to creating more chaos, duplication, data transmission problems but are also deteriorative on entity of health care system [2].

1.2.1.1 Health data

Health data are valuable sources of information to improve a health care system. The domains of their utility vary. Health data highlight health problems to policy makers and can help to identify a suitable strategy to tackle problems. The historical data also provide priceless information and aids policy implementation. They can be called an eye for policy makers to see and decide efficiently[17]. This is getting much more important due to the paucity of resources which demands a very sensible way of resource allocation. Scholars discuss health data from different angles and outline several purposes: Lippeveld considers the data usage in planning and management, evaluating health services with an ultimate aim of recovering health conditions at the individual and population level[2]. Cibulskis agrees that health information is useful for planning and monitoring. In addition, he expands the utility of data beyond the mentioned factors. He discusses that it will increase organisational accountability and secure financial resources as well as improve the knowledge of a system on the long term [18]. The data are collected to be employed at different levels. However, they are used efficiently at the district levels when the decision are made at this level [19].

Furthermore, health data that are collected routinely are considered to be one of the main sources of data in scientific research such as epidemiology [3] . The studies which use these data have some benefits regarding time, money and adequate sample size. As these data are collected routinely, there is no need to invest extra money and time to collect them. Also, they provide data from large samples and are representative as well as have a low likelihood of recall bias [4].

The need for availability and the utility of health data are increasing in many countries and in developing countries in particular. This is because not only a country needs the data for its own purpose but the data are also necessary at the international and global level.

Boerma and his colleague describe that, presently, the financial support devoted to developing countries is increased. This leads to an emerging necessity to measure the improvement in achieving the goals. In addition, monitoring of development is one of the global concerns such as the achievement of Millennium Development Goals (MDGs). This demand is discussed to be a unique opportunity to improve health statistics in developing countries[5]

However, some drawbacks to the health data are suggested in the literature. First of all, over-attention on the MDGs and some contagious diseases have negative consequences such as insufficient investments to improve the availability and quality of data, distorting attention from the ongoing health transition and double investments in data collection and surveys [5].

Secondly, regarding the use of data in scientific research, the quality of data and the way they are collected is not under the control of the researcher [4]. Additionally, overemphasis on the data usage for monitoring and evaluation are challenged by Lilford and his colleague. They argue that emphasis on outcome data such as mortality can put health provider organisations under a great deal of pressures and distort attention from real improvement to superficial or dishonest behaviour [20].

In summary, although there are some shortages and drawbacks with data collection, it is beyond doubt that the benefit of the availability of such data is considerable and can ensure the availability and accessibility of good care for individuals. Above of all, it makes individuals visible by recording their birth and deaths which in turns makes the governments responsible for its citizens [21].

Health data are collected from different sources which can be divided into six categories; general population data e.g. census and civil registration, community service data e.g. family planning, general practice data e.g. GP surgeries files in the UK, hospital data, laboratory data, prescribing analysis and cost data [22].

1.2.1.2 Civil Registration and vital statistics system

Civil registration is defined as a legal, obligatory, continuously and endlessly process of recording vital events [23]. Deaths, births, marriage and divorce are characterised as vital events [23]).

A vital statistics system is defined as “the total process of:

“(a) collecting information through civil registration or enumeration on the frequency of occurrence of specified and defined vital events, as well as relevant characteristics of the events themselves and of the person or persons concerned[; and]

(b) compiling, processing, analyzing, evaluating, presenting and disseminating these data in statistical form. The main source is civil registration, supplemented by data from population census, sample surveys and administrative records” [24].

The vital statistics system and the civil registry system can operate under the same or different organisations. It is discussed that the same authority for vital statistics and the civil registry is preferable due to more unification and better coordination which facilitate the data usage [24].

Vital events data can be used for different organisations for example for legal issues such as issuing a passport, establishing the eligibility for school enrolment, social security , population estimation and health care activities [24].

Registration of vital events is considered to be one of the most important priorities in human societies. A record of birth, confirm the existence of a person which is the first step to protect his rights to life and then his social rights such as freedom[25]. The differences in occurrence of these events identify high risk groups who need specific attentions. Hence, they are used in planning and ultimately aim to make the governments accountable for people [25].

Information on vital events is considered to provide the basic information in dealing with health issues. AbouZahr discusses that the key question in dealing with the health issues is *who* has died leading to the second question which is *why* someone has died [17].

In spite of the pressing necessity of vital registry, less than a third of population births and deaths are recorded accurately worldwide [25]. This problem is more pronounced in developing countries where people are born and die without any trace. This is discussed to be because of little development of the vital registry system in

those countries over the past 30 years which in turn makes the poor invisible and uncounted [26].

1.2.1.3 Maternal mortality

As noted before, this research is going to study maternal mortalities ratios over time from different sources. The aim is to find out the usefulness of routine data collection to track the long term effects of a disaster. The following section is going to define maternal mortalities, source of data and the method of estimation of maternal mortality. Other factors that affect maternal mortalities are also discussed. It is very useful to draw connections between the disaster outcome and effective factors in maternal mortality occurrence.

Maternal mortality and maternal mortality indicator definitions

Maternal mortality is defined as a death that has occurred due to either obstetric problems or due to a pre-existing disease which has been exacerbated by the pregnancy, either during pregnancy or 42 days after its termination [10]. The maternal mortality rate is defined in various ways. In the Oxford text book of public health, the maternal mortality *rate* for a specific time period, usually a year, is defined as “the number of death resulting from complications of pregnancy, labour and puerperium per 100,000 live births” [27]. In a WHO report, however, this conventional definition has been criticised because it is not truly a rate, as there is no element of time in the denominator. It quantifies deaths per pregnancy, regardless of the time span of data collection. The authors therefore argue that this conventional maternal mortality “rate” would be more appropriately labelled as maternal mortality *ratio*. They believe that even though it is not a true rate, it is a useful statistic. Yet, they point out that the subgroup of women who die, when there is no live birth (for example still births/and abortions), are missed by this statistic. The authors state that the best denominator for the maternal rate is the number of pregnancies, but this figure is seldom accurately known, even in developed countries.

The authors advocate the definition of maternal mortality *rate* as “deaths per year (due to pregnancy) per 100,000 women aged 15-49 years”. In my research, I will use maternal mortality ratio, as per the WHO report [10].

Maternal mortality overview

Annually, 529,000 women die due to pregnancy or child birth [28]. It is beyond doubt that maternal deaths will affect the families in a variety of ways. The consequences of maternal mortality on family and society are: increase of child mortality; decrease of household income; reduction in care available to elderly relatives and greater likelihood of early marriage for their daughters, which in turn is a risk factor for subsequent maternal death of that daughter [28].

In order to estimate maternal mortality indicators it is necessary to have a registry of maternal deaths. However, such deaths completely reported only in developed countries and in a few developing countries [10]. Incomplete records are not the only problem with registration in developing countries; indeed even the registered deaths often lack the reports of accurate cause of death [29]. Regardless of developing and developed country, maternal deaths are, as other deaths, prone to be diagnosed inaccurately [30] [31]. In order to categorise a death as a maternal death the cause of death and time of death regarding the pregnancy or its termination must be considered [10]. Some women die before they or their relatives know they are pregnant. Another issue is that sometimes a woman dies as a result of obstetric problems but more than 42 days after delivery with the result that the death will not be reported as maternal death[32]. Yet, this error is more pronounced in developed countries than developing ones because of existing sophisticated obstetric facilities that enable longer survival for hospitalized women [33].

Intentional and unintentional misreporting is another source of error. In some societies where abortion is illegal such as Iran, maternal deaths due to illegal abortion may be misreported to protect the person who performed the abortion. Unintentional misreporting often takes place when a woman dies in emergency or on other than maternity wardss. Under-reporting of maternal deaths can also happen when the health professional knows the maternal cause of death but do not report it because it has not been requested. Such issues have resulted in large discrepancies in the reporting of maternal deaths and hence to underestimation of maternal mortality [10].

Factors associated with maternal mortality

Maternal deaths are very useful indicators for policy makers. they reflect not only the quality and quantity of health care but also the socio-economic status. Factors associated with maternal deaths are outlined below.

Demographic and socio-economic factors

The role of socio-economic factors in maternal deaths is examined in the literature. They unanimously show that low socio-economics status is associated with maternal deaths. It has been shown that poverty [34], living in a rural area, low education levels in women [12] and a stagnant economy [35] can be associated with increased maternal death rate. Other associated factors are age at pregnancy, with increased risk of mortality in teenage mothers and mothers above 35 years [36]. In addition, it is discussed that the utilization of maternal health services can be influenced by religion and culture. Two studies suggest that Muslim women and people who prefer traditional methods are less likely to access maternal health care than other groups [37] [38].

Maternal mortality is considered as an indicator of development and poverty. The main targets of the United Nations Millennium project are decreasing poverty and increasing development, human rights and democracy, protection of the environment, peace and safekeeping. Maternal and child mortality are indices which are affected by development, poverty and democracy. Therefore improvement of maternal health and reduction in child mortality are two goals of the UN Millennium project [13]. In terms of human rights, it is the right of every woman to have access to health services that provide adequate support for safe motherhood. Therefore, maternal mortality could also be an indicator of the basic human rights [39].

Antenatal care:

Provision of special care, such as iron and folic acid supplements, and tetanus vaccination, can reduce pregnancy-related problems and the risk of infant and mother death [40]. On the other hand, it is argued that antenatal care does not affect maternal death directly, but ensures that pregnant women obtain skilled attendance at the delivery [41].

Skilled attendance at the delivery

‘Skilled attendance’ is attendance by a qualified health professional such as a midwife, doctor or nurse who has been educated and trained to provide proper care during pregnancy, childbirth and the postnatal period, and to identify complicated cases and refer them to a obstetric health centre [42].

In the absence of skilled attendance, delivery can put the lives of both the mother and child at risk. It has been shown that professional midwives play a crucial role in reducing maternal death by raising awareness of its importance and by maintaining health during pregnancy, giving advice on how to do so, and providing expert care at the time of delivery and in the immediate post-natal period [43]. The aim of providing traditional midwives with education was to reduce maternal deaths, which highlights the importance of minimal essential education for attendance at births [44].

Family planning

Provision of family planning services are associated with a reduction in maternal mortality, mainly it is conjectured by reducing unwanted pregnancies, and hence reducing the need for recourse to abortion and its associated risks [45]. Family planning provision can also prevent pregnancies in very early or late age [46].

Health services

Maternal mortality is discussed to be an indicator for monitoring health care performance[47].In order to have a safe motherhood, health facilities during the pregnancy, during normal delivery and caesarean sections must be provided. In the case of complications, blood transfusions and an operating room with anaesthetic facilities for caesarean sections must be available [48]. Another important issue is accessibility of health facilities for abortion. Furthermore, to achieve the best maternity care it should be borne in mind that there will be an ongoing need for upgrading the maternity health care services [48]. Indeed, it has been discussed that to reduce the risk of maternal mortality there is a need for improvement of both facilities and quality of care [11].

Source of data for maternal mortality

Vital registration is defined as the constant, unending and obligatory nature of recording vital events[49]. In countries with a high coverage and complete vital registry it can be the main source for maternal deaths [50]. Despite the fact that the mortality information draws a straight and palpable relationship to human welfare and health care, there are serious limitation in registering the deaths in developing countries [51]. Countries with incomplete vital registry data use interim methods to estimate maternal mortality indicators. These methods include household survey models, reproductive age mortality survey, indirect sisterhood method, direct sisterhood method, census and modelling. Estimation of maternal mortality on its own is not the aim of this study. Indeed, this study uses maternal mortality ratios estimated from different sources to flag problems with data collection. Therefore, discussion of these methods and their advantages and disadvantages would be beyond the scope of this study.

1.2.2 Disaster

In the previous section, maternal mortality was discussed. In this section, the readers will find some information on disasters including the definition and their effects on human societies. A disaster can have devastating effects on society and on health care which in turn can affect maternal deaths. Therefore, this section is useful because it facilitates the understanding of the link between maternal deaths and disaster which underpin this study. Disasters have been one of the imperative threaten for human societies. They have affected considerable proportions of people worldwide. According to WHO, about 2 billion people were affected by disasters and 600,000 lost their life merely in the 90s [52]. Based on the literature, 60,000 people on average die and 250,000,000 are affected by disasters annually [53] [54].

Disasters are referred to as “catastrophic events that overwhelm a community’s emergency response capacity, threatening public health and environment”[55]. It has also been defined in a broader context as “any occurrence that causes damage, ecological disruption, loss of human life or deterioration of health and health services on a scale sufficient to warrant an extraordinary response from outside the affected community or area [7].

Two main categories are developed from the disasters concept; natural disaster and man-made disaster[56]. Natural disasters such as earthquakes, volcanic eruptions hurricanes, floods and fires are caused by nature’s power while man-made disasters are created by human beings [57]. A man-made disaster is also known as a technological disaster such as Chernobyl nuclear disaster in 1986 for example[52]. Tornados, floods, earthquakes, hurricanes and tsunamis are the most common natural disasters in the world [58]. In 2006, flooding was the most common disaster and earthquakes caused the highest number of fatalities [59].

The occurrence of natural disasters has increased over time. Recent studies show that globally, there has been an 18% increase in the frequency of natural disasters frequency between 2004 and 2005 [59]. However, this could be due to an increase number of natural disasters reported [59]. In addition, the number of affected people is still increasing but the number of fatalities has declined [59].

Although disasters are described as temporary events [9], they pose challenges for the society shortly after they have occurred and become long term problems. The stages of a disaster are outlined as follow;

1. Emergency stage: This is immediately after the disaster has occurred, where victims and casualties are rescued and given assistance.
2. Rehabilitation stage: This includes activities of a society to return to its pre-disaster condition. These activities comprise the provision of primary care, such as maternal care to help a society return to the pre-disaster conditions and to prevent increasing levels of mortality and morbidity [57].

The effects of disasters effects are grouped into three broad categories: human-related, economical and ecological [60]. People can be hurt physically or mentally and even die during a disaster. Another aspect of a disaster is environmental deterioration such as loss of forests[60]

Also, the economy is highly likely to be influenced by a disaster on different levels. The economical consequences of a disaster can be divided into two groups: direct and indirect [9]. Direct damages include any damage to buildings, infrastructure such as roads, transportation, electricity supplies, and the health system. Indirect damage comprises any disruption of the flow of goods, a decrease in production and increasing productions costs [9]. Charvériat discuss the economical effects of disasters at individual or household level including any physical effects on the breadwinners such as death or physical or mental problems, which could lead to a fall in the household's income. In addition, loss of properties and a decrease in income are other impacts caused by a disaster. Otero and Marti describe a broader concept which includes macroeconomics. Macroeconomics include variables like inflation, consumption and gross domestic products which are affected by a disaster [60]

It is estimated that disasters have caused 67 billion dollars worth of loss each year over the past decade. The economic cost has been increased fourteen times since 1950s [54].

Population movement is another common phenomena which is documented in the articles. After a disaster, a number of some people who used to live in the disaster-stricken areas leave their habitats to find a safe place to live. On the other hand , non

disaster residents might flee to the disaster area to seek shelters and food which are provided by national and international aids [57].

Previous studies confirm that the effects of a natural disaster are higher in developing countries [61] [62]. This can be explained by several factors including a higher occurrence of disasters in these areas, poor responses in the incidence of a disaster and poor preparation before a disaster. Based on a report by the United Nations almost 50% of all developing countries studied are at high risk of the occurrence of a disaster. Approximately 10 % of them have already experienced a couple of major disasters per year over a 15-year-period [63]. It is estimated that 97% of deaths due to natural disasters occur in developing countries [64]. Lack of infrastructure and capacity to deal with the situation are supposed to be the main factors in an increase of the death toll after a disaster in developing countries [62].

A disaster can affect the health domain by damaging the health system infrastructure including building and facilities in addition to losing members of staff or affecting them mentally [8]. A large volume of literature addresses the physical and mental problems after a disaster, including cardiac deaths and myocardial infarction [65], acute renal failure [66], diabetes [67], pneumonia, dehydration and peptic ulcer[68], asthma[69], parasitic infection [70], cerebral vascular disease [71] and skin problems. There is also a wide range of papers about mental disorders. However with the exception of mental health, long term effects of disasters on health has not received enough attention [72] [73] [74] [75].

1.2.3 Disaster & safe motherhood

Health effects of a disaster are discussed to be different in women and men. Broadly speaking, in non disaster condition women have less capital than men [76]; during a disaster, the difference increases because there is limited access to resources [52] [77]. Regarding pregnancy, studies have shown that stressful events can lead to a premature delivery [15]. It has also been reported that in the 48 hours after an earthquake the chance of a premature delivery increases [78].

Apart from the short term effects of disaster on safe motherhood, living in camps after a disaster has raised another concern regarding the quantity and quality of reproductive health facilities in such camps. Although some studies find an

acceptable level of some aspects of reproductive health care [79] it is discussed that there is shortage at different stages of related health care. In terms of family planning strategies, studies show that there are problems regarding the awareness of the importance of contraceptives, their availability and quality [80] [81].

Similarly, there are pronounced problems with access to health facilities ranging from referral systems and policy impediments [82]. Shortage in training of staff, sanitary places and laboratory equipment in camps are identified as problems in another study [14] [83].

However, concerning maternal mortality, two studies argue that maternal deaths were lower in women that live in camps compared to women who did not reside in camps. A study conducted in 2001 on Afghan refugees using, a census and verbal autopsy in the refugees camps in Pakistan indicates that the maternal mortality ratio is lower among residents in the camps than women who live in Afghanistan. The figures are 291 per 100,000 for the former and 820 per 100,000 for the latter [84].

Also, a lower number of maternal deaths in camps in Tanzania were reported in comparison with the host, Tanzania, and home, Burundi. Maternal mortality ratios in the camps were 70 to 199 per 100,000 live births while the estimated number in Tanzania was 1100 per 100,000 and 1900 per 100,000 live births in Burundi [79].

On the other hand, Bartlett points out that due to the different methods of estimation of maternal mortalities for refugees and countries, figures should be compared with caution [84]. In addition, even if the same scale is used for estimation, the results depend on the condition of camps and the level of health care across the country. If a country has a very poor health services even in non disaster condition it is likely, that due to the international standards in the camps, better health care is provided there, whereas in a country with an acceptable level of health care, the results might be different.

1.2.4 Natural disaster and Iran

In this section, I am going to highlight facts about Iran as a disaster-prone country. The section also includes some information about Bam earthquake which is my study setting.

Iran is one of the most disaster-prone countries in the world. The most frequently occurring disasters are natural: droughts, earthquakes and floods. Among these disasters, floods have the greatest frequency while earthquakes have caused the largest number of deaths (Table 1.1).

Table 1.1: Descriptive figures per disaster types in Iran*

Disaster type	Disaster per year	Casualties (killed/year)	Physical exposure (number/year)
Droughts	0.10	0	6285132
Earthquakes	1.43	2250.8	2094097
Floods	1.90	131.2	10903040

*Source: united Nations development programme

1.2.4.1 Bam

Bam is an ancient city on the old Silk Route. It has a warm weather and is located in the Kerman province in the South East of Iran. Bam is most well known for Arg-e-Bam which is famous for its religious and commercial aspects. It was a holy place for the Zoroastrian in 224-651. It was also an important commercial and trading centre on the Silk Road [85]. Bam was almost destroyed by an earthquake on 26 December 2003[86]. Prior to the Bam earthquake, in 2002, the estimated population in Bam city, comprising 5 city districts and 13 rural or town districts with 572 villages, was 242,438. A recent estimate of its population is 223,000 [87].

The main economic activity in Bam and most surrounding villages is agriculture which provides direct employment for more than 25% of its population. Bam is famous for high quality dates and citrus fruit and for its industrial and trade economy including automobile manufacturing [88]. Before the 2003 earthquake, Arg-e-Bam, the largest adobe building in the world, was listed by UNESCO as part of the World Heritage Site and attracted many tourists [88].

Bam earthquake effects

The Bam earthquake of 2003 resulted in 31828 deaths, 17,500 injured and 525 lost, and in addition 75,000 were rendered homeless [87].

There was a major shift in population after the earthquake. Many survivors moved to other cities while many people from the surrounding areas fled into Bam to seek shelter and other disaster related services [88].

Based on the official statistics, the earthquake resulted in the death of about 50% of the health staff in Bam [89]. Two government hospitals and one private hospital were the only hospitals in Bam before the earthquake, and these suffered 100%, 100% and 50% destruction respectively [90]. In addition, 'Health Houses' were destroyed to varying degrees [91].

In the immediate aftermath of the earthquake many businesses foundered and a great number of people lost their jobs. The earthquake has exacerbated the social and economical situation of the population of the Bam region, who were already suffering the cumulative effects of years of drought, drug trafficking in the area, as well as a substantial influx of Afghan refugees [88].

As many houses were destroyed, people were provided with 100,000 tents. [92]. However the tents were not very suitable due to the hot weather and strong sand storm. Three months after the earthquake people still lived in the tents. In summer when the temperature reached to 55 degree Celsius in summer the government started building semi permanent houses. It was anticipated that the reconstruction would be finished by mid 2007, three years after the earthquake [93]. My observation of Bam, interview at maternity hospital and living in a temporary accommodation provided by Bam Health Network plus visiting some friends in 2007 realised me they still live in the temporary buildings.

1.3 Background on Iran

In the previous chapter the importance of health data in general and mortality data in particular for policy makers is discussed. The role of maternal mortality as an indicator of health care and socioeconomics was highlighted. In addition, the effect of a disaster on socioeconomic situation and the health care system was accentuated. This chapter is going to provide information about Iran, the health system of Iran and data collection methods in Iran. This is because these systems might be unfamiliar to the reader. Also, it makes the results of the study understandable by providing descriptions of the headings and names mentioned in the results section.

1.3.1 Demography and health characteristics in Iran

Iran is a Middle Eastern country in southwest Asia. It is a low-middle income country. It has an area of 1.648 million km², making it the fourth largest country in Asia. Iran is divided into 30 province, 293 districts, and 885 cities [94]. Based on estimates in 2004, the population of Iran was 67477000, 49% female and 51% male [95]. In terms of the economics point of view, the economic growth and investment rate remained static with a high unemployment rate, leading to 15 to 25% of the population living in poverty [94]. Despite the key polices to improve social equity, there is a considerable gap in income/wealth distribution between the poor and the affluent [96]. In Iran, the poor economic situation has been attributed to the eight years war with Iraq and economic sanctions by USA [96].

Table 1.2 summarises the vital statistics of Iran. Based on a WHO report in 2005, 29.6% of population are under 15 years old and 4.6% are 65 years and over[97]. In 2002 population growth was 1.2% [97]. Ischaemic heart disease, road traffic accidents, and cerebro-cardiovascular diseases are the most important causes of death respectively [98]

Table 1.2: Summary of the vital statistics of Iran*

Summary	Year	Males	Females	Both sexes
Population(million)	2005	35.3	34.3	69.5
Life expectancy(years)	2004	68	72	70
Adult mortality(per 1000)	2004	190	180	

* Source Mortality country fact sheet 2006 [98].

1.3.2 Narrative history of health issues of Iran

In 1979, the Islamic revolution in Iran overthrew the monarchy. The main goal of the revolution was to ensure even-handedness and social fairness for all people administered by Islamic laws. As a result, there was a strong emphasis on the provision of key services and facilities such as road, electricity, safe water for drinking, schooling, basic health facilities and social security accessible to the whole population.

Over time, considerable progress has been made in health and education. Increases in life expectancy and a dramatic reduction in maternal mortality and child mortality are the most important achievements. According to a WHO report on Iran, the estimated maternal mortality ratio from the census data is 76 per 100,000 live births and under 5 year mortality is 38 per 1000 live births [99]. Vaccination coverage is almost nationwide and almost the entire population have access to essential health facilities [96]. Antenatal care coverage with at least 4 visits was 77% in 2001 and skilled attendance at birth was 90 % in 2000 [100].

Although at the beginning of revolution there was not an explicit policy concerning family planning, an official policy to reduce population growth was launched in 1989. Now, free contraceptives are available and the effectiveness of the family planning programme has been shown by a reduction in the population growth [101]. This is despite the fact that abortion is not allowed unless the pregnancy is life threatening for the mother. The improving trend in Iran on health area over time is reflected in table (1.3)

Table1.3: Trend on health area over time in Iran

year	Life expectancy at birth (years)	Adult literacy Rate	Combined first second and third gross enrolment	Real GDP per capita	Adjusted Real GDP per capita	Life expectancy index	Education index	GDP index	Human development (HDI) index
1988	61.6	57.1	65.6	3715	3715	0.61	0.59	0.72	0.64
1989	62.9	59.7	67.0	3766	3766	0.63	0.62	0.72	0.65
1990	64.2	62.4	76.9	4170	4170	0.65	0.67	0.80	0.71
1991	64.7	65.2	74.9	4676	4676	0.66	0.68	0.86	0.73
1992	65.2	66.6	76.7	5086	5086	0.67	0.70	0.93	0.76
1993	65.8	68.1	77.7	5364	7364	0.68	0.71	0.88	0.76
1994	66.3	69.7	77.9	5374	5374	0.68	0.72	0.87	0.76
1995	67.0	71.3	76.0	5372	5372	0.70	0.72	0.84	0.75
1996	69.2	72.9	75.9	5257	5257	0.73	0.73	0.81	0.76
1997	69.5	74.5	75.0	5222	5222	0.74	0.74	0.78	0.75

Although there has been considerable improvement in health in the country overall, the speed of this progress has not been the same for all provinces. For example, The Statistical Centre of Iran classified the whole country into 5 categories based on mortality and fertility rate. Category one has the best performance in terms of socioeconomic measures, mortality rate and fertility rate. According to this grouping, the lowest levels of mortality and fertility are in Tehran and Gilan, grade one, and the highest levels are in Sistan & Blochistan, Kokiloeyeh & Boyer-Ahmad, and Kurdistan, grade 5. When it comes to socioeconomic measures, Sistan & Blochistan has the poorest index in the country, grade 5, while Kokiloeyeh & Boyer-Ahmad and Kurdistan have a better performance of 4. Kerman, the study setting, has a medium performance, grade 3.[102]

More details relating to comparisons of national statistics between different provinces are summarised in table (1.4)

Table (1.4) Health statistics by province in Iran

Province	Infant mortality Rate(per 1000 live births)	Under-five mortality rate (per 1000 births)	Births attended by trained health personnel(%)	Maternal mortality rate (per 1000 live births)
Iran	31.7	38.6	81.1	37.4
Ardebil	45.9	58.9	62.2	56.8
Boosher	42.4	53.3	80.4	52.8
Chahar mahal & Bakhtiari	45	57.5	82.4	65.2
East azarbayjan	42.8	54.1	83.7	47.6
Fars	38.5	47.8	86.0	24.1
Gilan	27.7	33.3	96.4	46.9
Hamedan	46.6	60.0	88.8	20.1
Hormozgan	45.1	57.7	59.8	44.0
Kordestan	63.7	86.7	70.9	99.4
Lorestan	50.7	66.4	71.5	28.0
Markazi	41.8	52.6	90.5	20.3
Qom	37.9	47.0	97.5	6.8
Semnan	35.8	44.0	94.4	40.9
Sistan & Balichistan	65.5	89.7	40.9	25.2
Tehran	26.9	32.3	98.9	23.2
West Azarbayjan	48.1	60.1	68.4	83.8
Yazd	37.2	44.9	99.3	8.2
Zanjan	45.6	58.4	77.9	74.9
Ilam	53.0	70.1	83.1	56.5
Isfahan	28.1	33.8	99.1	13.8
Kerman	47.1	60.8	87.0	30.4
Kermanshah	48.6	63.2	86.5	38.3
Khozestan	41.1	51.8	81.8	30.6
Khorasan	51.7	68.0	78.1	50.2
Kohkiloyes	56.1	74.8	56.4	62.8
Mazandaran	38.9	48.4	94.1	27.5

Source: Human Development Report of the Islamic Republic of Iran, 1999

Based on the World Bank dataset, 83% of Iranians have access to improved water compared to 73% for Eastern Mediterranean countries in 2000. Also Iran has a considerable higher level of school enrolment than other countries in the region, 128.4 vs 104.9 respectively. However in relation to environmental issues, Iran has a poor performance in comparison with other Eastern Mediterranean regional countries, for example, CO₂ emissions are 7 vs 3.7 metric tones per capita respectively [103]

Regarding the achievement of the Millennium Development Goals (MDGs), the reports show that Iran is on the right track and has achieved remarkable progress towards most of the goals [104]. There are significant improvements in a number of areas: a reduction in the national poverty line, from 13.5 percent in 1999 to 7 percent in 2006; a reduction in the proportion of underweight children from 15.8 percent in 1991 to 5 percent in 2006; and a reduction in maternal mortality from 91 in 1989 to 24.6 per 100,000 live births in 2006. Also, there are other improvements such as in literacy, gender equity and HIV control, which are summarized in table 8 in Appendix. However, there are aspects that need further attention such as the fraction of the population living below the poverty line, and also the need to create jobs for educated women, particularly in decision making and in managerial positions[104]. Another point is that Iran has shown a poor performance in terms of environmental sustainability through lack of attention to the prevention of deforestation, energy use and CO₂ emissions [104]

1.3.3 Health system in Iran

In Iran, the health system is a combination of health care delivery and medical education. The health system in Iran is highly centralized with main decision-making at the central level [105]. There have been some steps towards decentralization such as devolving some aspects of health care provision and health management to the provincial level, and conducting an experimental model of hospital autonomy in one hospital [106]. However the following limitations have been recognised to impede the move to decentralization: limitation of experience suitable to conditions in Iran, appropriate rules and regulations, a shortage of experts, inadequate management skills and a shortfall in local budgets [106].

Both public and private sectors undertake provision of health care [107]. The government manages the market for the cost of health care. It is a managed market by government. In fact the government decides the health service costs and all insurance is paid based on these fixed costs. As a result, people pay their health care expenses either by their insurance or by the private sector. However, the public sector is another matter. All expenses including the salaries and health services in the Health Houses and Health Posts are paid for by the government. In public hospitals under the supervision of medical universities and in rural and urban health centres, the main costs such as the staff salaries are paid by the government and a small proportion are paid by people and by insurance. The hospitals under the supervision of a social security organisation have all their services paid for by this organisation and patients do not have to pay any money towards their health care [108]. In general, people or medical insurance pay more than 50% of the total health costs and the government pays the rest [107]. The health budget in 1991 was doubled from what it was in 1982-1988, with 40% devoted to primary care [109]. In 2003, the total expenditure on health as a proportion of gross domestic product was 6.5% and general government expenditure on health as a percentage of total expenditure on health was 47.3% [100].

In terms of social security expenditure in 2003, 30.9% of the total health governmental expenditure was devoted to social security [100]. However, the welfare system in Iran suffers from some issues such as an inadequate budget, unemployment, and an ageing population [107]. As regards health care capacities, in

2004 the population density per 1000 for physicians was 0.45, nurses 1.31, midwives 0.07 and dentists 0.09 [100].

Another characteristic of the Iranian health system is the validation of health service providers regulated by the government. For instance a physician, specialist and midwife can work on the condition that the government validates him/her directly. However Behvarzes who are health staff in rural areas, nurses and other BSc graduates cannot work independently of a physician. This mean their validation depends on the physician's validation as they work under his/her supervision [108].

Taken as a whole, the government plays a role in the following issues: provision of primary health care and minimum health determinants, acting as a founder of the health services, and supervision of the quality of care in public and private sectors. Other government responsibilities are helping all sectors to subsidize the cost of complex equipments and expensive medicine which are needed, providing health information for different people, and helping the poor to pay their health care costs. It also helps the private sector when it becomes overwhelmed in disaster conditions. The government keeps the cost of health care stable during periods of instability in the economy and market [108].

In terms of human resources, the high unemployment rate of graduates of medicine and other health care professions perhaps due to over production, is one of the challenges for the Iranian government [110]. However the Health Ministry has staff shortages in many fields particularly in the peripheral cities and remote areas [110]. All medical graduates from the governmental sectors have to work for a period of two years in an area designated by the government in order to gain their degree. Over this period, they receive a salary which is the same as an official government employee. If they are not required in these centres, they are then exempt from working for the two year period, and can receive their degree. However it is considered that this rule which enables the supervisors to recruit is prone to subjectivity and does not necessarily consider the actual performance of the medical graduates [110].

A comparison of manpower in the eastern Mediterranean region (EMRO) shows that Iran has a much better figure compare with Afghanistan and slightly better than Iraq, two of its neighbours. However Iran has a significant lower rate of manpower when compared with other regional countries such as Syria, Bahrain and Egypt, as detailed in table (1.5)

Table 1.5 Human resources indicators Rate (R) per 10 000 population

country	Manpower	Rate	year
Afghanistan	Physicians	2.1	2009
	Dentists	0.3	2009
	Pharmacists	0.3	2009
	Nursing and midwifery	5.0	2009
Bahrain	Physicians	21.1	2008
	Dentists	3.2	2008
	Pharmacists	6.0	2008
	Nursing and midwifery	42.0	
Egypt	Physicians	28.3	2009
	Dentists	4.2	2009
	Pharmacists	16.7	2009
	Nursing and midwifery	35.2	
Iraq	Physicians	6.9	2009
	Dentists	1.5	2009
	Pharmacists	1.7	2009
	Nursing and midwifery	13.8	2009
Syrian Arab republic	Physicians	15.0	2008
	Dentists	7.9	2008
	Pharmacists	8.1	2008
	Nursing and midwifery	18.6	2008
Iran	Physicians	8.9	2005
	Dentists	1.9	2008
	Pharmacists	2.1	2005
	Nursing and midwifery	8.2	2008

Source: World Health Organisation, Regional office for the eastern Mediterranean

1.3.4 Health system structure

There are 30 provinces in Iran. In each province there is at least one Medical Sciences University which is the official representative of the Ministry of Health and Medical Education. Each Medical Sciences University has three main branches: teaching hospitals, District Health Network and the Medical Sciences Schools [106]. The District Health Network is the official administrator of health and medical care in the districts. The first point of contact to medical services is Health Houses in rural areas and Health Posts in urban areas. These Health Houses cover most rural areas but growing population in cities hinder complete coverage in urban areas [111].

1.3.4.1 Rural health facilities

Health services in rural areas are provided through Health Houses which are the most peripheral health centres located in the villages. Approximately 86% of the rural population is covered by health facilities [112]. Each group of rural Health Houses is supervised by a Rural Health Centre which is the next step up in the hierarchy of health services in the rural areas.

Rural Health Houses

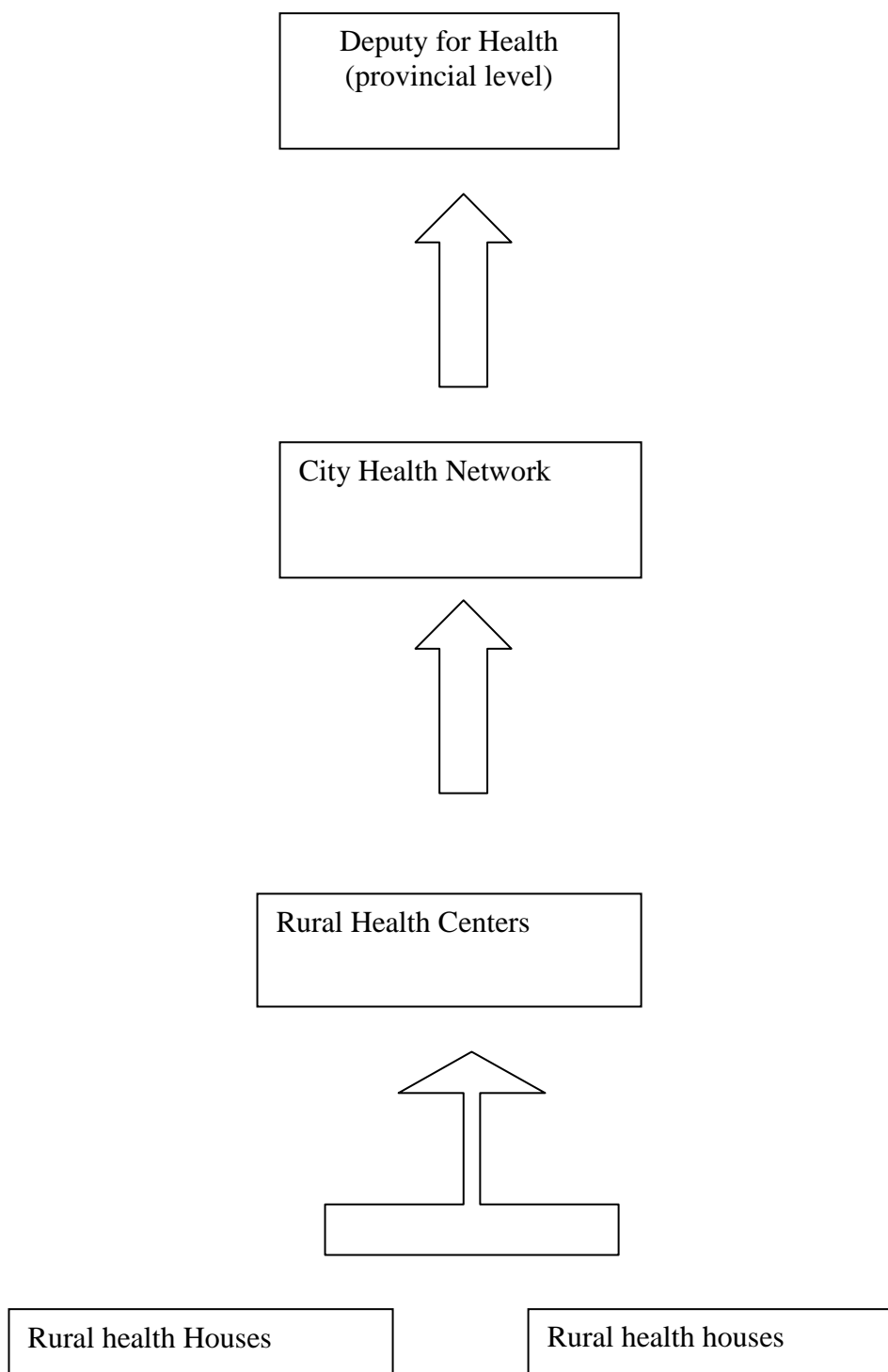
Health Houses are staffed by health workers who live in the village and are trained for two years called Behvarzes [113]. Prior to 2001 the required qualification was graduation from secondary school. Since then, the requirement has been a high school diploma [108]. Reviewing the amount of services provided by a health house shows that a Behvarzes can provide services for 1000 people in one year [112]. Considering the culture and the type of work, two Behvarzes, usually one female and one male, supply health services for a population of 2000 people. Typically, one Health House covers a few villages within a defined distance from the health house (approximately 1 hour walking from the villages to the Health Houses). The village where the Health House is located in is known as the main village while the other villages covered by health house are called the peripheral villages [112]. Rural Health Houses provide a variety of services including dealing with patients, mother and child care mental health, students' health, health for those with mental and

physical disabilities, and preparing and sending health care data to the upper level. These activities are explained more explicitly in Appendix 2.

Rural Health Centre

Rural Health Centres are the next level of health services in rural areas. They are staffed by a physician, a technician for family health, disease control, environmental health, oral health, a laboratory, and administrative personnel to supervise the health related matters in the village and in some other Health Houses. This system is illustrated in figure 1.1.

Figure 1.1: A figure of the health system organisation in rural areas and its connection to the provincial level



Rural Health Centre services

Rural Health Centres provide several facilities for their clients such as ambulatory patient admissions and specialist referral if needed. In addition there are a range of other services provided such as a physical examination, undertaking laboratory tests appropriate to the available facilities, prescribing medicines, provision of essential training and consultation. A physician in a rural health centre also has other responsibilities, for example, supervision of the rural health centre, Health Houses and their activities [108]. On average 5 Health Houses with a population of 900 are under the supervision of one rural health centre [112].

Health staff responsibilities:

Female health technicians not only supervise the Behvarzes but also provide more technical services. Male health technicians are assigned responsibility for environmental and occupational health issues in addition to disease control. Oral health technicians create the capacity for teeth and oral health facilities to be provided as well as undertaking some technical work such as filling dental caries. Medicine technicians prepare medicines for patients based on a doctor's prescription. The laboratory technicians carry out some laboratory tests which are possible at certain centres [108].

Based on the empirical evidence and data, this system can provide services for 80% of the population. The remaining 20% of the population needs to be referred to an upper level of the health care organisation [108].

Health care accessibility in rural areas

Taking into consideration accessibility of health care in rural areas, these areas can be divided into three groups: main villages, peripheral villages and remote areas. Main villages have a Health House which provide health care coverage for all of the population. It is situated in the largest village, which is surrounded by other villages. Peripheral villages are small villages near to the main village with a lower population than the main village. They usually have poorer population with fewer facilities and

infrastructure than the main village. People from these villages can go to the Health House to receive health care services. However, Behvarzes must go to the peripheral villages once a week and provide health care service to those who could not get to the main village. In 2004, 24% of the population covered by the Health Houses lived in peripheral villages [112].

Remote areas are compromised as they often have inadequate roads and primary facilities in a village. Lacking a sufficient population and being too far from the main village makes them unsuitable for being a main or peripheral village. This often means that they cannot access the health care network. Until 2004, 14% of the population lived in these areas. The health care provided for this population is mainly vaccinations and control against infectious diseases such as malaria. In addition, there is some provision of family planning services and mother and child health care. These services are given by health staff travelling to these areas. There is a census for these populations undertaken by health staff once a year which records age group and gender [112].

Mobile groups

Mobile populations are made up of health staff / Behvarzes sent to remote areas mainly to provide health services including disease control, vaccination and basic family planning [112].

1.3.4.2 Urban health facilities

In contrast to the situation in rural areas, there is a complex health system in urban areas. Both governmental and nongovernmental bodies are involved in this system. In the following section, there is a brief description of these subsystems.

Health Posts

In cities, the equivalents of the rural Health Houses are Health Posts. All services provided by Health Houses in rural areas are supplied by Health Posts in urban areas. Health Posts differ from Health Houses in that a midwife is the health professional responsible for the provision of maternal health care, including family planning and insertion of intrauterine devices (IUD). In addition, health volunteers are trained in

Health Posts once a week to learn essential health issues. Another difference is the way in which health services are made available. In cities, health care provision is passive while it is active in villages. This means that in cities, people must go to the health posts to use the health facilities while in rural areas, the Behvarzes go to them to provide health care services [112].

Urban Health Centres

Urban Health Centres correspond to the Rural Health Centres. These institutions supervise health posts and the provision of health facilities for urban citizens.

Other urban health facilities

There are a range of other health facilities which are run by government, the private sector, charities and private sector-public sector collaboration. These facilities include general clinics, clinics, polyclinics, personal offices, limited surgery offices, laboratory units, radiology units, pharmacies, and hospitals. These facilities are explained in detail in Appendix 3.

1.3.5 Iranian data collection

Owing to the research questions, the focus of this section will be on data collection relating to vital events. This will be followed by a discussion of maternal mortality data collection in a separate section. This is because there is a parallel system for maternal mortality data collection.

1.3.5.1 Mortality data collection

The following organisations record mortality data in general or maternal mortality specifically. The Civil Registry and the Statistics Unit are under the supervision of the Health Department of the Medical Sciences University. These organisations collect general mortality data including maternal mortality data. In addition, the Family Unit under Health Department of Medical Universities collects maternal mortality data exclusively.

Civil registration

Civil registration was established in 1918 with the aim of registering vital events including births, deaths, marriage and divorce [114]. This organisation has a centralized and governmental setting under the Ministry of the Interior, with the main offices in the centre of each province and peripheral administration branches around the country [114]. This organisation is also responsible for producing the statistics relating to vital events. It also issues certificates to register the birth of a child, and on the other hand, invalidates the national identification cards for the deceased [115].

Live births

All births, regardless of the parents' nationality, must be registered with the vital registry officer. The father, or alternatively the mother if the father is not available, or the grandfather, or any legal guardian (person or organisation), can register a birth. Any of the following documents can be used to register a birth: an official midwife's or doctor's certificate, or a certificate from a hospital or any official place where the baby is born. Alternatively, a birth can be registered by two witnesses. The legal timeframe in which to register a live birth is 15 days after the birth of the child.

Deaths

All deaths that occur in Iran, including stillbirths and neonatal deaths, and regardless of the nationality of the deceased, should be recorded. Any of the following people can register a death: close relatives, the owner of the property where the death occurred, anyone who had been present at the time of death, and also the police. A doctor's certificate or alternatively two witnesses are necessary to register a death. The legal deadline to report a death is within 10 days of its occurrence.

Statistics unit at the Medical Sciences University

Apart from the civil registry, the second source of mortality data is the Statistics unit at the Medical Sciences University. There is an increasing need to have data collated from multiple sources including hospitals, Cemetery Offices, Forensic Medicine, Health Houses and Rural Health Centres [116]. This provoked the Health Ministry to initiate a new system for the collation of death data through the Statistics Unit under the Department of Health at the Medical Sciences University. The first recording system in the headquarters in the Health Ministry was set up in 1997 in Boshahr province [117]. Other provinces took an interest in this death record system which led to the establishment of death records system in 18 provinces by 2001. Kerman province launched this system in 2000 [117].

The data is collected in a uniform format. During the fieldwork of study, it was mentioned by interviewees that the Statistics Unit is also responsible for collating a variety of data such as vaccination, Health House activities, family planning, contagious disease, mental health and oral health. The Statistics Unit in the Treatment Department also collects mortality data, which it receives from hospitals.

Data collection in rural areas covered by Health Houses

The main data collection tool from the most peripheral level of the health service in the Health Houses and Health Posts is the vital Zij. Zij is an Arabic word which means a table to find the stars' movements [112]. Vital Zij is a sheet with a few tables which is 50 to 70 cm in size. At the beginning of 1989, it only applied to recording the births and deaths, but it gradually developed to record more data [112]. There is a census at the beginning of each year carried out by Behvarz to collect

population data based on age and gender. They also keep a record of women aged 15 to 49 years old. At the beginning of each year the old Vital Zij will be replaced by a new one. The old one is checked by the Rural Health Centre and then sent to the local Health Network. . [112] Then all vital Zij are computerised using Persian designed software. The data will be integrated to form the province data on a provincial level before being sent to a national level [112].

The tables and figures in Appendix 1 provide more detailed information on some events such as maternal and child mortality, family planning, pregnancy results and using the iodisation of salt. Iodine deficiency was prevalent in Iran. In 1989 a national programme was launched to tackle this problem by recommending that people use iodised salt [118]. This type of data is collected at the time of the census based on the testing of salt in the household.

All data in the vital Zij are in tally form except for the circle data and family planning table which are in numerical forms. In addition, Behvarzes have to send other data such as death, vaccination, family planning, and maternal care using the other forms.

Maternal mortality data collection at the Family Unit

Apart from the Civil Registry and the Statistics Unit at the Medical Sciences University, maternal mortality is collected through the Family Unit at the Medical Sciences University. It was launched by the maternal and neonatal mortality committee which was established in 1995 on national, provincial and local levels in Iran [116]. The main aim of the committee was to reduce maternal deaths. In 1996, maternal mortality was studied through the census. Following this, in 1997 a Reproductive Age Mortality Survey (RAMOS) was conducted to estimate maternal mortality statistics [116].

Based on RAMOS, deaths of women which are reported in each city relating to pregnancy and delivery should be investigated to ascertain whether these are true maternal deaths. These data are obtained from the Statistics Unit in the Medical university [116]. The results of RAMOS show that in 1996 382 deaths were recorded which were directly related to obstetrics problems. The major causes of deaths are

haemorrhage, eclampsia, cardiovascular disorders and puerperal infections. These findings emphasise the importance of obstetric care [119]

After reviewing the results of the RAMOS study of maternal mortality, the committee created a modified version of the RAMOS questionnaire. This questionnaire was intended to survey maternal deaths in order to reduce them. In 1999, this new approach was evaluated. The result of the assessment showed that this system had to be modified because of the following reasons: shortage of complete and timely data, lack of classification on deaths based on the cause of deaths, and few proper interventions [116].

In order to tackle these problems the national system of maternal mortality surveillance was set up in 2000 [116]. In the national maternal mortality surveillance system, there are four main activities: collection of data on maternal mortality, investigation of maternal deaths, planning interventions and evaluation of them. Here is a brief description of the mentioned subjects.

The data collection tool is a questionnaire with structured and open ended questions. The method of collecting data is by interview, reviewing official documents and verbal autopsy. The data can be classified into three groups: verbal autopsy by interview with the deceased relatives; private interview with the health staff involved in provision of health care for the deceased body; and clinical autopsy [116].

The next stage is to investigate the death in order to find any avoidable causes of death. It has a crucial role to set up intervention and planning in order to reduce future deaths [116].

Once the factors leading to the death have been identified, suitable interventions are planned. The committee is responsible for managing the implementation of interventions. Indeed, all details including the intervention, the people who are responsible for the intervention, and the time of the intervention should be clarified by the committee [116].

The evaluation method is undertaken on two phases: process evaluation and outcome evaluation. Process evaluation is applied from the death report to planning the intervention and evaluation of the intervention. Outcome evaluation is appropriate to evaluate the general function of the surveillance system [116].

1.4 The remainder of this thesis

The thesis comprises five chapters: introduction, literature review, results and discussion. The current chapter, introduction, has provided general information and background information on the study topic. The next chapter, the literature review, consists of three sub-chapters. The first one, theoretical underpinning, discusses the WHO framework which was the framework I used for data collection. The second sub-chapter presents the literature on different aspects of data collection. The last sub-chapter gives a view of literature on methods that were used in the study.

The methods chapter outlines the methods used for data collection, data analysis and preparatory work undertaken before data collection.

The results section, the fourth chapter of this thesis, is divided in to four sub-chapters. The non-numeric data are presented in the first three sub-chapters. These discuss data collection in disaster and non disaster situations as well as maternal mortality data collection in the Family Unit. The numeric data are presented in the last sub-chapter reporting maternal mortality ratios from different sources.

The final discussion chapter highlights the use of numeric data to report mortality ratios during and after a natural disaster along with non-numeric data to better understand the processes involved in collecting these data. It also includes the limitations of the study and conclusions that can be drawn.

1.5 Summary

Health data have a vital role in evidence-based decision making. They are collected from different sources including the Civil Registration organisation. This organisation has a duty to collect data on vital events including live births and deaths. Birth data and mortality data are important types of health care data because they account for each member of the population of a country. Maternal mortality is a very important and useful health indicator as it can reflect socioeconomic situation, development and health care quality. Disasters can be viewed as destructive events which affect the socioeconomic situation and health care services. The effects of disasters on women have been shown to be greater than men. Safe motherhood might also be affected by low quality and quantity of health care after a disaster. Iran is a very disaster prone country in the world experiencing a considerable number of natural disasters over time. The Bam earthquake was an extremely destructive earthquake affecting society and the health of the local population on an extraordinary scale. This earthquake devastated the health system and socioeconomic situation in Bam.

Iran is a low-middle income developing country showing a significant improvement in health and education over time. The health system in Iran is a combination of health care delivery and medical education. Health care delivery in the urban areas is undertaken through both governmental and nongovernmental sectors while in the rural areas the only active bodies are governmental services. Health care in the rural areas is delivered through Rural Health Houses which can send referrals to Rural Health Centres. Data collection in the rural areas is undertaken by Rural Health Houses and Rural Health Centres through prepared forms. Mortality data are collected through two organisations: the Statistics Unit at the Medical Sciences University and the Civil Registry. However, another section collects maternal data: the Family Unit. This organisation works under the supervision of the Medical Sciences University. Therefore, there are three data sources for maternal mortality: the Civil Registry, the Statistics Unit at the Medical Sciences University, and the Family Unit at the Medical Sciences University.

Chapter 2 Literature review

The literature review consists of three sub-chapters. The first, entitled Theoretical Underpinning, discusses the framework I used for my study. The second sub-chapter, Data collection systems in the literature, examines the literature on health information systems. The last sub-chapter discusses the methods that were used in the study in relation to the literature. The literature review has been an ongoing process. It started immediately after stating my study. The initial key words used to search were: natural disasters, natural disasters AND impacts, health outcomes AND natural disasters, Earthquake, Earthquake impacts, long term effects of disasters. In addition, maternal and child mortality, and safe motherhood were main key words. Finally, health information system, data usage, maternal death registration, death registration, disaster AND data collection, disaster AND health information system, routine data, routine data AND disaster were the key words used to interrogate the search engines. The main search engines used were Google, Google Scholar, Pub med, WHO and Scopus. This search strategies were had no time limitation applied.

2.1 Theoretical underpinning

The previous chapter discussed the background relating to the health system and health data collection in Iran. Two different data sources, the Statistics Unit at the Medical Sciences University and Civil Registry were discussed. In addition, an extra source of data for maternal mortality, the Family Unit at the Medical Sciences University, was explained. This section is going to discuss the theory underpinning the study which is the WHO health metrics framework. This framework was introduced by the WHO in order to help developing countries to strengthen their health information systems. The framework comprises different elements of a standard health information system. Owing to this fact, the concept of a system will be explored first followed by an explanation of the strategies available to study a system.

2.1.1 Health information system evaluation

The concept of an information system is grounded in the “systems” notion [120]. Hence, prior to the focus on the health information system it is sensible to define a

'*system*' in general terms. Semprevivo defines a system as "a series of interrelated elements that perform some activity, function, or operation." [121] In system assessments, the following questions are addressed: What is being done?; why and by whom?; how is it being done?; and what are the main problems? [121] Bobbitt revealed that two studies can be carried out to study an organisation. First of all, a descriptive study can be used to describe a system in order to explain the system. Secondly, a normative study can be employed which aims to highlight what should be done in order to have an effective system [122].

Two main methods of study in an organisation are discussed as the closed system method and open system method [123]. The closed system method is based on the assumption that all important factors in a system are internal and there are no external effects on the organisation's function. In contrast, an open system approach argues that to understand a system it is necessary to study not only the structure of a system, the internal factor, but also the environment in which an organisation is working [123]. The closed system looks at the traditional perspective of a system which takes the decisions at the top of an organisation. These decisions are then carried out throughout the system.

Open systems, on the other hand, look at the different parts of an organisation or other organisations which can affect the given task [124].

Lipsky argues that making generalisations about an organisation without considering the context within which the organisation works is just a superficial way of studying it. He states that sometimes an organisation functions on the contrary to its own rules and aims. Therefore he suggests scrutinising these problems through street level bureaucrats' behaviour and attitudes. Street level bureaucrats are defined as those people who "interact directly with citizens in the course of their jobs and who have substantial discretion in the execution of their work". Health workers are an example of street level bureaucrats [125].

These stances underpin two different methods of analysis: top-down analysis and bottom-up analysis, which are discussed well by Sabatier. Top-down analysis begins with decision makers and the state. Therefore analysis of the behaviour and views of the lower levels, such as the private sector, are overlooked. On the other hand, bottom-up analysis starts with people involved in service delivery and asking their

views about strategies and connections. This will then be followed by finding all people involved in different levels. The final step of this approach will involve the policy makers [126]. Top-down analysis ideally needs several conditions to be implemented such as: a military like organisation, forcing rules and objectives, acting on exactly what you are requested to carry out and introducing a high level of communication between unit and organisation without time restraints and pressure [127]. Both top-down and bottom up have their own limitations. The former is unrealistic, ignorant about the private sectors and public servants' views in addition to being difficult to use when there is no dominant policy. Yet the bottom-up method also has weaknesses: it overestimates the ability of sub-levels, underestimates the indirect effects of the central organisation and lacks the ability to come up with a theory [127].

To tackle the problems emerging from each method; Sabatier suggested a combination of both methods starting with the bottom-up and followed by the top-down method [126].

2.1.2 Current research with respect to the theory

In my research I explored the structure of data collection on selected data based on the WHO framework which is explained in the next section. In addition, interviews with different people provided me with information beyond a simply descriptive study. I would consider my study as a mixed method of top down and bottom up analysis.

Exploring the literature convinced me, for the following reasons, that the best framework for this project is WHO framework. First of all, some research relating to health information systems was aimed at evaluating health information technology such as [128],[129], [130], [131], [132], [133]. Although, these studies are very useful and helped me to broaden my view, they could not fulfil my aim of exploring the whole system, of which technology is only a part.

In addition, some studies used a framework which was broadly similar to the WHO framework in the main structure, but only included a limited number of items. For example in evaluation of surveillance data in Scotland [134] the researchers evaluated three main parts of a system: structure, process and outcome, which is

similar to the main structure of WHO. However, in the first part, structure, they just included resources which were not sufficient for my research. Moreover, some studies assess a part of health information systems such as evaluation of availability and utility of data [135], quality of data [136], [137], [135], evaluation of secondary data sources [4], investigating a subgroup of data for different reason such as accuracy [138], [139], [140], [141] and quality [142] ,and [143]. Also, some countries used the Health Metrics Assessment tool to evaluate their health information system [144]. This is a very helpful tool to evaluate the health information system. However, the purpose of this study, in the first instance, was to give an overview of the system and then diagnose the existing problems within the system. This will not be achieved by using The Health Metrics Assessment tool.

Furthermore, in a study carried out by Kenny and his colleague the problems with data collection in maternity units in England were explored [145]. They used a questionnaire comprising different stages of data collection to know how data were collected, processed and used. This method includes the main items of the WHO framework. However, the WHO framework is more practical by being more detailed providing a step by step guide for each stage. In addition, the WHO framework is a straightforward and organised reference. Therefore it is easy to follow the structure and appears to be the only comprehensive framework in the literature.

However, using the WHO framework as a standard framework might initiate some concerns. Regarding data usage, this question poses itself: would this framework be applicable to any type of health system? When a health system is organised as a centralized system, this means that the main decisions are taken at the national level and, in contrast, the local levels mostly have administrative roles. On the other hand the philosophy behind the framework is to use data in all levels. When a system is centralized the efficiency of this model might be questioned at the data usage stage. Also, there are some concepts which are mentioned implicitly in the framework with no explicit definition, e.g. introducing incentives as important factors in data utility. If we consider these financial incentives some drawbacks might be observed. For instance, financial incentives took place in Malawi to increase the data importance by donors. They started to remunerate the districts based on the timely submission of the routine data [146] . Now if there is a delay in preparing the data due to staff shortage

or technical problems, pushing the districts to prepare the data might lead them to sending of inaccurate data. This even could be worse because the data might be just made up to ensure receipt of the financial support which is crucial to keep working.

Nevertheless, these shortages do not affect my study because the aforementioned problems are not the primary focus of my research. Indeed, they are a small part of my findings and I will use these to expand my discussion on related issues. In addition, in this research, having WHO framework, as standard model of a health information system has many advantages. It organised the research, broadened my view of what is expected in a functional health information system and allowed me to focus on which parts should be explored. In addition it promoted my interview guide.

WHO Health Information framework

The necessity of investing in and developing health information systems in developing countries was identified by international organisations such as the World Bank [147] and WHO. Building upon the need to improve health information systems (HIS), the WHO established the Health Metrics Network (HMN) in 2005 [148]. The aim of HMN is to develop a harmonised framework for countries, to support developing countries in familiarising themselves with the framework, and to provide them with technical support and financial support. Also they aim to increase the quality and usage of data [6]. This awareness resulted in gaining support for developing countries such as Peru, the Solomon Islands, Honduras and Lesotho to strengthen their health information systems through international organisations [149]. The framework provides a perspective on different dimensions of a health information system. This is not only a comprehensive guide to develop a system. It is also useful to assess the current system and recognise the problems with the current system [6].

Furthermore the WHO framework can be more influential than any other framework in countries around the world because it is promoted by the WHO, which is a leading and important organisation in the world.

2.1.3 Health Information System: WHO framework

This section will describe a health information system based on the WHO framework. Health information systems are divided into 6 components including: health information system resources, indicators, data sources, data management, information products, and information use. These components are grouped under three broader headings: inputs, processes and outputs [6].

2.1.3.1 Input

According to the WHO framework, input is related to health information system resources and is an expanding area of legislation, planning framework, human and financial resources, and information and communication technology in addition to coordination mechanisms between all components [6]

Health information system coordination and leadership

It is recommended to have a representative national committee consisting of the key involved organisations in order to develop and keep the system in existence. This committee has a crucial role in defining the main guidelines for the health system, to facilitate collaboration between different stakeholders, to introduce key statistics on a short term basis and to monitor activities and anticipate the budget on a medium and long term basis [6]

Health information system information policy

Appropriate rules and regulations are emphasised in the WHO framework. It is implied that they enhance collaboration between different organisations and facilitate in gathering the data from private and public organisations. They also introduce a standard framework for ensuring consistency with international statistics. Ethical issues should be defined in a legal framework [6].

Health information system financial and human resources

Based on a WHO report, there is little research into the annual cost. The cost estimated for a health information system is \$0.53 to \$2.99 per capita [6]. In terms of human resources, it is necessary to employ and train staff at all levels. Experts in

statistics, epidemiology and demography are needed at all levels to ensure enacting standards in collecting, processing and analysing data. If care providers were required to carry out the tasks related to data they would be overburdened and see it as an unnecessary and unwelcome job [6]. It has been suggested that employing sufficient staff with an appropriate academic background would be a beneficial way to improve the system. In addition it is inferred that having an independent or semi independent and powerful statistics unit can provide an opportunity to recruit high level staff. [6]

Health information infrastructure

Health information infrastructure is mentioned as another important factor in the WHO framework. The availability of all the necessary tools from a simple pen to an internet connection are considered to be part of a health information infrastructure. All levels should be connected to each other. Therefore, offices should be set up with communication tools such as a telephone, transport equipment and email. Utilisation technology in the health system provides speed and accuracy when processing data [6]. The WHO framework advocates the use of coherent programmes and systems which are compatible with each other on different levels. [6]

2.1.3.2 Process

In the WHO framework, processes are concerned with data indicators, data sources and data managements.

Indicators

The basic indicators are defined for the three main areas of health: determinants of health, health system and health status.

Determinants of health

These indicators measure parameters which form the environment within which the health system acts such as socioeconomic, demographic and genetic factors [6].

Health system

These indicators cover a range of activities which show the inputs to a health system such as human and financial resources, equipment and infrastructure. They include some outputs such as health service availability and quality [6].

Health status

These indicators comprise the statistics which show levels of mortality , morbidity and well being [6]. The framework recommends that these indicators should be available stratified by subgroups such as gender, socioeconomic, ethnicity and resident's home[6].

It is suggested that all countries need to have a set of essential indicators which are important in planning, monitoring and evaluation. It is also necessary to maintain a minimum acceptable series of indicators [6]. Based on the framework a set of 40 core indicators has recently been introduced [6]. The defined set of indicators should meet national and international goals such as ,the Millennium Development Goals.

Data sources

The framework divides data sources into two main categories: population based and institutional based. Data from the former are collected from the population through censuses, civil registries, and population surveys while the latter is concerned with data collected by different organisations such as occupational reports and hospital records [6].

Data management

This section deals with data storage, data quality, data processing and data collection [6].

Data storage

This implies that appropriate storage makes the data valid due to its effects on accuracy, completeness and reliability. It also makes it possible to analyse the data to find trends and to evaluate the quality of care. The data should be stored in a place,

where only authorised staff can access it. This is in order to ensure confidentiality by using the correct codes for retrieved data and by filing the data according to the correct instruction [6].

Data quality

The framework outlines the following items as pertaining to data quality: timeliness, periodicity, consistency, representativeness, desegregation and confidentiality [6].

Data processing and collection

This section deals with the activities concerned with data extraction from different sources, ensuring data consistency and quality. The following steps are outlined in the framework

“Removing mistakes and correcting for missing data,

Providing documented correcting the errors.

Capturing the flow of transactional data for safe keeping

Adjusting data from multiple sources to allow them to be used together

Structuring data to be usable by end-user tools

Tracking the above to tangibly support data quality assessments.” [6]

Also it is stated that the system should be able to cope with possible changes in national conditions or new technology development [6] . Promoting a metadata is another recommendation by the framework. This is a comprehensive document detailing data definitions, data elements and their use in indicators, data sources, periodicity, and data collection [6].

2.1.3.3 Outputs

Outputs are involved with information products and dissemination and use.

Information products:

The framework implies that even data which is of high quality is of low value if it is not transformed into information. The data can be analysed and enriched with other data sources. Applying proper statistics, exploring any inconsistency, finding any bias and giving a brief overview of situation and trends are the main aspects of this section [6].

Dissemination and use:

The ultimate aim of a Health information system is to make information available to policy makers for evidence-based decisions [6].

It is suggested that the information should be available day to day for managers. The culture of making evidence-based decisions should be encouraged by applying incentive mechanisms [6].

The framework discusses that in order to enhance the use of data in decision making the data and information should be linked with resource allocation. The indicators should be defined for short, medium and long term. Considering incentives such as an award for the best performance based on data is another suggested method to enhance data usage [6].

2.2 Data collection systems in the literature

The prior chapter discussed the WHO health information framework as the framework used in this study. This section is going to explore the literature on health data collection systems. As the study setting is Iran, a developing country, the literature review is focussed more on developing countries. Data collection has received more attention since the 1990s [6]. Therefore it is almost a new topic for research. In my literature review I came across many papers addressing the importance of data collection and evidence-based decision making. However there are few countries that have started revising their health information system. The paucity of published literature in this field was noted by Sauerborn as well [150]. Hence, it does not come as a surprise that an exploration of health information systems was found in only a few articles. To undertake my literature review, I searched the Iranian libraries and theses. I could not find any documents about health information systems in Iran except one which was a very superficial explanation of the hierarchy system in a part of system [106].

This section has three sub-chapters; data capture, data handling and data usage.

2.2.1 Data capture

This section is going to discuss the prerequisites for a health information system which were discussed in previous studies. These are factors which can affect data capture including coordination and collaboration in addition to rules and regulations.

2.2.1.1 Coordination and collaboration

A high level of coordination and collaboration is considered as an imperative key to the success of a health information system. All levels of a health system including health staff and managers must perceive the importance of the information [151]. This makes a system more efficient by reducing duplications and decreasing the resistance to data extraction [19].

In a study that was carried out in Papua New Guinea, introducing the national health information system to the relevant managers, donors, health staff, and governmental and non governmental institutes was considered as the first step to strengthen the health information system [152]. It is necessary to involve all sectors including the

private sectors in data collection and data processing. In a study conducted by Macfarlane and her colleagues in England, it was pointed out that lack of data about the private sector resulted in difficulty in evaluation of the general trends [153].

2.2.1.2 Rules and regulations

The WHO framework advocates establishing appropriate rules and regulations to facilitate obtaining the data from different sources [6]. This should be along with appropriate strategies to enforce the execution of rules. This is very important particularly in the developing countries where there is little enforcement of rules [154]. Also introducing appropriate organisational rules and regulation including using standards in diagnosis and treatment, characterisation of staff tasks, provision of management procedures and computer maintenance is necessary to ensure the effective use of health information system resources [155].

2.2.2 Data handling

This section aims to present the literature on the issues relevant to data handling; addressing data transmission, communication infrastructures, data quality, data checking, periodicity, guidelines and resources.

2.2.2.1 Data transmission

Data transmission is when data is transferred across the system from the peripheral level to the upper level [156]. The ultimate aim of data transmission is to make data available to those who need the data at different levels [156]. It is argued that developing countries are improving in data transmission. This is due to two issues: growing attention to use data at the local level, and making better use of technology to transfer the data [156].

Data can be transferred via three methods. In the first method, data are sent to each upper level aligned with the hierarchy of the health system. The second method skips some intermediate administrative levels to speed up the process. In the third method, data from the peripheral levels are sent to a central unit. It is suggested that method one and two use paper to send the data while the third method use technology and

networks to send the data. The comparison of these methods show that the third method has more quality, speed, complexity and accessibility [156].

A review of national health information system in Pakistan shows that the most of the districts send their data to the district computer centres before sending to the provincial levels. They finally are transferred to the national levels using diskettes [157].

2.2.2.2 Communication infrastructures

Technology has helped humans in many aspects of life by increasing the speed and accuracy of jobs. Hence, it does not come as a surprise that in health information systems where we deal with records, numbers and figures, computers have a crucial role to play in improving output. It has been shown in different studies that accuracy [141], [143] and timeliness of data increase by using the computer [156].

Wilson discussed the usefulness of using computers in health information systems explicitly. He noted that using technology can enhance the efficiency of plans by the following methods: analysing large amounts of data in a short time, producing different outputs for different users, reducing duplication, increasing accuracy with automation of data checking [150].

Also there are some indirect benefits of using computers: providing an opportunity to review the manual system, [158] changing attitudes of personnel towards data usage and reconsidering the indicators needed [159], [156]. In a study carried out by Jayasuriya [160] in the Philippines, it was shown that data collection through paper-based methods were time consuming, typified by duplication and delay.

Apart from the speed that internet brings, it also provides more privacy protection than sending data by CD or floppy disk. Furthermore, using technology allows the linkage between different data sources through compatible software. Making the data compatible and transferable has important benefits by stopping double data collection and increases the accuracy of data as well [132]. Inadequacy of linkage between different parts of health information system is observed as one of the problems in the African Region [161] .

However, the efficiency of using a computer depends on the efficiency and sufficiency of programs designed for data collection and data processing, otherwise

it might not fulfil all users' objectives [162]. Different types of software can be used in health information systems: modifying software used in other countries, non-specific software like Epi Info, and an entirely new customised package [158].

Each package has its own advantages and disadvantages. The success of the first type of software depends on the flexibility of the original package to be modified and the availability of sources for codes. The second type is easy to use for data entry and conducting some analyses but has serious problems in data linkage. The third type is very useful when the level of complexity is high. However, to design a successful software package, a high level of technical expertise is required [158].

Furthermore, applying an identical programme in different countries might not be useful. For example, Heeks discusses the same system working in developed countries might not be functional when applied in developing countries [162].

However there are other limitations in developing countries which can restrict the benefits of computer usage. This originates from the system development viewpoint. For instance, in Cuba a low number of computers, regular power failures and low access to the internet are the main problems in its technology infrastructures which is common across the country and not just limited to the health information system [163]. Also, none operational computer packages are discussed to be one of the problems in Swaziland [164]. Another problem observed with using such technology is the limited number of personnel with computer skills [157]. Sandiford discusses that in some cases training a member of staff to learn skills relating to using technology is used primarily to promote the staff member, and not to deploy the staff member to take advantage of his/her ability to use the technology [159].

In summary, availability of data to several users simultaneously, high speed of data transfers and linkages with different regions are the advantages of using the internet in a health information system. However this requires an adequate budget and special skills [158].

Considering all the advantages and drawbacks of using computer systems in developing countries, it can be questioned whether we should use technology in health information systems in developing countries. Wilson advocates using both computer and manual systems on condition that they are fully integrated [158]. He

suggests there are some factors that can affect the decision on choosing paper methods or computer methods including the amount of data which are collected and processed, the ability of a region to provide equipment and technical support, and the ability to train staff[158].

2.2.2.3 Periodicity

The main aim of a health information system is to produce data for decision making. Health information management has a key role to ensure producing high quality and timely data [155]. Data are valuable if they are up to date. It is suggested that out of date data, even if they are of a high level of quality, are useless [150]. According to the WHO health information framework, information should be available day to day for managers [6]. However, in developing countries data are prepared with delay and managers have to make decisions in the absence of data [150].

2.2.2.4 Data quality

Data quality is defined as accuracy and completeness [135]. The scope of data quality is expanded to encompass the size of the data sources, registration period, data accessibility, cost, data format and recording linkage [4]. Policy makers should be convinced that there is not only evidence of need to change but also they need to be certain of the quality of data which indicate these needs. Any planning and implementation based on incomplete data may result in a biased conclusion and challenge the national programmes [165].

Data quality is relevant to data usage [157]. It is beyond doubt that piling data in a storage cabinet with no usage leads data collectors and data processors to consider their work as a useless and unnecessary task. On the other hand, ongoing data usage and evidence-based decision making trigger the process of revision and feedback on the data to the data collectors and processors which ultimately improve the quality of data. It is discussed that the process of giving feedback should be aimed to improve the quality of data, and not to punish staff for not achieving the targeted goals [156]. Hence, the quality of data will be improved if the data are used [166]. Another method suggested to improve the completeness and accuracy of data is linking

records from different sources [139]. Also cross checking is discussed to be helpful to find errors and ultimately increase the quality of data by correcting them [157].

Although the requirement for high quality data is an important demand of decision makers, in developing countries a range of problems are observed in different stages. In terms of data collection and data reporting, non-reporting of data, reporting in irregular intervals, missing some elements in reporting have been noted [146]. Also when it comes to data processors, incorrect coding, and making mistakes in the entry of data in the right fields are frequent problems [146]. The quality of data can also be affected by poor technical skills of staff [150]. Apart from the above limitations there are few opportunities to give feedback to data processors and data collectors to improve the quality of data [146]. The same results are reported by Herman regarding no quality control or feedback in manual data and in vertical programmes, where the data are collected from the bottom level and sent to the upper level of the system [128]. Another matter of concern is timeliness and availability. These are noted to be two problems within the African region [164].

The quality of data might be uncertain when there is a risk of conflict of interest. It is discussed that if the care deliverers are supposed to undertake the measurement and monitoring of a system to achieve the goals, a conflict of interest may arise which affects data quality [17]. A good example to avoid this risk is using an independent system from the health system such as the UK Health and Social Information Centre which is independent of the National Health Service [17].

Another factor affecting the quality of data is accuracy of cause of death which has often been ignored even by medics [167]. Accuracy of these data allow relatives to make sense of the cause of death and also it allows policy makers to be aware of the causes of death to plan and allocate the financial budget to the right place [167]. Data checking is suggested to improve the quality of data which is explained in more detail in next section.

2.2.2.4.1 Data checking

Several sources of errors can occur during different stages of a health information system which can affect the quality of data. They are listed as occurring with “inappropriate data collection and procedures, poor reporting and recording, and errors in processing data” [156]. Inappropriate data collection and procedures involve

low precision in definitions of data and lack of protocols to define the cases which might lead to an overlapping of classifications. Poor reporting can be due to inadequate communication facilities to send data, or not sending data intentionally when there is user resistance. Finally poor recording of data can happen during transferring, aggregation and coding of data [156]. Inadequate familiarity of staff is considered as one of the sources of errors [156].

In order to reduce the errors that happen during the computerisation of data, the following strategies are suggested. Firstly, editing the data can be conducted manually or by using the ability of software to find missing data or inconsistent data. The second method is double entering; some organisations enter the data twice to avoid any mistakes. The third method is tabulation of data and then searching for any inconsistency or confused results [156].

2.2.2.5 Guidelines

One of the main goals of data collection is to compare different areas and groups to find high risk groups. It is obvious that reporting a variety of inconsistent data does not lead to the achievement of this goal and is discussed to be a waste of money and time [18]. This becomes more important when the target country is a developing country. Because these countries often have financial problems, it is crucial to watch what they are spending their budget on. In a study conducted in China, lack of united indicators and standard definitions of indicators were recognised as the major problem with their health information system. This resulted in limited opportunity for comparing data. It also caused repetitive data collection from different sources [132]. In addition the reason for collecting each dataset should be fully considered and justified. In a study carried out in Cuba, a massive collection of data on what was being done was challenged by the author. He discussed that these data have low value and are collected just due to political reasons. He suggested replacing collecting these data with collecting those types of data which are actually needed [163]. Introducing a guideline has many benefits for both data collectors and data users by providing clear goals for data collection and data utility in different levels [168]. This is initiated by achieving consensus over a minimum set of data among the different actors involved with data collection and users at the beginning of establishing or restructuring a health information system [151]. The dataset should

include the necessary information which each level needs, from the national level to the facility level.

However, achieving a consensus on the indicators is not an easy and straightforward job. The reason is that even those who do not use the data sufficiently wish to bring all data related to their work under 'routine data collection' [146]. On the other hand, new indicators required by donors is another problem to keep the indicators to an essential minimum set [149]. In addition, an established minimum set of data can be disrupted due to the possibility of a radical change in the data collected by the system. Implementation of these changes might need some extra money which is considered an unaffordable investment. For example, in Papua New Guinea experience of strengthening the health information system for this reason they just changed the method of reporting from different monthly forms to the united A3 folded sheets without any basic changes to the data collected [18].

The next step is defining the indicators' elements. A transparent and comprehensive definition of the elements for each indicator can increase consistency and data quality [169]. This was recognised as an important need to strength the quality of the information system in Mexico [166], [146].

2.2.2.6 Resources

Health information resources are defined as human and financial resources. Developing countries have considerable problems in provision of resources. In most countries, governments invest in the health information system. Some developing countries are dependent on donors to maintain their health information system. In Africa, it is estimated that between 20 to 70% of the budget for statistical units comes from donors [170]. The costs for a comprehensive health information system might be a considerable proportion of the health system budget. However it is beyond doubt that the usefulness of the results gained by the improvement in data and consequently the improvement in the efficiency of health care exceeds the cost [171].

Human resources comprise managers, planners, statisticians, data collectors and processors. [172]. It is necessary to recruit people with the relevant academic qualifications to a health information system. Also training for staff is considered as

a basic step to improve the health information system [157]. Training consists of broad concepts of computer software skills, data analysing, interpretation and data usage [173]. Nevertheless, training and recruiting appropriate personnel are other challenges within developing countries.

Green outlined three main problems with human resources in developing countries. The first one is the paucity of trained staff which is discussed by Cibulskis as a factor which results in dependency on external help [152]. The second one is too many trained but unemployed staff and the last one is employing those with inappropriate skills [174]. Regarding health information systems and human resources, an assessment of the health information system in Swaziland revealed there were very few experts in the fields of statistics and epidemiology [164]. In both Papua New Guinea and Malawi, the low number of experts was perceived as a fundamental problem and basic practice was required to strengthen the system in the early stages. For this reason, staff were provided with the skills and knowledge to use the tools and calculate the indicators [152],[146].

Having discussed the importance of employment, it should be born in mind that being employed on its own is not the only desired issue. Job security is an important factor in promoting staff productivity, innovation and health [175]. It is defined as a multifaceted issue depending on the probability of losing a job, probability of finding a new job, the merits of the current job and the future job, plus the time span of being unemployed whilst finding a new job [176]. However, in the study carried out in Swaziland it was revealed that there is not only a shortage in the number of experts, but also a high turnover of staff. This was also observed in a study conducted in a review of the health information system in Afghanistan [144]. This might create an uncertain situation for staff which in turn can make staff feel less responsible and reduce their interest in their work.

2.2.3 Data usage

The final aim of the collection of data is transforming the data into information. This leads to gaining knowledge through communication of information [157]. The knowledge is used to take appropriate action to solve problems. Both managers and politicians can use these data to make decisions [156]. Decision making is defined as

the ability to frame options, guesstimate effects, and make choices [156]. Lippeveld discusses that different format and level of analysis might be needed in different situations. For example care providers decide continue visiting patient by asking how well patients are without any complex analysis. If the patient is well they stop regular visiting. Routine data which are related a series of activities are more relevant to the daily managerial task. However, there are other sort of information which might be needed to be analysed monthly or annually [155].

Although there are considerable emphasis on the importance of data it is discussed that even if there is high quality of data the data might not be processed or used [1]. In order to enhance the data usage in decision making several factors are discussed to be important including data characters, type of problems and decision, health system structure, difference and communication between data people, who deal with data and policy makers, who deal with decision making [1].

In terms of the data characters the following issues are discussed by Sauerborn [1] ; If decision makers feel a sense of ownership to the data the data is more likely to be used. This is achieved when the decision making are involved in designing health information system in all level including promoting indicators required. Ensuring of validity and quality of data is another factor can enhance the data usage. If the data is based on the service usage it is prone to be biased [17]. Modification data to the user's need and timely data are of other requirements [155]. Those data are too detailed might be useful for a group of users while the policy makers needs more aggregated data [17]. Health information system in developing countries is discussed to be inefficient in providing the necessary information for decision making. Although huge amount of data are collected they are rarely used [150].

In these countries, even if the policy makers tend to make decision based on evidence and know how to use the data the quality and availability of data are not satisfactory [5].

For example, In African Region the data are not up to date, available, complete and comprehensive [164]. Hence, it does not come as a surprise that the decisions are likely to be made without any evidence [164].

2.3 Literature review of methods

This section is going to discuss the literature on methods that are used in this study. Ethical considerations play an important role in the conduct of this research. Different aspects of ethical issues are explained at the beginning of this subchapter. This will be followed by the research strategy, and the research design including sampling and data collection methods. The last section deals with data analysis methods.

2.3.1 Ethical considerations

Ethics are considered to be a very sensitive matter in all research. Regardless the type of study, ethical issues must be taken into account at all stages including the formulation of aims, the design of the study, the data gathering process and the interpretation and usage of results [177]. However, no single specific framework of ethics is applicable for all research[178] In the other words, each research needs to define and consider those ethical issues that emerge in the context of the respective study. The following section discusses the ethical considerations which became important in my study.

2.3.1.1 Gaining access

Regarding access to the research setting, there are two types: covert access and open access. Covert access is strictly protected by gatekeepers whereas open access is freely available [179]. Silverman [180] describes covert access as research carried out in the absence of case awareness while overt access needs the cases' permission which is gained through the gatekeeper. Lincoln and Guba describe gaining access as one of the initial considerations in all research, they argue that there are formal and informal gatekeepers with the authority to allow or prevent the researcher to conduct research in their domain. Gatekeepers need to be informed of the study and any risk and expense that it may bring for them and their staff. In a political analysis and evaluation, gatekeepers weigh up the advantages and disadvantage of the study before granting permission [181].

2.3.1.2 Consent form

Informed consent is deemed an imperative principle of all research. All participants should be informed of the objectives and nature of study. Also, any possible risk that may affect their life and career must be discussed. It is their obvious right to choose or refuse to be a participant. The methods used to gain the participants' consent are different in medical and social research. In the medical research a written form of consent is necessary whereas this is not necessarily the case in the social research [182]. A leaflet is a useful tool to inform the participants about the purpose of the research. It enables the researcher to explain the research and to provide information to the potential participants [183]. It is visual, straightforward and reasonably priced and includes information on how to contact the researcher [183]. However, it has some disadvantages such as being only suitability for literate people and sometimes being time-consuming [184]. In my research a leaflet was designed in order to give more information to the interviewees.

2.3.1.3 Confidentiality

Confidentiality means that the identity of the participants is not revealed. A common strategy to keep the confidentiality is avoiding the respondents' name and characteristics in the computer or cassette, instead using a label with a code for each participant [185]. However, full anonymity can not always be achieved in research, for example research relating to a respondents' job. In other words, if the interviewee is the only person qualified to be interviewed, such as the head of an organisation, full anonymity can hardly be achieved [185].

2.3.2 Research strategy

This study used quantitative and qualitative methods to collect and analyse the data. Quantitative data can be obtained from closed-ended questions and from the numeric data provided by a document such as a census data, while qualitative data are gained through open-ended questions which are asked in interviews or data collected via documents and observation [186].

Mixed qualitative and quantitative methods are a suitable method to conduct complete and informative research (Green 1989). This method is discussed to be useful because it provides a better insight into a problem [187].

2.3.3 Research design

Mixed quantitative and qualitative research can be designed in different ways. Creswell outlines four different methods of designing a study, including embedded, explanatory design, exploratory design and triangulation. Triangulation is applied when the statistical results are intended to be compared, contrasted or validated with qualitative results. Embedded design describes a research design in which one of the studies has the supportive and secondary role to the other. Explanatory design is a two-stage mixed study which uses qualitative data to explain or develop initial quantitative results. Exploratory results, as with the explanatory design, has two phases: qualitative research is conducted first, followed by quantitative research. However, Tashakori considers the last two methods as one design called sequential studies [188].

2.3.3.1 Sampling

Depending on the study method there are different types of sampling, including probability sampling and purposive sampling. Probability sampling has several subgroups, characterised by generalization and statistical applications [185]. Purposive sampling is suitable when rich information is needed from those who can provide this type of information [189]. The sampling method used in this research was probability and purposive sampling.

2.3.3.2 Data collection methods

There are generally different resources of data for scientific research, including asking people for their experience or knowledge, observing and recording, making inference from a person's behaviour, studying a person's relationships, and using data and documents collected by others [188]. These data are collected through a

variety of methods, including self reporting, questionnaires and interviews, participant observation as well as archival data [188].

2.3.3.2.1 Interview

Interviews are considered as a suitable method for accessing rich data and individuals' articulation of feeling about events. However, it is not suitable to deal with precise numerical data [190]. It is discussed that the advantage of using open-ended questions is to allow the interviewees to have more options of response. However, disadvantages are that it is time-consuming, more expensive and difficult to record accurately verbatim [191]. Recording of interviews can increase the accuracy of data, but Pickard argues that recoding the interview can make the interviewee uncomfortable and very careful of what is reported and how things are said [190]. The interview must then be transcribed. It is discussed that, depending on the research method, transcribing can be done either word for word or by including only pertinent sections. However, the researcher must be very careful in choosing the method of transcribing in order to keep all important sections in the analysis [190].

2.3.3.2.1.1 Translation

Word for word translation from another language into the English language has raised some concerns regarding details and concepts. This issue is discussed well by Strauss. He argues that translation should be kept to a minimum level: "*A main reason for some translating is so the English readers can get at least some degree of feeling about, or insight into, what the interviewee is saying and thinking as well as a sense of what the coding looks like. On the other hand, the difficulties of accurate, let alone nuanced translation, are legion. Few of us are specially trained or natively skilled at overcoming those difficulties, especially for extended passages. [...] For presentation or publication in a country other than the one in which the data were collected (if the language is different), key passages and their codes can be translated, approximating the original as closely as possible*" [192].

2.3.3.2.2 Documents

Documents are another source of data for research. They can be used in practical and political decisions making for daily routine or long-term planning [193]. Scott (1990) defines a document as follows:

“A document in its most general sense is a written text. Writing is the making of symbols representing words, and involves the use of pen, pencil, printing machine or other tool for inscribing machine the message on paper, parchment or some other material medium. [...] Similarly, the invention of magnetic and electronic means of storing and displaying text should encourage us to regard files and documents contained in computers and word processors as true documents. From this point of view, therefore, documents may be regarded as physically embodied texts, where the containment of the text is the primary purpose of the physical medium” [194].

The type of documents that are used in research depends on the nature of the study. For instance, positivist research would make more use of official government statistics and reject more informal reports, while phenomenology research might appreciate the unofficial documents [195]. Creswell explains the advantages of this source of data as follows: It provides a possibility for studying the texts in the original words with no need for additional recording and transcription. However, he considers incompleteness of the record, travelling costs, difficulty in authenticating documents and difficulty in obtaining access to documents as its disadvantages [187].

2.3.3.2.3 Observation

Observation is a very useful method to gain some information on the understanding of the research setting context and the interviewee's opinion [195]. It is discussed by Denscombe that this method depends on what a researcher sees from an event rather than what people say they do [196]. It can be in a natural venue or in a laboratory environment. It also can be conducted via participant observation or even through non visible presence of the researcher [197]. The observation can be free in that the researcher notes down what happens, or it can be structured and based on a pre-defined checklist [197].

2.3.4 Data analysis

Creswell suggests different approaches for data analysis depending on study design. Databases of qualitative and quantitative should be analysed separately at the beginning of a mixed method analysis. Quantitative method analysis is carried out based on the objectives and questions of the research project, whereas data coding and labelling are the primary activities in data analysis in qualitative methods. The first method of data analysis is triangulation analysis. According to this method, two sets of results are merged to give a comprehensive overview of the data. The second method, sequential data analysis, is used for embedded, explanatory and exploratory studies. The purpose is to use the data from the first dataset to enlighten the second dataset. According to this method, the information from the first dataset is reviewed in a separate analysis and those results that are important are selected to explain the second dataset [198].

2.3.5 Data presenting

Qualitative data presenting is an important step in qualitative research. Qualitative research is characterised by gaining rich and comprehensive data. Needless to say, the whole data can not be presented in the final writing up. Bryman discusses that leaving out the data is "painful", but that it is necessary to compress the data. Otherwise, any argument would be meaningless [199]. In presenting the qualitative

results, it is important to articulate a key story. This is undertaken by selecting data to illustrate and to exemplify the data [200]. Data can be presented in different ways. It can be presented in a natural way with the aim of keeping the natural flow of a story. Alternatively, the presentation can be based on a specific order such as from the most simple to the most complex or from the most important to the least important [201]. The balance between interpretation and quotation depends on the aim of the study. For example, if the study aims to explore the feelings of a group of people about a specific issue, this group's voice should be quoted with little interpretation by the author. On the other hand, when the author has identified themes from the data, he will use the quotes to support these themes, something that is done in grounded theory [200].

Summary

The WHO health information framework introduces the key elements of a standard health information system. The framework considers the health information as a system with three dimensions, including input, process and output. Input consists of some preparations to establish a health system. Process involves activities from data collection to data analysis, whereas output is concerned with data availability and data usage. Although this framework has some weaknesses, it is a very comprehensive and useful tool to assess a health information system.

The next chapter is going to discuss the points appeared in the literature on health information system.

The literature on health information systems in developing countries reports the following problems in one or more countries: In terms of data capture, scarcity in financial and human resources and a lack of infrastructure for using technology are pointed out. When it comes to the data handling, it is mentioned that no defined mini set leads to repetition and increases the staffs' load work. Finally, quality checking is rarely undertaken and there is low utility of data in decision-making.

There are different aspects of ethical issues which should be considered in conducting research, including access to the field, informed consent and confidentiality. A mixed qualitative and quantitative method is deemed a useful method to gain a deep understanding of a topic. Purposive sampling and interviews are discussed to be suitable methods to gain rich data.

Chapter 3 Methodology

In this section the methods undertaken in this study will be discussed. It consists of two main sub-chapters, outlining the qualitative and quantitative part of the study. Each research design is presented separately. In the section on the qualitative study, the methods of sampling and data collections are discussed explicitly. Also, the preparation undertaken before commencing the study, including the interview topic guide, is discussed. In the section outlining the quantitative study, the method of data collection and the way the data has been extracted are outlined.

3.1 Research strategy

As was noted in section 1.1.2, a mixed qualitative and quantitative method seems suitable for this study as it provides a better understanding of the problem. This research commenced with numeric results of maternal ratios and then employed qualitative methods to gain a better understanding of the data collection system.

3.2 Research Design for qualitative research

Qualitative research investigates mortality data collection systems, focusing on the methods used for data collection, processing and analysis in disaster and non-disaster situations. It also includes the investigation of maternal mortality data at the Family Unit which is independent from the Civil Registry and the Statistics Unit. In this sub-chapter, the methods used for sampling and data collection in the qualitative study are discussed.

3.2.1 Sampling

I applied purposive and probability sampling which is explained in the literature review chapter in section 2.3.3.1. Regarding purposive sampling, a list of the job titles of the interviewees was prepared based on my previous knowledge of the system including the Civil Registry Office, the Statistics Unit in the Health Departments in Kerman, Bam and Tehran, and the cemetery office in Kerman.

Selecting Rural Health Centres based on their distances from Bam was discussed due to the possibility of a distance effect on the interview results. As a result, villages the furthest, nearest and at a medium distance from Bam were selected to be studied. The reasons for not including more villages in the sample were, apart from time and financial limitations, lack of safety at the fieldwork site and lack of a proper transportation system in the region. The respective region has had many problems regarding safety because of issues associated with opium smuggling. As the data collection system is centralized, it is however likely that this approach generated an adequate sample to give a representative account of the system. While doing the fieldwork, I realized there were 18 Rural Health Centres, each of them cover approximately three to five Health Houses. Three Rural Health Centres were selected based on the distance, and subsequently, one health house was selected randomly from each Rural Health centre. Urban Health centres were also selected randomly. During my fieldwork, I discovered the Family Unit as another source of maternal mortality data. I therefore included two additional interviews with people working at the Family Unit in Kerman and Bam. In order to enrich my data, I had a number of conversations and interviews with informants from Kerman Medical Sciences University and from Kerman Health network.

Taken as a whole, all interviewees were the only source of information. In other words they did not have replacements. However, this was not the case with the staff working in the Rural and Urban Health centres, and health houses. Therefore, they selected randomly.

3.2.2 Data collection method

In this study, interviews, a review of documents, and personal observation are the main methods of data collection. To collect the data, I made three trips to Bam, the first one for arranging accommodation and gaining permission to conduct research, the second one to conduct the interviews and the last one to visit the Rural Health Centres and Health Houses. Two trips to Tehran and the remainder of my research was done in Kerman.

3.2.2.1 Interview

Interviewing was deemed the best approach to attain the study objectives. Interviews can produce valuable information, which is not available either on the web or in books about the data collection system in Iran. In addition, they provide an opportunity for interviewees to express themselves and their feelings on the topic, which may be very useful to achieve a deep understanding of the system. Another advantage of using interviews is that they provide an opportunity to observe the interviewees in their workplace milieu, and it also increased the response rate.

Before heading to Iran, a set of open ended questions based on the interviewees' responsibilities were prepared. As a result, the questions for data collectors and data holders were different. The main aim was to cover as many aspects of the WHO health information metrics framework as possible. In addition, due to a lack of background information on the topic, I had to ask some general questions at the beginning of the interviews, such as the interviewee's responsibilities and the flow of their work. My data were enriched by asking some additional unplanned and probing questions.

I met each of the interviewees twice; once to explain my study, to show them the permission letter and to seek their consent. I then arranged the interview for another time. At the beginning, I planned to make appointments by phone but found that it was very time-consuming as the phone lines were very busy. In addition, I thought that a face-to-face account might increase the response rate. I started my interviews from the Family Unit and Statistics Unit in Kerman (provincial level) and then interviewed informants in Bam and its rural areas (local level). Consequently, I performed more interviews in Kerman including in Forensic Medicine, the Cemetery Office, the Statistics Unit in Kerman, the Health Network, the Civil Registry as well as the unplanned conversations. The last attempt to conduct interviews was undertaken in Tehran (national level) although it was mentioned that they could not provide information about data collection.

I did not record all interviews as I found that some respondents were too cautious about what they were saying, and were giving me information on what they were supposed to do rather than on what they were actually doing.

I transcribed the recorded and wrote reports on the unrecorded interviews on the day of the interview. In terms of translation, at first I intended to translate all interviews word for word because of more accuracy of word for word translation but I realized that this type of translation, for some sentences, may be vague for English readers. Therefore, I decided to translate in a way that would make it feasible for the reader to understand the context while including all important points. Therefore, I decided to translate word for word as far as the context was clear and use free translation when word for word translation did not give a clear meaning. I did not transcribe all interviews in their entirety because some interviewees told their personal story of earthquake replete with lots of sadness and affection which I preferred to not translate from the point of ethical consideration and their irrelevancy to my research. Following each interview, I reflected on the interview from different views, such as the interview context and environment, the interviewees' response and behaviour in order to decide how to prepare for the next interviews.

3.2.2.2 Documents

Documents were an important source of information because my study is based on routine data collection. In addition, they have an important role in developing either the background information or the main data. This study looked at two types of documents: governmental publications and the routinely collected data in the different organisations described earlier. The main drawbacks of this data source were that the process was time-consuming, access to documents was not easy, and many documents were incomplete.

3.2.2.3 Governmental Publications

During the interviews, I was referred to some documents, all of which were governmental publications, such as those at the Health Ministry, Kerman Medical Sciences University, Death Registry Office and Forensic medicine. Almost all of them were not publicly available. I also obtained other valuable documents relating to background information from the Health School Library and Kerman Management and Planning Organisation.

3.2.2.4 Observation

My personal experience of obtaining data, of their availability, timeliness and storage plus my observation of interviewees in their workplace provided me with tangible information on the data collection system in the study setting. Furthermore, living for a few days in Bam for doing the field work and visiting some of my friends working in Bam provided a valuable opportunity to know how living condition would be after the earthquake

3.3 Data analysis methods for qualitative data

The interview analysis started as soon as I listened to the interviews to transcribe them. My knowledge of the data was developed by reading the transcripts several times. I then organised the transcription based on the interviewee's job. It helped me to gain a general picture of my data. It also helped me to identify similarities and differences between different respondents and analyse them with regard to their occupation. Data collectors (**DC1 to DC10**), data compilers (**DCO1 to DCO6**), data entry administrators (**DEA1 to DEA4**), data processors (**DP1 to DP3**), policy maker (**PM1 to PM3**), informants (**INF1to INF6**) were the main category of the respondents. The questions are asked by the interviewer are marked by "**In**".

Data collectors are defined as anybody who collects the data in the rural or urban areas, whereas data compilers are those who collate the data manually before sending it to the data entry administrators. Data entry administrators computerize the data; data processors collate the computerized data and can potentially calculate the indicators. Informants are members of staff who are not connected directly to the data collection procedures but are aware of the procedure of data collection and might have supervision roles in the data collection process. Policy makers are interviewees involved with decision-making.

I did not label the respondents as rural, urban, local and provincial in order to keep confidentiality. I read each transcription systematically to identify the main themes that emerged from each interview, bearing in mind the WHO framework of input, process and output as the main topics. I found additional themes which were not covered by WHO framework. I wrote each key issue that emerged from the data on the margin of the text, next to the sentence. After several readings and thinking about

the themes, I decided to divide the themes under three main headings; WHO framework, interviewees' concerns and earthquake-related issues. The sections labelled WHO framework dealt with the structure of the systems, whereas those labelled interviewees' concerns dealt with the respondents' concerns, suggestions and opinions about their jobs with the potential to affect data collection. Earthquake-related issues discussed problems that occurred after the earthquake and affected the data collection.

This type of classification sounds very mechanical and made it difficult for readers to follow the flow of results. I therefore decided to choose a more fluent and natural strategy to present my results. As achieving a natural flow of data was my main aim in presenting the results, quoting all interviews was not a suitable method. Therefore, I decided to quote interviews which tell the key story and make sense of the data. I also described those parts of the interviews that related to data analysis and organisation publication. I decided this because it would have been too repetitive if I had quoted what they said and therefore articulated it through my own words.

The non numeric results are presented in the three sub-chapters. The first sub-chapter of my results explores the data collection flow in a non-disaster situation with respect to death notification, data transferring, data processing and data utility which are labelled as *data capture*, *data handling*, *data usage*. Although the themes have different label to the WHO framework, the content includes the WHO framework. The data are extracted from the interviews, observation and conversations. This sub-chapter aims to explore the method of data collection and processing in the Civil Registry and in the Medical Sciences University in non-disaster conditions. It is very useful to flag existing shortcomings within the systems. Consequently, it would allow the understanding of inconsistencies between different data sources.

The second sub-chapter aims to study data collection after the earthquake by addressing the question: What effects did the earthquake have on mortality data collection?

The data are presented under two main headings: data collection immediately after the earthquake and ongoing data collection after the earthquake. Also, the problems with ascertaining the cause of deaths are discussed. The data are extracted from the interviews with informants.

The third sub-chapter gives an account of the maternal mortality data collection at the Family Unit with respect to the maternal mortality committee guideline. The results of this chapter are presented based on two groups of data: The first one, which is obtained through documentary analysis, is an overview of the policy of the maternal mortality committee to report maternal deaths. This is compared with the second group of data gained through the interviews. .

The data extracted from the interviews are presented into two forms; if they are taken from recorded interviews, they are printed indented and in italics; if they are taken from the non-recorded interviews, they are printed indented, in italics and marked by brackets {} .

3.4 Preparation for field work

Before beginning the fieldwork, some concerns arose regarding the best method to use for undertaking the research. The following is a brief description of those considerations.

3.4.1 Ethical consideration

As explained in section 2.3.1, each study raises its own ethical issues. In my study the following ethical issues are considered as the main concerns prior to commencing the research.

Permission letter

Based on my personal experience of working in Kerman Medical Sciences University in Iran, I knew that to do research or to access health data, it is necessary to have a permission letter from the chancellor of Kerman Medical Sciences University or one of his deputies. This meant that there was a possibility that I would not be allowed to interview staff or have access to the data. The permission letter is obtained by a formal request by the researcher to the chancellor of Kerman Medical Sciences University. Therefore, a letter requesting permission was prepared, and included the following information: my name, university name, the title and the aim of the project. I also enclosed a letter from my supervisor which explained the necessity of doing this field work for my PhD project.

Consent form

The necessity of having a consent form was discussed in the supervision meeting. I explained that, based on my personal experience of working in the research field at Kerman Medical Sciences University and familiarity with the culture, it might be better to not use a consent form and instead obtain verbal consent. I was concerned that it would reduce the response rate or lead to inaccurate responses. However, I knew that the respondents consent is a very important issue, so I suggested fully introducing myself, explaining my research including the aim and objectives, methods and the possible usage of the research to the participants verbally and by leaflet. If they would give verbal consent, I would interview them. I also would like to clarify that all interviewees were in a position of power to express their unwillingness to participate in the study, and I was in no way able to force them to be interviewed.

Confidentiality:

Another issue of consideration was confidentiality. In order to keep the respondents' anonymity I gave an abbreviation to all interview notes and tapes. I also considered the possibility of performing the interviews in a private place when necessary. Another point was that, due to the organisation of power/employment in the health system, it may be possible to identify the interviewees based on the information given, so I had to be very careful in presenting data in the results and discussion.

3.4.2 Leaflet

In order to give more information, I prepared a leaflet containing information about my study, its objectives, and my name and address in English. It was revised and approved by my supervisor. Then, the final version of leaflet was translated to Persian.

3.4.3 Voice recording

Knowing the work culture, I was aware that using tape recorders may make the interviewees uncomfortable and too cautious about their responses. On the other hand having a complete and accurate record of the interview encouraged me to use it. As a result, I decided to initially use it and see if it influences the interviews, but then stopped using it in most of the remaining interviews.

3.4.4 Topic guide

A structured guideline can have an important role in helping to be organised during the study. Therefore a guideline was designed and included the following content: an overall timetable with the order of achieving different stages of project in Kerman and Tehran. A series of tables were also prepared presenting the study objectives, the tools required to gather the data, a list of potential interviewees, topics to address in the interviews, and the approximate time needed. Also, alternative interview questions according to the type of objective and interviewees were prepared.

Here is a brief description of the guideline elements.

Guideline tables

These tables describe the methods, interviewees, documents and approximate time needed for each objective. The methods table gives the details of interview prompts used and the type of data to be obtained in each objective. The interview table introduces some potential and expected interviewees. The table of questions details topics of questions, which include the central themes that were designed based on WHO health network information. The last table is the approximate time needed to do the interviews. The approximate time needed for travel, writing and interviews were determined based on the objectives and the number of interviews to be undertaken.

Interview question guides

The interview questions guide was designed according to the WHO health metric information, and covered the input, processing and output sections of the data collection system. In order to have a smooth and in-depth interview some general questions such as the interviewees' responsibilities, and the problems which they face in data collection/processing were included.

Practice interviews prior to departure

Practice interviews were performed with my supervisor in preparation for the research. In the practice interviews my supervisor played different interviewees' roles to demonstrate how different people's attitudes may be in the interview, and what I could do to control the interview. She explained that the introductory part of

the interview is very important and a proper introduction gives more credibility to my project. She recommended explaining my position as a PhD student at Edinburgh University at the beginning of the interview and then explaining the objective and aims. Being non-directive, and non-judgmental during the interviews were other issues that were practiced. She also emphasised asking follow-up questions to gain a greater depth of information and to avoid asking leading questions. In addition, before my fieldwork I had an opportunity to attend a very useful course entitled “Research skill in social science: data collection”. I found the workshop sessions particularly useful as they provided me with an additional opportunity to practice my interview skills with other students and to have the tutor’s feedback.

Interviews planned

Based on some documents, university web sites and also my personal experience of working in Kerman Medical Sciences University the expected interviews were outlined in Table 3.1. Each column indicates the expected interviewees, and a checkmark for the interview topics to be discussed.

Table 3.1: The interviews planned for each objective in Iran

	Child mortality	Maternal mortality	Live births	Death registration	Health data in general
Deputy for health					✓
Deputy for treatment					✓
Behvarz in Bam (1,2,3)	✓	✓	✓	✓	
Administrator of Statistics Unit in the health department	✓	✓	✓	✓	
Administrator of Statistics Unit in the treatment department	✓	✓	✓	✓	
Informant in Civil Registry			✓	✓	
Forensic Medicine	✓	✓		✓	
Data holder of maternal mortality in Bam network		✓			

Table 3.1 (continue): The interviews planned for each objective in Iran

	Child mortality	Maternal mortality	Live births	Death registration	Health data in general
Data holders in Bam hospitals (private/ public)	✓	✓	✓	✓	
Midwife interview		✓	✓		
Informant in the Health Department for maternal mortality (Tehran)		✓			
Health Department for child mortality (Tehran)	✓				
Health Department for live births (Tehran)			✓		
Administrator of Statistics Unit (Tehran)	✓	✓	✓	✓	
Death Registry (Tehran)				✓	

3.5 Changes to methods once in the field

The working procedure was slightly different in practice from what I had expected. This was because there are very few documents about Iranian data collection system on the Internet, and there were changes in some routines, such as requesting maternal mortality reports from the Family Unit and establishing a death registry system under the Medical Sciences University. Also, there were some cultural differences that made me make changes in the field to some of the preparation I had undertaken for my work. Here is a brief description of those changes.

3.5.1 Permission

In a formal meeting with the Deputy for Education I found that there was a newly established unit under the Education Department known as the Scholarship Unit, which deals with all scholarship/academic issues. It was clarified that I can get a letter granting permission from this unit rather than from a meeting with the chancellor of Kerman Medical Sciences University.

An official letter was issued showing that I am a scholarship student and need to work in Iran on certain areas, thereby granting me access to the deputy for health, treatment, research, forensic medicine and the cemetery office. It then was signed by the Deputy for Education, and was the first approval letter, which allowed me to start my study. The next stage was to go to the relevant organisations and ask their permission to do interviews. The interviewee's consent then was sought.

Although having scholarship student status approval from the Health Ministry and having previous experience of working in the Kerman Medical Sciences University facilitated gaining permissions at all levels, I encountered some difficulties when dealing with the local authority in Bam. I discussed this with one of the informants. She/he mentioned that this is because of the political considerations when working with foreigners.

3.5.2 Leaflet

A leaflet was given to most of the interviewees. The reason that I did not give it to all of the interviewees was that, during practice interviews with some of the health

staff, it was suggested by those in the lower positions with no academic training that the best way to inform them about the research is to give them a very simple and non technical explanation of my study instead of a leaflet (explained in page 12). Hence, I decided to give verbal information to this group of interviewees. However, it was kept in my mind that they should be informed as much as the other groups and I was as thorough as possible.

Here is an example of the way I explained the study to them.

I am one of your colleagues in Kerman Medical Sciences University. I am studying the data collection methods on births and deaths in general, and maternal and child mortality in particular. The focus of this study is the Bam earthquake and changes in maternal mortality over this time and the way the data were collected. I do not know the system very well as I have been away for nearly 2 years because I am a scholarship student sponsored by the Medical School at Edinburgh University. I am sure that you have a very important job in this field and can help me so much. In this interview the main questions are on the routines that you are doing and the data collection procedures used. The data will be confidential and your identity will not be disclosed to others. One of the analyses of this data is comparing this system to a standard system to give suggestions to improve it. If you have any questions before, during or at the end interview I am very happy to answer them.

As my research progressed I realised that with this method I could develop a rapport with the interviewees and have smooth interviews.

3.5.3 Voice recording

I recorded some of the interviews but not all as I realised recording their voice made them very cautious about what they were saying and made them uncomfortable. Another problem with recording was that some interviewees told me the expected method of doing their job, not what they were actually doing. Obtaining different and sometimes conflicting responses with recorded interviews on the same subjects made me think that it might be due to using the tape recorder. For instance one of

interviewees stated that the data from one of the related organisations are obtained by sending a specific representative to that organisation with a formal letter. I tried to schedule an interview with the representative but then realised that there is no such representative. Subsequent interviews clarified that the above mentioned organisation does not send data to the Medical Sciences University. Later on, I found out that sending a representative is one of the methods of collecting data described in an official document [117], but not used in practice. In addition a few people did not allow me to record their voice such as one of the Behvarzes. To tackle this problem of inaccurate data I performed some additional unplanned but related interviews without a tape recorder, to be sure of avoiding this sort of misleading response. Rich information relating to the actual methods used was gained through these unplanned interviews. Overall, 27 planned interviews and 4 unplanned interviews were performed, of which 10 were recorded interviews. In addition, I had some technical problems with the tape recorder. I was using a digital voice recorder which records the voice with high quality for approximately 3 hours. Therefore, I would transcribe the interview and then record it to a non digital voice recorder to have a document of my research. After that I would need to erase the records from the digital voice recorder to prepare for the next interview. However at the beginning of the fieldwork I exceeded the time limitation for the digital voice recorder and therefore lost a part of one of my interviews. I also lost a part of another interview due to an unexpected change in the interview time by the interviewee before I had time to prepare. The recorded and unrecorded interviews are presented in Table 3.2.

3.5.4 Topic guide

The prepared topic guide helped me to be organised at the beginning of my field work. However due to some unplanned changes I had to be flexible and adopt more suitable methods to do my research, which was not detailed in my prepared topic guide. Here these changes are outlined.

- ❖ Maternal deaths were reported to the Family Unit in the Health Department as well as Statistics unit
- ❖ There were no exclusive records of child deaths; indeed, they were recorded with all the other deaths

- ❖ The Health Department is the only place to record deaths in Kerman Medical Sciences University
- ❖ Gaining rich information on some topics encouraged me to do more unplanned interviews
- ❖ Having some unplanned and informal discussions provided useful information
- ❖ Some additional relevant questions were used that weren't covered by the prepared questionnaires

3.5.5 Further practice interviews (in Persian)

Before beginning my interviews in Iran, I performed some practice interviews with a number of my former colleagues who are still working in the hospital as midwives or paediatric ward secretaries. During these interviews I became aware of some points which were potentially important to optimise further interviews. These pilot interviewees found that the interview questions were acceptable, and judged the questions would not be perceived as insulting or threatening. However they suggested the following points in order to make the respondents more comfortable:

- ❖ Appreciating the importance of the interviewee's job as it would improve communication with the interviewees who have a lower academic degree than the interviewer.
- ❖ Having a friendly opening part in the interview by introducing myself as one of their colleagues instead of a PhD student at Edinburgh University. They argued that it would make the participants feel that they were almost on the same level with the interviewer and make them more comfortable. There can also be a sense of distrust of foreigners in some situations, and I did not want to be perceived as working solely for a foreign university. It was suggested that a full introduction of my current academic position be explained later in the interview.

3.5.6 Unplanned interviews or discussion

In the course of my field work, I had the opportunity for some unplanned conversations that provided me with additional and valuable information on the topic.

Table 3.3 presents the unplanned discussions and interviews performed during fieldwork and the type of information obtained.

I started my interviews with the Family Unit and Statistics Unit in Kerman (provincial level), then with informants in Bam and its rural areas (local level). Consequently, I performed more interviews in Kerman, including Forensic Medicine, the Cemetery office, the Statistics Unit in Kerman Health Network, Civil Registry, and other unplanned conversations.

The last interviews were done in Tehran (national level).

Table 3.2: The interviews undertaken as per prior plan

Interviews undertaken	Child mortality	Maternal mortality	Live birth	Death registration	Recorded	Health data
Deputy for health						✓
Administrator of Family unit (Kerman)		✓			Partially recorded	
Administrator of Statistics unit in the health department (Kerman)				✓	✓	✓
Administrator of Statistics unit in the treatment department (Kerman)				✓		✓
Administrator of statistics unit in Civil Registry (Kerman)			✓	✓	✓	
An Informant plus the statistics administrator in the Forensic medicine (Kerman 1,2)		✓		✓		
Administrator of Family unit (Bam)		✓			✓ (It crashed after transcribing)	
Behvarz (1,2,3) (Bam)	✓	✓	✓	✓	✓ (not with number 3)	
Nursing manager (maternity hospital, Bam)		✓	✓		✓ partially	
Midwife interview (Maternity hospital, Bam)		✓	✓		✓	
Nursing manager (Private hospital, Bam)	✓	✓	✓	✓		
Statistics administrator (general public hospital, Bam)	✓	✓		✓	✓	
Paediatric and neonatal ward's secretary (general public hospital, Bam) (1,2)	✓				✓	
Health technician Rural Health Centres (Bam) (1,2,3)	✓	✓	✓	✓		
Health and midwife technician in the Urban health centres(Bam) (1,2,3)	✓	✓	✓	✓	One of them recorded	
Administrator of Statistics unit in research department (Tehran)	✓	✓	✓	✓		
Administrator of Statistics unit (Kerman health network)						✓
Administrator of Statistics unit in Cemetery office (Kerman)		✓				
Administrator of Family unit Health department in Health Ministry (Tehran)						He refused to be interviewed as he stated he did not know any thing about data collection
Administrator of statistics unit in Bam health network					✓	

Table 3.3: Unplanned discussions based on each objective in Iran

Informal chats	Child mortality	Maternal mortality	Live birth	Death registry	Health data
Administrator of development of health network			✓		✓
Administrator of midwifery issue			✓		✓
Informant in Health department for death records(Tehran)				✓	
Infectious disease control administrator (Kerman)					✓ (she gave me some data on the remote areas)
Stat staff					✓

3.6 Research Design for quantitative research

In order for me to conduct the quantitative research I needed to obtain the routine data collected by different sources. Therefore the following data were gained following the interviews: mortality for 5 years (2001-2006) from the Family Unit in the Health Department of Kerman Medical Sciences University, death records based on the individual from Statistics Unit in the Health Department of Kerman Medical Sciences University for 2004 to 2006, the total number of death records from the Civil Registry Office, and also the total number of live births for five years from the Civil Registry office and vaccination records from the vaccination unit in the Health Department of Kerman Medical Sciences University for five years. In order to gain the data an approval letter from the upper level representative of each unit was required to gain collaboration from staff in order to obtain data. However, it was not a straightforward process. The following paragraphs discuss this issue in each data source.

During an interview with the statistics administrator in Civil Registry Office, I explained to him that I needed the data on deaths and live births for the past 5 years. He directed me to another office which worked under his supervision, introduced me, and asked them to collaborate. They then arranged a date to have the data prepared. However, it was not done on time and required several visits. Sometimes, they said it was not ready because they were too busy, but finally, they said that recently the head of Civil Registry had changed so they needed another approval letter from the new head. A friend in Kerman Medical Sciences University told me that the Kerman Province Governor also has Civil Registry data, and suggested to ask them for the data. They however said that the single source of these data was the Civil Registry, though they then gave me another recommendation letter to allow access to the Civil Registry data. Part of the data was not accessible due to technical problems in Kerman Civil Registry requiring a trip to the central office in Tehran to obtain the rest of data.

Regarding the mortality data recorded at the Statistics Unit of the Health Department at the Medical University I needed an approval letter from the deputy for health. This formally allowed me to have access to the data but, similar to my experience at the

Civil Registry; the process was again not straightforward. The request for data on deaths was given to the interviewee on the day of interview, and a date arranged to provide the data. The data were not prepared on time and I found out that I should contact a new staff member who was recently employed to obtain the data. The new staff member did not, however, know how to work with that software and required help; this further delayed the data extraction. The data were reported to have been recorded for the past 5 years, but were not accessible for the first two years. This was apparently due to technical problems, such as poor compatibility with other software and some problems in the hardware which even made it impossible to turn the computer on. Then I asked Tehran (Health Ministry) for these data but they could not due gain access to them due to the same technical problems. As a result I could only get data on the past 3 years. In terms of maternal mortality data at the Family Unit, as mentioned, these data were supposed to be kept in the Family Unit in the Health Department of Kerman Medical Sciences University. However, during the interview I realised that they were in the hands of the deputy for health. Therefore, I had to make an appointment just to seek the deputy for health collaboration to obtain access to the data. These data are collected in order to investigate maternal deaths to find the cause(s) of maternal deaths. They were in written form and included comprehensive documents of general information of the deceased such as age and place of residence, as well as medical results and interviews with many relevant people such as the midwife, husband and the doctor. Therefore, I extracted the data from those files, and checked the data twice to avoid of any mistakes. It was a very time-consuming and tiring task.

Regarding child mortality data, unfortunately there was no data on child mortality specifically. They were recorded with all other deaths.

Taken as a whole, I have made every effort to get complete data during my visit and I do not think it is possible to get access to further data.

A summary of the data I could obtain from different sources are presented in Table 3.4.

Table 3.4: Data obtained from different sources

Data sources	Data obtained
Civil Registry	Total deaths in integrated forms for 5 years (grouping based gender, age, resident place)
The Statistics Unit	Total deaths for 3 years (in individual/original form)
The Family Unit	Maternal deaths for 5 years (in individual forms)

3.7 Data analysis methods for quantitative data

The numeric data are maternal mortality ratios over 5 years (2 years before and 3 years after the earthquake) in Bam from different sources. In order to compare different sources with different formats, I exported the Statistics Unit data which were originally in Access into Excel. Then I coded the data which were in Farsi into English. Afterwards, they were exported into SPSS. I sought some advice to write appropriate syntax to be able to recode the data. The final data were grouped similarly to the Civil Registry cross table output. The data from the family Unit initially were in paper form and were extracted from deceased files and computerised using Excel software. As noted there are three sources of maternal mortality data, the Civil Registry, the Statistics Unit and the Family Unit. Based on the primary objectives 5 years of data were needed. However the data of the Statistics Unit were accessible for only three years due to technical problems. Hence, they were not able to represent the effects of the earthquake on the maternal mortality. However, they were a good source of data for conducting case matching with the Family Unit data.

In order to estimate maternal mortality ratios based on the WHO definition, explained in the literature review, the number of maternal deaths and live births are needed. As was explained before there are three sources of data for maternal mortality. In addition, there is one official source of data for live births which is the Civil Registry. However, during the interview I realised that the related health staff use the number of children who receive the first polio vaccination instead of live birth records. They argued that these data are more complete than the Civil Registry data. Therefore two groups of maternal ratios are calculated; the first group uses the number of maternal deaths and live births recorded at the Civil Registry. While the second groups use the maternal deaths recorded at the Medical Sciences University and the number of children who received the first Polio vaccination as a surrogate for number of live births.

Then, the denominators and numerators of maternal mortality ratios from different sources were explored. This is followed by case matching of individual data of maternal deaths. This could not include the Civil Registry data because the Civil Registry does not make individual data accessible. However, it was still interesting to

know whether the Statistics Unit and the Family unit which are authorised by the same organisation, the Medical Sciences University, have the same data. Hence, the individual data from these units for three years are matched case by case. Data on the total mortality of Bam and Jiroft, a city which did not experience an earthquake, were gained from the Statistics Unit of the Medical Sciences University and from the Civil Registry. The data from the Medical Sciences University were grouped based on the grouping used in the Civil Registry. This was necessary to compare the data from the targeted organisations. The next chapter outlines the qualitative and quantitative results respectively. The first three chapters are qualitative results providing the main findings relating to data collection systems in disaster and non disaster situations, mortality data in general and maternal deaths in specific. The sub chapter presents quantitative results highlighting numeric results of maternal mortality ratios from different sources.

Chapter 4 Results

As explained in the methods chapter, the results are presented under four sub-chapters. The first sub-chapter includes an explicit explanation on the flow of data collection with respect to data capture, data process and analysis to the data usage stage and resource usage. In addition, it explores the systems to provide more insight to their function and help to understand the inconsistent results of sub-chapter four. The second sub-chapter shows the results that are related specifically to data collection in the context of the Bam earthquake. The main themes in this sub-chapter are mortality data collection immediately following and in the long term after the Bam earthquake. The third sub-chapter presents maternal mortality data collection at the Family Unit in relation to the maternal mortality committee guideline and what is actually done by staff on the ground. Finally, the last sub-chapter presents changes in maternal mortality which are estimations of maternal mortality ratios from different sources. The first three sub-chapters consist of non-numeric data explaining explicitly the systems and methods used to collect and process data, whereas the last sub-chapter comprises numeric results produced by different data collection systems.

4.1 Result (1): Data collection systems

There are dramatic differences in data collection and data processing between the Civil Registry and the Medical Sciences University. Each organisation applies its own system to collect and process data. The results of the study show that there are a number of shortcomings in different stages of the data collection system in each organisation which are discussed in detail in following sections.

4.1.1 Data capture

Data capture describes the way that the organisations which collate mortality data, the Civil Registry and the Health Ministry, are notified about deaths from rural and urban areas.

In relation to the Civil Registry, based on the current rules if somebody dies in a rural or urban area, he or she is required to be registered by his/her first degree relatives in the Civil Registry [115]. Based on the interview, death registration is free unless there is a judicial issue such as inheritance. Deaths can be registered in any branch of the Civil Registry. A small amount of money is charged as a fine for relatives who do not report a death [115]. However, the interview with the informant shows that the fine might not be applied. Also, it was discussed that if there is a judicial issue, such as insurance or inheritance, the relatives have to register the death for its financial benefits.

In: Do they have to pay money to register the vital events?

INF4: Death registration is free unless they need it for legal issues but birth registration costs a small amount of money (less than £1).

In: What is the legal time to register births?

INF4: It is 15 days for births and 10 days for deaths otherwise there is a fine, although this law is not applied (Further conversation with the judicial section of Vital Registry confirmed the above point).

In: Do people have to register a vital event in just their place of residence?

INF4: No they can register wherever they like.

Another matter of discussion in the fieldwork interviews was the establishment of a new committee at the national level to increase the coverage of registration of vital data. This committee has an aim to increase collaboration between organisations involved in recording data of vital events, such as the Health Ministry and Forensic Medicine, with the Vital Registry

In: Do they [involved organisations] collaborate with the Vital Registry?

INF4: Not really

In: Do they have to send these data to you, or do you have to go and get the data?

INF4: It depends on their workload and the distance. It is obvious that they do not leave their jobs to bring the data. Anyway, the new committee still has its own weaknesses

The interview found that low registration rates and late registration are perceived as the main problems with this type of vital events notification, particularly in the remote areas.

INF4: Generally speaking, there are two kinds of problems; late registration and low registration. Late registration means that people do not come to register in the designated time and low registration take places when people postpone registration until they need it. ... For example, a baby is born in the village and he does not need to have ID card until he wants to go to school or his parents want to have medical insurance..... Any way, it happens in the southernmost part of Kerman province where there are very remote and deprived areas with no access to the Vital Registry office. The same happens for deaths. Many people do it just because of legal issues such as inheritance or salary otherwise they don't do it.

On the other hand the Medical Sciences University requires different sources, such as health facilities (private/public), Forensic Medicine and the Cemetery Office, to send

their death data to the Statistics Unit in the Health Network [117]. The interviews found that these sources are required to send the data on specific forms designed at the Health Ministry. The process of data collection is different in rural and urban areas.

Rural areas

In rural areas, 86% of the rural population are covered by the Health Houses in the main village or a peripheral village[112]. In these areas the death reports are sent by the Health Houses to the upper levels in the rural facilities before sending them onwards to the Health Networks of cities and finally to the Statistics Unit at the Medical Universities. This is illustrated in Fig (4.1)

The interview found that death data from main villages are collected directly by the Behvarz, whereas the data from the peripheral villages are usually collected by word of mouth around the area, and also by conducting a periodical census. The following discussion relates to the data collection from peripheral villages.

In: How are you informed of deaths and births in peripheral villages?

DC1: This is a very small region so, all news is spread around the villages and I will be informed. I also have to visit the peripheral villages once a week.

In : Are you able to make it to all villages covered by the health house?

DC1: In fact, this is a huge burden of responsibility.....it is very difficult to go to the peripheral villages.

DC3: There is only one peripheral village which is attached to the main village so news is spread very easily. Also the census is another source of data for peripheral villages.... There is a census at the beginning of each year

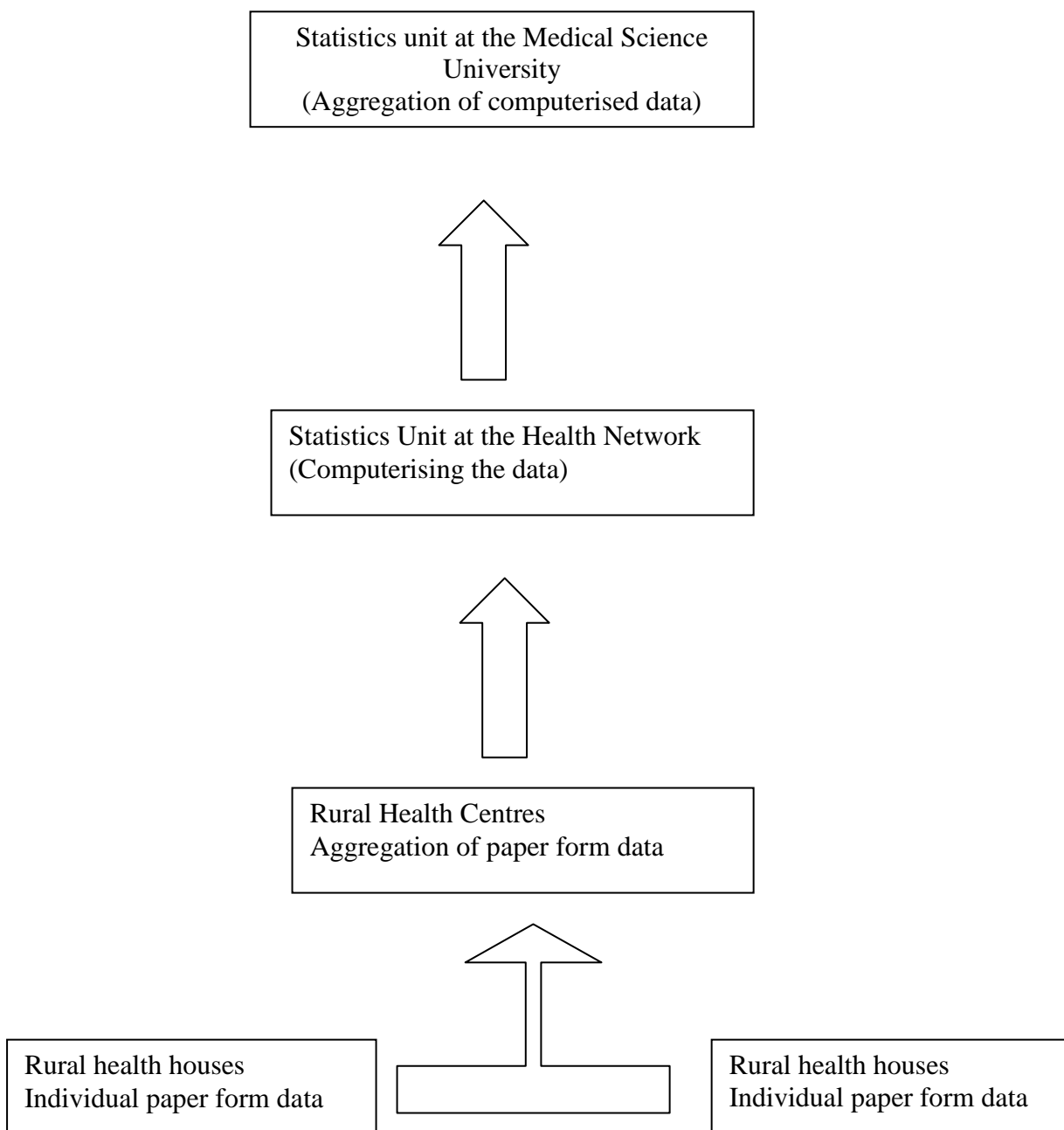
In: How often is the census is done door to door?

DCO1: The census is done door to door every 5 years but the population information is checked every year based on family files

A proportion of rural areas, 14%, are too remote and not covered by any of the Health Houses. A remote area was defined below, obtained from in an unplanned conversation with one informant in the Medical Sciences University:

{INF1: Those populations are living in places that are not near enough to any health centre. They can be a series of few houses or agriculture or a cultivation land with a family living there. They are covered by the mobile health group to receive vaccinations and some forms of family planning.}

Figure 4.1: The procedure of sending data from the rural areas covered by the Health Houses to the upper levels



Urban areas

In the urban areas, during interview I found that the flow of death notification to the Medical Sciences University is more complicated. It depends on where the death happens and which services are used to bury the deceased. Those deaths that occur in the public hospitals, not maternal hospital, are reported to the upper levels and then to the Medical Sciences University. Deaths that happen in one of the maternity hospitals in the cities do not report to the Statistics Unit.

In terms of private hospitals, there is inconsistency in sending data from different cities. The study shows that in one of the cities under study some private hospitals send data to the Statistics Unit while others one do not. The following quotation is taken from the interview with **DEA2** in response to the data sources.

{DEA2: the data sources are hospitals (only public hospitals neither maternity hospitals nor private hospitals), the cemetery office, rural health houses, urban and rural health centres, death registry organisation}

Furthermore the study revealed that non-hospital deaths in urban areas need to be reported to either private doctors or Forensic Medicine in order to have a death certificate issued, which is necessary to bury a corpse or to transfer a corpse to another place. However, these two sources do not send the data to the Statistics Unit at the Medical Sciences University. However, Forensic Medicine analyse its data and send a copy of the results to the Statistics Unit of the Health Ministry annually. In the interview with the informant in Forensic Medicine it was mentioned that their data is confidential. Also in a conversation I had in the Health Ministry it was mentioned that Forensic Medicine did not send the data to the Medical Science University because of their concern about confidentiality. The following quote is taken from the conversation with an informant at the national level in response to their problem in death data collection.

{INF6: lack of collaboration of forensic medicine as they believe their data are secret. They only send data once a year in an integrated form. }

All deaths, regardless of whether they occur in a hospital or another place, need special services such as washing the corpse, renting an ambulance, and carrying the dead body to his home for a final farewell. The interviews revealed that these services can be obtained from private or semi private services. However some of the dead bodies may also be transferred to another location for burial, such as the deceased’s home town, using a personal vehicle and not necessarily using all of these services. From all mentioned services the only sources which send data to the Medical Sciences University is the semi-private service which is under the supervision of the municipality.

{In: Do all cases use your services [burial services]?

DEA3: No there is another private company that provides the same services for people who live in the other cities or suburb areas without registering [deaths]. Also sometimes people transport their deceased relatives using their own car and take them to their village for burial but in Kerman they have to come here to access services to wash and burry.}

Further interview with relevant people confirmed that the only source of data from cemetery offices is from the semi-private cemetery office.

The data sources for each city is presented in Table 4.1

Table 4.1: The data are sent to the Statistics Unit at the Health Network in each city

Statistics Unit at the Health Network	Sources of data
city 1	private hospitals, public hospital, Health Houses, and semi private Cemetery Office
city 2	Non maternal public hospital, Health Houses, semi private Cemetery Office

The above results lead to the question of whether there are any rules or obligations for data sources to send their data. The following data was extracted from interviews which reflected upon this issue:

{In: Is there any obligation from related organisations to send their data?}

PMI: Theoretically, yes but the point is that if they do not send [data], we can not do anything as there is no sanction}

4.1.2 Data handling

Data handling addresses how the data is processed and who deals with the data. The first issue will be answered through exploring the following issues: data entry & technology infrastructures, periodicity, accuracy of data and guidelines on using data. The second issue will be answered through exploring human resources using results reported in the resources section.

4.1.2.1 Data entry and technology infrastructures

The interview with the informant at the Civil Registry, INF4, shows that the original data are collected in written form and then computerised. The data are entered into special software designed at the Civil Registry in Tehran and sent to the all other branches. The deaths reported to the Civil Registry are classified into 17 groups based on ICD9¹ classification [117]. In an unplanned conversation it was mentioned that this software is not compatible with Office software, and therefore it is not possible to import the data into the Office software. The results of the interviews found that the Civil Registry had adequate hardware and software in all levels with internet connections with each other. The data are transferred through the internet to different levels.

Regarding the Medical Sciences University, the interviews with data collectors reveal the original mortality data are recorded on specific forms by Behvarzes and ward secretaries in the hospitals, in the rural and urban areas respectively. Thereafter,

¹ International Statistical classification of Disease & Related Health Problems

the data are integrated manually by the data compiler before being sent to the data entry administrators. The data are then recorded in electronic form by data entry administrators. Finally, the data are sent on floppy disc or CD to the provincial level. All of the Statistics Units under the Health Department, at the local and provincial levels, use the same software which is designed by the Health Ministry. It previously operated in the DOS environment but since 2004 a new programme has been designed to operate in the Windows environment. During the interview with the (DP1) it was stated that these two versions are not compatible and that there are problems with operating the old version. He/she mentioned that the new version of software has the ability to produce different reports based on different factors such as demographic factors

DP1: it is possible to have a record based on gender, age and other characteristics.

However, an interview with one of the data entry administrators (EDA1) found that she/ he was not aware of this ability.

{In: Is it possible to have a particular subgroup of data?}

DP2: If we need this I have to calculate manually as the death registry programme does not have these facilities}

Also, some interviewees from the local and provincial levels mentioned that their computers have not been working for a while and technical support is lacking.

{In: are the data that are saved accessible?}

DP2: No in fact the computer crashed one week ago and nobody has come to fix it yet. Another problem is that there are some floppy discs containing previous data but none of them are labelled or even can be opened}

Based on these interviews, it was also found that none of these sections are connected to each other through the internet.

4.1.2.2 Periodicity

The next point of interest of the results is how often data are sent. The interview at the Civil Registry indicates that the data are supposed to be transferred to the Civil Registry at the provincial level monthly. However this is flexible based on staff workload. The following citation addresses how often data are sent from the lower level to the upper level.

INF4: It depends on their workload; usually [data] are sent on a monthly base including total deaths according to gender. We then send the data by email to Tehran.

Regarding the Medical Science University the results of the interviews found that although data are required to be sent regularly, monthly, there is a delay in sending the data.

The shortage of personnel, multiple responsibilities of staff, undermining of rules by experienced staff and inadequate knowledge at the lower level are perceived by the interviewee (DP1) as the causes of the delay.

DP1:we have to tell them [peripheral levels] in advance several times to prepare these data otherwise they do not collaborate because they have much to do. You know, they are very busy with several responsibilities. Also nobody knows the importance of data collection. In general I think young staff work better as they want to prove their abilities while experienced people do not pay too much attention. I have heard in other countries each person works based on her major and has responsibility in only one area while we have to do lots of jobs.

In: Do the hospitals send their data regularly?

DP2: No we have to contact them several times to encourage them to send the data

However based on my observation during the fieldwork I would add that it might be because of low data usage and problems with the shortage and usage of computers as well.

Regarding the demographic information in both organisations, it was mentioned that identification cards are used to gain the information.

4.1.2.3 Accuracy of data

When a death is reported this question might be asked: which sources are used to extract information relating to the cause of death? The interview results show that the government has introduced a standard form as the death certificate. Based on the document, the Civil Registry considers the cause of death as that documented on the death certificate [115] Nevertheless, in cases where a death certificate is lacking, the Civil Registry relies on relatives' testimony for the cause of death [115].

In terms of the Medical Science University the interview found that death certificates are the main source of data for cause of deaths in urban areas. However, the interviews show that when a death occurs at home in the urban areas, a private doctor can issue the death certificate. The doctor might be inaccurate in the cause of death. Cardiac arrest was exemplified as a common error used as the main cause of death in interview with (DP1).

In the rural areas, there is no need to have a death certificate. However some villages which have GPs might have death certificates issued. Hence, if there is not a GP the causes of deaths are ascertained by a Behvarz. The following extract taken from an interview reflects on the Behvarz response on the determination of cause of death.

DC1: there are two sections for cause of death: main cause and grounded cause such as delivery, infection, aging. Then we write on the form and send it to the health network monthly..... but I do not know what main cause is

DC2: Natural death, grounded death such as accident, cancer or something like that and direct death such as natural death.

Following data entry, it is reasonable to find out whether there is any data checking. In the interview with informants at the Civil Registry the possibility of errors occurring and data checking were discussed. The following extract taken from the interview reflects on this.

INF4: some mistakes are detected by the software and some of them by the data entry staff.... It is possible to correct errors before printing a document. After printing it is very difficult unless there is a typing error

In terms of the Medical Sciences University, it was mentioned that in the interview with (DP1) that the software has an inbuilt ability to find some of the errors. Also manual checking by data compilers and some of the data entry administrators was mentioned as another source of checking of data (DE1).

In: Are the data checked for any mistakes?

DP1: Yes, for example, last year they (the Statistics Unit at the Medical University) asked us to recheck for a record of an old man with a diagnosis of measles that was a mistake.

In: How do you check the records of cities?

DP1:It is very time consuming. We take a report of deaths based on cause of death, age and gender. We then check the computerised data if there are weird cases based on age and cause of death.

Checking includes revising the data which has been entered by pencil before finalizing by pen and recheck the data with death certificates at the hospital before sending to the Health Network. Also, data from different sources such as the hospital and cemetery office are cross-checked before computerising to avoid any duplication.

However, the interview found that regular checking is not conducted at different levels.

In: Is there any way to check the data quality?

DP2: No there is no way to check the data. We have to accept whatever they send us

4.1.2.4 Guidelines

During the fieldwork it was clarified that there is a book at the Civil Registry entitled, “*A series of registration rules and regulation*” explaining comprehensively all information the staff needed. I could borrow the book. It is used as the guideline for registration of vital events. The book explains explicitly about the regulation for registration including which data should be extracted and who is eligible to report the vital events.

Regarding the Medical Science University, the interview with different levels at the Medical Sciences University clarified that there is no comprehensive guideline for data collection. Instead, when the Medical Sciences University needs certain data this is asked by a circular letter explaining which sort of data the data collectors should collect. My observation of borrowing certain circular letters show that the circular letters might be misplaced in a wrong folder or even missed out.

In: Have you had any guidelines on how to collect and send data?

DC4: There are some circular letters as guidelines

In: What is asked in each circular letter?

DC4: They ask, for example, to extract some data from a particular information source and then our head teaches us how to do that

In: Do you have any book or guideline that shows how to send data?

DCR1: No, we are asked to do so.

DCR2: No there are only some meetings held by health network to tell us whatever is needed.

DPI: There is a basic guideline and a guideline for completing the death certificate. I do not know if the guideline is available or not but as far as I can remember it mainly explained the software.

PMI: there is no definition or protocol.

Dp3: No there is not

Lack of guidelines and mini set of essential data were discussed to be two of main problems in the data collection system by one the interviewees, (PM1)

PM1: However I think in general our problem is worse regarding the data collection as there is no definition or protocol

Furthermore, lack of a guideline could result in the overburdening of staff.

The following extract from an unplanned discussion with an informant reflects upon this subject.

{INF3: Another problem is that other offices or upper levels of the health system ask us to calculate some statistics or prepare data but they are not in the same format. It makes our work hard as it is difficult to find different formats of data and calculate different statistics}

Also it causes extra work for data collectors. The interviews with data collectors in the hospitals revealed that they have to send mortality data to the Statistics Unit at the Health Department, and the Statistics Unit at the Treatment Department. Health Houses send death data through two forms: the Vital Zij form to the Development Network Unit, and a Health Ministry form to the Statistics Unit. The Cemetery Office send death data to different destinations using different formats, including the Statistics Unit in the Health Network, the Statistics Unit in the Treatment Department and the Civil Registry. The data sources for each unit are summarised in Table 4.2.

Table 4.2: The data sources and the report forms for each data collector

Data Collectors	Death Reports Forms	Destination
Rural data collectors	Vital Zij Statistics form	development of health network unit health department
hospital data collectors	Statistics form Mortality form Hospital mortality form	Health Department Internal committee hospital Treatment Department
Cemetery office	Statistics form Civil Registry form Death certificate	Health Department Civil Registry treatment department

4.1.2.5 Resources

Resources are considered to be one of the main requirements for a data collection system. Up to now the procedures that are undertaken by two organisations were discussed. Now it might be of interest to know whether there are enough resources to maintain the systems.

In terms of human resources, the results of the interview at the Civil Registry show that there are a few people with a background in statistics working in the Civil Registry. However, there were no experts with demography or epidemiology backgrounds. In the interview, the number of experts was not mentioned as a problem. Instead, an unplanned conversation with one of the members of staff with a statistics background pointed out that there is little statistical demand in their job, and

if she/he had another degree it would not make any difference as there is little data analysis performed.

The Medical Sciences University has many problems in human resources including shortages in the quantity of staff working in data collection /processing and having responsibility in multiple areas. The following section gives an account of the variety of responsibilities the staff have besides the data collection.

In the rural areas the data collections are undertaken by Behvarzes who have many other responsibilities including health care delivery.

DCO1: We do all health works including environmental health, family health, family planning and vaccination

DOC2: Family health and family planning, providing care for pregnant women and for[children] less than 5 years old , environmental health, mental health, schools' health and many other activities

DOC3: We have lots of responsibilities including family planning, vaccination, pregnant women care, child care, school health, environmental diseases and so on all of them are recoded in these logbooks. The monthly data are contagious disease, health school, family planning, pregnant women and vaccination. The vital Zij data are reported every three months

It was confirmed in the interview with one of the policy makers.

PM1: Another problem is the Behvarzes. In fact, we did not consider their abilities and only ask them to do huge health activities.

When it comes to the urban areas there are some staff working as secretaries in the public hospitals to collect and send data to the upper level. These staff have other responsibilities as well, such as patient admissions and discharge, and requests for medicine. The scarcity of staff was more pronounced at the private hospital. Data entry administrators stated further responsibilities such as helping other sections to type and enter their data. This was confirmed by my personal observation as I found

them busy with other responsibilities during the interviews or facing difficulties when I wanted to make an appointment for the interview.

DPI: there are huge amount of tasks we should do such as administrative jobs, family GP plan, health data, the health personnel employment work.

Dealing with a patient's needs and clients were mentioned as the main priorities for those who have many responsibilities beside the data collection. The following extract taken from interviews with different respondents shows their job priorities.

DC1: Pregnant women's control and vaccination

DC2: Childcare and family planning are the most important ones

DC3: I would say the most important one is maternal care

DC4: obtaining a patient's information before discharge, the next priority would be paperwork related to the patient's discharge then requesting medicines for a patient from the Pharmacy

DC5: Patient's discharge is the most important one, then requesting medicine from the pharmacy

The second problem is scarcity of experts dealing with the data. This study found that there are very few people with the appropriate academic degree working in the data collection system in the Medical Sciences University. The limited knowledge of staff working in data collection areas about the importance and utility of data is perceived by one of the informants in the interview as one of the cause of low accuracy of data.

Additionally being jobless after the end of the contract with the Medical Sciences University and the high turnover of staff are discussed as other difficulties in the interview.

{Dp3: when they (the staff) realise the importance of data they are replaced by somebody else}

The interviewee (DP1) stated her/his frustration due to the mentioned problems.

DP1: but it [data analysis] has not been done yet because my job does not have a clear position

Another matter is providing appropriate training for the staff. The interviews show that the only group receiving training about data collection is Behvarzes. They learn the strategy of data collection in addition to their other responsibilities in the Behvarz School. They also have monthly meetings with the Health Network, where they are informed of any changes in the routine. The Behvarz undergo a training course. However the other respondents report that there has not been any such training on data collection/usage for other staff before commencing their job or during their work. They pointed out that they learn the routine by their working experience or by the help of an experienced colleague. Nevertheless, my observation during the field work found that it was not easy for new staff to find experienced staff with time to spare to ask questions about the task. This compelled them to use trial and error for some tasks such as working with the software. The respondents stated that they are informed of any new requests or changes by a circular letter. The following quote is taken from interviews with different levels on this issue.

In: Is there any educational course for data collection such as the way to collect, periodicity and where you should send the data?

DOC1: No there has not been [a course] about data collection, no we did not have such courses but if there is any new circular letter on any changes in vaccination, for example the measles vaccine used to be administered at age 9 months and 18 months. Recently it has changed to 4-6 years and in turn its reporting form has changed. A training course has been held to explain it

In: who said to you to send the data like that?

DC1: In our training courses in Behvarz institution and in retraining meetings

In: What do they teach you?

DC2: It is about our routine work or any changes such as change in childcare

In: Have you had any training session on data collection?

DC4: No, I did not. I have learnt it while I was working.....

In: Have you had any training course before you started working?

DEA1: No I have learnt empirically

DPI: I could learn from her [her colleague] how to work with the software. When she left here there was nobody to do her job for a while. Then I had to take this responsibility.

DCO1: There has not been any training session at work or even in the university courses. We have to learn all our responsibilities from other health staff or empirically

In: Have there been any training courses for data collection held by the ministry?

PM2: For data collection no but when there is a change in programmes they inform us

In: How about data analysis?

PM2: Not at all

In terms of financial issues the interview findings show that there is no specific budget devoted to data collection and processing at the Medical Sciences University. Indeed, data collection and processing are undertaken in addition to other responsibilities.

4.1.3 Data usage

This section is going to discuss the issues that can affect data usage including data analysis, data availability and storage. Then the results of the interviews with different people, policy makers and people who deal with data, give two different perceptions of inadequate data usage.

4.1.3.1 Data analysis

The interview with the informant at the Civil Registry shows that the software has the ability to produce cross tables of total deaths distributed by certain factors such as age groups, gender, place of residence, and cause of death. The data (births and deaths) are also categorized as current events and delayed events. Current events are those which happened within the current year, and delayed events represent the events that happened in past years but were not registered until the current year. The interviewee mentioned that there are seasonal publications of vital events published by the Statistics Unit of the Civil Registry in Tehran (a sample of this was made available to me). These publications include the total number of marriages, divorces, births and deaths that happened in the country sorted by province, as well as some graphs indicating the changes that have occurred in comparison with the previous year.

Regarding the Medical Sciences University the interviews with people at different levels found that there is little analysis done routinely at the provincial and none done at the local level. In addition, interviews with the data processors found that there is an annual analysis and publication of mortality data for each province; this is carried out in the central office in Tehran. These data were based on the different provinces and categorized by different demographic factors. This report was made available to me, and is otherwise only available to those in the health system, not the general public. There is no publication at the provincial level.

{In: Do you apply any statistics to the data?

EDA1: No statistics are calculated in the deputy for health}

In: Are the results of analysis sent to the cities?

DPI: No, if it is needed we analyse the data for them but it has not been done yet ...cities can not do it.

4.1.3.2 Data availability and storage

In order for me to obtain the data from the Civil Registry it was necessary to have a authorisation letter from the head of the Civil Registry organisation. My personal attempts of data extraction and the information gained from interviews show that individual data are accessible to authorised staff only. If somebody requests the data, only the aggregated forms of data are available. In my study due to some technical problems I had an unplanned trip to Tehran in order to obtain additional data that were not available at the provincial level.

When it comes to the Medical Sciences University some problems about data storage were pointed out during the interviews or were observed during the field work. In an interview with one of the data entry administrators, it was noticed that they also receive data from the maternity wards on live births. However these data are stored away without use of a proper filing system and were not used or even really accessible. The following is extracted from the interview with DAE4:

In: Do you collect any data on live births?

DEA4: There is a form to send the data from maternity centres but it is not routine and these forms are piled here without applying any statistics analysis

In my personal attempts to obtain the data and from interviews I found that each office has its own storage method. Most of the written documents were stored in folders/ binders and some of them were misplaced in the wrong folders. Therefore, it was difficult for both the staff and me to retrieve the data. This was perceived as a major problem by one of the data processors. She/he pointed out that in order to calculate statistics they themselves have to find the data from different files from different units, which is very difficult because of poor filing methods. In an interview with one of the data processors it was discussed that there was drawer full of floppy discs without labels. She/he stated that many of these floppy discs can not even be read and she/he does not know what sorts of data are saved on them. This extract is taken from the interview about this issue.

{DP3:Another problem is that there are some floppy discs from previous data and none of them have labels or even can be opened.

...the offices have only crude data and I have searched all their files and finding the required data - that is a very tough job and very time consuming as they have their crude data that makes me search many files to find the relevant information and then extract the needed data. However if they need a statistic I have to calculate it for them using their data.}

Regarding the accessibility, my personal observation found that the data are accessible only to authorised staff and are available if there is a formal letter granting permission from the deputy for health or Chancellor of the Medical Sciences University.

Data extraction also needs collaboration from the staff to produce the data. My experiences of gaining data show that the availability of data is not easy either in the Civil Registry or in the Medical Sciences University.

In both organisations the type of software used for handling data was changed over the time. The data relating to the two first years of the study were difficult to access due to a shortage of the new staff members' knowledge about the primary software or due to technical problems. Therefore a part of data which was saved in the old software was neither accessible nor available without delay.

In addition making the requests for data are not well received by staff who were already overloaded by other responsibilities and might perceive this as an extra job. Regarding the cost of data availability, there is no charge for those who need the data in both organisations.

4.1.3.3 Interviewee's perception of data usage

The data usage from the Civil Registry is outside the scope of my study. Hence, my results on data usage apply just to the Medical Sciences University. No data analysis at the provincial level is concerned with whether the data are used for decision making. The role of data was discussed in the interviews. The respondent PM1 described the data usage in the budget allocation. The PM2 and PM3 perceived the importance of data in planning their activities.

However they mentioned that there are some problems in using the data in decision making. The interviewee **PM1** stated more fundamental and general problems which can affect data usage. The second one, **PM2**, considered the root of problems in the upper level of system.

{PM1: Our system [health system] is not an organised system and data analysis is not carried out. In fact there must be a sensitive and organised data collection system but there is not.

The health data are not used effectively. We do only daily routines without any long term plans. However, even if there is a plan there is no budget. In general there is no written plan.

However I think in general our problem is worse considering the data collection since there is no definition and protocol. Also private doctors do not have sufficient information about societal health so they are not sensitive enough to report the required cases to the deputy for health.}

PM2: *Well as you know we have problem [in data collection] in non-disaster situations let alone in the disaster situations. If I have the data and I want to plan our activities based on data there is no guarantee to apply the data due to such executive problems as no support and no budget. Anyway, problems should be resolved from the upper levels. It is frustrating since you think you cannot do anything. You think you are doing your best and doing your job with a high accuracy but when it comes to decision making nothing happens which can be very frustrating....*

The problem with data usage can also be due to the low accuracy of data. The following extract from the interview illustrates the hesitancy of the interviewee in discussing data quality and reliability.

{In: *How long does it take to receive the data?*

PM1: *[Ironically] Which data do you mean!!! }*

However an expert depicts another picture of low usage of data in Iran. The respondent argued that lack of familiarity of health managers with statistical methods, unreliability of data and the frequent changing of managers before they have the opportunity to be aware of the importance of data are the biggest obstacles to improved data utility. She/he listed a range of problems that she/he perceived to be implicated with poor data usage which are cited below.

{Dp3: There are three main problems regarding the health data in Iran; firstly, some of the authorities do not know the importance of health data, another group know but they do not know how to use them, the third group know how important are health data but they can not trust the data. Concerning the coordination there has been some coordination but it is not complete or sufficient

In: In general what do you consider the problem in data collection?

Dp3: They can be listed as the following:

- *lack of coordination between different offices and organisations resulting in parallelism which in turn leads to wasting time, wasting money and inaccuracy*
- *Lack of a correct conception of data and lack of support from the authorities because they always are changing so when they became aware of the importance of data they have to leave their position*
- *Lack of a standard or framework plus lack of definition for statistics*
- *As each office collects its own data there is parallelism*
- *Lack of a central place responsible for overall data*
- *Lack of a book defining health statistics*
- *No quality control process*
- *No making decisions based on health data*
- *Shortage of the expert people*
- *There are many software options but none of them are compatible}*

Regarding the above results the interview with one of the policy makers highlights that she/he does not know the implication of the data.

{PM3: { the data are very important in health planning such as using maternal mortality to calculate child mortality.}}

4.2 Results (2): Earthquake and data collection

The results found that there are many limitations affecting data collection after the earthquake. These limitations are rooted in basic problems within the existing data collection system and a lack of co-ordination between the groups collecting the data, including national and international aid groups that provided help after the earthquake. Here are the details of results.

4.2.1 Recording of immediate deaths after the earthquake

The Medical Sciences University and the Civil Registry had different accounts recording the immediate deaths happened by the earthquake.

Based on the interview with INF4 in the Civil Registry after the earthquake the Civil Registry reacted quickly to register the deaths by establishing temporary branches of the Civil Registry in different areas of Bam. It was also mentioned that registration was encouraged by the government by offering an indemnity for registration. It was discussed in the interview that if all family members died any relatives or neighbours could report the deaths. Double registration and registration of an alive as having died were mentioned as the problems with this sort of registration. The following is taken from the interview with the informant, INF4 in the Civil Registry upon this issue.

In: Is there any unregistered cases [of deaths due to earthquake]?

INF4: No, we begin working [registration deaths] on the day 3[after the earthquake] in 7 parts of city

In: Who did register a family death if all the family members died over the earthquake?

Those who were beneficial to their inheritance did it

In: So as far as I understood those people were beneficial to their inheritance come to register. Is that true?

Yes and also they receive an indemnity to register the deaths from the government

In: If a distant relative come then what happen?

According to the rule everybody even neighbour can notify a death but I do not know if they could receive indemnity or not as it was not given by vital registry. Regarding the registration there were some problems such as double registration, and registration of the living as the dead

On the other hand, the Medical Sciences University illustrates another picture of the effects of the earthquake on the data collection system. From the interviews it was found that the Medical Sciences University missed out those data of deaths happened immediately after the earthquake. This was due to the huge effects of the earthquake on the health care system. Almost entire equipment and work place were destroyed. The respondents stated that it took time to have a place to work and equipment to use for work. Also it is reported that the priority of data collection was changed from the prior routine after the earthquake.

{DEA2: There was no place to work in. the first data collected were the daily hospital activities including admissions and discharges. The routine work started in 6 months after the earthquake. Computers were available from the next September which is 9 months after the earthquake}

{DCO5: the recording data was not accurate and some times we had to estimate the data which was mostly the number of admission; there was no space to record the data, all patients' files were destroyed under the debris.}

4.2.1.1 Cause of death

Regarding the death certificate, it was mentioned that the magnitude of the earthquake was such huge that hinder any legal formalities such as issuing death certificates. The follow are quoted from the interviews regarding the possibility of having a death certificate issued after the earthquake.

{INF2: the number of deaths were very high and most of them were unknown, even there is no reliable total number of deaths. There was no possibility to examine deceased people. Most of the Corps trapped under heavy debris so there was possibility of having stinking corpses. In addition, because of severe tragedy of the situation nobody thought about legal matters resulting from not issuing the death certificate. Even there were some cases that inquired about a death certificate for someone else via the legal process then it was cleared that the person was alive. People who needed to transfer their deceased relatives to other cities were the only groups that requested death certificates.}

Also during the fieldwork I realised that the earthquake deaths data at the Civil Registry are recorded as the accidental deaths. This means that they include any other accidental deaths such as car accident, poisoning and suicide. An unplanned conversation with an informant in the Civil Registry revealed that even 2 years after the earthquake people were still registering deaths in their families. This is confirmed by the numeric results at the Civil Registry in Table 4.3.

Table 4.3: the frequency of Accidental, Poisoning, and suicide deaths before and after the earthquake in Bam

March 2001 to March 2002	March 2002 to March 2003	March 2003 to March 2004 <i>earthquake</i>	March 2004 to March 2005	March 2005 to March 2006	March 2006 to March 2007
143	144	23615	5829	342	242

4.2.2 Ongoing data collection after the earthquake

This section presents the results on reporting the non earthquake deaths including deaths happened in medium and long term after the earthquake.

The interview shows that the special presence of the Civil Registry in Bam after the earthquake last for three months then they got back to the routine.

On the other hand, the interview at the Medical University found that following the earthquake the native health staff worked with Red Cross organisation for a considerable time. During this time they did not send data to Kerman Medical Sciences University. Initially, the data were collected at the Red Cross organisation was in English and then Farsi, official language in Iran. They also pointed out that due to the extraordinary nature of the earthquake; the Health Network was kept busy with contagious diseases.

In: How long did you work in the temporary shelters?

DC6: about one year, then other temporary shelter [under Red Cross Organisation supervision] was used

In: Did you collect any data at that time [after earthquake]?

DC6: Yes there was a logbook for every activity but the patient's file was mostly in English...

In: Did you have any connection with health network in order to send the data?

DC6: No, at that time.

This was also confirmed by other interviewees.

DCO2: There were log books from Red Cross organisation that were initially in English and then Farsi....When the Red Cross ended its activities we handed in their note books.

DCO2 We did not work with the health network. We worked with Red Cross Organisation so we did not send any data to the health network. In fact they were very busy with contagious diseases so the Family Health Unit was not very active.... From December 2004 the condition returned to normal [sending data to Kerman Medical Sciences University].

In: Were maternal deaths reported after the earthquake? Was it mandatory?

PM2: *No, it was not mandatory after the earthquake, there were not any reports of maternal death, well, ummm, I do not know maybe they [the health staff] were too busy to report them [maternal deaths].*

In: How long after the earthquake were the data collection resumed?

PM2: *We were very upset. We lost our liaison [the midwife working in family unit in Bam]. All staff died, the only person who survived was a health administrator. In practical terms there was no link. Finding a replacement was difficult for me. In general it took 1 to 1.5 year to replace her. For that period our plans were suspended.*

Also changing the role of the Medical Sciences University from the supervisory to the supportive was perceived by one respondent as another obstacle for receiving the data.

PM2: *After the earthquake we had a supportive not supervisor role, and health services were provided mainly by other countries and cities. They were not responsible for sending data to us*

4.3 Results (3): Maternal mortality data collection at the Family unit

The results of this sub chapter are based on two areas. The first one is data extracted from a book published by maternal mortality committee used as a guideline for maternal mortality data collection and follow up. While the second one is the results extracted from the fieldwork. There are discrepancies between what is required to be done by the committee and what is really done. For example, some of the data sources are not aware of reporting maternal deaths urgently to the Family Unit. In addition, maternal deaths were defined differently by the interviewees. The detailed results are presented below.

As mentioned the following information are extracted from the book which is used as the guideline for data collection. This book is very comprehensive and easy to understand. However during the fieldwork I realised that this book is not available in all centres which might deal with maternal deaths and reporting them. The decision to collect maternal deaths exclusively by the Family Unit was developed by a maternal mortality committee. [116]. This committee aims to decrease maternal mortalities by investigating any death which might be a maternal death. These deaths are asked to be reported *urgently*. The following sources were identified as data sources by the maternal mortality committee: [116]

- A) In the provinces in which there is a system of recoding deaths, the Statistics Unit has a list of all deaths of women aged 10 to 49 years old due to any cause except accidents, as reported by the Family Unit of the Health Network [116]. The peripheral health staff investigate the maternal deaths that have occurred in the home setting by interviewing the relatives [116].
- B) If maternal deaths occur in the hospital, the nursing manager or supervisor has to report it immediately to the health manager in the Health Network [116].
- C) Any maternal deaths in the rural areas are to be reported by Behvarz, the doctor in the rural health centre or any residents by phone or filling the form immediately. [116].

D) In urban areas the private medical offices, different organisations, urban health centres and unofficial people are to report the deaths [116].

However the results show a difference between what the guideline suggests and what actually is done.

The data drawn from the interviews with those that maintain the data indicate that the main data sources in urban areas are hospitals (maternal wards), and in the rural areas it is the Health Houses. It was also mentioned that in remote areas maternal deaths are reported by the health staff who visit these areas for vaccination..

PM2: The sources of data in urban areas are mainly hospitals and in the rural areas Health Houses covering most of the villages.... some maternal deaths are uncovered when their fathers ask for subsidised artificial milk from the Family Unit in their cities.

In: Who informs you of maternal deaths in uncovered areas?

PM2: A group of health staff [called mobile health staff] are supposed to go to these areas to do children's vaccination; we become aware through these health staff

In: So do you think you have all of the data on maternal deaths?

PM2: No, in fact in the hospitals, maternity wards are the only wards are being aware of reporting maternal deaths. As a result, if there are any maternal deaths in other hospital wards they may not be reported to us.... Also in many of urban areas the coverage of health centres is not enough and we can not be sure of having all data.

Further interviews with relevant persons working in the general hospitals that do not have maternity wards confirmed the report of not sending data on maternal deaths. These sorts of maternal deaths might happen with a delay after the delivery in the non maternity hospitals/wards.

In: How is the death data of child and maternal mortality collected in the hospital?

DCO5: We do not have any maternal mortality but we have child mortality

Also an interview with an informant regarding the mobile health staff, providing vaccinations in remote areas, found that they are pressed for resources by having a limited number of staff.

{In: Is there any limitation for your mobile team to cover particular population?

INF1: In fact it is necessary to consider the population composition and plan to provide the target areas with necessary cares and then send our team but we have only one mobile team so we can not do it properly}.

Furthermore, reporting maternal deaths was not perceived as an urgent requirement by a group of respondents, as it is suggested by the committee. In fact, if there is a maternal death it is reported along with other deaths to the Statistics Unit.

In: Is there any urgent report for any deaths?

DC1: Yes for children

In: Do you report any information earlier than a month?

DC2: No

In: What happen if somebody such as a child or a mother dies?

DC3: We report it to the Health Department in the monthly forms and Network Development Unit by the Vital Zij

In a conversation I had with one of the staff working in the Family Unit it was mentioned that they check their data with the Vital Zij data annually to find any missed cases which are reported through the Vital Zij.

Another matter of discussion was the classification of a death as a maternal death.

The maternal mortality committee had adopted the maternal mortality definition from ICD -9, which is defined as a death during pregnancy or during 42 days after the delivery. This does not take into consideration the mother's age, gestation period, or type of birth as a contributor to maternal mortality. Also, the cares provided during pregnancy are not considered in relation to problems in birth. [116].

However, during the interviews different descriptions were given by the interviewees. The following definitions of maternal mortality were given by the interviewees, in different levels of data collection/process.

PM2: *Deaths during pregnancy or 42 days after pregnancy because of pregnancy or its outcomes*

PM3: *death of women because of pregnancy which happened during pregnancy or 40 days after delivery*

DC1: *A mother's death due to delivery or after delivery up to 4-5 days or may be 1 month after delivery for any cause even a car accident but if she is pregnant and has a car accident it is not maternal death. Abortion is also considered as a maternal death.*

DC2: *Maternal deaths are deaths during delivery or 40 days after delivery for each cause even cancer.*

DC3: *Maternal deaths happen during pregnancy or 40 days after delivery because of abortion, bleeding, eclampsia or infection*

DC7: *Any maternal death during pregnancy or 42 days after delivery*

{DCO1: *Any maternal deaths happened at pregnancy/ delivery or 2 months after delivery because of problem related to pregnancy such as bleeding or eclampsia}*

{DCO2: *Maternal deaths because of pregnancy during pregnancy or 42 days after delivery}*

{DCO3: *Deaths because delivery such as bleeding, high blood pressure, abortion but not accident. }*

{DOC4: *If a mother dies due to pregnancy during the pregnancy/ delivery or 40 days after delivery such as pre eclampsia/ eclampsia or injury is considered as a maternal death. The accidental or death secondary to other reason is not maternal death}:*

Also in the Forensic Medicine department there is no specific classification for maternal deaths.

In: *Do you investigate any maternal deaths?*

{INF5: No it is Health Network responsibility. We do not have any category as maternal death.... For example, if a woman dies after delivery because of infection we would say cause of death is infection and do not classify the death as maternal or whatever.}

Another important point is that the aim of the committee is identifying maternal deaths in order to recognise the factors might associate with them and ultimately reduce maternal deaths. The interview with PM2 found that the reports on maternal deaths are investigated and if there is any flaw from personnel they will be punished. The interview mentioned they do the best to find the truth cause of death then she/ he mentioned that there was a maternal mortality case which happened because of shortage in health care provision but the medical file was falsified to cover the truth.

4.4 Results (4): Exploring mortality data

The previous sub –chapters provide views on mortality data collection in general and maternal mortality data collection in particular in Iran. Also it was pointed that maternal deaths due to factors such as changing socio economic factors , the policy and willing too old and too young parents to have baby is expected to be changed. However upon to previous chapters and difference to the methods are used for data collection and processing inconsistency might be observed. This are examined in this sub –chapter. The results of the estimation of maternal mortality ratios from different sources present inconsistent pictures. This inconsistency is found in both of the denominators and nominators. Also, the results of case matching show that the data collected from two different sources authorised commonly by the Medical Sciences University are not consistent. Additional exploring on the mortality data in disaster and non disaster cities reveal that the inconsistency is not limited to the maternal mortality data. Indeed, there is considerable difference on the total mortality data reported by these two organisations in both cities. More details are presented following.

4.4.1 Maternal mortality ratios

The results of the interview found that higher high risk pregnancy might be expected after the Bam earthquake. This is due to not only the general effects of a natural disaster on the health care system and socioeconomic situation but also some changes on the contemporary policies. These are including changing the policy of health care provision and changing governmental policy to encourage young women to marry. Also, willingness of parents lost their children at the earthquake to have new babies, and high immigration were mentioned as other contributory factors. The following extract taken from the interview reflects upon this issue.

PM2: Regarding maternal health, after Bam earthquake the main concerns has been; first, young people are encouraged [by the government] to get married. As a result, there have been many young mothers under 18 years old. In addition many of the older mothers with health problems such as high blood pressure, diabetes, heart disease had lost their children during Bam

earthquake. They want to have more children and therefore they become pregnant. The next was rushing pregnant women from rural areas to Bam city for delivery due to the free health facilities provided by Red Cross organisation for the population in Bam. This in turn resulted in increasing the number of deliveries

In order to find out whether there are any changes in maternal deaths maternal mortality ratios are calculated. The result shows that these data sources produce different patterns of mortality ratios over the time (figure 4.2).

There is a remarkable difference in maternal mortality ratios in the year of the earthquake and the year after the earthquake between two data sources. While the Civil Registry shows the highest maternal mortality ratios at the year of the earthquake, the Family Unit shows the second lowest ratios in the period under study. However, maternal mortality ratios are very high at the Family Unit the year after the earthquake. Surprisingly, the Civil Registry presents one of the lowest numbers of maternal ratios in the year of the earthquake. These contradictions can be traced back to the inconsistency in either the denominator or the nominators or even in both of them. Therefore the data which are used for calculation of maternal mortality ratios are explored and compared in Table 4.4. The data indicate that live births recorded at the Family Unit are significantly higher than those for the Civil Registry over the period under the study. Maternal mortality numbers are also higher in the Family Unit in comparison with those of the Civil Registry, with the exception of the year of the earthquake which was two for the former and ten for the latter.

Figure 4.2: Pattern of Maternal mortality deaths per 100000 deaths according to the different data sources (the Civil Registry, the Family Unit) in Bam from 2001 to 2006

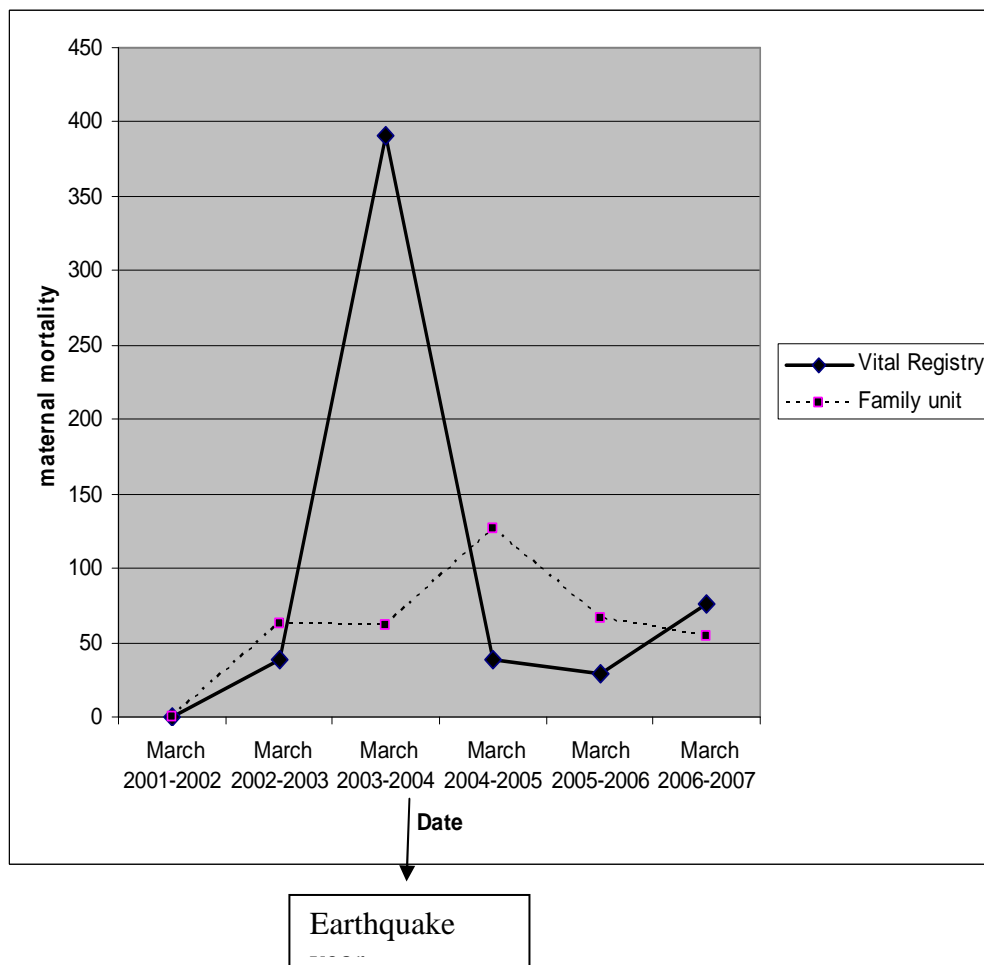


Table 4.4: Maternal deaths, live births and maternal mortality ratios in Bam based on different sources, the Civil Registry and the Family unit, from March 2001 to March 2007

Source of data	year	2001	2002	2003	2004	2005	2006
Civil Registry	Maternal deaths	0	1	10	1	1	3
	Live births	2479	2616	2562	2575	3466	3948
	Maternal mortality ratio	0	38.23	390.32	38.83	28.85	75.99
Family Unit	Maternal deaths	0	3	2	5	3	3
	Live births	5075	4771	3258	3590	4543	5537
	Maternal mortality ratio	0	62.88	61.39	126.58	66.03	54.18

4.4.2 Case matching of individual data

Because the data at the Civil Registry is not available in individual forms a cross match checking to check if these two organisations have captured the same deaths is not possible. However, it still is interesting to know if different organisations produce different results or the data are not consistent in the same organisation. To address this question, the data from the Family Unit and the Statistics Unit which are both under the same organisation, the Medical Sciences University, are matched. Data at the Statistics Unit are available for 3 years in individual forms. Therefore, the data from the Family Unit and the Statistics Unit from 2004 to 2007 are matched case by case based on the common factors of recording.

The total number of deaths in the Family Unit is 11 while it is 8 in the statistics unit. These 8 deaths are reported in both sources. Age, resident place and date of deaths are recorded commonly in these two sources therefore they are examined to find out whether they are consistent with each other. Table 4.5 provides some information on the number of cases which are not matched from these factors.

Table 4.5: Factors not matched in mortality data among the two systems (family unit and statistics unit) in Bam from March 2004 to 2007

Factors	Cases
Age	3
Date of death	4
Resident place	2

4.4.3 Examining total deaths in two cities

The findings acquired up till now trigger this question; whether these variations are observed just in Bam or maternal mortality. Hence, the total deaths distributed in different subgroups from a non earthquake city plus Bam are examined in Table 4.6.

Table 4.6: Age group, sex and resident place distribution of death records based on the organisations in Bam and Jiroft from March 2004 to 2007

Organisation	Total		Jiroft		Bam	
	Civil Registry	Medical University	Civil Registry	Medical Sciences University	Civil registry	Medical Sciences University
Age group						
Stillbirth	0 0%	126 2.7%	0 0%	65 3.8%	0 0%	61 2%
<5 years	96 2.3%	479 10.1%	28 1.6%	140 8%	68 3%	339 11.3%
5-25	563 13.8%	743 15.7%	259 14.4%	322 18.4%	304 13.3%	421 14.1%
25-64	1486 36.3%	1657 34.9%	572 31.8%	560 31.9%	914 39.9%	1097 36.7%
>64	1944 47.5%	1737 36.6%	937 52.2%	666 38%	1007 43.9%	1071 35.8%
Total	4089 100%	4742 100%	1796 100%	1754 100%	2293 100%	2991 100%
Sex						
Male	2737 66.9%	3096 56.3%	1192 66.4%	1202 68.6%	1545 67.4%	1894 63.4%
female	1352 33.1%	1646 34.7%	604 33.6%	551 31.4%	748 32.6%	1095 36.6%
Total	4089 100%	4742 100%	1796 100%	1753 100%	2293 100%	2989 100%
Resident Place						
Urban	2542 62.2%	2444 51.5%	1496 83.3%	1018 58.1%	1046 45.6%	1426 47.7%
rural	1547 37.8%	2299 48.5%	300 16.7%	735 41.8%	1247 54.4%	1564 52.3%
Total	1547 37.8%	2299 48.5%	1796 100%	1753 100%	2293 100%	2990 100%
Total deaths Recorded	4089	4743	1796	1753	2293	2990

The results indicate inconsistency among the data produced by the Medical Sciences University and Civil Registry in the non earthquake city as well. The striking feature of this table is the difference of results based on the age groups and resident place. In both cities the number of deaths is recorded as young people, under 25 years, are higher in the Medical Sciences University than in the Civil Registry. This is particularly pronounced with the stillbirths and under 5 years old. However, there is an opposite picture of recording for elderly people in these two data sources. The Civil Registry recorded more deaths of people over 25 and particularly over 64 than the Medical Sciences University. Another noticeable difference is the deaths reported from the resident place. In both cities the Medical Sciences University has higher records of deaths from the rural areas than the Civil Registry. These inconsistencies could trace back into the way these systems are working.

Chapter 5 Discussion

The aim of this study was to explore the usefulness of data collected routinely in Iran to monitor the effects of a natural disaster. A mixed quantitative and qualitative research approach was used to achieve the aim. Inconsistencies were noted in the numeric data which indicated that there was a problem with routinely collected data. However, the quantitative research methodology was not able to tell us which one of the two data sources was problematic or which data source would be more reliable to be used for research or policy making. The qualitative research approach provided tangible knowledge of both systems. This was very helpful to understand the systems and to interpret the differences noted in the numeric results that were obtained from the target organisations.

This chapter has five sub-chapters: data capture, data handling, data usage, data collection and earthquake, and maternal mortality data collection. In the data capture sub-chapter, the qualitative results are used to discuss the numeric results. The data handling chapter discusses the data collection procedures at the Civil Registry and at the Medical Sciences University. The problems that emerge following an earthquake are discussed in the fourth sub chapter. The last chapter, maternal mortality data collection, gives specific attention to the data collection of maternal deaths at the Family Unit.

5.1 Data capture

5.1.1 Maternal mortality ratios inconsistency (non-earthquake year)

Maternal mortality ratios estimated from the data gained from the Family Unit of the Medical Sciences University were higher with the exception of the year of the earthquake.

The inconsistent results of estimation of maternal mortality ratios triggered an exploration of the denominators and numerators. Further scrutiny showed that both the denominators and the numerators were different at these organisations. This could be due to the difference in data capture methods, explained in the following paragraphs.

Higher reports of maternal deaths at the Medical Sciences University might be explained by three main factors.

Firstly, different methods were applied for death notification at the Civil Registry and the Family Unit. While the data were collected through the health staff at the Family Unit, the Civil Registry recorded a death following notification by the deceased's relatives. This method requires a high collaboration from people. Low collaboration might reflect an inadequate motivation on the part of relatives to register deaths. It has been noted that the population may benefit from improved recording of vital statistics as this can increase accountability of the government [25]. However, some groups of the population may not feel that they derive a direct benefit from registering a death. In addition, a lack of strong regulations, or a failure to enforce existing rules, can reduce the likelihood of having every birth and death in the population reported to the government agencies. Poor enforcement of existing rules has been noted to be common in developing countries [202]. These circumstances have resulted in the reporting of births and deaths to be reliant on an individual's willingness rather than a routine occurrence.

The second reason might be due to the different role of each organisation. Vital events data have a variety of usages in different organisations [24]. This might affect the strategies of data collection and the scope of their activities. For example, the

Medical Sciences University which deals with the health services might pay specific attention to record maternal deaths. This group of deaths are important from health care provision and monitoring perspectives [47]. On the other hand, the Civil Registry deals with judicial issues such as inheritance. Hence, within the current system, it is reasonable to expect higher reporting of deaths for those deceased who had a property. The results of Table 4.6 show that deaths of elderly people and men are more likely to be reported to the Civil Registry. The main reason for this might be financial motivation. However, women [76] and young people have less capital to leave for inheritance, and therefore a death in these groups may be less likely to be reported.

The third possible reason for the recording of a higher number of maternal deaths at the Family Unit is the increased likelihood of the Medical Sciences University to capture data on deaths from the rural areas. Maternal mortality had been reported to be higher in disadvantaged societies [12]. Although the data collectors do not send maternal death data to the Family Unit directly, the Family Unit data are supposed to be checked with the Vital Zij data. The results of Table 4. 6 show that rural mortality data recorded at the Medical Sciences University are higher than the Civil Registry data. This can be explained by better coverage of the Medical Sciences University, which has health facilities that collect these data in 86% of rural population. The Civil Registry, however, has no branches in the rural and remote areas of Iran.

5.1.2 Maternal mortality inconsistency (earthquake year)

When it comes to the year of the earthquake, the results shows that there is a higher maternal mortality ratio in the year of the earthquake recorded at the Civil Registry in comparison to the ratio recorded at the Medical Sciences University. This could be due to a smaller denominator, a larger numerator, or even both. Table 4.4 shows that the Civil Registry had a higher number of recorded maternal deaths (the numerator), and a lower number of recorded child births (the denominator).

The higher number of maternal deaths can be explained by the fact that the Civil Registry was the main active data source for a considerable amount of time after the earthquake. However, it should be noted that in cases where a death certificate has not been issued, the Civil Registry relies on people's testimony for information about

the cause of death. This makes the reliability of those deaths reported as maternal deaths dubious.

Regarding the denominator, the number of live births registered at the Civil Registry is lower than the number of children who had their first polio vaccination. The low registration of births at the Civil Registry could be, again, due to the reliance on people to give notification of a birth when there is no motivation to report it in a timely manner.

On the other hand, the Medical Sciences University uses the number of children who received the first polio vaccination as a surrogate for live births. This would cause the Medical Sciences University to have a higher number of births recorded. This is due to the fact that all vaccinations are free across the country and vaccine cards are necessary to enrol children in school [203]. However, this figure might underestimate the correct total number of live births because it might miss out those children who died before the age of vaccination which is 1.5 months.

5.1.3 Data coverage at the Medical Sciences University

According to the discussion above, it is reasonable to consider the Medical Sciences University as a more complete source of data in non-disaster situations for maternal deaths. However the results of this study flagged some problems which hinder the Medical Sciences University from having complete data.

The first problem is no coverage of health facilities in 14% of remote areas[112]. If there is no health facility in a particular area, then no data would be sent to the Medical Sciences University.

The second problem is inadequate collaboration between those organisations involved in capture of death data, such as private cemetery offices and the Forensic Medicine Unit, and the Medical Sciences University. This is discussed to be an important factor to ensure that data are transferred between organisations in a consistent manner [19]. Collaboration can be achieved by placing appropriate leadership and coordination with a powerful central committee and establishing appropriate rules and regulations. This committee should consider different views of data holders and stakeholders to increase their interest in collaboration.[6] For example, the results show that concerns about confidentiality hinders the Forensic

Medicine Unit from sending their data to the Medical Sciences University. The central committee could discuss these sorts of issues and find solutions to reassure the data holders about their concerns. The central role of this committee was recognised as the primary step in strengthening the health information system in Papua New Guinea [152].

The third problem is the fact that some data sources are not aware of how maternal deaths are classified. The results show that staff working in the non-maternity hospital do not consider the possibility of maternal deaths occurring in their hospital. This might be the case when a women die in another ward such as emergency ward instead of maternity ward [10]

. Lack of knowledge of the classification of maternal deaths could be the cause of this problem. This is confirmed with the poor consistency with which respondents defined maternal death classification. In addition, to ensure a complete set of data is collected, not only is collaboration required from the organisations that capture and send data, but also the same classification criteria should be applied within each organisation. For example, this study found that there were no deaths classified as maternal deaths at the Forensic Medicine Unit.

In addition to the above, interviews with the Behvarz who worked in rural areas revealed that they were not aware that maternal deaths should be reported to the Family Unit. This could be due to an inadequate informative system which fails to inform all the wards and hospitals involved in the care of women after childbirth.

5.2 Data handling

The results of case matching, Table4.5 shows that there are inconsistencies in data recorded at the Family Unit and data recorded at the Statistics Unit which are both authorised by the same organisations. The Civil Registry data are not accessible in individual form and there is therefore no case matching for the data in this organisation. However, the following discussion includes factors which might affect the quality of data. Hence they can be applied to the Civil Registry as well. These factors include the accuracy in recording of cause of death; the use of technology in data transmission, data processing, and checking the data for errors; the use of guidelines; and issues relating to human resources.

5.2.1 Data entry and technology

The results found that in both organisations the original data are in paper. The data in the Civil Registry are computerised on site and sent via the internet to the upper level. However, the data at the Medical Sciences University are sent from peripheral levels to the upper levels and are integrated before being computerised. This method might be prone to error, low speed and low accessibility [156]. In Pakistan, the data from peripheral levels are sent directly to the district level [157] This method, however, is not the best one from the perspective of speed, quality and accessibility. However, it may still be better than the method employed in Iran. This is because the Pakistani method is likely to be faster [156] and it also reduces the errors that might happen during integration.

In terms of technology, there are three main points which are discussed: the availability of adequate computers and internet connection; the availability of technical support; and, the use of appropriate and efficient software.

The Civil Registry has a satisfactory number of computers with internet connection in all branches. The Medical Sciences University, however, has limitations in the quantity of computers at the lower levels (hospitals and rural health care facilities) of its hierarchical data collection system. Inadequate number of computers were also observed in Cuba [163]. Furthermore, there is no internet connectivity between different levels at the Medical Sciences University's data collection system. This can impede the simultaneous usage of data, the sharing of data and high speed transmission {Wilson, 2000 566 /id}. Inadequate linkage between different parts of health information systems is observed as one of the problems in the regions of African [161]

The Medical Sciences University may not achieve the benefits of implementation of improved technology because of the limitation in existing provision of computers. It has been shown in different studies that accuracy [141], [143] and timeliness of data increase by using the computer [156]. Sending the data in paper forms and also integration of data before sending to the upper level might increase the risk of errors which could happen during the integration [156] and cause delays and duplication. In

a study carried out by Jayasuriya in the Philippines [160], data transmission through computers was found to be more accurate and to decrease the risk of duplications.

Availability of technology does not necessarily mean improving outcomes. Adequate technical support and appropriate training for staff before launching technology usage must be in place [158]. It is discussed that if there is no availability of technical support, using paper-based data might be preferable [158]. The results show that there was some limitation in availability or use of technology in both organisations. There were limitations in retrieving the data which were saved in the old software used previously at both organisations. This might be due to the lack of technical knowledge of staff [158] or a failure of the computer software package [164]. Also, some computers at the Medical Sciences University were non-functional and they would have required a considerable amount of time to be fixed. This indicates the limitation of technical support at the Medical Sciences University. It has been reported that the limitation in using technology in developing countries is a fundamental problem regardless of type of organisation. Low numbers of computers, regular power failures, limited access to the internet [163] and non-operational computer packages [164] are problems that happen commonly in the developing countries.

Another matter for discussion is the use of appropriate software. The software should help the organisation to achieve its aims and to make use of technology efficiently. However, the results show that the software designed at the Civil Registry in Tehran has little compatibility with other software, including the software designed at the Medical Sciences University. Also data at the Family Unit are in paper- form while they are computerised at the Statistics Unit resulting in no linkage between data. This impedes the ability of technology to share and match the data with other data sources. This can lead to duplicate data collection and decrease the accuracy of data [132]. The WHO framework advocates using coherent programmes and system which are compatible with each other at different levels [6].

5.2.2 Periodicity

The second concern is timeliness. Possible delays in sending the data from the peripheral branches to the Civil Registry and regular delays in sending data to the Medical Sciences University are reported in the study. This can be traced back to the lack of strong regulation or enforcement of rules, overburdening of staff, low data usage in decision making and limitations in using the technology. Some of these problems, such as problems with rules and regulation, have been discussed earlier. Other factors will be discussed in the following sections.

5.2.3 Accuracy of data

This section deals with issues affecting the accuracy of data. They are including accuracy of cause of death and data checking.

5.2.3.1 Accuracy of cause of death

The accuracy of recording of cause of death in both organisations might be dubious due to the fact that death certificates are not issued in the case of all deaths. The results found that, at the Civil Registry, people's testimony is used to gain information about the cause of death in cases where there is no death certificate. On the other hand, the Medical Sciences University relies on the Behvarzes' ascertainment when there is no GP. A previous study found that, even if the cause of death is diagnosed by a doctor, it is likely to be inaccurate [30],[31]. This may be even more pronounced when the cause of death is identified by non-qualified staff. Interview respondents were uncertain about the definition of classification of cause of death. This makes the accuracy of cause of death uncertain. Despite the uncertainties surrounding accuracy of cause of death data, even when determined by a doctor, this could be an important source of information for policy makers to allocate the budget appropriately [167].

5.2.3.2 Data checking

Apart from the accuracy of cause of death, there are two factors which can make a difference in accuracy of data between the Civil Registry and the Medical Sciences University. First, due to the role of the Civil Registry in judicial affairs, the data are

expected to be handled more sensitively. Second, there is no aggregation of the paper form of data before computerization.

On the other hand, the Medical Sciences University can be more prone to have inaccuracies of data. Errors might happen in data entry in the original paper form, during data aggregation or during data entry. Although data checking is undertaken via tabulation, this method does not seem to be adequate to discover different errors. No feedback from the lower levels, irregular data checking, and using an indirect method of data collection from peripheral villages are factors which can affect efficient data checking and data quality. It is discussed that in developing countries incorrect coding, and making mistakes in the entry of data in the correct fields are frequent problems [146]. Limited data checking might also indicate low data usage by policy makers; if the data are used, they are checked and feedback on data will be sent to data collectors and processors. It has been noted that in developing countries there are few opportunities to give feedback to data processors and data collectors to improve the quality of data [146].

5.2.4 Guidelines

The results show that the data are not sent from some sources. On the other hand, the staff are required to send the same data to different places in different formats with little unification in indicators. This can be due to the lack of introduction of a minimum set of data [146] or a standard definition for each indicator [169]. The results show that non-maternity hospitals do not send any data to the Family Unit and maternity hospitals do not send the data to the Statistics Unit. This might be traced back to the fact that there is no guideline explaining the elements of each indicator, or where the data should be sent. Staff are therefore confused with the variety of sources which require data.

Consensus between different stakeholders about a minimum data set has been suggested as one of the main requirements of a health information system [151]. This is very helpful to facilitate capturing of data from different sources. Lack of data transmission from the Forensic Medicine Unit and their failure to categorize appropriate deaths as maternal deaths reflect the lack of consensus on the indicators and the absence of a guideline to explain the indicators.

Promoting a guideline was recognised as an important need to strengthen the quality of the information system in Mexico [166], [146].

5.2.5 Human resources

Adequate recruitment of staff is a requirement to establish a health information system [6]. However, the results of the study imply a shortage of human resources, particularly at the Medical Sciences University. Staff dealing with data have a number of additional responsibilities: the data collectors in the rural areas were also care providers; in the hospitals, secretaries had many other responsibilities. They prioritized their other responsibilities over data collection. By devoting time to other responsibilities, this can affect the quality of data. In addition, lack of guidelines and a standard unified form to collect data can overburden the staff. The results show that data collectors have to send mortality data to different destinations with different forms. Also it was mentioned that some data were received from lower levels of the data collection hierarchy without any attempt to store, process or use the data.

Another risk of overburdening staff with other responsibilities is reducing the opportunity to check the quality of data which results in reduced accuracy of data.

Furthermore, it might affect the availability of data. In my study, asking for data was not received well by the relevant staff. It is discussed that if tasks related to data collection and processing are required from health care providers, it would make them overburdened resulting in them viewing this as an extra and unwelcome task [6].

Requiring staff to take on multiple responsibilities might reflect either a shortage of staff in general, or the low priority that authorities give to the importance of data collection. The former was discussed as one of the problems that is consistently found in developing countries [174]

Another problem discussed in the results is the lack of job security and high turnover of staff in the data collection system at the Medical Sciences University. Job security promotes staff productivity, innovation and health [175]. High turnover and few opportunities to have a permanent job might be very discouraging [176], particularly for recently graduated staff, and may provoke inaccurate results. High turnover of

staff were observed in other studies carried out in Swaziland [164] and Afghanistan [144].

Additionally, recruiting staff with appropriate academic qualifications in different levels of the data collection system is recommended to improve quality of data (World Health Organisation, 2008b). There are very few people with appropriate academic qualifications in the Medical Sciences University. This might reflect the fact that there is little demand for people who are required to undertake statistical manipulation of data at the Medical Sciences University. This was the case in the Civil Registry when one of the experts mentioned during interview that, despite having higher qualifications, these skills were never used in his/her daily job.

Another matter for discussion is the necessity of launching a training programme for staff at different stages. Training of staff can improve data quality [6]. This must include training to use the technology [158]. The results show that apart from the Behvarzes, the staff did not have any training before commencing employment. Also, the fact that some staff were unaware of the ability of the software to produce tabulation demonstrates the need to train staff to use the technology and to familiarize them with the capabilities of the technology. The results show that gaining information about the technology and learning how to work with the software was not an easy and straightforward job. The new staff relied on experienced staff to teach them, who were busy with other responsibilities or who have ended their contracts with the Medical Sciences University.

5.3 Data usage

This section discusses different perspectives related to data usage including data analysis, data availability and storage, and interviewees' perception of data usage.

5.3.1 Data analysis

The results of this study found the only publication produced by the Civil Registry is a seasonal publication of total numbers of vital events conducted at national level. There is also an annual publication of death data produced by the Health Ministry.

The data are presented in aggregated form. This type of publication might be inadequate to meet all data users' needs because different data users need different levels of complexity for data analysis[155] While the policy makers are more interested in more aggregated data, researchers need more detailed data [1].

On the other hand, use of aggregated data can reflect low data usage at the provincial and district level. Inadequate data usage at the local level may reflect a number of problems. One of them is the structure of a health system as a centralized system. In such systems, main decisions are made at the national level; local levels do not have an important role in decision making [120]. The second problem may be low integrity of a health system [150]. These two might be the case in this study as the Iranian health system is a centralized system[105]. Furthermore, lack of a powerful health system was mentioned at the interview as another obstacle to use the data. It also can reflect that there is a culture of low data usage in the country. The culture of using evidence-based decisions should be encouraged by applying incentive mechanisms [6]. However, the interview results show that there are no such incentives in place.

5.3.2 Data availability and storage

Another matter of discussion is availability of data when the data is needed. Even if there is a culture of data usage and tendency to use the data the data should be available. However the results found that there is limitation of availability of data at both organisations which rooted in storing the data or technology limitation.

The data should be stored properly in a way that they can be retrieved any time that it is necessary. This should be the case for both paper and computerised forms of data. This is particularly important to enable reporting of trends in vital statistics and monitoring health care services [6].

This study found that there are problems with data filing at the Medical Sciences University. A pile of forms of data was found in no specific order and it was not in a designated space. In addition, retrieving information on maternal deaths from individual case files was a difficult job due to some of the files being misplaced. Regarding the Civil Registry, examining appropriate filing for paper-based forms of data was beyond the scope of the study. However, the study found significant

problems in retrieving some of the data which was saved using the old software at the Civil Registry. This may reflect a lack of technical support or a limitation in staff knowledge in using the technology.

The study found that there are several problems with computerised data storage at the Medical Sciences University; some of the data were inaccessible for both me and the staff. This was possibly due to the old software not working or the new staff's lack of familiarity with the old software. This is explained further in the technology section.

5.3.3 Interview's perception of data usage

In this study, different groups perceived the cause of low data usage differently. The policy makers perceived the problem to be poor data quality, no guidelines for data collection, lack of forward planning for health issues in general, and no incentive to use the data. The expert added that there was low awareness amongst policy makers of how to use the data, and the high turnover of managers was a contributory problem.

The usage of data has a direct correlation with the quality of data[1]. If data are of poor quality, they are unlikely to be used. If the data with low quality are used such as using the data on people who use the services they are likely to mislead policy makers[17]. On the other hand, poor quality data can reflect the poor usage of data and lack of feedback to improve the data [156]. There should be training at all levels of a data collection system. This training programme should include policy makers in order to increase their knowledge about the implication of data usage on decision making and interpretation of results. On the other hand, the data people should be aware of managers' interests and needs. This will lead to improving data usage [1]. Introducing guidelines can make clear the objectives of data collection and enhance data usage, particularly when the policy makers are involved in these processes [1]. Promoting a system of incentives for data usage is likely to increase data usage [1]. However the study found that there are few incentives to use data to plan future health services.

The WHO framework advocates the necessity of limiting access to routinely collected data to authorised staff only [6]. This is very important to maintain

confidentiality of data. The study found that in both organisations data are accessible to authorised staff and are only accessible to others with a letter of formal permission, consistent with the WHO framework.

5.4 Earthquake and data collection

In Iran the main policy decisions are made in the Health Ministry [105]. Therefore, the Health Ministry is one of the main data users. However, the results of this study flag some serious problems which limited the data usage by the Health Ministry. In terms of data collection immediately after the earthquake, the limitations are, firstly, as mentioned in the results, the Civil Registry collected data through people's reports while the Medical Sciences University collected data through its health staff. The large destructive effects of the Bam earthquake on the health system blocked the routine method of data collection by the Medical Sciences University. This difference in the data collection methods did not allow the Medical Sciences University to collect data by its own methods immediately after the large disaster. Therefore, it had to rely on the Civil Registry data, which is the aggregated form of data available in cross table format. This form of data might be insufficient for epidemiological research to recognise at-risk groups during an earthquake which is claimed to be one of the major issues in disaster relief functions [204]. This in turn might impede planning and evaluation for the next disaster. On the other hand, even if there is judicial permission for making the individual data available, the lack of compatibility between the two software packages used in these organisations make data transference from the Civil registry to the Medical Sciences University impossible. This problem was reported in Romania as one of the obstacles in the health information system[205]. In addition, the fact that earthquake mortality data were recorded based on the people's testimony resulted in limiting the knowledge of the exact cause of death of victims. This limitation is important for epidemiologists conducting research in this subject area.

There are a number of long term effects of a disaster on the routine collection of data. Several factors hindered the resuming of data collection shortly after the earthquake. Firstly, recovering the routine data collection system to its pre-disaster state takes considerable time. This long recovery time could reflect either limitation in the

ability to rehabilitate the system to its pre-disaster state or the Medical Sciences University's priority setting after the earthquake. The latter can be explained by two issues. In the early period after an earthquake, there is a tendency for policy makers to solve the daily problems and short term ones rather than the longer term problems [1]. Furthermore, there is little enthusiasm to use data when policy makers may lack the skills and knowledge to use the data which can hinder the data utility [163].

Secondly, the effect of the earthquake on living conditions diverted the policy makers' attentions from routine activity to emergency and surveillance actions. Although these tasks are very important in the critical conditions in the aftermath of a disaster, they should not undermine routine tasks from being undertaken, particularly when the collected data are used not only to monitor the longer term effects of a disaster, but to also make governments accountable to the people [152].

Finally, poor coordination between the national and international aid agencies to send routine data to the province was another problem after the earthquake. Although the role of national and international aid agencies is very important in disaster relief after an earthquake, poor coordination and lack of task definition regarding routine data collection resulted in no data being sent for a few months after the disaster. This time would have critical effects on the population's health due to changing socioeconomic factors. Needless to say, these data have a critical role in recognizing the problems that develop after a disaster. They can be used as indicators for need of health care services and ultimately for planning future responses to similar situations in a developing country.

5.5 Maternal mortality data collection

In this section I will discuss the usefulness of establishing a parallel system to the current national system for collecting data on maternal deaths. While health workers reported being overburdened with a significant number of tasks during interview, the maternal mortality committee launched a parallel system to collect maternal deaths exclusively. This initiative was intended to reduce maternal deaths.

It remains uncertain whether this new policy can improve detection of maternal deaths. Establishing a system in parallel to the main data collection system might give better quality of data but it undermines the main data collection system and the Civil Registry and is destructive for entity of health system [2]. It also causes duplication, and increasing the work load of staff [2] . Another point is that this happen when the data user and policy maker believe that there is a problem with national health information system [2]. This belief might hinder any attempt to improve the national health information system by deviating all attentions and budget to substitute parallel programmes.

Another matter of findings of the study is that, due to the instigation of a specific investigation into maternal deaths, the accuracy of data may have deteriorated. Staff who had the dual responsibilities of caring for patients and collecting data on maternal deaths reported a conflict of interest when targets to reduce maternal mortality were introduced [17]. There were reports of staff being punished following investigation of a reported maternal death. This could have resulted in non-reporting of maternal deaths or falsification of data. This is of particular concern if decision relating to health policy and health care resource allocation were to be based on the incomplete or inaccurate data.

In addition, there are other problems discussed previously. These are outlined in following. The results showed that data were not sent to the Family Unit from all data sources including non-maternity hospitals, rural areas and the Forensic Medicine Unit. Non-maternity units and health facilities in rural areas did not know that maternal deaths must be reported to the Family Unit. Therefore these deaths were reported with other deaths to other destinies, such as the Statistics Unit and the Development Unit. This could reflect the lack of an efficient informative system to inform all relevant staff of a new rule. Also there was inconsistency in defining a

maternal death in comparison to the standard accepted definition. This might reflect a lack of availability of guidelines. Furthermore the results found that data were not sent from the Forensic Medicine Unit. This, as noted before, could reflect lack of coordination and collaboration before introducing this programme and also lack of guidelines on how to define maternal deaths categories.

5.6 Limitations

There is very little research on routine data collection after disasters. This study has revealed useful information in this important area. However, I acknowledge that there are some limitations with this study. First of all, it is unlikely that this study could be generalised to all data collection system and all disaster types. The Bam earthquake was a very destructive earthquake with extreme effects on the health system. Therefore, the significant problems that have been described might be different after other types of disasters, such as a flood or a minor earthquake.

In addition, the setting of this study is Iran which is a developing countries. This means its findings might not apply to developed countries. These countries are likely to have better infrastructures for data collection systems, which are likely to be more robust in the context of a natural disaster.

When undertaking interviews during qualitative research, ideally a voice recorder is used, thus allowing accurate transcribing of an interviewee's spoken words. As mentioned in the method section, for some reasons I could not record all interviews. This hindered me from recording the full details of some of the interviews. Although I tried to capture all of the main points, it still possible to miss out some of the points mentioned during interview.

The interviews were conducted in Farsi. On occasion, some phrases and slang terms were extremely difficult to translate word-for-word into English. I sought some advice from experts and also used textbooks to tackle this problem. However, some of the nuances in language usage have been lost when presenting the data in English.

Due to the time and financial limitations, this study has been conducted in one province. Although in Iran all provinces work under a united system, conducting the same research in another province might have provided more information and revealed other angles to the problem with data collection systems. Also this are focused on routine data collection the results might be different in non routine data collection

Data from the Civil Registry were not available at the individual level. This impeded any effort to undertake case matching to find if the Medical Sciences University and the Civil Registry has found the same cases. Despite this significant limitation, discrepancies were still observed between the two organisations which have been explored. If matching had been undertaken and the mortality figures from each organisation had been attributable to different cases, the maternal mortality ratios reported would have been a significant underestimation.

Furthermore, data were not available for the first two years of the five years study period at the Statistics Unit which hindered the comparison of maternal mortality ratios estimated from this data source with the Family Unit and the Civil Registry.

In addition to above, the existing problems found with the data collection systems raise concerns regarding the usefulness of using such data to monitor the effects of the earthquake. My first objective was to use these data to study the pattern of maternal deaths over the time. However, the data from any of these units have not been found to show a reliable pattern of maternal deaths.

Furthermore, there were some significant limitations on my ability to conduct the study. The main problems were those that emerged as a result of the earthquake and had not been resolved by the time I undertook the fieldwork. These included the lack of availability of landline telephones and the fact that mobile phones that are registered in other cities are useless in the field. As a result, the Family Unit administrator was able to help by using her mobile phone to confirm that the interviewees would attend their routine monthly meetings, which are held in the Bam health network. I could then arrange another date to visit their workplace and complete my interviews. Another problem was the difficulty in finding addresses due to the relocation of buildings that were destroyed by the earthquake, and the unfamiliarity of non-native drivers with the streets which were devastated by the earthquake and remained unnamed.

In addition, I am slightly concerned by the acquiescence that occurred in some interviews, particularly in those with the data collectors. This was because in responding to the question: “How do you prioritize your responsibilities?” the answer was “Maternal care”. I tried to articulate my questions very carefully to be non-directive but I think that in explaining to the interviewees the nature of my study topic made, this made it hard to avoid this bias.

This study, therefore, had significant limitations, and it was not possible to capture all of the data that was planned at the outset of the study. However, this is the first study conducted on data collection in Iran which gives specific attention to the data collection systems in the context of a disaster. Developing countries and disaster-prone countries might, therefore, use the results to improve their own data collection systems, particularly in the aftermath of a large disaster.

5.7 Conclusion

Examining the pattern of maternal deaths to find the effects of natural disaster on maternal deaths was the main initial aim of this study. However maternal mortality ratios estimated from different data sources produced contradictory picture of maternal deaths. This triggered more exploring to the mortality data from different settings. This, in turn, addressed how data collection systems work in disaster and non disaster situations. A mixed quantitative and qualitative study conducted to achieve the goals. The main results which are obtained through interview with relevant people, documents and observation are summarized in this chapter are based on numeric and non numeric results.

5.7.1 Numeric data

The results of estimation of maternal mortality ratios from different sources produced different pattern of maternal deaths. More scrutiny on mortality data from different unit and cities showed that the inconsistency of mortality data is not limited to the maternal mortality and to Bam city. Also case matching of data from two units under the Medical Science University found that the problems with the quality of data are unlikely being related to the type of organisations.

Thus more exploration of the data collection systems was conducted in disaster and non disaster situations.

5.7.2 Non numeric data

The results of this study found that there are a range of problems in data collection system in the Civil Registry and in the Medical Science University. These include poor performance in data capturing due to lack of coordination and collaboration of data sources to send the data to the targeted organisations, and in adequate rules and regulation or enforcement of regulation to report the deaths. There are also problems with data handling such as transferring the data through paper to the upper levels in part of the system which does not come as an accurate and fast method of data transition. Also having many limitations in availability and using the technology can cause many problems with data quality. Additionally the quality of data can be

deteriorated via little data checking, in adequacy of human resources and little data usage. Moreover, lack of a guideline hinders availability of clear and straightforward definition of the data collection strategy and indicators should be collected. This has caused duplications and can also over burden the staff. On the other hand the data analysis is limited to the national levels with inadequate data usage.

As far as the Bam earthquake concern there has been problems in data collection immediate after a disaster for the Medical Science University. This originated through not working the routine data collection systems run in no disaster situation from the Medical Science University immediately after a disaster. Also low consistency between the software used in the Medical Science University and the Civil Registry, as the solitary source of data, hampered any data transmission from the Civil Registry to the Medical Science University.

Furthermore, no data sending from the international organisations aided the country in health provision after the Bam earthquake limited the accessibility of the Medical Science University from the data related to that period.

Another main point of results focus on maternal deaths data which are collecting through the Family Unit. This strategy might provide more complete data but it can not be a suitable method of data collection with the ultimate aim of improving the data due to being parallel to the main data collection system. Also punishing the people based on the data they are sending might provoke falsifying of data.

The main finding of this study suggest that the data might be failed in fulfilling the ultimate aim of data collection systems which is using the data in decision making to improve the function of health system. The data are not representative due to not capturing a part of deaths data. This can be jeopardized for plans which are supposed to be designed based on the data. The data which is missed out a group of people can give a biased picture of deaths happened at the society. This can be the case particularly with those who live in the remote areas and might be in need for special attention and planning. Therefore planning based on such data could lead to an unfair service delivery and ultimately.

The second concern is timeliness. Possible delay in sending the data from the peripheral branches at the Civil registry and regular delay in sending the data at the

Medical University are reported in the study. This can be traced back into the lack of strong regulation and inadequate management ability, overburden of staff and also low data usage in decision making. It is discussed that the information should be available day to day for managers [6].

Also they might not be a good source of data for epidemiological studies. Low accuracy and incomplete data do not reflect the true pattern of mortality on different groups and different geographical areas. Hence, the true high risk and vulnerable people might not be recognised.

This study can be the first step of strengthening the health information system in Iran. This is beyond doubt that if the system is not known it is hardly possible to improve it. It also takes the policy makers' attains to this imperative that which part of systems needs to be revised and which part should be amended. This study suggests different approaches to strengthen the system. They can be applied in no disaster and disaster situations. First there are some requirements before setting the systems including introducing appropriate rules and regulation to oblige different data sources to send the data and sharing different stockholders' views before launching the data collection systems on definition the long term and short term indicators for monitoring activities. Also allocating enough resources including human resources and providing appropriate training before commencing the job are of important factor to improve the system. Having good and strong enough communication infrastructures can increase the speed and accuracy of data.

In addition, some supervisory activities should be in placed to ensure that the data collection procedures is on the right track and data checking is undertaken by related stuff. Using consistent software in different organisations provides not only more complete data by data transferring they can also improve the quality of data through data cross checking.

Finally the data usage culture should be encouraged by the government in all levels including national, provincial and districts levels. This can be achieved through

introducing a system of incentives for use the data in decision making and allocating budget via the data. However inadequate of knowledge about the data, statistics and interpretation of data might hinder any attempts to increase the data usage in the decision making, thereby it is suggested to enhance the knowledge of managers by launching training courses about these issues. Also appropriate training courses for data collectors and data processors to increase their knowledge about the way they are undertaking their job and importance of data should be in placed.

Another matter of concern is lack of a guideline. Initiative a guideline explaining the indicators for short term and long term activities is very helpful. This not only prevent any ambiguity about what each indicators mean and which data should be collected they also can reduce the duplication on data collection.

Furthermore sending the same data with different formats is a tedious job. Having a statistics unit in each department might be wasting time and money and duplications. Therefore launching one independent statistics unit responsible to deal with data might decrease the load of work of staff collecting the data and also provide more focused and accurate system of data collection. This type of system might also facilitate the supervision activities which in turn improve the quality of data.

Regarding disaster and data collection it is very important to have the collaboration of international organisation to send the data to the host country. Low collaboration might be due to this fact that there is little awareness about the importance of having the flow of data collection after a disaster for planning for disaster stricken country. Therefore appropriate strategies might be needed to increase this awareness in the national and global level. This can be achieved through international organisations such as World Health Organisations or Red Cross Organisations.

The next step followed by this study can be evaluation of knowledge of different groups which deal with data including decision makers, data collectors and processors. This is important to find out the level of knowledge to design the proper training programme for these groups. Furthermore, capture-recapture, a quantitative

approach is suggested to deal with the incomplete data sources. Therefore, applying this statistical method could compensate for an incomplete dataset if such a study is conducted in the future.

Although there are some limitations such as generality of results to some settings such as developed countries, this study which is conducted for the first time in Iran is an original piece of work highlighting problems existing with the data collection system in Iran in order to help the country to strengthen the system. This would be useful for other developing countries with similar systems. Also disaster prone countries can be beneficial of results due to originality of this study in flagging the problems with routine data collection after a disaster.

Appendix

Appendix1: Tables in the vital Zij and the Millennium Development Goals (MDGs) & Iran

Table 1: population based on gender and age (vital Zij)

Place and gender	Main village		Peripheral village		Total	
	Male	Female	Male	Female	Male	Female
Age(year)						
1>						
1-4						
5-9						
10-14						
15-19						
20-24						
25-29						
30-34						
35-39						
*40-44						
45-49						
50-54						
55-59						
60-64						
65-69						
70-74						
75-79						
80-84						
85<						
total						

The population table has two columns for women between 10 to 49 years old; the colore column shows the married women

Table 2: the data on the births and mother

Delivery condition	Traditional midwife		Main village	Perinheral village
	Trained midwife	Educated midwife		
Mother's age at the birth	Hospital/maternity			
	45-49			
	40-44			
	35-39			
	30-34			
	25-29			
	20-24			
	15-19			
	10-14			
	Weight and age of new born	Not weighed	female	
male				
>=2500gramm		female		
		male		
<2500gramm		female		
		Male		
Live births	female			
	male			
Still births	Female			
	Male			
Village			Main village	Perinheral village

Table 3: maternal deaths because of pregnancy and delivery based on age and cause of death

Age		10-14	15--19	20-24	25-29	30-34	35-39	40-44	45-49
		Place and cause of death							
Main village	Bleeding								
	Infection								
	eclampsia								
	Other causes								
Peripheral village	Bleeding								
	Infection								
	eclampsia								
	Other causes								

Table 4: Deaths data based on the age and gender

Place and gender Age	Main village		Peripheral village	
	Male	Female	Male	female
1 month>				
1-12 months				
1-4 years				
5-9				
10-14				
15-19				
20-24				
25-29				
30-34				
35-39				
40-44				
45-49				
50-54				
55-59				
60-64				
65-69				
70-74				
75-79				
80-84				
85<				
total				

The data are recorded in the tally form

Table 5: Death of children less than 5 years based on the cause of death

Resident Place and age Cause of death	Main villages			Peripheral villages		
	1 month>	1-12 months	1-5 years	1 month>	1-12 months	1-5 years
Respiratory infections						
Diarrhoeal and vomiting disease						
Accidents, poising, burning						
Low birth weight						
Prematurely						
preventable disease by vaccine						
Neonatal deaths because of delivery problems						
Congenital disorders						
Other causes						

Table 6: family planning coverage based on the type of contraception

Period of time		End of	End of	End of	End of	
Resident place and contraceptive method		spring	summer	autumn	winter	
Main village	Tablet					
	Condom					
	Tubectomy	women				
		men				
	Injection					
	Norplant					
	Others					
	Natural					
Peripheral village	Tablet					
	Condom					
	Tubectomy	women				
		men				
	Injection					
	Norplant					
	Natural					

Table 7: using Iodization salt

Resident place	The number of families	The number of families using salt Iodization
Main village		
Peripheral village		

Table (8): the Millennium Development Goals (MDGs) & Iran

Aim	measurement	Index	trend	figure
Eradicate Extreme Poverty and Hunger	Extreme poverty	proportion of population with income below \$ 1(PPP) per day,	Decreased	0.9% - 0.2% (1999 – 2005)
		proportion of population with income below \$ 2 (PPP) per day	Decreased	7.3% - 3.1% (1999 to 2005)
		poverty gap ratio based on \$ 1 and \$ 2 (PPP) per day	Decreased	0.2% and 1.4% To 0.1% and .6% (1999- 2005)
		The poverty gap ratio for the food	Decreased	3.9%- 1.9% (1999-2005)
		poverty share of total consumption of the poorest quintile	Increased	5.5% - 5.9% (1999-2005)
		Extreme Hunger	national poverty line	Decreased
	Underweight five years old	Decreased	15.8%- 5% (1991-2006)	
Achieve Universal Primary Education		net enrolment ratio	Increased	85% -98% (1990-2005)
		proportion of pupils starting grade 1 who reach grade 5	Decreased	13% - 6.6% (1990-2006)
		literacy rate for the 15-24	Stable for men Increased for women	81.1%- 96.7% (1990- 2005)
Promote Gender Equality and Empower Women		ratio of female students enrolled in primary, secondary and tertiary	increased	79.2 % - 94.3% (1990- 2005)

Aim	measurement	Index	trend	figure
		education		
		ratio of women to men in higher education	Increased	37.4% -110.5% (1990- 2002)
		ratio of literate women to men in the 15-24 age group	Increased	87.9% - 98.6 (1990-2005)
		share of women in wage employment in the non-agricultural sector	Increased	10.5% -16.1% (1990- 2005)
Reduce Child Mortality		child mortality rates	Decreased	68 in 1000 live births (1990) to 36 in (2000.)
		infant mortality rate	Decreased	52 per 1,000 live births in 1990 to 28 per 1,000 live births in 2000.
		proportion of one-year-old children immunized against measles	Increased	85%- 99 % (1990- 2003)
Improve Maternal Health		maternal mortality ratio per 100,000 live	Decreased	91 in 1989 to 24.6 in 2005
		proportion of births assisted by skilled attendants	Increased	89.6% 97.3 (2000-2005)
		the contraceptive prevalence rate in the country	Increased	49% - 78.9% (1989- 2005).
		Adolescent (15-19)	decreased	54 children per 1000 women in

Aim	measurement	Index	trend	figure
Combat HIV/AIDS, Malaria and Other Disease	fertility rate			1996 to 26.8 children per 1000 women in 2000.
	Malaria	The prevalence of malaria	Decreased	94 in 1996 to 30 in 2005
	HIV	The total number of registered HIV/AIDS infected cases was calculated as 12,698 by late September 2005, of which 94.5 percent were men.		
		Cases where the mode of transmission is unknown were estimated at 26.2 %, injecting drug use at 64.2 % is the highest mode of transmission responsible for		

Aim	measurement	Index	trend	figure
	Tuberculosis	the spread of HIV/AIDS in the country and the next highest mode at 7.4 % is through sexual contact. notification rate of tuberculosis	Declined	from 43 cases per 100,000 in 1990 to 27 in 2006
Ensure Environmental Sustainability		ratio of the area protected for maintaining biological diversity to total surface area of the country Energy use (kilogram oil equivalent) per \$1 GDP (PPP) Carbon dioxide emissions per capita	Increased Increased Increased	4.6% 7.32% percent (1997- 2005) 0.309 kilogram in 1990 to 0.327 in 2006. 4,002 in 1996 to. 5,284 Kg in 2006

Aim	measurement	Index	trend	figure
		The proportion of the population with sustainable access to an improved water	increased	89.6 % - 93% (1990- 2000)
		percentage of the population with access to the sanitation.	Increased	64.3% - 82.8% (1990-2000)
Develop a Global Partnership for Development		proportion of debt service as a percentage of exports of goods and services		63.2% -33.7% (1997- 2005)
		The unemployment rate among 15-24 year olds	Decreased/ Increased	23.8 percent in 1990 , 19.2 in 1996, 21.6 percent in 2005
		The number of telephone lines	Increased	4.04 per 100 population in 1990 to 29.6 in 2005.
		the number of personal computers per 100 population.	Increased	6.28 in 2000 to 10.37 in 2006
		number of Internet users per 100 population		9.87 persons in 2006

Appendix 2: Rural Health Houses activities

The main functions of Health Houses areas are described as follow by Naghavi [108].

Dealing with patients

A Behvarz is trained for prescribing the symptomatic treatment for some illness which they have their necessary treatment. They also Refer the patients to the doctor for those illnesses they do not have any training. If it is an urgent case the reference will be at the same time otherwise an appointment will be arranged with the doctor when the doctor comes to the village. The physicians are supposed to come in the health house one day a week to visit the patients.

Mothers and newborns Care and preventive activities

There are some cares and preventions for these two high risk groups including the height and weight control, umbilical cord examination, training the mothers on the correct way to do breast feeding, wash the baby, family planning and other related subjects. In addition, they administer the BCG, Polio and hepatitis vaccine over the neonatal period.

Child care

They provide children with the subsequent services; Height and weight control, training mother on the feeding the baby, administrating the necessary vaccines including polio vaccination in three times starting at one and a half month age and record all the details in the mother and child files. A check up is undertaken every two months for all 12 to 26 months children then it is 3 times in the age of 24 to 36 months. The check up is every 6 months for each 36 to 60 months child.

Pregnancy care

The pregnant women are controlled 13 times during their pregnancy. The cares includes a series of actions to find any high risk mother to refer to the physician such as weights, blood pressures, edam in the inferior limbs control.

Postnatal cares

After delivery women receive care three times by the Behvarzes; over the first 2 days, 10 days and 42 days after delivery.

People with hypertension

Screening the people over 30 years old for high blood pressure is added to their responsibility recently.

Mental health

Provision of care for people with mental problems

Student's health

The periodical examining of students are of other Behvarz responsibility.

The Handicaps cares

Provision of cares and training for family with a handicap child is undertaken by the Behvarz

Other responsibilities

There are a number of other responsibilities such as environmental sanitation, food sanitation, and water sanitation , data collection and annual health census[113].

Appendix 3: urban health facilities

General clinic

They are run by a few general practitioners funded by private or charity working in the different shifts. They provide the following services: ambulatory patient admission, consultation, medicine prescription, ambulatory and small surgery operation performance, preliminary preparation activities to refer patients with an emergency condition to the specialized centres [108].

Clinic

These centres are similar to the general clinic funded by charity, private or public while running by the specialists to provide more specialized cares. They also provide people with consultation, diagnostic test, prescribing the medicine and ambulatory cares.

Polyclinics

They consist of different types of specialists working in the same building. Sometimes they work beside the private and public hospitals.

Personal office

All general practitioners, specialists, dentists can have their own office which is utterly a private section. There are no public or charity ones. Midwives can have their office on condition that their office is beside a general practitioner or a specialist.

Limited surgery operation (Day clinic)

They are private centres to provide small surgery operation that do not need to have anaesthesia or a large surgery operation which needs anaesthetics without hospitalization. In this case patients can leave the centre in a few hours.

Laboratory unit

These units supply population with laboratory services dividing to clinical pathology, clinical diagnosis, and anatomic pathology, clinical and anatomic pathology with together. They provide a range of laboratory services for population.

Radiology unit

Provision of diagnostic radiology tests are their main responsibility.

Rehabilitation unit

These units help people with disability to keep their rest abilities and rehabilitate them to lead a normal life.

Pharmacy

They provide people with medicine (making and selling) and medicine consultation.

Hospitalization services

They include, hospitals, maternity hospitals and any type of services equipped to the beds to admit and hospitalize the people in need. They can be private, public, charity or related to other organisations such as social security or army

District hospitals are responsible for providing services to referred cases from the Rural Health Houses and Urban Health posts [113]. Although this referral system exists officially, in practice it is insufficient because of scarcity in budget and suitable facility for Health Houses and because of a shortage of health professionals in remote areas [109].

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Introduction

The hand out consists of details of each study including a table with information on tools, interviewees, and approximately time needed plus different questionnaires and guide lines according to the type of study and interviewees.

The appendix includes time table, back ground information on health information system and the interview prompt for health system.

Study A: The health system in Iran

The table provide some information on the objective, the method and interviewees and approximately needed time to achieve the objective (A)

Table 1. Detailed plan for achieving objective of Study A

Objective (A)	Give an account of the health system in Iran
The method	<ul style="list-style-type: none">• Interview using interview prompt (1)• If the interviewer refers me to the further documents or informants they will be included
Interviewees	Health, education and treatment deputies in Kerman Medical University (n=3)
Approximately needed time	4 days

The Health System Interview guides have been designed according to Appendix (1): Two slightly differing interview guides have been prepared for the Health and Treatment Deputies (HSIG 1), and for the Education Deputy (HSIG 2). These can be found on the next two pages.

Health System Interview Guide (1) – HSI1

Interviewees: health and treatment Deputy

1. Which sector of health (primary ,secondary, rehabilitation) is under supervision of health deputy/ treatment deputy
2. Given that the answer of question (1) is primary, the second question could be what the definition of primary care is in the Iranian health system?
3. Given that the answer of question (1) is secondary, the second question could be what the definition of secondary care is in the Iranian health system?
4. Given that the answer of question of (1) is rehabilitation, the second question could be what the definition of rehabilitation care is in the Iranian health system?
5. Which types of primary care /secondary care/ rehabilitation are available: if they are private, public, voluntaries or charities?
6. Who/which body is financially supporting the primary care /secondary care/ rehabilitation e.g. equipments, utilities and premises and staff salaries?
7. Who regulate primary care /secondary care/ rehabilitation from financing aspects such as medical fees, prescription fees, nursing and midwives care, the method of employments and the number who is needed to be recruited and working time
8. What is the role of national, sub national, international level and also public or private section in the health policies regarding for primary care /secondary care/ rehabilitation?
 - If they are decided in the provincial level or other sections
9. Who/which body is responsible for staffing of primary care /secondary care/ rehabilitation (administrative and health staffs)?
10. What percentage of human resources is in private and government sectors in the primary care /secondary care/ rehabilitation?
11. How different are the rural and urban area in terms of services delivery in terms of primary care /secondary care/ rehabilitation?
12. What types of insurance are available, does it differ from the jobs and residential place or so on? Coverage in terms of types of groups of people classified by job, resident place,

13. What do these insurance cover in terms of medical care e.g. dental treatments, prescription, site test, surgery expenses and laboratory examinations

14. Who/ which body regulate them from the mentioned aspects and the proportion of health fees they pay?

Health System Interview Guide (2) – HSI2

Interviewees: education deputy

1. What types of health educational organisations are there in Iran? (Private, government, semi private.....)
2. Who/ which body fund the medical universities? From equipment, utility, premises aspects
3. Who pay staff salaries in both administrative and professional level?
4. Which organisations staff them (private, public or semi private)?
 5. Who regulate different aspects of these organisations such as cost, education materials and rules
6. What is the university entrance regulation?
7. How many medical students graduate each year?
 8. What was the rate of growth in the number of medical university and medical students over the time?
9. What percentage of students is employed in health section?

Study (Bi & ii) Qualitative and Documentary study of Maternal and Child Health Routine Data Collection System in Iran

The table provide some information on the objective, the method and interviewees and approximately needed time to achieve the objectives of (Bi, Bii)

Objective (Bi),(Bii)	Examine the data collection system in Iran for maternal and child mortality, by (i) interview and (ii) by obtaining copies of documents such as data collection guides and reporting requirements
The method	<ul style="list-style-type: none"> • Interview using interview Data Collection Interview Guide • Obtaining copies of documents from interviewees or following up on and obtaining copies of documents cited by interviewees. In addition recommendation available from the internet (will be included for comparison.)
Interviewees	<p>Health, treatment deputies in Kerman Medical University, data holders in the Kerman medical university(treatment and health deputies), data holders in forensic medicine and death registry, data holders in Bam network (is there not more than 1?) and Bam hospitals (n=?) and data collectors in the hospitals(public and private, n=?)</p> <p>What about Beharvs...? (n= at least 10!</p> <p>Tthe last 3 are probably most important as to what actually happens, compared to what the Deputies think should happen!</p>
Approximately needed time	10 days

The Health Information System Interview Guides (HISIG) have been designed according to Appendix (2): Health information system

Health Information System Interview Guide (3)
Interviewees: health and treatment deputies

- 1) Is there any person or organisation responsible for data collection at the provincial and national level?
 - If yes, is it public or private? (Then I will ask permission to interview with him or her)
- 2) Is there an obligation to report health related events such as maternal mortality, child mortality and live birth information from public and private and non health sectors (death and birth registry, forensic medicine)?
 - How strongly these enforced? If data are not sent are any sanction happened?

- 3) Are routinely data collecting used in the health policy in the provincial levels or national levels? If yes what is the usage of routinely collected data on maternal and child mortality?
 - If for example a high maternal death is reported and confirmed is there any thing Kerman medical university do or it should be reported to Tehran and they make decision?

- 4) How long it takes to receive the results of data analysed.
 - Do you think it is on time and usable? If not, why?
 - Do you think the results are enough information?

- 5) Is there any investment in data collection analysis and utilization? If so what percentage of the health budget?

- 6) In terms of expertise, who works in HIS?
 - At national level
 - Sub national level
 - Peripheral level

- 7) What is the position of health information within the ministry of health with reference to?
 - Is there a statistics or semi statistics unite
 - Can They influence the health policy

8) Is there any coordination and leadership from the following stakeholders to determine their demands and their requirements for data and indicators?

(Statisticians, health professional and NGOs representative, Academics, international and national agencies)

Health Information System Interview Guide (4) - maternal death child death and live birth

Interviewees: data holders

- 1) What is the flow of data collection maternal and child mortality plus live birth (from the beginning, where it happens, to their data warehouse) then I will ask a copy of the data they have received from the lower level.
- 2) Is there any warehouse to save the data? If so who design it?
- 3) How long does it take to receive the data from the bottom to the top level of data collection flow
- 4) Who/ which body demands the data?
- 5) Do they have to prepare the results according to the pre designed forms? Or according the decision makers or authorities ask?
 - What is the problem of prepared form (if they include enough information?
 - What is the problem of providing base on the decision makers or authority's needs? Then if it is a prepared form then I will ask to see them
- 6) How often the out put must be sent to the higher level? Or decision makers?
- 7) Have they asked to collect, save, analyse or disseminate this data? If they do so in which form they are presented; table, statistics, or raw data. Then I will ask them to look at them.

Given that the answer of question (7) is they analyse the data then the following questions (8-11) will be asked;

- 8) Have the statistics needed are determined such as maternal mortality and child mortality rate and ratio clearly if so by who/ which body?
- 9) Have the denominators and nominators are clearly defined? If so by who or which /body? Then I will ask to look at the available documents in this field.
- 10) Has linking indicators been determined with data collection strategies, suitable data sources for each selected indicators identified
- 11) Is there any standard definitions for indicators (Maternal mortality rate and ratio) if so, who determine them? Then I will ask to look at them
- 12) Are there any written protocol about the suitable way of collection data for each variable, periodicity, analysis, estimation methods and possible of biases data
- 13) Is there any audit to correct bias and confounding
- 14) In terms of confidentiality what is the requirements for data access? And who can access them?
- 15) During the Bam earthquake how was the flow data collection?
- 16) Do you face any problems regarding the timeliness, illegibility, language, completeness and the extend of information
- 17) What are their academic majors and if they have any previous experience, what is their job situation; they are full time or part time...)

18) Is there any continuous training for them? If so how many / how often? By whom and in what field and subjects, if it was possible see the material

19) How are data transferred to the higher level , hospital, district health network, provincial and national levels (hand writing, CD, Internet)

20) Do they have enough equipment such as computers, printers, Internet, mobile, telephone and transport vehicle

21) The last question is that if a woman die in the Kerman hospital but she is from Bam if they record her as Bam or Kerman statistics.

Health Information System Interview Guide (5) maternal death child death and live birth

Interviewees: data collectors in the hospitals

- 1) What is the flow of data collection maternal and child mortality plus live birth (from the beginning, where it happens) then I will ask a copy of the data they have sent to the higher level.
- 2) How long does it take to send the data o the higher level
- 3) Who/ which body demands the data?
- 4) Do they have to prepare the results according to the pre designed forms? Or according the decision makers or authorities ask?
- 5) What is the problem of providing base on the decision makers or authority's needs? Then if it is a prepared form then I will ask to see them
- 6) I will look at this form and see how suitable are (if they include enough information
- 7) How often the out put must be sent to the higher level? Or decision makers?
- 8) Have they asked to collect, save, analyse or disseminate this data? If they do so in which form they are presented; table, statistics, or raw data. Then I will ask them to look at them.
- 9) Given that the answer of question (7) is they analyse the data then the following questions (8-11) will be asked;

- 10) Have the statistics needed are determined such as maternal mortality and child mortality rate and ratio clearly if so by who/ which body?
- 11) Have the denominators and nominators are clearly defined? If so by who or which /body? Then I will ask to look at the available documents in this field.
- 12) Has linking indicators been determined with data collection strategies, suitable data sources for each selected indicators identified
- 13) Is there any standard definitions for indicators (Maternal mortality rate and ratio) if so, who determine them? Then I will ask to look at them
- 14) Are there any written protocol about the suitable way of collection data for each variable, periodicity, analysis, estimation methods and possible of biases data
- 15) Is there any audit to correct bias and confounding
- 16) In terms of confidentiality what is the requirements for data access? And who can access them?
- 17) During the Bam earthquake if they collected data or not how was the problem of collecting data?
- 18) What are their academic majors and if they have any previous experience, what is their job situation; they are full time or part time...)

- 19) Is there any continuous training for them? If so how many / how often? By whom and in what field and subjects, if it was possible see the material
- 20) How are data transferred to the higher level , hospital, district health network, provincial and national levels (hand writing, CD, Internet)
- 21) Do they have enough equipment such as computers, printers, Internet, mobile, telephone and transport vehicle
- 22) The last question is that if a woman die in the Kerman hospital but she is from Bam if they record her as Bam or Kerman statistics.

**Health Information System Interview Guide (6)- Death registry
Interviews: data holders**

- 1) What is the flow of data collection on death from different sources?
Then I will ask a sample of a form they have received from the data sources
- 2) How long does it take to receive the data from the bottom to the death registry from different sources? In other word can you estimate how long takes from the death time to registration time?
- 3) Is there any warehouse to save the data? If so who design it?
- 4) Do they have to prepare the results according to the pre-designed forms? Or according the decision makers or authorities ask?
 - 1) What is the problem of prepared form? (Does it include enough information?)
 - 2) What is the problem of providing the data base on the decision makers or authority's needs? Then if it is a pre-designed form then I will ask to see them
- 5) Have you been asked to collect, save, analyse or disseminate this data? If they do so in which form they are presented; table, statistics, or raw data. Then I will ask them to look at them
- 6) Which body/ who use or ask your data?
- 7) How often you must disseminate the data to the corresponding organisations?
- 8) How are data transferred to the higher level , hospital, district health network, provincial and national levels (hand writing, CD, Internet)

- 9) How many types of equipment such as computers, printers, Internet, mobile, telephone and transport vehicles are there? Do think they are enough?
- 10) Are there any written protocol about the suitable way of collection data for each variable, periodicity, analysis, estimation methods and possible of biases data? If so who designed it?
- 11) Is there any audit to correct bias and confounding e.g. if one person is recorded twice , cause of death, not reported
- 12) Is there any obligation to record death in Iran?
- 13) What punishment will be happened if some body do not register his relative's death?
- 14) How data collected at the emergency phase and if there was any coordination between death registry and national and international organisations to collect and send data to death registry organisation?
- 15) Were there any obligations for them to send this sort of data to death registry?
- 16) Was there any standard form to get data from these organisations? If yes, who designed them?
- 17) Do you think it included enough information
Then I will ask to look at the form
- 18) What were the problems of registering a death because of such disaster as Bam earthquake?

19) Was there any punishment or motivations to report a death because of disaster? Do you think the recording of deaths were timeliness, accurate (from cause of death or demographic variables)

Study (Biii) Assessing quality of Maternal and Child Mortality Data

The table provide some information on the objective, the method and interviewees and approximately needed time to achieve the objective (Biii)

<p>Objective (Biii)</p>	<p>This objective consists of two separate sections:</p> <ul style="list-style-type: none"> • The first one is validation of quality of data by means of cross-comparing summary data obtained for the same aspects form differing sources. In this part the data on maternal mortality are collected at the very first stage that they happened, hospital wards, and then these data will be checked with those are available in the Bam hospitals, Bam net work, Kerman medical University, and death registry which are collected before and supposed to be the same as those I will collect • The second part is check of non maternal hospital death to find any maternal which is classified as non maternal
<p>The method</p>	<ul style="list-style-type: none"> • Guideline (1) Studying the non maternal files and find any misclassification
<p>Interviewees</p>	<p>No interview</p>
<p>Approximately needed time</p>	<p>43 days</p>

Guideline (1) Accuracy and completeness of maternal mortality for 1 year

Maternal mortality data collection from case notes to summarised data

Quality of data:

- b) Completeness**
- c) Accuracy**

Completeness:

- Completeness of case notes
 - i. If all maternal death have death certificated
 - ii. How complete are the different sections in the death certificate forms
- Completeness of reported deaths to the higher level of hospitals in terms of number and demographic factors
- Completeness of aggregated data in terms of number and demographic characteristics in the districts and provincial level

Accuracy:

- Accuracy of case notes
 - They are really maternal
- Accuracy of reported data to the hospital level (the extent to which they are consistence with the case notes
- Accuracy of aggregated data (the extent to which they are consistence with the case notes and hospital records)

Study (Ci, Cii) Description of maternal and child mortality pre- and post- Bam earthquake

The table provide some information on the objective, the method and interviewees and approximately needed time to achieve the objective (Ci, Cii)

Objective (Ci)	Describe maternal and child mortality from 2 year before the earthquake and 3 years after the earthquake using officially collated data as available (if necessary adjusted to take account of findings for reliability/accuracy in Biii)
Objective (Cii)	Describe maternal and child mortality from 2 year before the earthquake and 3 years after the earthquake using officially collated data as available (if necessary adjusted to take account of findings for reliability/accuracy in Biii)
The method	Using summary data according to Guideline(2)
Interviewees	No interview
Approximately needed time	At the same time of interview

The tool will be used for these two objectives is Guideline (2)

Guideline (2) Maternal and child mortality from 2001 to 2006 and process indicators

1) Monthly death records on maternal and child mortality will be requested from Kerman Medical University if they do not have it *monthly* then Bam network or Bam Hospitals will be asked.(if demographic characteristics are available then I will obtain them)

In case of not availability of data before Bam earthquake, Jiroft data will be draw up

2) The following data are necessary for process indicators:

Population size (**Kerman medical university**)

Birth rate (**Kerman medical University**)

Health facility data (**Kerman medical university**)

Number of caesarean sections (**Bam hospitals**)

Number of maternal death (**Bam hospitals**)

Number of complicated cases (**Bam hospitals if they are available**)

3) Skilled attendance and antenatal care (**Kerman medical university**)

Study (D) Integrative analysis

The table provide some information on the objective, the method and interviewees and approximately needed time to achieve the objective (D)

Objective (D)	Critique the maternal and child mortality data collection in Iran
The method	<ul style="list-style-type: none">• Guideline (3)• The result of my study that show to what extend the data collection system are usable
Interviewees	No interview
Approximately needed time	-----

Guideline (3) Accuracy of the data collection system

Quality of maternal mortality data collection

1. Is any duplication for collecting data? (The same data for different unites in different time
2. Is there any local quality control and use of data?
3. Is there clear definition of data elements?
4. Is there any up to data training and frequent feedback to those collecting and using data?
5. Are electronic communication facilities available?
6. Is there any strong rule to draw up the data from other organisations (public private, hospitals, and non health sectors?)
7. Is there any international **standards** in terms of *impartiality*(who collect them), *scientific* (the standard definition, correct analysis and presentation), *ethics aspects* (who and how can access the data), and *consistency*
8. Is there any body responsible for the data collection procedure in the provincial level? And national level?
9. Is there any link between routinely data collected and monitoring programme in the provincial level and national level?
10. Is there any audit in the data collection?
11. Is there a particular budget for the data collection? If so what percentage of health budget in public and private sections?
12. Are data analysed available for decision makers in the hospital, health network and Kerman Medical University?
13. Is there enough experts people at national level: skilled epidemiologist, statistics and demographic and in the provincial level they health information staff for collection, reporting and analysis

14. How is the position of health information system, Is there a strong position for the health information in the health ministry at a level of equivalent of major disease control ?

15. Is there a statistics or semi statistics unite in the national and provincial level?

16. Is there a warehouse designed by a professional designer?

17. How the data are disaggregated? In terms of availability of statistics stratified by sex, age, socio-economic status, geographical area?

interview Prompt (1) Health system*

1. Medical Education

- Type of educational organisation (private, government, semi private.....)
- Funding the universities in public and private
- Staff salaries in educational organisations
- Organisations provide staff for them (public or private section)
- regulator different aspects of these organisations such as cost, education materials and rules
- the rules to entering the university
- the number of medical students graduate each year
- growth of university number and graduation
- the percentage of students is employed in health section

2. Primary, secondary and rehabilitation cares

- Kind of delivery services: If they are private , public, voluntaries or charities
- funding them
- regulating them
- the role of national, sub national, international level and also public or private section in the health policies
- the organisations that staff them(administrative and health staffs)
- staff salaries
- Percentage of human resources in private and government
- Number of beds and bed occupancy in the private and public section
- Rural and urban discrepancy in terms of services delivery

3. Insurance

- Insurance type, coverage and regulation
- Rural and urban discrepancy in terms insurance

* Source: Oxford textbook of public

Health information system (HIS)*

Health information system can be described in terms of:

- A. **Input:** resources
- B. **Process:** selection of indicators, data sources, data collection and management
- C. **Output:** information products and information dissemination and uses

A. Input (resources):

- 1) The legislative, regulatory and planning framework to ensure a fully functioning HIS
- 2) The resources available for health information include:
 - Human resources, logistic support, information and communications, technology, coordinating mechanisms

B. Process:

- Indicators: a minimum of indicators includes: determinants, health system inputs and outputs, health service coverage and quality
- Data sources: there are two main sources:
 - General population- based estimators: census, vital statistics and household / population based survey and surveillance
 - Those depends on health service or administrative records: disease surveillance, health facility records, administrative records and health facility surveys
- Data management: this covers all aspects of data handling from the collection, management and flow of data to its processing and analysis

C: Output: Transformation from raw data to information, evidence, knowledge and health action

*Source: WHO, health metrics networks: framework and standards for the development of country health information system

Input (HIS resources) :

A. Information policy: supportive and regulatory environment

- i. The legal and regulatory context (draw up information from public and private sector and non health sectors)
- ii. International standards such as the fundamental principle of official statistics such as impartiality, scientific, professional ethics, transparency, consistency, efficiency, coordination and collaboration
- iii. Identifying main actors and coordinating mechanism
- iv. Ensure links to programme monitoring
- v. Accountability mechanisms

B. Financial resources: Investment in data collection, analysis and utilization

- i. The annual cost of comprehensive health information system have been estimated 0.53 to 2.99\$

C. Human resources: National technical expertise and leadership, sub national resources to ensure observation of data quality standards and data use

- i. At national level; skilled epidemiologist, statistics and demographics are needed
- ii. At peripheral levels; Health information staff for data collection , reporting and analysis
- iii. The position of health information position within the ministry of health should be graded at a level of equivalent of major disease programme
- iv. Stabling a statistics or semi statistics unite
- v. Training in all level [pre service (Msc, PhD degree at the university), continuous education]

D. Communication infrastructures: infrastructure and policies for transfer of information between products and users within and outside the health system

- i. In national and sub national level :Computer, Internet , telephone mobile
- ii. transport equipment
- iii. Privacy and ethical

E. Coordination and leadership: a committee of key stakeholders from statistics and health in a high position in the health ministry , NGOs, academia, international and national agencies to determine their demand and requirements for reporting of data from health programme

Process

A. Indicators

- i. Domain of health information:
 - Determents of health: socio-economic, environmental, behavioural and genetic determinants or risk factors.
 - Health system: **Input** to the health system and related **process** such as policy, organisations, human resources, financial resources, health infrastructure, equipment and supplies
outputs: health service availability and quality, information availability and quality, Immediate health system outcomes: coverage of population with key health services
 - Health status: mortality, morbidity, disability and well being

- ii. Defining core indicators:
 - Careful selection and regular review of core indicators are key steps in efforts to strengthen a health information system
 - The process of defining core indicators should involve key national and international stakeholders in the country
 - Link core health indicators and related data collection strategies to a border national statistics strategy such as poverty reduction

- iii. Linking indicators with data collection strategies: suitable data sources should be identified for each selected indicator

B. Data sources

There are some common principles applies to all data sources that are: standard definitions for indicators, appropriate data collection methods, meta data, audit data trail, use of routine procedures to correct bias and confounding and ready to primary data.

Data sources are:

- Population based health information sources include the census, vital events, civil registration as well as sample or sentinel surveillance of birth, death and cause of death, population based survey, surveillance, vector and environmental quality surveys
 - a) **Census**: happening periodically, risk factors such as poverty, sanitary facilities may include and also maternal and child mortality
 - b) **Civil registration**: important factors are: completeness , using medically certificated cause of death, using demographic surveillance system, verbal autopsy to improve the quality, day to day operation of system including the registration and statistical reporting functions, the network of registration office, physical equipment and supply, personnel issues
 - c) **Population based surveys**: house hold data are used to generate; data on child and maternal health, nutrition, use of services, knowledge and practice related to health care, health status evaluation and description,

determinants of health :knowledge, beliefs and practices related to disease prevention and transmission, household expenditure on health

- Health survey based source generate data as an outcome of health –related administrative and operational
 - a) Health and disease records: those for notification of case disease as part of surveillance system, individual patients’ records, cancer registries. Such as growth monitoring, antenatal, delivery outcome and disease records
 - b) Health services records report on services provided at health facilities as well as during outreach and at community level. The important elements are coverage, quality of care, treatment and administered**
 - c) Administrative records: generate data on the overall functioning of the health system such as the availability of human resources, infrastructure and commodities and financial flows. The next step is geographical mapping of facilities, human resources and key services. The next level is quality of services that can be done with interview with clients

C. Data management

Collection, storage, analysis and distribution of data is called data management

- **Accurate and complete data are a fundamental prerequisite data management**
 - a) Reducing the amount of data to the minimum necessary
 - b) Regular local quality control and use of data
 - c) Clear definitions of data elements
 - d) Up to data training and frequent feed back to those collecting and using data
 - e) Availability of electronic communications facilities

- **The following stages are required to have a sound management :**
 - b) Creating a metadata dictionary: it relates data from multiple sources to develop common definitions and to understand the characteristics of each data elements. The metadata dictionary strictly defines data elements and their use in indicators including numerators and denominators. It also specifies the data collection method, periodicity, analysis, technique used , estimation methods and possible biases of the data
 - c) Sound data storage procedure: makes availability of data to decision-making then providing immediate reporting to all levels, being a warehouse, managing by a professional designer with

database experience, data base administrator, a query report designer, a managing board with representative from data sources organisations, a stakeholder. In this place extraction of data are done

d) Data analysis and presentation: being a warehouse in local and districts level to have immediate impacts

e) Data distribution: at all levels(national and international), connectivity with internet , ability to be printed

Output:

Converting data to in formation:

- Extraction data: selecting data elements from the raw data. Transformation of the data may include aggregation, calculation, cleaning, normalizing, merging tables, translating code values, transposing values. Then data become information then evidence and finally knowledge

Standard of data quality:

- a) Timeliness; The gap between when data are collected and when become available to a higher level or are published
- b) Periodicity: the frequency with which on indicator is measured
- c) Consistency and transparency of revision; Internal consistency of data within a data as well as consistency between datasets and over time, extent to which revision follow a regular well established and transparent scheduled and process
- d) Representatives : The extend to which data adequately represent the population or relevant subpopulation
- e) Disaggregating ; the availability of statistics stratified by sex, age, socio-economic status, major geographical or administrative region and ethnicity as appropriates
- f) Confidentiality, data security and data access, the extent to with practices are in accordance with OECD Guideline for protection

Time table and order of doing different stages of the project

Procedure	Time
1) Getting a permission from chancellor of Kerman Medical University for: <ul style="list-style-type: none"> • using data in Bam and Kerman • interviewing with informants in Bam and Kerman • a recommendation for death registry • a recommendation for forensic medicine to have access to their data and interview(I think to do these it is better to have my supervisor's letter) 	1-2 days
2) Make an appointment to the health deputy	1 day
3) Make an appointment with education deputy	1 day
4) Make an appointment with treatment deputy	1 day
5) Search and find introduced documents	1 day (It also will be done at the interview day)
6) Interview with data holder in statistics unit in health deputy in Kerman medical University	1 day
7) Interview with data holder in statistics unit in health deputy in Kerman medical University	1 day
8) At the same time ask both statistics unites in health and treatment deputy a copy of data they hold on maternal and child mortality , health facilities and skilled attendance (summary data and ,if there are, non aggregated data for 2001 and 2006). However if “monthly” data is not available in Kerman Medical University they will be requested from the Bam health network or hospitals	At the interview day
9) Interview with death registry data holder	1 day
10) At the same time ask the maternal death for 2001 to 2006	At the interview day
11) Interview with the forensic medicine data holder and if possible see the women death records for the recent year	1 day
12) Having a trip to Bam and find data holder on maternal mortality in the Bam health network and have interview with them	1 day
13) Ask the mentioned person in the Bam health network a copy of data they hold as maternal mortality for the recent year (non aggregated and aggregated data for recent year)	At the interview day
14) Interview with data holders in the public hospital and find a copy of data on maternal mortality death for the recent year	1 day
15) Interview with data collectors in the public hospital (maternity and obstetrics ward in public hospital)	1 day
16) Find all maternal death from nursing notes happened in the recent year to later cross check and at the same time see if they could be non maternal in public hospital	2-3 days
17) Interview with data holders in the private hospital and find a copy of data on maternal mortality death for the recent year	1 day
18) Interview with data collectors in the private hospital (maternity and obstetrics ward in public hospital	1 day

Time table and order of doing different stages of the project

19) Find all maternal death from nursing notes happened in the recent year to later cross check and at the same time see if they could be non maternal in private hospital	2-3 days
20) Study the all non maternal death between 12-50 years old (Those are not because of suicide, accident, poisoning) in the private hospital	10 month
21) Study the all non maternal death between 12-50 years old (Those are not because of suicide, accident, poisoning) in the public hospital	1 month
22) If I can not find some of my responses (about data collection and health system) in Kerman Medical University and I could not find their answers by email and telephone then I will have a trip to Health Ministry in Tehran	3- 4 days
Total	67 days

List of publications:

1) Evaluation of the usefulness of maternal mortality ratio on monitoring long-term effects of a disaster: a case study on the Bam earthquake (**accepted for publication in Eastern Mediterranean Journal**)

2) Exploration of health information system in Iran; a case study on Kerman Province (**accepted for publication in Eastern Mediterranean Journal**)

3) Data collection after massive natural disasters (Focusing on Bam earthquake, Iran) (**accepted for Disaster management and prevention**)

4) A gap between policy and practice: a case study on maternal mortality reports, Kerman, Iran(**under review at Iranian Journal of public health**)

Evaluation of the usefulness of maternal mortality ratio on monitoring long-term effects of a disaster: a case study on the Bam earthquake.

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Abstract

The maternal mortality could be an indicator of socio-economic conditions. This study aims to examine the maternal mortality ratio changes from two years prior to the Bam earthquake to three years after it. The study used a mixed quantitative and qualitative method.

Results found that there is a remarkable difference in maternal mortality ratios in the year of the earthquake and the year after the earthquake between two data sources. This study suggests more collaboration between international aid agencies and disaster stricken country to report the routine data and strengthening health information system in non disaster situation

Keywords

Disaster, long-term effects, maternal mortality ratio, data quality

Running title

Usefulness of maternal mortality data in monitoring a disaster.

Introduction

Disasters have been one of the imperative threats for human societies. They have affected considerable numbers of people worldwide. According to WHO, about 2 billion people were affected by disasters and 600,000 lost their lives in the 90s alone [52]. Based on the literature, on average 60,000 people die and 250,000,000 are affected by disasters annually [53] [54]. Previous studies confirm that the effects of a natural disaster is higher in developing countries [61] [62]. This is explained by a couple of factors including a higher occurrence of disasters in these areas, poor responses and poor preparedness in the disaster incidence[62].

Health effects of a disaster are discussed to be different in women and men. Broadly speaking, in non disaster conditions women have less capital than men [76]; in a disaster, this would be even worse due to poor access to the resources and policy makers [52] [77]. When it comes to pregnancy it has been shown that stressful events can lead to preterm delivery [15]. Also, it has been reported that in 48 hours after the earthquake preterm delivery increases [78].

Apart from the short term effect of a disaster on safe motherhood, living in camps after a disaster has brought up other concerns regarding the quantity and quality of reproductive health facilities and staff in camps [80] [81] [82].

Concerning maternal mortality, one study found that maternal deaths were lower in women who live in camps compared to women who did not reside in camps [84]. However, it should be borne in mind that due to the different methods of estimation of maternal mortalities for refugees in different countries, the results should be viewed with caution [84]. In addition, even if the same scale is used for estimation, the results depend on the condition of different camps and the level of health care across the country. If a country has very poor health services even in non-disaster conditions it is likely due to the international help in the camps that some provide better health care, while in a country with an acceptable level of health care the results might be different.

Although disasters are described as temporary events [9] they challenge the society immediately after the occurrence and continue for the long term. However, with the exception of mental health, long term effects of disasters on health have not received enough attention [72] [73] [74] [75].

On the other hand, health data highlight health problems to the policy makers who have to choose the suitable strategy for tackling the problems. The historical data also provide invaluable information which helps to provide a better policy implementation. They can be

called an eye for policy makers to see and decide efficiently [17]. With a view to monitoring the long-term effects of a disaster on health systems and society, maternal mortality can be a useful indicator. This is due to the fact that maternal mortality could be affected by changing the life conditions and level of access to the health facilities after a disaster. In addition, it reflects the socio-economic factors which could collapse after a disaster and take considerable time to rehabilitate [34] [12] [35].

The maternal mortality ratio is an indicator with which to measure maternal deaths. The Civil Registry in countries with a high and complete coverage can be the main source for maternal death figures [50].

This study, using different data sources, aims to examine the maternal mortality ratio changes from two years prior to the Bam earthquake to three years after it.

Background on Iran

This section gives a view of Iran to those readers who are unfamiliar with Iran from disaster and health system perspectives.

Disaster and Iran

Iran is one of the most disaster-prone countries in the world. In 2003, a very severe earthquake destroyed Bam, an ancient city on the old Silk Route. This earthquake left dreadful effects on the society by collapsing the socio-economic infrastructures [88] and the health care system [89] [90]. The earthquake left huge numbers of casualties, deaths and injuries and also led to homelessness on a major scale [87]. Since many houses were destroyed, people had to live in temporary accommodation for a long time after the quake.

Health system in Iran

The health system in Iran comprises a combination of health education and health care [107]. There is at least one Medical Science University in each province, which is the official representative of the Ministry of Health and Medical Education in that province [109]. The District Health Network is an office under the supervision of the Medical University, and is the official administrator of health and medical care in each district [106]. Most of the rural population (86%) is covered by health houses which are working under supervision of the Medical Universities [112].

Live births and mortality data collection in Iran

There are two main sources of mortality data including maternal deaths: the Statistics Unit under the supervision of the Health Ministry and the Civil Registry under the supervision of the Interior Ministry. In addition, maternal deaths are collected through the Family Unit at the Health Ministry. The only official source for live births data is the Civil Registry. However, the health staffs use the number of children who received the Polio One vaccination as the surrogate for the live births numbers. They argue that this is more accurate due to the low accuracy of data at the Civil Registry and the almost nationwide coverage of vaccination. The latter was confirmed in the literature [96].

Methods:

This study is a part of a larger study carried out in Bam, in a town located in Kerman province, and in Kerman, the centre of Kerman province. The original study is a mixed qualitative and quantitative study and the data were collected via interviews with informants and documents. As noted, there are three different data sources for maternal deaths: the Family Unit at the Kerman Medical University, the Statistics Unit at the Kerman Medical University and the Civil Registry. The data from the Statistics Unit were available for just three years; therefore this data source cannot be used to study the effects of the earthquake on maternal mortalities. However, it is a very valuable source of data when it comes to comparison. This is because the Statistics Unit has the data in detail so it provides an opportunity to do a case matching with the Family Unit. The other sources, the Civil Registry and the Family Unit, have the data for the period at which the study was initially aimed.

As noted above, the Medical Universities are the official representatives of the Health Ministry; hence, the author needed to have the permission from the Chancellor of Kerman Medical University or the Deputy for Health. This permission, which was necessary to commence the study, was obtained through the Deputy for Health. Collaboration with the Civil Registry was obtained through a letter issued from Kerman Medical University to the Civil Registry, asking for their collaboration in this study. The permission to launch the interview at the Civil Registry was issued by the head of the Civil Registry. The data obtained from different sources were not in the same format. The data from the Family Unit were extracted from the maternal death files. The files provided a variety of data including medical history, demographic and personal information. The author extracted only the personal and demographic characteristics of cases. The data from the Civil Registry and the Family Unit were entered into Excel with a format similar to that of the Civil Registry. The

data from the Statistics Unit, which were originally in Access, were exported into Excel. Then the data which were in Farsi were coded into English. Afterwards they were exported into SPSS before recoding. The final data were grouped similarly to the output of the vital Registry cross tables.

Finally, maternal mortality ratios at the Family Unit were calculated using maternal deaths records for Bam as the nominator and the number of children received Polio one vaccination in Bam as the denominator. Maternal mortality ratios for the Civil Registration were estimated by the number of maternal deaths and live births recorded at the Civil Registry.

Results

The estimated maternal mortality ratios over the time are presented in figure 1. There is a remarkable difference in maternal mortality ratios in the year of the earthquake and the year after the earthquake between two data sources. While the Civil Registry shows the highest maternal mortality ratios at the year of the earthquake, the Family Unit shows the second lowest ratios in the period under study. However, maternal mortality ratios are very high at the Family Unit the year after the earthquake. Surprisingly, the Civil Registry presents one of the lowest numbers of maternal ratios in the year of the earthquake.

Figure 1 : Pattern of Maternal mortality deaths per 100000 deaths according to the different data sources (the Civil Registry, the Family Unit) in Bam from 2001 to 2006

These contradictions can be traced back to the inconsistency in either the denominator or the nominators or even in both of them. Therefore the data which are used for calculation of maternal mortality ratios are explored and compared in table 1. The data indicate that live births recorded at the Family Unit are significantly higher than those for the vital registry over the period under study. Maternal mortality numbers are also higher in the Family Unit in comparison with those of the vital registry, with the exception of the year of the earthquake, which was two for the former and ten for the latter.

Table 1 : Maternal deaths, live births and maternal mortality ratios in Bam based on different sources, the Civil Registry and the Family Unit, from March 2001 to March 2007

Because the data at the Civil Registry were not available in individual forms a cross match comparison to check if these two organisations have captured the same deaths was not possible. However, it still is interesting to know if different organisations produce different results, or the data are not consistent in the same organisation. To address this question, the data from the Family Unit and the Statistics Unit, which are both under the same organisation, the Health Ministry, were matched. Data at the Statistics Unit were available for 3 years in individual forms. Therefore, the data from the Family Unit and the Statistics Unit from 2004 to 2007 were matched case by case based on the common factors of recording. The results are shown in table 2. The total number of deaths in the Family Unit is eleven while in the Statistics Unit it is eight. These eight deaths were reported in both sources. Age, place of residence, and date of deaths were recorded in both sources; therefore they were examined to find out whether they are consistent with each other. Table 2 provides some information on the number of cases which are not matched from these factors.

Table 2: Factors not matched in mortality data between the two systems (the Family Unit and the Statistics Unit) in Bam from March 2004 to 2007

In this section the strategy of each organisation after the earthquake for data collection is examined. Following the Bam earthquake, the Civil Registry reacted quickly to register the deaths by establishing temporary branches of the Civil Registry in different areas of Bam. It was also mentioned that registration was encouraged by the government by offering an indemnity for registration. It was discussed in the interview that if all family members died, any relatives or neighbours could report the deaths. Double registration and registration of a person alive as having died were mentioned as the problems with this sort of registration. Further information about death records immediately after the earthquake is discussed elsewhere (Zolala, accepted for publication in Disaster Management and Prevention Journal).

On the other hand, the Medical Sciences University illustrates another picture of the effects of the earthquake on the data collection system. From the interviews it was found that the Medical Sciences University missed out those data of deaths which happened immediately after the earthquake. This was due to the huge effects of the earthquake on the health care system. Almost entire equipment and work place were destroyed. The respondents stated that it took time to have a place to work and equipment to use for work.

On the other hand, the interview at the Medical University found that following the earthquake the native health staffs worked with the Red Cross organisation for a considerable time. During this time they did not send data to Kerman Medical Sciences University. Initially, the data collected at the Red Cross organisation were in English and then Farsi, the official language in Iran. They also pointed out that due to the extraordinary nature of the earthquake, the Health Network was kept busy with contagious diseases. Additionally, changing the role of the Medical Sciences University from the supervisory to the supportive was perceived by one respondent as another obstacle to receiving the data.

Discussion

In Iran the main policy decisions are made in the Health Ministry [105]. Therefore, the Health Ministry is one of the main data users. However, this study flags up some serious problems which limited the data usage by the Health Ministry.

The results reflect two main problems. One problem is that of sustained data collection routinely done, and a second one is the problems being exacerbated by a disaster. The problems observed in the non-disaster situation are discussed explicitly somewhere else (submitted to East Mediterranean Journal.)

There are a number of long-term effects of a disaster on the routine collection of data. Several factors hindered the resuming of data collection shortly after the earthquake. Firstly, recovering the routine data collection system to its pre-disaster state takes considerable time. This long recovery time could reflect either limitation in the ability to rehabilitate the system to its pre-disaster state, or the Medical Sciences University's priority setting after the earthquake. The latter can be illustrated by two issues: in the early period after an earthquake, there is a tendency for policy makers to solve the daily and short term problems rather than the longer term problems [1]. Furthermore, there is little enthusiasm to use data when policy makers may lack the skills and knowledge to use the data which can hinder the data usefulness [163].

Secondly, the effect of the earthquake on living conditions diverted the policy makers' attentions from routine activity to emergency and surveillance actions. Although these tasks are very important in the critical conditions in the aftermath of a disaster, they should not undermine routine tasks from being undertaken, particularly when the collected data are used not only to monitor the longer term effects of a disaster, but to also make governments accountable to the people [152].

Finally, poor coordination between the national and international aid agencies to send routine data to the province was another problem after the earthquake. Although the role of national and international aid agencies is very important in disaster relief after an earthquake, poor coordination and lack of task definition regarding routine data collection resulted in no data being sent for a few months after the disaster. This time would have critical effects on the population's health due to changing socio-economic factors. Needless to say, these data have a vital role in recognizing the problems that develop after a disaster. They can be used as indicators of need for health care services and ultimately for planning future responses to similar situations in a developing country.

Conclusion:

This study used epidemiology data to open the window to policy makers to see the problems which are found in the collecting of health data, and to flag up the necessity of paying attention after a natural disaster. It is very important to have the collaboration of international organisations to send the data to the host country. Therefore appropriate strategies might be needed to increase this awareness at the national and global level. This can be achieved through international organisations such as World Health Organisations or Red Cross Organisations.

This study was conducted after the Bam earthquake which was a very devastating disaster; therefore the results might be different in smaller disasters.

Acknowledgement

This project is financially supported by Kerman Medical University, Iran. The author recognises the high collaboration of Kerman Medical University and Bam Health Network by facilitating access for fieldwork. I would like to acknowledge and thank my supervisor Dr John Forbes for his professional guidance and encouragement. I also acknowledge the contribution from Kerman Medical University staff and Bam Health Network for donating their time to be interviewed.

Figure 2 : Pattern of Maternal mortality deaths per 100000 deaths according to the different data sources (the Civil Registry, the Family Unit) in Bam from 2001 to 2006

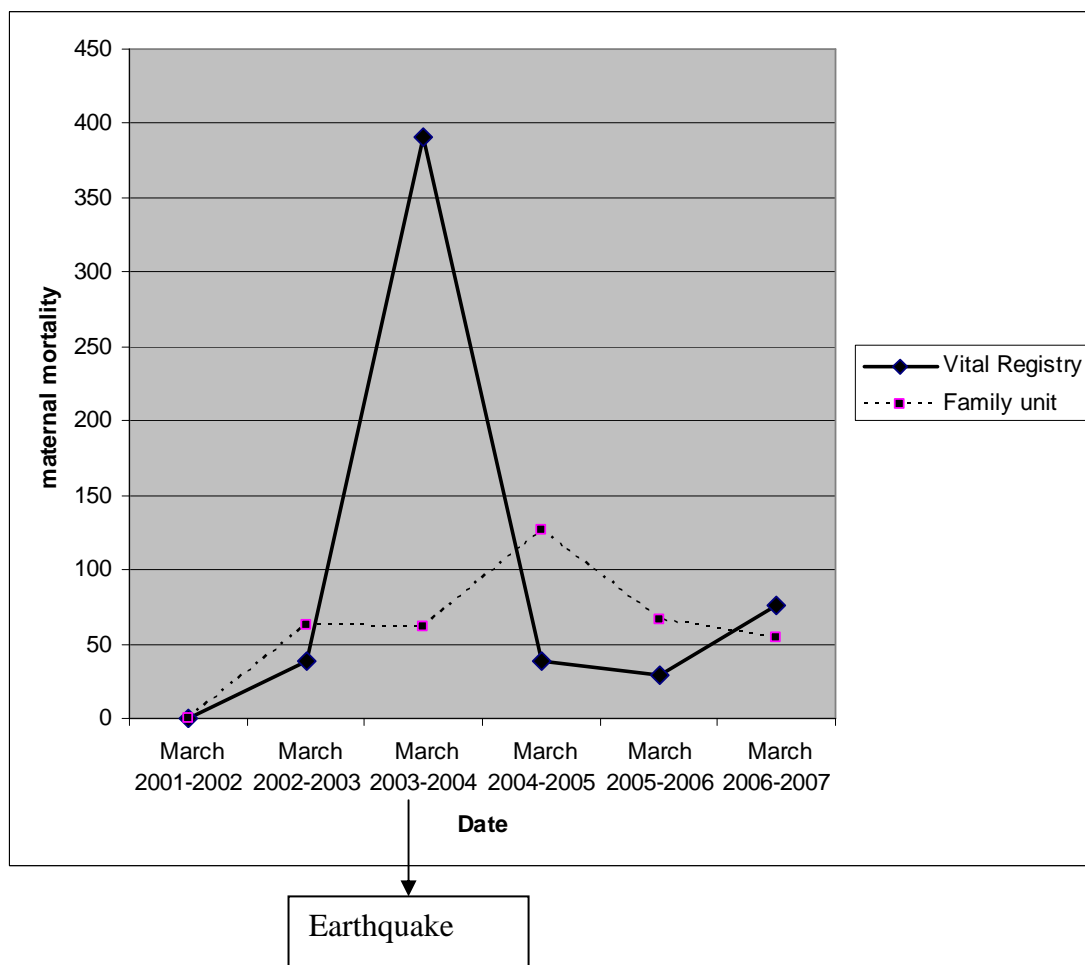


Table 2 : Maternal deaths, live births and maternal mortality ratios in Bam based on different sources, the Civil Registry and the Family unit, from March 2001 to March 2007

Source of data	year	2001	2002	2003	2004	2005	2006
Civil Registry	Maternal deaths	0	1	10	1	1	3
	Live births	2479	2616	2562	2575	3466	3948
	Maternal mortality ratio	0	38.23	390.32	38.83	28.85	75.99
Family Unit	Maternal deaths	0	3	2	5	3	3
	Live births	5075	4771	3258	3590	4543	5537
	Maternal mortality ratio	0	62.88	61.39	126.58	66.03	54.18

Table 2: Factors not matched in mortality data among the two systems (the Family Unit and the Statistics Unit) in Bam from March 2004 to 2007

Factors	Cases
Age	3
Date of death	4
Resident place	2

Exploration of health information system in Iran; a case study on Kerman Province

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Abstract

Health Information System has responsibility for providing information for decision-making. The aim of this paper is to explore mortality and live birth registration in Kerman province. The study applied a qualitative method via in-depth- interviews, observation and documents.

The results show that there are a range of problems in such as inadequacy in rules, staff, data checking and publication.

This study suggests different approaches to strengthen the system such as introducing appropriate rules and regulations to oblige different data sources to send the data and allocating enough resources, including human resources, technology infrastructures plus providing appropriate training.

Keywords

Health information system, vital data, birth, death

Introduction

Health Information System (HIS) is defined as a system with responsibility for providing information for decision-making at different levels [16].

The domains of its use vary from planning and management to evaluation of the health services. The ultimate aim is improvement of the health conditions at the individual and population level[2].

The need for availability and use of health data is growing in many countries and in developing countries in particular.

Boerma and his colleague describe that, presently, the financial support being devoted to developing countries has increased. This leads to increased need to measure the improvement in achieving the goals assigned to health systems. In addition, monitoring of development is one of the global concerns such as the achievement of Millennium Development Goals (MDGs) [5]. This can be achieved through monitoring some health indicators.

Despite the crucial role of HIS in recognising problems and ultimately improving health systems, most of the developing countries have poor health information systems. To tackle this problem some of developing countries have added several parallel systems to their national health information system to gain better information [2]. These types of systems might achieve better quality of information on specific topics. However such systems are not only unlikely to help the system due to creating more chaos, duplication, and data transmission problems. They are also damaging to the entity of health care systems [2].

Health data are being collected from different sources such as civil registration [22] which is defined as a legal, obligatory, continuous and lasting process of recording vital events [23].

Registration of vital events is considered as one of the most important priority in human societies. A record of birth confirms the existence of a person which is the first step to protection of his rights to life and then his social rights such as freedom[25]. The differences in occurrence of these events illuminate the high risk groups who need specific attentions. Hence, they are used in planning and ultimately aim to make the governments accountable to people [25].

The necessity of developing HIS in developing countries was identified by international organisations such as the World Bank [147] and WHO. Building upon the need to improve health information systems (HIS), WHO established the Health Metrics Network (HMN) in 2005 [148].

Based on WHO framework a health information system is divided into six components including health information system resources, indicators, data sources, data management, information products, information use. These outlined components are also grouped under three headings: input concerns with health information system resources, process includes indicators, data sources and data management. Information products and information use are categorized under outputs heading [6]. The aim of this paper is to explore mortality and live birth registration in Kerman province (The second largest province in Iran located in south east). The study used the Health Metrics Network framework as a standard framework to examine the system.

Background on Iran

This section gives a view of Iran to those readers who are unfamiliar with Iran from health system and data collection systems perspectives.

Health system in Iran

The health system in Iran comprises combination of health education and health care [107]. There is at least one Medical Science University in each province, which is the official representative of the Ministry of Health and Medical Education in that province [109]. The District Health Network is an office under the supervision of the Medical University, and is the official administrator of health and medical care in each district [106].

Health services in the rural areas are provided through the Health Houses which are the most peripheral health centres located in the villages. Approximately 86% of rural population are covered by health facilities [112]

Live births and mortality data collection in Iran

There are two main sources of mortality data: the Statistics Unit under the supervision of the Health Ministry and the Civil Registry under the supervision of the Interior Ministry. The only official source for live births data is the Civil Registry.

Methods:

This study is a part of a larger study carried out in Bam and Kerman which is the centre of Kerman province. The study applied a qualitative method to gain deep understanding of systems. The data were collected via in-depth- interviews, observation and documents. The interviews were conducted at different levels of data collection systems including data collectors in rural and urban areas, data processors and policy makers at the local (Bam)and provincial (Kerman) levels. Also conducting interviews at the work place led the researcher to obtain better perception of which problems could affect the data quality. The documents used in this research are mainly accessible just at the targeted organisations. .

As noted above, the Medical Universities are the official representatives of the Health Ministry; hence, the permission to commence the study must be gained from the Chancellor of Kerman Medical University or Deputy for Health. This permission was obtained through the Deputy for Health. Collaboration with the Civil Registry was obtained through a letter issued from Kerman Medical University to the Civil Registry, asking for their collaboration in this study. The permission to launch the interview at the Civil Registry was issued by the head of the Civil Registry.

Results:

The results are presented under three main headings' input ,which is concerned with data capture, data processing ,which highlights problems in processing the data, and data usage points out the shortages in data usage.

Firstly input: the results found out that the Civil Registry is notified of death by people testimony. However people might postpone notifying the Civil Registry of deaths and births until they need it for some reason such as heritage, insurance and school enrolments. Also based on the current rules there is a small fine for no or late registrations with inadequate enforcement. In addition, it is likely to include some deaths with no heritage without registration. This might happen mostly in rural and remote areas where residents have to travel to gain access to the Civil Registry branches.

Although the Medical University and its data collection in the rural areas has a better coverage of vital data in comparison with the Civil Registry, it is still has its own shortages. As mentioned at the back- ground section, the health system in Iran covers 86 percent of rural areas which means that even with completeness of data there is 14 percent of the rural population which are not covered by the Health Houses.

When it comes to the urban areas, the following sources are required to send the data to the Statistics Unit in the Health Network [117]; health facilities (private /public) , Forensic Medicine and the Cemetery Office. However the interview found that the Medical University has failed to gain data from the Forensic Medicine and from the private cemetery office. Furthermore there is inconsistency in data sending from private hospitals between different cities (table 1). Another matter is that semi-private cemetery offices and hospitals are required to send their data in a different format to the Deputy for Treatment.

Table 1: The data are sent to the Statistics Unit at the Health Network in each city

Statistics Unit at the Health Network	Sources of data
city 1	private hospitals, public hospital, Health Houses, and semi- private Cemetery Office
city 2	Non maternal public hospital, Health Houses, semi- private Cemetery Office

Data processing addresses the questions on how the data are processed and who is dealing with the data.

The interviews show that the original data are in written forms which are then computerized. At the Medical University, the data are integrated manually at the peripheral level before being sent to the Health Network for computerization. The software used for data entry at the Civil Registry is different and incompatible whit that used at the Medical University. Also these organisations use two different version of ICD for coding of mortality data. The Medical University has also a

shortage of computers at some levels. Also there is limitation in technical support for those who use computers in case they need it. Regarding the data-checking there is some sort of checking, in both organisations, conducted by software. However there is little manual data checking to find out errors. The feed back on data quality are rarely conducted.

The study revealed that there is inadequate staff with the appropriate academic degree working with data the Medical University and the Civil Registry. Those who work with data at the Medical University complained of doing other tasks beside the data collection and of a high turn-over of staff working in data processing. In addition there has been little training of staff before commencing their job or during their working period. This is even exacerbated by a lack of guidelines explaining the procedure of data collection in detail. Another problem mentioned was delay in data sending from the lower levels to the upper levels.

Three items are considered as reflection of data usage ; data analysis , data availability and policy makers view The results of this study found that the only publication produced by the Civil Registry is a seasonal publication of total numbers of vital events conducted at national level. There is also an annual publication of death data produced by the Health Ministry. Regarding the availability of data there are some sort of limitations at both organisations which are rooted in storing the data or technology limitation. The policy makers perceived the problem to be poor data quality, no guidelines for data collection, lack of forward planning for health issues in general, and no incentive to use the data.

Discussion:

The results of this study found that there is a range of problems in data collection systems in the Civil Registry and in the Medical Science University. These include poor performance in data capturing, due to lack of coordination and collaboration of data sources to send the data to the targeted organisations, and inadequate rules and regulation or enforcement of regulation to report the deaths.

This is considered to be an important factor in ensuring that data are transferred between organisations in a consistent manner [19].

There are also problems with data handling such as transferring the data through paper to the upper levels in part of the system which does not appear to be an accurate and fast method of data transfer [156].

In Pakistan, the data from peripheral levels are sent directly to the district level [157]. This method, however, is not the best one from the perspective of speed, quality and accessibility. However, it may still be better than the method employed in Iran. This is because the Pakistani method is likely to be faster [156] and it also reduces the errors that might happen during integration.

Lack of compatibility of software and data coding used at the Medical University and the Civil Registry impedes the ability of technology to share and match the data with other data sources. This can lead to duplicate data collection and can decrease the accuracy of data [132]. The WHO framework advocates using coherent programs and system which are compatible with each other at different levels [6].

The quality of data can be deteriorated because of little data checking, inadequacy of human resources, and little data usage.

It is discussed that in developing countries incorrect coding and making mistakes in the entry of data in the correct fields are frequent problems [146]. Limited data checking might also indicate low data usage by policy makers; if the data are used, they are checked and feedback on data will be sent to data collectors and processors. It has been noted that in developing countries there are few opportunities to give feedback to data processors and data collectors to improve the quality of data [146].

Additionally, recruiting staff with appropriate academic qualifications at different levels of the data collection system is recommended to improve quality of data [32]. It is discussed that if tasks related to data collection and processing are required from health care providers, it would make them overburdened, resulting in them viewing this as an extra and unwelcome task [6].

High turnover and few opportunities to have a permanent job might be very discouraging [176], particularly for recently graduated staff, and may provoke inaccurate results. High turnover of staff were observed in other studies carried out in Swaziland [164] and Afghanistan [144]. Also, there should be training at all levels of a data collection system. These training programs should include policy makers in order to increase their knowledge about the implication of data usage on decision-

making and interpretation of results. On the other hand, the data personnel should be aware of managers' interests and needs. This will lead to improved data usage [1]. Moreover, the lack of a guideline hinders availability of clear and straightforward definition of the data collection strategy and how indicators should be collected. This has caused duplication and can also overburden the staff. Introducing guidelines can make clear the objectives of data collection and enhance data usage, particularly when the policy makers are involved in these processes [1]. Promoting a guideline was recognised as an important need to strengthen the quality of the information system in Mexico [166] [146].

Possible delays in sending the data from the peripheral branches at the Civil Registry and regular delay in sending the data at the Medical University are reported in the study. This can be traced back to the lack of strong regulation and inadequate management ability, overburdening of personnel and also low data usage in decision-making. It is suggested that the information should be available day to day for managers [6].

Use of aggregated data can reflect low data usage at the provincial and district level. Inadequate data usage at the local level may reflect a number of problems. One of them is the structure of a health system as a centralized system. In such systems, main decisions are made at the national level; local levels do not have an important role in decision-making [120]. The second problem may be low integrity of a health system [150]. These two might be the case in this study as the Iranian health system is a centralized system [105]. Furthermore, lack of a powerful health system was mentioned at the interview as another obstacle to use the data. It can also reflect a culture of low data usage in the country.

The usage of data has also a direct correlation with the quality of data [1]. If data are of poor quality, they are unlikely to be used. If the data with low quality are used, such as using the data on people who use the services, they are likely to mislead policy makers [17]. Promoting a system of incentives for data usage is likely to increase data usage [1].

Furthermore, sending the same data in different formats is a tedious job. Having a statistics unit in each department might be wasting time and money and cause duplications. Hence establishing a powerful and central statistics unit could reduce duplication, increase the accuracy and even bring about greater availability.

Conclusion:

This study can be the first step in strengthening the health information system in Iran. It is beyond doubt that if the system is not known it is hardly possible to improve it. It also takes the policy makers' efforts to decide which part of the systems needs to be revised and which part should be amended. This study suggests different approaches to strengthen the system such as introducing appropriate rules and regulations to oblige different data sources to send the data. Also allocating enough resources, including human resources, and providing appropriate training before commencing the job are important factors in improving the system. Having good and sufficiently strong communication infrastructures can increase the speed and accuracy of data.

In addition, some supervisory activities should be in place to ensure that the data collection procedures are on the right track and data checking is undertaken by competent staff. Using compatible software in different organisations provides not only more complete data by data transferring; it can also improve the quality of data through data cross checking.

Finally the data usage culture should be encouraged by the government at all levels including national, provincial and districts levels. Introducing a guideline explaining the indicators for short term and long term activities and a central statistics unit would be very helpful in improving the quality of health data.

Acknowledgement

This project is financially supported by Kerman Medical University, Iran. The author recognises the good collaboration of Kerman Medical University and Bam Health Network by facilitating access for fieldwork. the author would like to acknowledge and thank her supervisor Dr John Forbes for his professional guidance and encouragement The author also acknowledges the contribution by staff of Kerman

Medical University and of Bam Health Network for giving their time to be interviewed.

Data collection after massive natural disasters

(Focusing on Bam earthquake, Iran)

Abstract:

Purpose:

The aim of this study was to explore mortality data collection after a destructive earthquake in Bam, Iran.

Study design

This is a case study of mortality data collection using a qualitative approach. The study data were collected through interviews with people involved with data collection and processing in Iran, and an evaluation of routinely collected data.

Findings:

The results found that there were many limitations affecting data collection after the earthquake. These limitations are rooted in basic problems within the existing data collection system and a lack of co-ordination between the groups collecting data, including national and international aid groups that provided help after the earthquake.

Originality:

This study highlights the problems affecting routine collection of mortality data after a disaster, due to little attention being paid to proper documentation.

Practical implication

The main target group of this study are the decision makers involved with the disaster relief issues at the national and international levels. This issue of data collection is imperative during for future disaster aid.

Research limitation

This research is based on a very large and destructive earthquake; the results may be different for other natural disasters such as floods.

Keywords:

Disaster, mortality, data collection, Iran

Introduction

Disasters have been described as the most impending threats for human societies, and have affected many populations worldwide. According to the WHO, about two billion people were affected by disasters and 600,000 lost their lives in the 1990s alone [52].

Disasters can affect the societies in different ways, including health and socio-economic situations. These impacts can occur immediately after the disaster and can linger for a long time. The economical effects of a disaster can be on the individuals, such as the death of breadwinner [9], and on the broader macroeconomic community, such as inflation (Otero and Marti 1995: 16-18.).

In order to measure the effects of a natural disaster there should be ongoing and routine data collection commencing immediately after a disaster. These data produce information needed for planning, management, and evaluation of the health services, with an ultimate aim of returning to the original health conditions, at both the individual and population levels [2]. The number and characteristics of casualties are considered to be one of the main aspects of a disaster effects study [206]. Also, mortality data such as maternal and child mortality can reflect the longer term effects of a disaster, indicating the socio-economic effects of a disaster [34] [35], as well as the quality and quantity of health care services [40] [42] [44] [48].

Iran is one of the most disaster prone countries in the world. The most frequent disasters occurring are natural: drought, earthquake and flood. Bam is an ancient city on the old Silk Route located in Kerman province in south east of Iran, and was almost destroyed by an earthquake on 26 December 2003 [86]. This earthquake resulted in 31,828 deaths, 17,500 injured and 525 lost,

additionally 75,000 were rendered homeless [87].

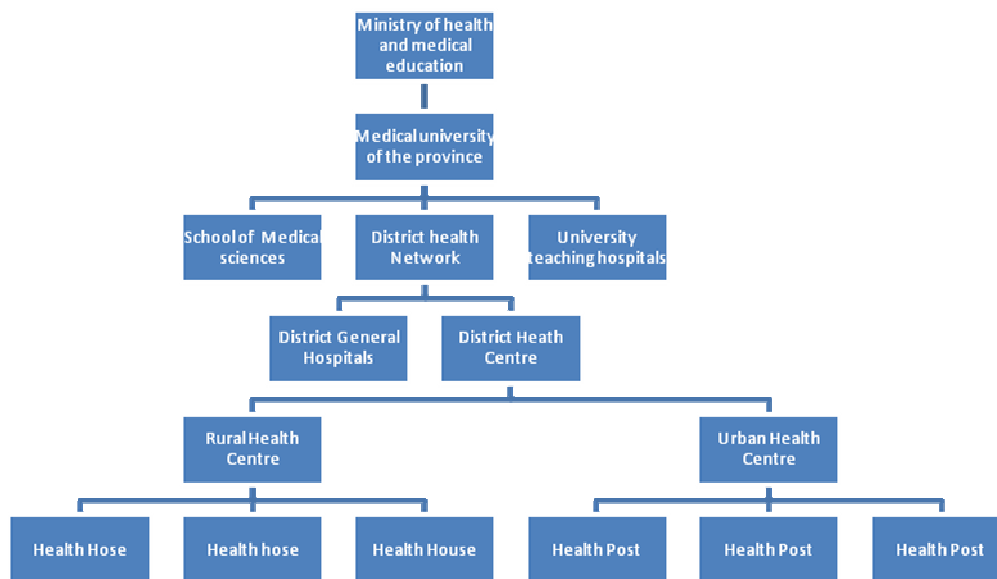
The aim of this study is to explore mortality data collection after a destructive earthquake in Bam, Iran.

Background

Health system in Iran

The health system in Iran is a combination of health education and health care .There is at least one Medical Science University in each province, which is the official representative of the Ministry of Health and Medical Education in that province [109]. The District Health Network is a bureau under supervision of Medical University, and is the official administrator of health and medical care in each district. The first points of contact with medical services are Health Houses in rural areas and Health Posts in urban areas. These Health Houses cover most rural areas, but a growing population in cities hinders the same level of coverage in urban areas [111]. This system is illustrated in Figure (1).

Figure 1: Health system in Iran



Death registration system in Iran

Mortality data in Iran is recorded by two organisations: the vital Registry and Health Ministry. Vital Registration in Iran was established in 1918 with the aim of registering vital events including births, deaths, marriage and divorce. This organisation has a centralized and governmental setting under the Ministry of Interior, with the main offices in the centre of each province and peripheral administration branches around the country [114]. People should visit the vital Registry to register the deaths. The problems encountered with capturing all deaths, and the poor accuracy of cause of death, by the vital Registry made the Health Ministry initiate a new system to collect mortality data [117]. For the Health Ministry, mortality data are collected by the health staff from rural and urban areas, which are then sent to the district, then to the provincial level, before being sent to the Health Ministry. This hierarchy is demonstrated in figure (1)

As mentioned above mortality data are very useful indicators of health and are used in planning and evaluation.

Methods:

This study is a part of a larger study carried out in Bam, a town located in Kerman Province, and in Kerman, a city in the centre of Kerman province. This is a qualitative study and the data were collected via interviews and documents. The interviewees were selected so as to involve informants involved in all level of the data collection procedure, including data collectors in the rural and urban areas, data compilers and data processors. There were also a few interviews with policy makers. Subjects were selected

in the number of ways, starting with purposive sampling to cover the hierarchies, snowball sampling to widen scope, and random sampling of a subset of health houses. Another source of data were documents, there is minimal information available on the Iranian health information system on the internet. There are however some books published in Persian which provided useful information (e.g. “A series of registration rules and regulation” by Mansoor,2003), these can be accessed through the official health institutions. WHO health metrics information framework was used to develop the interview guide, and in-depth interviews were used to gain rich information.

Results:

The results of this study relate to the number of deaths that happened immediately after the earthquake and were directly caused by the earthquake, as well as the number of deaths that happened within a few months following the earthquake.

The results of the interviews with data processors showed that there are no records of deaths caused by the earthquake at the Health Ministry. Indeed, the vital Registry is the only organisation which recorded the deaths caused by the earthquake. Information from interviews and viewing some of the data produced by the vital Registry found that these data are available in cross tables based on gender, age groups, and causes of death. The data are not accessible from the original forms in order to maintain confidentiality, unless there is judicial permission. The data are entered electronically using software designed by the vital Registry, which is different from the software being used in the Health Ministry. This makes it impossible to directly export data from the vital Registry to the Health Ministry. In addition, deaths caused by disasters are registered as deaths

due to accidents, and therefore are included along with deaths from incidents such as car accidents, suicide and poisoning. Deaths are to be registered by the relatives, neighbours or friends of the deceased. The interviews found that double registration of a death, and falsely reporting a living person as dead were problems associated with this method of registration. The interviews also illustrated that due to the mass tragedy and numerous casualties it is impossible to exam the bodies and determine the exact cause of deaths.

In terms of the recording of deaths that occurred after the earthquake, the results of interviews with data collectors, health staffs and policy makers revealed two types of problems, in both the provincial and local levels. At the provincial level, findings of this study show that, there was no routine connectivity between Kerman Medical University and Bam Health Network. At that time, Kerman Medical University did not maintain a supervisory role over the health network for a few months, instead Bam health staff worked in close relationship with the Red Cross and the Health Ministry. Interviews with the health staff in Bam found that initially the events were recorded on the patient's file and on the Red Cross Organisation log books, which were in English. They were then replaced by patients files and log books in Farsi, the formal language in Iran. These files and logbooks were given to the Red Cross organisation when their responsibility for health care delivery ended.

At the local level, the Bam Health Network had collapsed after the earthquake, and there was no place to hand in the data collected from the urban and rural health centres. This data included the routinely collected mortality data from the rural and urban health centres. Also, there was no way to enter data for a few months, those involved with the data collection and data processing said there was no place to do the work and no

working computers. The interviews also revealed that after the earthquake the authorities were distracted from routine data collection, and focused on specific data collection, such as infectious disease. The large scale of the tragedy created by the earthquake made the routine data collection less of a priority. During an interview with one of the policy makers it was mentioned that “at that time [after the earthquake] nobody was thinking of routine data collection”.

Discussion:

Health information system data, including mortality data, have an imperative role in decision-making processes. Cibulskis divided the utility of health information into four major groups: firstly for planning and monitoring; secondly for increasing organisational accountability; thirdly for securing financial resources; and fourthly for increasing the knowledge of systems in the long term [18]. In Iran the main policy decisions are made in the Health Ministry [105], and therefore the Health Ministry is one of the main data users. However, the results of this study flag some serious problems which limited the data usage by the Health Ministry. In terms of data collection immediately after the earthquake the limitations are that the data at the vital Registry are collected through individuals reporting it to the registry, while the Health Ministry collects the data through its health staff. This difference does not allow the Health Ministry to collect the data routinely on its own immediately after a large disaster. Instead it relies on the vital Registry data, which is aggregated into forms of data presented as cross tables. This form of data might be insufficient for epidemiological research to recognise at risk groups during an earthquake, which is claimed to be one of the major issues in disaster

relief functions [204]. This in turn might impede the planning and evaluation for the next disaster. But, even if there is a judicial permission for use of individual data, the inconsistency between the software used in these organisations makes it impossible to transfer the data from the vital registry to the Health Ministry. This problem was also pronounced in Romania as one of the obstacle in the health information system [205]. Also the way earthquake mortality data were recorded relied on the people's reports. This in turn limits the knowledge of the exact cause of death for victims, which is important in epidemiological research.

Regarding the long term effects of a disaster on routine data collection, several factors hinder the resumption of data collection shortly after an earthquake. Firstly, restoring the routine data collection system to the pre-disaster conditions takes considerable time, this can reflect either the ability of rehabilitation or the priority setting after an earthquake. The latter can be further explained by two issues: initially, the tendency of policy makers to solve the daily and short-term problems rather than the longer-term problems [1], and finally, little interest in the collection of routine data. This may be due to the lack of skills and knowledge of data usage among policy makers which can hinder the data utility [163].

Secondly, changes in conditions caused by the earthquake, such as living conditions, distract the policy maker's attentions away from the routine activities, instead focussing them on emergency and surveillance actions. Although these tasks are imperative in the critical conditions that occur in the aftermath of a disaster they should not undermine the routine tasks, particularly when the data are not only used to monitor the longer-term effects of a disaster, but also to make the governments accountable to their people [152].

Finally, low co-ordination between the national and international aids, in terms of sending routine data to the province was another problem after the earthquake. Although the role of national and international aids are imperative in the relief efforts after a disaster, poor co-ordination and a lack of defined tasks regarding routine data collection resulted in no data being sent to the Ministry of Health for a few months after the disaster. This time has critical effects on people's health due to changing socio-economic factors. And, these data have a critical role in recognizing the problems that develop after a disaster, and can be used as important indicators during decision-making. There is very little research on routine data collection following disasters, and this study could provide useful information in this important area. However, this study was conducted on the Bam earthquake, which was a massive earthquake. Therefore, the results might be different in less serious disasters, and other type of disasters such as floods.

Conclusion:

The occurrence of natural disasters is increased over the time. Recent studies show that globally there has been an 18% increase in the natural disasters frequency in 2004 and 2005 [59]. This means that the preparedness and planning for future disasters should be a main priority for most societies. This study aimed to explore the problems that arose from the Bam earthquake in terms of data collection, which is an imperative part of disaster preparedness. With regards to the availability of good quality data after a disaster, in developing countries most problems originate from the poor infrastructures. Furthermore, this study found that poor co-ordination between national and international

aids to collect and register data leaves a significant hole in the data collected from the disaster stricken areas. This data can provide important information for recognition of vulnerable people, as well as on health services quality and disaster relief performance. This study suggests a multifaceted effort in the global and national level to strengthen the health information systems as a disaster preparedness activity, to be done by considering its efficacy during and after a catastrophic event.

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A gap between policy and practice: a case study on maternal mortality reports, Kerman, Iran

Maternal mortality is defined as death that has occurred due either to obstetric problems or to pre-existing disease which has been exacerbated by the pregnancy or 42 days after pregnancy termination [10].

Annually, 529,000 women die due to pregnancy or child birth around the world [28].

Also a significant number of women suffer post-pregnancy morbidity, that is, from disability and health problems [207]. It is estimated that about 15 % of all pregnant women will face unforeseen difficulties during their pregnancy [10].

The main targets of the United Nations Millennium Project are decreasing poverty and increasing development, human rights and democracy, protection of environment, peace and safekeeping. Maternal and child mortality are indices which are affected by development, poverty and democracy. Therefore improvement of maternal health and reduction of child mortality are two indicators of achieving the main goals of the UN Millennium Project [13].

Therefore, reduction in maternal mortality is one of the main goals in many countries including Iran. The next section gives a brief overview of the efforts made to investigate and control maternal deaths in Iran.

Background

The Health System in Iran

The health system in Iran comprises a combination of health education and health care [107]. There is at least one Medical Science University in each province, which is the

official representative of the Ministry of Health and Medical Education in that province [109]. The District Health Network is the official administrator of health and medical care in the districts. The first points of contact to medical services are the Health Houses in rural areas and the Health Posts in urban areas. These Health Houses are situated in most rural areas, but the growing population in cities prevents the same degree of cover in the urban areas [111]. The health staff working at the Rural Health Houses are called Behvarzes.

Maternal Mortality in Iran

Maternal and Neonatal Mortality Committee

Apart from the official source of mortality data, the Civil Registry and the Statistics Unit at the Medical Sciences University, maternal mortality records are collected through the Family Unit at the Medical Sciences University. This collection was launched by the Maternal and Neonatal Mortality Committee, which was established in 1995 at the national, provincial and local levels in Iran [116]. The main aim of the committee was reducing maternal deaths. In 1996, maternal mortality was studied through the census; in 1997 a Reproductive Age Mortality Survey (RAMOS) was conducted to estimate maternal mortality statistics [116]. The RAMOS questioner was reviewed by the Maternal Mortality Committee. A modified version of the RAMOS questionnaire was used to survey the maternal deaths. The main aim was reduce maternal mortalities. In 1999, this new approach was evaluated. The results of the assessment showed that this system had to be modified for the following reasons: a) the shortage of complete and accurate data, b) the lack of classification of maternal deaths based on the International Classification of Cause of death, and c) few proper interventions based on the results of the survey [116].

In order to tackle these problems the national system of maternal mortality surveillance was set up in 2000 [116]. This information is summarized in table (1).

Table 1: summary of activities conducted to estimate and control maternal mortalities by the Health Ministry of Iran

year	Activities
1995	Initiative the Maternal and Neonatal Mortality Committee
1996	Estimation of maternal deaths based on census data
1997	Estimation of maternal deaths based on RAMOS
1999	Evaluation of the modified RAMOS questioner
2000	Initiative national system of maternal mortality surveillance

Issues concern the national maternal mortality surveillance system

In the national maternal mortality surveillance system, there are four main processes: collecting data on maternal mortality, investigation of cause of deaths, planning plus intervention, and evaluation. Here is a brief description of each of these.

First data collection, which conducted via a interview guide with structured and open-ended questions. The method of collecting the data was through interviews, investigating the recorded documents, and verbal autopsy. The data can be classified into three groups; verbal autopsy at interviews with relatives of the deceased, private interviews with the health staff involved in provision of health care for the deceased body, and clinical autopsy [116].

The next stage is to investigate the cause of deaths in order to find any avoidable causes of death. It has a crucial role in setting up the intervention and planning [116].

On the premise of the cause of death, suitable interventions are planned. The committee is responsible for managing the implementation of interventions. Indeed, all details including the intervention, the people who are responsible for carrying it out, and the time of intervention should be clarified by the committee [116].

The last part of process at the national maternal mortality surveillance system is evaluation. The evaluation is undertaken by two basic methods: process evaluation and outcome evaluation. The process evaluation is applied from the reporting of death to

planning, intervention and evaluation of the intervention. The outcome evaluation is used to evaluate the general function of the surveillance system [116].

Based on the above explanation, as an independent and external evaluator, this study aims to explore the gap between policy decided at the national level on maternal mortality investigation and the policy implementation at different related levels.

Methods:

This study is a part of a larger study carried out in a town located in Kerman province (Bam), and in Kerman, the centre of Kerman province. A qualitative study was conducted and data were collected via interviews , documents and observation. In order to gain access to the fieldwork (Kerman and Bam), the author needed to have the permission from the Chancellor of Kerman Medical University or deputy of Health Department since both cities are within the same catchments area. This permission was obtained through the deputy of Health Department. Collaboration with Forensic Medicine was obtained through a letter issued from Kerman Medical University.

To achieve the aim, two groups were interviewed; data collectors who collect and send the data and policy makers who investigate the deaths and had role in policy design. Data collectors in rural and urban areas were interviewed to understand the routine process of maternal deaths report. Policy makers at the provincial and local levels were interviewed to find out the problems they perceived with the current system.

Also there was a book used as a guideline explaining all procedures including data collection and reporting maternal deaths based on the national maternal mortality surveillance system. This was available just in the fieldwork and obtained through the interview.

In addition the interviews were conducted at their workplace which led to gain valuable information due to observation.

Due to some research limitation such as the expense of travel to the rural areas, only three such areas were included in the study. Bearing in mind that distance from the

centre might affect the response; three Rural Health Centres were identified, based on their distance from Bam (outmost, middle, nearest). Regarding the Rural Health House, the most peripheral health centre, (each Rural Health Centre covers several Rural Health Houses), one Rural Health House was randomly selected from each of the Rural Health Centres. Therefore, there were three Rural Health Centres and three Rural Health Houses in the rural areas.

Results

The results are based on two main areas. The first section presents the gap between the policy and practice through comparing the guideline with the results of interviews and observation on what was carried out. The second part is findings extracted from the interview and observation to explain the relevant factors to this gap.

Based on the guideline a wide range of sources were identified as data sources to send the data to the Family Unit by the Maternal Mortality Committee. These include hospitals (maternal and nonmaternal), any organisation and office holding maternal deaths data, investigation of mortality data on women aged 10 to 49 years old reported to the Statistics Unit and any unofficial people aware of maternal deaths. Also the guideline suggests reporting these deaths urgently.

However, the results of interview show a difference between what the guideline suggests and what actually is carried out.

The data drawn from the interviews with those that keep the data indicate that the main data sources in urban areas are maternal wards at the hospitals, and in the rural areas it is the Health Houses. Therefore those maternal deaths which might occur with a delay after the delivery in the non-maternity hospitals/wards could be missed.

Also if a death, including a maternal death, happens at home it needs to be reported to the Forensic Medicine Department in order for a death certificate to be issued. However, there is no specific classification of maternal deaths at the Forensic Medicine

Department. For example, if a mother dies due to infection following the delivery, the cause of death is infection and is not categorized as maternal death. They also were not aware of reporting maternal deaths to the Family Unit exclusively. Further scrutiny in other data sources revealed that some of them were not aware of this policy as well.

Furthermore, reporting maternal deaths was not perceived as an urgent requirement by a group of respondents, as is suggested by the committee. In fact, if there is a maternal death, it is reported along with other deaths to the Statistics Unit.

The source of this gap was more scrutinized in following. First lack of training program, this concerns with two issues; recognition of maternal deaths and report them urgently. The results found that there was no training schedule for staff. Moreover, the only informative tool, the guideline was available in limited centers which might deal with maternal deaths and the reporting of them. This could be reflected on definition of maternal mortality. Maternal Mortality Committee had adopted the maternal mortality definition from ICD -9, which is defined as a death during pregnancy or during 42 days after the delivery. This does not take into consideration the mother's age, gestation period, or type of birth as a contributor to maternal mortality. Also, the care provided during pregnancy is not considered in relation to peri-natal problems [116].

However, during the interviews different descriptions were given by the interviewees were not consistent with any standard definition.

Another important point which might impede the flow of data is that following the identification of deaths as maternal ones, these are investigated and if there is a flaw in health care provision, some sort of punishment will be in place.

Discussion

The results of this study found out some problems concerning the implementation of the policy adopted by Maternal Mortality Committee which ultimately could affect the completeness of data.

Inadequate coverage of data is one of the factors which affect the quality of data [4]. Hardly reporting maternal deaths from some data sources such as the Forensic Medicine could be explained from different point of view. They are including, initiative little strategy for increase collaboration, Poor information systems aimed at informing all contributory bodies about the new policy and unavailability of guideline.

Collaboration between involved organisations such as the Forensic Medicine Department and the Health Ministry is a main obstacle to the recording of all deaths. Needless to say, if a new policy were to be in place, all relevant parties and stakeholders must be well informed and understand the importance of the new policy. In a study conducted by Macfarlane and her colleagues in England it was pointed out that lack of data about the private sectors results in difficulty in evaluating the general trends [153].

Another matter to be considered is that even if there were something to be gained by implementing this policy, would it really be conducted by competent staff? As noted in the results, there are discrepancies between what the committee requires and what is really done at the bottom level of the system. Lipsky argues that making generalizations about organisations without considering the context within which an organisation works is wholly superficial. He notes that sometimes an organisation functions in spite of its own rules and aims. Therefore he suggests scrutinizing these problems through the street- level bureaucrats' behaviour and attitudes. Street-level bureaucrats are defined as those people who "interact directly with citizens in the course of their jobs and who have substantial discretion in the execution of their work". Health workers are examples of street-level bureaucrats [125].

However, this sort of scrutiny has not been undertaken prior to decision-making.

Lack of availability of guidelines to all related offices could be another factor affecting the completeness. Introducing a guideline has many benefits for both data collectors and data users by providing clear goals for data collection and data use at different levels [168].

Another issue concern with completeness is that due to the instigation of a specific investigation into maternal deaths, the accuracy of data may have deteriorated. Staff who had the dual responsibilities of caring for patients and collecting data on maternal deaths

reported a conflict of interest when targets to reduce maternal mortality were introduced [17]. There were reports of staff being punished following investigation of a reported maternal death. This could have resulted in non-reporting of maternal deaths or falsification of data. This is of particular concern if decisions relating to health policy and health care resource allocation were to be based on incomplete or inaccurate data.

Inadequate training for staff procedures is discussed as a significant problem in the work place in developing countries [152]. Employing technology is not only an effective way of informing people about any changes or new policies, but it can also be used to train staff in target procedures..

At the end, this study might raise this question; do the advantages of implementing this policy weigh up the disadvantages? Establishing a system in parallel with the main data collection system might give better quality of data, but it would undermine the main data collection system and the Civil Registry and is detrimental to the entity of the health system [2]. It would also cause duplication, and increase the work load of staff [2].

The study highlights the problems with capturing maternal deaths in part of Iran which in turn indicates the insufficiency in capturing a complete set of data. However, as with many other qualitative case studies, there is limitation to generalise the results to other cities in Iran Therefore it is suggested to conduct similar research in other cities to reach a general conclusion about the situation.

Conclusion

The study underlines the gap between policy decided and policy implemented by relevant people. This could question the achievement of primary goals of Maternal Mortality Committee. Introducing a new policy requires some preliminaries, such as gathering the opinions of those who will be concerned with it. Furthermore, it is crucially important to consider the limitations and lack of knowledge at the bottom level to carry out the policy. It should be born in mind that an efficient information system should be used in a new policy and that initiative control criteria are required to ensure that the new policy is understood and carried out..

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