Inequities in health and health care between provinces of Iran: promoting equitable health care resource allocation

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Acronyms

AHCA	Australian Health Care Agreements
AIHW	Australian Institute of Health and Welfare
CSDH	Commission on Social Determinants of Health
CV	Correlation of Variation
DALYs	Disability Adjusted Life Years
DIN	Deprivation Index of Need
DoH	Department of Health
DHNs	District Health Networks
DHS	Demographic and Health Surveys
DHHS	Department of Health and Human Services
ERPHO	Eastern Region Public Health Observatory
EMRC	East Mediterranean Region Countries
EURC	Europe Region Countries
EDOCU	Index of Education and Occupation
EQUINET	The Regional Network on Equity in Health in Southern Africa
ERPHO	East Region Public Health Observatory
GHIN	General Health Need Index
GDP	Gross Domestic Product
GP	General Practitioner
GNP	Gross National Product
HFC	Health Care Financing
HIC	Health Insurance Commission
IDF	International Diabetes Foundation
IKRF	Imam Khomeini Relief Foundation
ISEQH	International Society for Equity in Health
NHS	National Health Insurance (British)

Acronyms

LGA	Local Government Areas
MDGs	Millennium Development Goals
MSIO	Medical Services Insurance Organization
MoHME	Ministry of Health and Medical Education
NCAHS	North Coast Area Health Service
NSCCAHS	Northern Sydney Central Coast Area Health Service
NHS	National Health Survey
NSW	New South Wales
NSW	Health NSW Department of Health
PAHO	Pan American Health Organization
PBRA	Person-Based Resource Allocation
PCA	Principal Component Analysis
PGR	Population Growth Rate
PHC	Primary Health Care
PHCN	Primary Health Care Networks
RAF	Resource Allocation Formula
RDF	Resource Distribution Formula
RAWP	Resource Allocation Working Party
UNDP	United Nations Development Plan
RII	Relative Index of Inequality
SII	Slope Index of Inequality
SIN	Single Index of Need
SSO	Social Security Organization
SMRs	Standardised Mortality Rates
SPSS	Statistical Package for Social Science
UNDP	United Nations Development Programme
WHO	World Health Organisation
YPLL	Years of Potential Lost Life

Abstract

Investigation of the influence of public expenditure on health lends support to the opinion that equitable distribution of financial resources would help to reduce inequities in health. This thesis set out to establish inequities in access to health care and health outcomes across the provinces of Iran and explore equitable resource allocation models to contribute to the reduction of health inequities. Inequities were measured based on the relationship between a range of health indicators and socioeconomic status in the provinces. Information on mortality, morbidity, and socioeconomic factors were taken respectively from the Death Registration System, Health Profile in Iran (2003), and Iran's 2006 census. There were significant relationships between mortality and socioeconomic indicators across the provinces, with the larger rates of mortality in the worst-off provinces. Coronary risk factors (diabetes, high serum cholesterol) were significantly associated with socioeconomic factors; with higher prevalence of the risk factors in the well-off provinces. There were also significant relationships between access to health services (hospital delivery and vaccination) and socioeconomic status; with lower access in the worst-off provinces. The resource allocation models based on population size and age/sex structure changed the health expenditure in favour of the well-off provinces to contribute to the reduction of inequities in morbidities. However, models based on mortality and deprivation changed the expenditure towards the worst-off provinces, in order to bridge the inequities in mortality and access to health services. Equity targets set, based on a combination of age/sex, mortality, and deprivation, indicated that nineteen provinces had received a share of expenditure higher than the equity target, with the largest in Mazanderan and seven provinces received a share lower than the target, with the largest in Tehran. A five-year plan was developed to move the expenditure from the hyper-financed provinces to the under-financed ones.

Preface

I have been working for over 10 years as a staff member on the budgeting and planning of the health sector in the Management and Planning Organization, currently called the President Deputy for Strategic Planning and Control, and am familiar with the Iranian health system, its strengths, weaknesses, and its plans for the future. In addition, I have been practicing as a medical doctor for 5 years at public and private centers and hospitals in Iran. My experiences as a general practitioner and as a professional in the planning and allocation of health care resources evoked the desire to work on health equity and equitable allocation of health resources in Iran. This research investigates and establishes the health inequities between the provinces of Iran, then explores alternative needs-based resource allocation models to promote equitable health resource allocation and contribute to the reduction of health inequities across the provinces.

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1. Introduction

1.1. Rationale for this study

Access to health care has an important influence on health and health inequities(Diderichsen 2004; Marmot et al., 2008) and despite some doubts (Nixon and Ulmann 2006), the influence of health expenditure (financial access) on health outcomes has been demonstrated in many studies in both developed (Martin et al., 2008) and developing countries (Bhalotra 2007; Bokhari et al., 2007; Anyanwu and Erhijakpor 2009; Gani 2009). This lends support to the opinion that equitable distribution of financial resources in health care systems would help to reduce inequities in health care and health outcomes.

Equity in health is defined as the "absence of systematic and potentially remediable differences in one or more aspects of health across populations of population subgroups defined socially, economically, demographically, or geographically"(Macinko and Starfield 2002, P 2), and is considered to be one of the main policy objectives for health systems. The right of all people to access equitable health and health care has been considered as an important issue by many national and international agencies for a considerable time. The Universal Declaration of Human Rights, article 25, reaffirms the right of everyone to medical care and security in the events of sickness and disability (United Nations 1948). The WHO (1978) in the Alma Ata Declaration strongly stated that health is a fundamental human right and the attainment of the highest possible level of health is a most important world-wide social goal. In addition, the WHO has stated that improving equity in health, both internationally and intra-nationally, constitutes one of the greatest challenges of the new century (Feachem 2000); "failure to do so properly will have dire consequences for the global economy, social order and justice, and for civilization as a whole" (P 1). The WHO Report (WHO 2008) also states that people in every country have the right to claim a greater health equity and solidarity in their society. It also emphasizes the protection of the right to health by governmental and non-governmental health authorities. The WHO's Commission on Social Determinants of Health (CSDH), founded in 2005, has focused on health equity, suggesting that bridging inequities in health should be through action on the social determinants of health and allocation of public resources based on need for health across social groups and geographical areas (Marmot et al., 2008).

The right of all people to health care is also embodied in the Constitution (Article 29) of the Islamic Republic of Iran which recognizes the rights of all citizens to health as well as an equitable distribution of health services in the country (Ramazani 1980). In “Iran’s Vision for 2020” (article 4), which is a long-term strategic development plan, “health” is referred to as a special item to consider in terms of promoting equity and equality in the country (I.R.Iran Expediency Council 2009). Based on Iran’s Fourth Economic, Social and Cultural Development Plan, the Ministry of Health and Medical Education is obligated to design a system for the delivery of health and medical care services to the country at the minimum required standards, based on service grading, rationalizing it in line with the needs of various areas of the country (Management and Planning Organization of Iran 2004). Equity in health is also an objective of the health system of Iran; according to the Social Security Research Institute Congress Report, all Iranians are eligible for community-based preventive, public health, and limited curative health services financed and provided through the country’s primary health care (PHC) network (Schieber and Klingen 1999). As a member of the WHO’s Commission on Social Determinants of Health (CSDH), Iran also established “the Unit for Social Determinants of Health” in the Health Ministry to highlight the socioeconomic determinants of health and health inequalities in Iran and provide information for making policies for intervention.

In the past three decades, Iran’s government has taken considerable actions to promote health and reduce health inequities by establishing the Primary Health Care Network and extending primary services to rural and remote areas, leading to an improvement of the average health status in the country. However, despite the actions by the government, there is significant evidence of inequalities in health, health care and determinants of health across the provinces. In 2004, life expectancy at birth in the province of Tehran was the highest (74 years), around 8 years more than that in Sistan & Baluchestan (the lowest with

66 years). Mortality in children under 5 in Sistan & Baluchestan (47 deaths/1000 live births) was twice that in Tehran (25 deaths/1000 live births). Mortality in men and women in the province of Kerman was the highest (218 and 132 deaths/100,000 respectively) while the figures in Tehran were lowest (149 and 117/100,000 respectively) (Ministry Health 2010). These health inequalities may indicate the different levels of need for health care and diverse public expenditure on health care across the provinces.

There are different elements of health systems contributing to the promotion of health and reduction of health inequities including: leadership and governance, strategy and policies, health system structure, inter-sectoral collaboration, health sector reform, health financing system, and health care resource allocation mechanisms (WHO 2007). Resource allocation has been considered as one of the most important means for the promotion of health equity; and allocation of health financial resources based on the need for health care has been stated to be the best mechanism for equitable distribution of financial resources across the populations and areas in a health care system(Smith et al., 2001; Diderichsen 2004; McIntyre et al., 2007; Smith 2008a). Needs-based resource allocation formulae are considered the most effective tool to move towards the equity objective in health systems. In addition, needs-based resource allocation models are an increasingly popular method for resource allocation in health as:

- Being funded equally and securing equity objectives is considered important by the recipients of the expenditures,
- Explicit criteria used in the funding models let the different stakeholders have an informed opinion around the resource allocation mechanisms,
- If the relative needs of the patients are not recompensed appropriately the recipients of the funds may seek to direct to less needy patients (cream-skimming) (Smith et al., 2001).

In spite of the emphasis on needs-based resource allocation as an appropriate mechanism for equitable resource allocation and the promotion of equity in health, the current method of public spending on health care in Iran is not based on the need for health in the population groups and geographical areas in the country. The health care funds are mostly allocated based on an incremental approach considering the number of staff and health establishments, as well as political negotiation and bargaining across the geographical areas (Abolhallaj 2006; EMRO 2006).

This thesis explores the links between philosophy and quantitative methodologies, putting together diverse areas of bioethics, politics, epidemiology, health policy, health economics, and statistics to provide a finance resource allocation tool to promote health equity in Iran. Given that, this thesis aims to identify the main health outcome and health care inequities across the provinces of Iran; then to propose a needs-based resource allocation model for equitable allocation of the health budget to contribute to the reduction of health inequities across the provinces. The results of this thesis will also be useful for anyone, from academics to policy-makers, who is concerned about the moral implications of health inequalities or inequities in health in populations of various types and sizes, in particular in the developing world.

1.2. The aim

There are two main aims for this thesis:

1) To assess and establish health status and health care inequities across the provinces.

2) To develop alternative needs-based resource allocation models for the equitable distribution of public expenditure in health care across the provinces of Iran.

To establish health inequities across the provinces, the following steps will be undertaken:

- The ethical and political background for equity in health is described.
- The concept and principles of health equity are evaluated.
- The main frameworks and methodological issues in the assessment and measurement of health inequities are evaluated, and an appropriate framework and methods to use in this study are identified.

- The main social conditions influencing health inequities in Iran are described.
- The main aspects of health in respect of inequity (health care and health outcomes) in the context of Iran are evaluated.
- The main health inequities across the provinces of Iran are measured and identified.

To propose a needs-based allocation model for reduction of the health inequities:

- The current health system of Iran in terms of structure, administration, and financing system is described.
- The current approach of public resource allocation in the health system of Iran is evaluated.
- The literature on needs-based resource allocation is reviewed.
- The methodological issues related to the development of needs-based resource allocation models are evaluated and the appropriate methods for this study are identified.
- Alternative needs-based resource allocation models for public health systems are explored and the most appropriate model is proposed.

1.3. Overview of the study

The first objective of this study lies in the investigation and establishment of health inequities (social inequalities in health that are deemed unjust or unfair) across the provinces of Iran. Evaluation of the ethical principles underlying health equity will identify the main ethical principles to support the health equity assessment and equitable health resource allocation in Iran. By evaluating the political context, the government's underlying perspective and its role in supporting the assessment and action on health inequities in Iran are identified. Concepts and principles of equity in health are described to clarify the appropriate definition and principle of health equity to use in the context of this study.

Investigation of the main frameworks and methodological issues will enable the identification of an appropriate framework and approaches for the assessment and measurement of health inequities in this study. By evaluating the socioeconomic and demographic factors, as well as health care and health outcomes, an overview of the main elements involved in the health inequities in Iran is presented. This will establish the main health inequities across the provinces of Iran and provide information for action on these inequities and promotion of health equity across the country.

The second objective of this thesis lies in the development of equitable resource allocation models for the distribution of health care public expenditure across the provinces of Iran. Evaluation of the health system structure and governance provides information on how health services are delivered and administrated in Iran. By evaluating the financing system, the main methods and sources of funds, including public expenditure, of the health system are identified. Investigation of the current approach of resource allocation will indicate how, and to what extent, the current methods of health public expenditure are equitable and contributing to promotion of health equity. Reviewing the literature on needs-based resource allocation will reveal the experiences of equitable approaches used for the geographic allocation of health budget in other countries. By evaluating the methodological issues, appropriate methods to use for creation of the geographic needs-based formula in this study are identified. Finally, given the context in Iran and global experiences, alternative needs-based models are explored for allocation of public health budgets across the provinces of Iran. The equitable distribution of health finances will contribute to reduction of health inequities in the country.

In light of this overview, this thesis is structured in two broad studies and presented in two main parts divided into 10 chapters as follows:

Part one: The first part of this thesis consists of four chapters. In the second chapter, the main principles underlying equity in health and health care resource allocation, as well as the political background for addressing health equity at global and national level, are described. This is followed by a description of the concept and principles of health equity. Action on health inequities will be discussed at the end of this chapter. In chapter three, I describe and discuss the main frameworks and methodological issues in the assessment and measurement of health inequities. The main elements of health inequities, including the main socioeconomic and demographic factors influencing health inequities as well as the main aspects of health in respect of equity (health care and health outcomes) in the context of Iran are presented in chapter four. Chapter five includes the results and discussion of findings relating to health outcomes and health care inequities across the provinces.

Part two: In chapter six, the overview of the health system in terms of health care delivery, administration, financing, and resource allocation is presented. In chapter seven, the global literature on geographic needs-based resource allocation is reviewed. Chapter eight describes the main methods for developing geographic needs-based models in this study. The results and discussion on the creation of the needs-based formula is presented in chapter nine. Chapter ten will give an overview of the thesis.

2. Ethical and political background, and the concept of equity in health

2.1. Introduction

Equity in health is important as "*health is among the most important conditions of human life and a critically significant constituent of human capabilities we have reason to value*" (Sen 2002, P 2). It is important for individuals, households, societies as well as governments and international organizations. Health equity is the moral aspect of health inequalities addressing based on the ethical principles and theories (Nuffield Council on Bioethics 2007); it is also a matter of social justice as people are dying on a grand scale due to social injustice (Marmot et al., 2008). Health equity is an ethical concept grounded in principles of distributive justice (Braveman and Gruskin 2003). Addressing health equity can be significantly influenced by the global and national governance as well as the political systems within countries (Marmot et al., 2008); the government ethical perspective may or may not be supportive for promotion of health equity (Oliver and Evans 2005; Nuffield Council on Bioethics 2007). Equity in health is considered as a very broad discipline accommodating quite diverse and disparate considerations (Sen 2002). It has been defined and conceptualized in several ways that can affect the establishment of and action on health inequities (Macinko and Starfield 2002). To address health inequities at national level, actions need to be taken by governments to evidence the inequities and provide appropriate tools to contribute to their reduction (Marmot et al., 2008).

In this chapter, first, the ethical principles that underlie equity in health and health care resource allocation are described to inform the inequity assessment and development of resource allocation models in this thesis. Then, the concept and principles of health equity are described, and the most applicable definition and effective principle of equity for assessing and dealing with health inequities across the provinces of Iran is identified. I describe ethical perspectives underlying governments and evaluate the political context in Iran in relation to the ethical perspectives to see how the current Iranian government may be supportive for promotion of health equity in Iran. The global and national background and the importance of equity in health are described in the next section. Finally, some actions to address equity in health, as recommended in the literature, are presented and the action to follow in this study is identified. However, I begin by describing the search strategy for the literature review for this thesis.

2.2. The literature search strategy

The research was informed through searches of the published and grey literature written in English and Farsi mainly from 1990 to 2011. Because of the multidisciplinary nature of this thesis and in order to include findings from a variety of viewpoints and minimize the potential searching bias, a comprehensive search was conducted through manual searches, computer supported searches (Aveyard 2007), and references in the literature reviewed. The main databases searched included PubMed and the Ovid online service, plus the related reports and studies published by the WHO and its branches, the World Bank as well as the books available. Further, some articles and texts written in Farsi were taken from the related organizations in Iran such as Iran's Ministry of Health and Medical Education (http://www.behdasht.gov.ir/), The Statistical Centre of Iran (http://www.amar.org.ir/Default.aspx.), and the Social Security Organization, from 2007 to 2011.

Keyword searches are the most common method of identifying literature (Levy and Ellis 2006; Ely and Scott 2007). However, in order to generate the expected data, keywords need careful consideration in order to select terms that will generate the data being sought (Cronin et al., 2008). Given that, to obtain further information, alternative keywords with similar meanings were examined. However, the following keywords were the main keywords for part one in this thesis which focuses on health inequities and social determinants of health:

- Ethical principles underlying health
- Equity in health outcomes

- Equity in health care
- Social determinants of health
- Health inequities
- Measuring inequalities in health
- Social determinants of health in Iran
- Health status and health care in Iran

In the second step a separate search was undertaken for articles related to health care financing and resource allocation in health care using alternative keywords with similar meanings but the core following keywords:

- Equity in health systems
- Financing of health care systems
- Equity in health care resource allocation
- Geographical needs-based resource allocation in health
- Health care financing in Iran
- Health care resource allocation in Iran

Searching for potential articles and studies to review using the keywords led to the extraction of a large number of articles on both parts in the study. In order to evaluate which information was incorporated into the review and to ensure that the relevant papers to address the questions were included (Aveyard 2007), the following criteria were developed, based on the nature of this study, to inform the inclusion and exclusion process.

Literature published in:

- English and Farsi languages
- Conducted 1990-2011
- Concept of equity
- Social determinants of health
- The methodology of health inequality measurement
- Report on findings which used quantitative methods
- The health and health system in Iran

- Equity in health financing system
- Equity in health care resource allocation
- Developing needs-based models in health systems

2.3. Equity (justice) as an ethical principle underlying health and health care

Equity (justice) is one of the main underlying ethical principles in health and many ethical theories have been developed to provide justification for actions by governments to achieve this ethical goal in health systems (Gillon 1994; Braveman and Gruskin 2003; Braveman 2010). This ethical principle is considered to underlie and link all parts of this thesis together; as this study is related to public health in Iran, where the government is responsible for making appropriate polices and providing health services for all citizens.

Equity (justice) is an ethical principle that has been developed to guide the relationship between health professionals and patients at micro-level, and the relationship between governments with individuals, populations and related bodies within a health system at macro-level (Nuffield Council on Bioethics 2007). “Justice” has been expressed as fairness, desert, and entitlement (Beauchamp and Childress 2001). It refers to the responsibility of acting based on the fair judgment among competing needs and demands (Duncan 2010). Any justice theory for health and health care needs to identify three main concerns: whether health care is a special good, where health inequalities are unjust, and, given the resource constraints, how competing health care needs can be met fairly (Daniels 2001). In moral terms it needs to justify that health care as a special good should be allocated more equally than many other social goods in society. Further, health and health inequalities can be affected by many social factors in addition to access to health care; therefore, judgments need to identify which of the inequalities are unjust. Different population groups may have different levels of need for health care and consequently different amounts of resources to meet the need; which needs to be explained and justified by the ethical principle of justice.

There are two main aspects of justice which relate to health care resource allocation, namely, procedural and distributive justice (Maiese 2003). Procedural justice implies that the reaction of an individual to a decision is affected by the fairness of the procedures used in a decision-making process (Hughes and Larson 1991); and its focus is fairness in respecting the processes leading to outcomes such as access to health care services and funds (Mooney and Jan 1997). In procedural justice the fairness of a process (e.g. providing health care) is judged through criteria including accuracy (using the most accurate information when deciding), consistency (e.g. like cases are treated alike), impartiality (of the decision makers), having a voice (by the people under the process) and transparency of the procedures (Tsuchiya et al., 2005). People will accept the outcomes of a process more easily if they feel that they are treated with respect and dignity during the process. In addition, procedural justice or fair processes are important in resource allocation as decisions on resource allocation may not be resolved only by the distributive justice principles (Peter and Joseph 1999).

The main concern in *distributive justice* is the fair distribution of resources and outcomes among individuals or groups in a community (Mooney and Jan 1997). It is concerned with giving all members of society a "fair share" of the benefits and available resources. Distributive justice has been the most commonly used justice principle in the realm of health and health care (Cookson and Dolan 2000; Blinderman 2009; Breyer 2009). Based on this principle all people should enjoy a fair health status and be given a "fair share" of the health care benefits and the available resources. This aspect of distributive justice is considered as the main principle that will underlie the evaluation of health outcomes and health care inequities as well as health care resource allocation in the health system of Iran in this study. Hence, in the next section I will evaluate the main theories developed for reaching the goals set up in the distributive principle of justice at both individual and population levels; to identify the appropriate theories that underlie this study. There are three main sub-principles introduced underlying the distributive principle in relation to health status and health care: (i) maximizing principles; (iii) egalitarian principles; (iii) need principles (Cookson and Dolan 2000).

Looking at these in turn, based on *maximising principles,* resources should be allocated so as to lead to the best possible outputs, i.e., optimizing a population's health status (Cookson and Dolan 2000). These principles only consider outcomes, not the process in which the good is distributed (Petrini 2010). Maximizing principles fall in the utilitarianism category which are the favored principles of many health economists (Lamont et al., 2008). *Utilitarianism* is a form of consequentialism, implying that actions are right if they promote the greatest good to the greatest number of people (West 2006). In other words, utilitarian theories are the effective way of maximising benefits for the greatest number of people. In health care, utilitarians would focus on the freedom of people in purchasing and using health care; further, the utilitarian perspective considers allocating resources to where the greater number of people receive care and not to those who are in greater need of health care (Capp et al., 2001). Treating patients who have greater capacity to benefit from health care is a rationing exercise considering the maximizing principle (Cookson and Dolan 2000). This principle is the basis for efficiency in health services in terms of value for money or the highest possible services within the given budget (Olsen 1997). It would be difficult to justify support for people who have little to offer the community but have a high tendency to use health resources where this principle is considered. The maximizing principles could conflict with other values such as fairness, justice, and honesty in many situations (Cookson and Dolan 2000) .

The second set of principles underlying health care are *egalitarian principles* which emphasise equal distribution of both social benefits and burdens (Capp et al., 2001). This requires that health care resources should be distributed in a way that bridges inequalities in health (Cookson and Dolan 2000). The "fair innings" debate or fair share of life is an egalitarian concern which considers an equal long and healthy life for all individuals in the community, not taking into account other justice principles (Williams 1997). Equality in opportunities for a healthy lifetime for all people, including individual freedom and autonomy of choice regarding health care options, is another kind of egalitarian principle (Le Grand 1991).

The egalitarian approach is popular as the non-discriminatory ideals of a just society are identified by these principles (Capp et al., 2001). However, this theory may be problematic to apply in the area of resource allocation as it may not be possible to provide fair opportunity of access to all health services in a health system. In this case rationing may need to be implemented and some individuals be given priority; e.g. larger share of resources allocated to the people with higher need for health care. This violates the integrity of the principle. In addition, in some cases there may be confusion surrounding the condition that is to be equitable. For example, it needs to be clarified whether it is equity in access to treatment or equity in the treatment and health care received. The most common interpretation is equity in receipt of treatment (Wagstaff and Doorslaer 1998); which implies that health care should be distributed according to need. These principles are not usually pursued purely, but they are considered in combination with other justice principles.

The third set of principles relating to distributive justice in health care are *need principles*, which imply that health care resources should be allocated based on the need for health care services (Cookson and Dolan 2000). This principle is considered the most commonly debated prioritizing principle in health care. The need principle is based on the view that some patients have a special claim on resources that rests not on the maximization of overall welfare, but on the greater need for treatment (Hope et al., 2003). The most thoroughly worked-out version of needs theory is that proposed by Rawls (Rawls 1971). Based on Rawls' theory, inequalities in the community are justifiable if they bring increased benefits for the entire community and if the most disadvantaged people in the society are no worse off due to any inequality. In justifying this theory, the utilitarian principle of "maximizing total welfare" and the libertarian "free for all" have been rejected by Rawls. Instead he proposed a theory of distributive justice based on the "choice by rational individuals" using the device of "the veil of ignorance" to ensure impartiality. In the veil of ignorance "*the individual should see himself as being in a position of genuine uncertainty; i.e. he should not perceive the existence of firm probabilities of various states of affairs in society*" (Andersson and Lyttkens 1999, p 1). In other words, the veil of ignorance implies that all people judge a rule as just, based on the supposition that none of them knows how the various alternatives (e.g.

social and economic position) will affect their own places in the society (Rawls 1999). In this way, personal bias is eliminated from the individuals' choice and the fairness of the rules is guaranteed. One criticism of Rawls' theory is that its concern is the distribution of primary goods (e.g. rights and justice, power and opportunities, and income and welfare) and not the effects or utility the goods provide for people (Olsen 1997). However, it is justified in the way that these goods are commonly considered as yielding utility, making it possible to compare a Rawlsian distribution with alternative distributions.

Given the shortcomings of the other principles, for example, concerning the utilitarian principle only with distribution of utilities or focusing Rawls' theory only on the distribution of primary goods (not what they do to the people), Sen (1982) introduced the "capability principle" that considers what goods do to the capabilities of functioning of people. This perspective reflects a shifting from the utilitarian principle which is based on utility, to the need for functioning (Olsen 1997). The welfare economists (utilitarians) used utility for evaluating interventions and programmes, while in Sen's "capability principle" the evaluation of programmes was based on functioning and capabilities (Coast et al., 2008). The perspective of "what goods do to the capacity of functioning of people" was used by Culyer in 1990 for the distribution of health care (cited by Olsen 1997). The need for such goods (health care), given the effects, is used as the basis for the allocation of health resources, and health care would then be allocated so as to achieve the preferred distribution of health. Two main concepts of need for health care are: need as severity of ill-health, and need as capacity to benefit from health care or the potential for improved health (Asadi-Lari et al., 2003). In the maximin principles (e.g. Rawls' theory), need corresponds mainly with the first concept (ill-health) while in utilitarian principle, need relates to the concept of capacity to benefit (Olsen 1997) (the different concepts of need is described in chapter 7).

Despite the challenges in applying the need principles in practice because of the different conceptions of need (described in chapter 7), the need principles are the most popular principles considered to underlie health care delivery and resource allocation as these consider the health of disadvantaged groups in the community (Cookson and Dolan 2000;

Daniels 2001). Deprived groups are generally evidenced to have lower health status and greater need for health care (compared to the advantaged groups) but receive fewer health care resources and services (Whitehead 1991; Diderichsen 2004; Marmot et al., 2008). The need principles can underlie the vertical equity which has been shown to be more effective in monitoring (Sutton and Lock 2000; Sutton 2002)(reduction of health inequities (Mooney 2000). (This will be described later in the related section.)Therefore, this study will consider the need principle as the main equity principle that underlies establishing health inequities and the development of health resource allocation models for the reduction of inequities across the provinces of Iran as aimed at in this research.

2.4. Concept of equity in health

Equity in health is considered as a very broad discipline accommodating quite diverse and disparate considerations (Sen 2002). The principles of equity in health derive from diverse fields of philosophy, ethics, economics, medicine, and public health; and it has been conceptualized and defined in several ways (Macinko and Starfield 2002). The terms of inequity and inequality have been used interchangeably in the literature, however, these two concepts are not synonymous (Braveman and Gruskin 2003); health inequality is an empirical term used to designate disparities, variation and differences in the health status of individuals and groups, while health inequity is a normative and value-based term representing the health inequalities which are systematic and unjust (Chang 2002). To address health inequity it is essential to clarify and identify a concept that can be useful for measuring and establishment of health inequities (Braveman and Gruskin 2003).

An earlier popular definition of health inequity was by Whitehead and Dahlgren in 1991 who define inequity in health as "*health inequalities that are avoidable, unnecessary, and unfair or unjust*" (Whitehead 1992, P 5; Whitehead and Dahlgren 2007). This was a simple and helpful definition of health inequity as it gives the abstract notion of equity a meaning that most people understand and recognise as a widely shared social value (Braveman and Gruskin 2003). However, regarding the recent advancement in health equity assessment, it is rudimentary and is not linked to the broader theories of justice (Norheim and Asada 2009). For example, it is silent on the question of whether all avoidable health inequalities arising from, say, small differences in educational attainment or income are unjust. It is also not clear on cases such as inequality in the number of deaths and injuries between adults who undertake dangerous sports (e.g. sky diving) which is unnecessary and avoidable but not unjust (Kawachi et al., 2002). In addition, the term "avoidable" in the definition makes considerable challenges for the measurement and addressing of certain health inequalities that are identified by this criterion (PAHO/WHO 1999); for example, it raises question of whether the inequality is avoidable in terms technical, financial, or moral (PAHO/WHO 1999) that can be difficult to distinguish in many cases. Further, in many cases, bridging the health inequities that are identified based on the "avoidability" criterion requires large changes in the underlying socioeconomic status that are impossible in the real world (Braveman and Gruskin 2003).

The International Society for Equity in Health (ISEqH) defined equity in health as the "*absence of systematic and potentially remediable differences in one or more aspects of health across populations of population subgroups defined socially, economically, demographically, or geographically*" (Macinko and Starfield 2002, P 2). This definition considers the important criterion that differences to equity are systematic rather than random or occasional. The systematic pattern of differences in health implies that there are consistent health disparities across socioeconomic groups or geographic areas which are not distributed randomly (Whitehead and Dahlgren 2007). For example, there is an increase in mortality when socioeconomic status (e.g. educational level) decreases. The magnitude and extent of the changes may differ in different countries or regions, however, the social pattern of ill-health is universal (Marmot et al., 2008).

The ISEqH definition implies that comparisons between groups are required to assess equity. However, it does not indicate that the relevant comparisons are between groups that differ on underlying social position; it thus could be applied without social justice implications to a wide range of epidemiologic studies (Braveman 2005). For example, by using the ISEqH definition, equity in health could be assessed by comparing rates of a particular illness (e.g., depression) between people who live in two different geographical areas which are similar in social terms. This kind of difference may be of public health concern but does not have social justice implications and hence seems not to be relevant to health equity (Braveman 2005).

Braveman and Gurskin (2003) defined equity in health as "*the absence of systematic disparities in health (or in the major social determinants of health) between social groups who have different levels of underlying social advantage/disadvantage—that is, different positions in a social hierarchy*" (P 3). Like the definition by ISEqH, this concept includes the criterion "systematic" in health inequalities to be considered as inequities, affirming that a health disparity must be *systematically* related to social advantage and the relationship must be significant and frequent or persistent, not just occasional or random. In this concept health is considered as both physical and mental wellbeing, not just the absence of disease; the social determinants of health are mainly referred to as workplaces and community conditions, household living conditions, health care as well as policies and programmes affecting any of these factors.

In this concept, health care is considered as a social determinant of health (as it is affected by social policies) and refers to aspects of access/utilisation of health services, financing of health care, allocation of health care resources, and the quality of health care services. *The underlying social advantage or disadvantage* is the attributes that define how people are grouped in social hierarchies; which are mainly wealth, power, and/or prestige. Disadvantage refers to absolute or relative deprivation (Wilkinson 1997; McIntyre et al., 2002); the *more and less advantaged social groups* are groups of people defined by differences that place them at different levels in a social hierarchy. Socioeconomic groups which are defined by measures of income, economic assets, occupational class, and/or educational level), racial/ethnic or religious groups, or groups defined by gender, geography, age, disability, sexual orientation are considered as the main more and less advantaged social groups (Braveman and Gurskin 2003).

Compared to the previous definitions the concept by Braveman and Gurskin (2003) considers the social justice implications in assessment of health equity; in addition, it is more practical to measure and operationalise equity as it does not have the implications of the previous concepts such as judgments on inequalities as being avoidable, unnecessary, and unjust. As a result this definition will be considered to underlie the measuring and establishment of health inequities aimed at in this study.

2.5. Concept of equity in health care

The concept of health care equity has been widely debated over the past decades. Mooney describes seven different notions of equity in health care (Mooney 1983; Mooney 1987; Mooney 1996; Mooney 2000):

- Equality of expenditure per capita;
- Equality of inputs per capita;
- Equality of inputs for equal need;
- Equality of marginally met need;
- Equality of utilisation for equal need;
- Equality of health
- Equality of access for equal need;

Equality of expenditure per capita implies an equal distribution of the health budget among the different geographical areas based on the number of population. This concept does not consider the differences in the need for health care; the main factor being considered is the population size in the areas. Based on the "equality of inputs per capita" physical resources are allocated equally among the different geographical health areas based on the population size. For example, health centres, hospital beds, or health professionals are distributed among the areas according to the number of residents. This definition takes into account the differing costs in the areas which is progress compared to the previous; however, similarly, it does not consider differences in need (Mooney 1987).

"Equality of marginally met need" implies that the need for health care in the areas is ranked in order of priority to be met in the same manner (Mooney 2000). Having this concept, equity will be achieved when each area is able to meet the need in the same priority (order) with its available resources. However, it is believed that this is better to be considered as an efficiency principle with the aim of maximizing health, rather than an equity principle (Culyer and Wagstaff 1993).

The concept of “equal utilization for equal need” implies that the system of health care is equitable if patients with the same need use the health services equally (Whitehead 1991). However, there are different issues that can affect utilisation of health services by different individuals and social groups; people seek health care with different levels of pain, access to care is different, and people with different cultures have different attitudes towards using health services. In addition, there is the concern of over-use of services due to induced demand by service providers (Field 2000; Rice and Smith 2001b).

The "equality of access for equal need" considers a fair geographical allocation of resources based on health care needs and ease of access in the geographical areas (Mooney 2000). This concept assumes that people with equal need should receive equal treatment or have equal access to health care regardless of the social, cultural, geographical, or financial barriers. Equality of access for equal need becomes identical to equal utilisation for equal need when people have access to the same preferences, tastes, and information for health care. This concept is the main definition used in the literature (Department of Health 1976; Asante et al., 2006 a; Zere et al., 2007). Starfield (2001) describes practical definitions of inequity in health care access: he states that inequity in access is the “*differences in access to health services for equal health need and/or absence of enhanced access for socially, demographically, or geographically defined population groups with greater health need*” (P 1). The notion of "differences in access to health services for equal health need" refers to the horizontal equity and the second part “differences in access to health services for equal health need and/or absence of enhanced access for socially, demographically, or geographically defined population groups with greater health need” concerns the vertical equity (described in the next section). This latter part will be considered to underlie the development of resource allocation models for equitable allocation of public health budget across the provinces in part two of this study.

2.6. Principles of equity in health

There are two main principles of equity in health, namely horizontal and vertical equity, which have been defined and used particularly in the realms of health care access and utilization (Mooney 1996; Mooney and Jan 1997; Mooney 2000; Sutton 2002; Slam 2007). Whether health sector decisions should be guided by vertical or horizontal equity goals is a topic of debate. Horizontal equity requires equality in the treatment of those with equal needs while vertical equity looks for unequal treatment of unequals (Mooney 2000). Much of the health economics literature has taken horizontal equity as a primary matter of service provision which is reflected in the goals of equal service inputs and access (or utilisation) for equal need (McIntyre at al., 2001). On the contrary, vertical equity refers to the unequal treatment of people whose needs are different by provision of different inputs according to their need for health care (Wagstaff and Van Doorslaer, 1993).

The main focus on equity issues until recently had been on achieving horizontal equity (van Doorslaer et al., 2000; Schneider and Hanson 2006; Lu et al., 2007; McGrail et al., 2009), with the exception of some studies focusing on issues of vertical equity in health financing (McIntyre et al., 2002; Sutton 2002). Increasing concern about the need for preferential allocation of resources to those with the worst health status has recently triggered debates on the issue of vertical equity. This is evident in arguments by Mooney (1996), on the need for emphasis on vertical equity in countries with substantial differences in health status between different groups in society. In his argument, Mooney mentions that in normal cases, ill health is not randomly distributed across different groups in society. Hence society might want to give preference, on vertical grounds, to those groups who on average are in poor health, thus implying preferential allocation of health care resources in favour of those with greatest need.

In line with the concept of vertical equity, if we are to reduce inequity in health status over time, it is also necessary to give a greater weighting to the potential health gains of those with very poor health status (Mooney 2000; Hanafin et al., 2002; McIntyre et al., 2002; Sutton 2002; EQUINET 2003; Zere et al., 2007; Ong et al., 2009). Vertical equity is of more interest to this study as the achievement of geographical equity in resource allocation and the re-distribution of resources between geographical areas requires preferential allocation based on increased need. Especially in a country like Iran with gross inequities in health, vertical equity, or the provision of different inputs according to different 'needs', would seem to be the most important principle to ensure that those with greatest health needs obtain and access greater public inputs for improved health.

It is not, in many cases, considered as a fair distribution of health care and appears to be inconsistent with policy statements concerning equity in health care (Sutton 2002). In addition, there is evidence indicating tangible failures in reaching equal health by running this horizontal principle in health systems (Mooney 1996; Mooney and Jan 1997; Mooney 2000). For example, it was shown that life expectancy in indigenous communities in Australia was 20 years shorter than in non-indigenous populations, and the proportion of diabetics was higher in the indigenous community than the non-indigenous groups, after a long time of allocation of resources using the horizontal approach (Deeble et al., 1998). The NHS in the UK was established based on this principle, "equal opportunity of access for equal need" (Department of Health 1976, P 7); however, it was concluded that the current patterns of health services would not resolve the unfair inequalities in health outcome; as a result, the resource allocation formula was revised to contribute to a reduction in health inequalities (Sutton et al., 2002). This indicates the need for vertical as well as horizontal equity.

Given the failure of the application of the horizontal principle to reach the equity objectives in health systems, vertical equity has been considered a more effective approach to follow for the reduction of inequities in health in recent years (Mooney 2000; Hanafin et al., 2002; McIntyre et al., 2002; Sutton 2002; Zere et al., 2007; Ong et al., 2009). In the vertical approach, health inequities are evaluated in relation to the socioeconomic factors influencing health; application of this approach across geographical areas could be the most effective method (Sutton 2002). Applying the vertical approach in the realm of health care can involve allocation of health resources based on health outcomes or the determinants of health (or a combination there of), indicating the need for health care and contributing to the reduction of health inequities (McIntyre et al., 2002; Manthalu et al., 2010). In fact, some kind of redistribution of resources happens in the vertical equity approach which makes it more effective than the horizontal approach in the reduction of health inequities.

In this thesis both the vertical and horizontal approaches for measuring health care inequities across the provinces of Iran will be examined, as well as developing needs-based resource allocation models for the allocation of health public expenditure across the provinces. I consider the notion of vertical equity as "*unequal but equitable access for unequal need*" (Ong et al., 2009, P 3), taking account of individual characteristics of the provinces and considering differences in pre-existing health status and thus differences in the 'need' for health care.

2.7. The role of government and equity in health

There is a range of underlying ethical principles that describe the relationship between governments and individuals and populations in societies. Adoption and implementation of these ethical principles is mainly dependent on the political context and the type of government in office (Nuffield Council on Bioethics 2007). There are three main underlying ethical theories that describe the association of governments with individuals and populations: the "libertarian perspective", which mainly describes the state-individual relationship; a "collectivist perspective" in which priority is given to the collective interests of the population as a whole; and the “liberal perspective” which considers both personal and political (social) spheres of life.

The *libertarian perspective* (conservative) mainly emphasizes the natural rights of individuals such as life, liberty, and property (Nuffield Council on Bioethics 2007). In this case, the main responsibility of the government is to secure individuals’ rights, without violation by others. In fact, the authority of the state is limited to legislation of rules to establish political, judicial and penal institutions to address the rights of people, to determine when these are violated and to punish those who commit such violations. In economic terms, the libertarian theory is appreciated by the free marketers, who are mainly interested in a market that satisfies the people’s wants (Capp et al., 2001). This theory does not agree with equalization processes or social interventions that restrict the individual’s liberty, implying that individuals are the best judges of their own welfare and individuals' health priorities are determined by their ability to pay (Nuffield Council on Bioethics 2007). However, this theory is not embracing in that it does not provide the basis for redistribution of society’s wealth so as to accommodate the needs of disadvantaged people (Sen 1992). Having health insurance or the ability to pay is an implicit characteristic of health systems based on the libertarian prospective. The health system in the US is an example based on the libertarian values (Mechanic 2004); the ownership of the health care system is mainly in the hands of the private sector and doctors and hospitals are generally reimbursed by payments from patients and insurance plans in return for services delivered. Libertarians are criticized on the basis that health care is different from other goods and services, therefore, should not be allocated based on the free market (Nuffield Council on Bioethics 2007).

In general, equity is not a key underlying concern of the libertarian perspective, where “autonomy” and “consent” are considered as the main underlying ethical principles. Therefore, promotion of the population’s welfare is not seen to be a proper responsibility for the government; and it may not provide enough support for the establishment of health programmes and policies for improvement of equity in public health.

From a political stance, in the "*collectivist point of view"* the central target is the population and public services. "*Collectivism is associated with a sense of duty toward one's group, interdependence with others, a desire for social harmony, and conformity with group norms*" (Green et al., 2005, P 2). There are different forms of collectivist views, of which the "utilitarian" and "social contract" are more related to health (Nuffield Council on Bioethics 2007). As mentioned in the previous section, maximizing and achieving the highest possible benefit to society is the primary aim of the utilitarian approach. In the field of health, it is the overall reduction of pain and suffering, promoting wellbeing and happiness or good health in the population. A collectivist government usually provides and implements health policies in a way that produces the greatest collective benefits to the community, even if the welfare or interests of some individuals need to be sacrificed.

The "*liberal perspective*" is a position between the libertarian and collectivist points of view, attempting to balance the needs of individuals with the concerns of the entire population (Bodenheimer 2005). Liberals believe that people should be treated equally in both personal and political aspects of life. They agree with libertarians that government authority should be constrained for the protection of individual freedoms and they also agree with the collectivist views that the welfare of citizens should be promoted through government authority. The utilitarian claim, that the freedom of some individuals can be significantly restricted to pursue beneficial interventions without further argument, is rejected by the liberal perspective (Parmet 2003). A liberal state has the responsibility for both the protection of fundamental individual rights and to care for the welfare of all citizens (Bodenheimer 2005). It may be acceptable, in some cases, without providing further justification, to intervene to promote the interests of the population, for example, providing opportunities for health care for disadvantaged and vulnerable groups. However, other interventions may not be acceptable or may require clear justification (Nuffield Council on Bioethics 2007). Rawls' theory of justice is considered as an influential liberal perspective as it considers personal freedoms as long as they do not violate the freedom of others and equal opportunity as well as inequality where it would benefit the least disadvantaged people. In general, from the liberal health care perspective, all people have equal right to health care and financing of health care should be equitable (Bodenheimer 2005).

Iran is an Islamic country situated in the Middle East sharing common features such as Islamic religion, traditions, and social organizations with the majority of other countries in the Middle East. However, a well-established historical, linguistic and racial identity for more than 2500 years makes Iran different from the rest of the countries in the region. The country is ruled based on the Constitution of 1979 (Ramazani 1980) which was amended in 1989 and which states that “the form of government of Iran is that of an Islamic Republic"(Ramazani 1980)(Article 1); and that the spirituality and ethics of Islam are to be the basis for political, social and economic relations (Article 4). The Islamic Republic, in theory, is a theocracy while it remains a republic, but its laws are required to be compatible with the laws of Islam (Chehabi 1991). The amended Constitution provides the legal background for the establishment of legislative (the Islamic Consultative Assembly or Majlis), Judiciary, and executive (the President and his Cabinet) branches of the government in Iran. The legislature (Majlis) consists of 290 members elected for four-year terms, ratifying all legislation. The executive branch is headed by the President who is elected by popular vote for a maximum of two four-year terms. Under the constitution, all Islamic judges rely on the civil code (United Nations 2008). There are 21 ministries as members of the Cabinet including the Ministry of Health and Medical Education, which is responsible for planning, policy making and providing health services as well as the education of health professionals (Mehrdad 2009). It is responsible for around 10% of total government expenditure (WHO 2009).

In the Islamic Republic of Iran, as a Muslim country, ethical issues are discussed among health professionals and religious scholars. The rules are mainly based on the Quran and principles of Islamic ethics, religious scholars’ opinions, national laws and ethic codes, and international guidelines (Zahedi and Larijani 2008). The main ethical principles of beneficence, non-malfeasance, autonomy, and justice, introduced in Western Countries, have been somewhat considered consistent with the Islamic rules; however, there may be different interpretations (Aksoy and Elmai 2002). For example, in the Western world the principle of non-malfeasance is applied for the prevention of unsuccessful or damaging treatments, while in the Islamic ethics this principle is used to forbid all actions that may damage life; also, whereas the principle of respect for autonomy in the West focuses on the need for informed consent, the Islamic interpretation places emphasis on respect for the patient (Westra et al., 2009).

Given the predominantly public responsibilities assigned by the Constitution (Ramazani 1980) and the 20-Year Vision (I.R.Iran Expediency Council 2009), the Iranian government tends to take a place between the collectivist and liberal state. A large part of the economic sector as well as social affairs such as education and health and welfare are run and governed by the government. In this regard, there is centralized governance in most sectors, particularly in social affairs. The main policies and plans in the health sector are developed centrally at national level. Providing access to basic health services for all citizens and the reduction of inequalities among different regions is emphasized in both the constitution and the development plans since it is an objective of the Iranian health system. All these provide appropriate support by the government for adoption of the principle of social justice and promotion of health equity in Iran.

2.8. Equity in health as a global and national agenda

Health is so important to individuals, households, and societies because of its contribution to wellbeing; health is a unique resource enabling individuals to function as agents to achieve other objectives in life, such as better education and employment (Starfield 2001; Anand 2002). Good health has been also considered a way of promoting the freedom of individuals and societies (Sen 2002). Health and health care are a necessary and important part of people’s capability to function and their ability to flourish as human beings (Sen 2002). Therefore, inequities in health are considered to be worrisome and more worrisome than inequalities in most other areas. They are also unacceptable for society; for example, lower ownership of sport vehicles by the poor is not a special concern, but systematically higher mortality and morbidity of poor children is likely to be a main concern for society. Similarly, individuals or families caused by out-of-pocket spending on unexpected health problems is not ethically acceptable by societies (O'Donnell and World Bank 2008).

Several issues make equity in health a main concern of health systems. There is consistent evidence showing that disadvantaged groups experience higher mortality and morbidity, suffer from a heavier burden of disease and have lower chances of survival than better-off groups (WHO 2000; Marmot et al., 2008). Globally, deprived groups have higher need for health care but their access to and utilisation of health services is limited (Diderichsen 2004). The poor, in particular in low and middle income countries, are often spending more on health care as a share of income than the better-off; in addition, some households around the world, in particular in developing countries, are becoming poor every year precisely because of unprecedented catastrophic health service costs (WHO 2000; O'Donnell and World Bank 2008).

Equity in health is also important as it is consonant with and closely related to the principles of human rights (Braveman 2010). According to the WHO (1948) everyone has the right to enjoy the highest attainable standard of health in their society. Further, any systematic socioeconomic differences in educational attainment go against this highly valued right (Whitehead and Dahlgren 2007). On the other hand, social factors and educational level are considered as determinants of health inequity (Marmot et al., 2008). As a result, addressing health inequities can improve the social disparities and promote the principles of human rights(Braveman 2010).

Equity in health and the right of all people to access to equitable health and health care has been considered an important issue at international level in recent decades. The Universal Declaration of Human Rights, article 25, reaffirms the right of everyone to medical care and security in the events of sickness and disability (Diderichsen 2004). In the Alma Ata Declaration the World Health Organization strongly stated that "*health is a fundamental human right and the attainment of the highest possible level of health is a most important world-wide social goal*" (World Health 1978). The WHO (1986) also stated that "*everyone should have a fair opportunity to attain their full health potential and, more pragmatically, that none should be disadvantaged from achieving this potential, if it can be avoided*". The PAHO has also emphasized that major determinants of health inequalities should be addressed urgently(PAHO/WHO 1999).This is because the burden of non-communicable and lifestyle-related diseases is increasing; the prevalence of some infectious diseases such as TB and AIDS is still increasing; and in addition, economic inequalities are increasing within and between countries due to the globalization phenomenon (PAHO/WHO 1999).

The 2000 WHO report has also emphasized the need to strive for the implementation of equity principles in health systems for the reduction of health inequities; wherein healthy people subsidize the sick and the better-off subsidize the less well-off. In the Millennium Development Goals, set in 2000, the United Nations Development Programme (UNDP)considered equity in health, requiring health systems to improve access to affordable essential drugs and safe drinking water, as well as to support the most vulnerable groups living in areas with the greatest social exclusion, helping to reduce mortality among children, thus producing greater equity (Torres and Mujica 2004). The World Health Report (2008) also stated that people in every country have the right to claim greater health equity and solidarity in their society. It emphasized the protection of the right to health by governmental and non-governmental health authorities (WHO 2008). In 2008, Margaret Chan, Director General of the WHO, also stated that health inequity really is a matter of life and death, emphasizing health equity as an urgent health problem to consider worldwide (Burke and Pentony 2011).

The WHO also formed an independent Commission on Social Determinants of Health (CSDH) in 2005, to provide more support and guidance for promotion of health and improvement of health inequities between and within the member countries (Marmot et al., 2008); overall, calling for the closing of the health gap in a generation. The Commission collected and synthesized evidence on the social conditions affecting health and health equities worldwide and provided recommendations for the reduction of the inequities. Three main concerns including passion for social justice, respect for evidence, and lack of appropriate actions on social determinants of health were addressed by the Commission. The key social determinants of health were described, including the daily living conditions affecting health and their underlying structural drivers (e.g. governance, social policies, and cultural norms and values). The Commission also provided evidence and actions taken on social inequalities in health at global and national level, and emphasized a global movement to address health equity through actions across the social determinants of health.

A new approach to the promotion of health and health equity was introduced by the Commission wherein "*health and health equity may not be the aim of all social policies but they will be a fundamental result*" (P 1). Taking this into account, three main recommendations and principles of action to address equity in health were suggested by the commission:

- Improve the conditions of daily life – the circumstances in which people are born, grow, live, work, and age.

- Tackle the inequitable distribution of power, money, and resources – the structural drivers of those conditions of daily life – globally, nationally, and locally.

- Measure the problem, evaluate action, expand the knowledge base, develop a workforce that is trained in the social determinants of health, and raise public awareness about the social determinants of health.

Equity in health has been documented as a national objective and a health system goal in most countries, including Iran. The right of all citizens to health care is embodied in the Constitution (Article 29) of the Islamic Republic of Iran, which recognizes the rights of all citizens to health as well as an equitable distribution of health services in the country (Iran and Algar 1980). Equity in health is also an objective of the health system of Iran; according to the Social Security Research Institute Congress Report all Iranians are eligible for community-based preventive, public health, and limited curative health services financed and provided through the country's primary health care (PHC) network (Schieber and Klingen 1999). Promotion of equity in health has been also addressed in "Iran's Vision for 2020" (article 4), which is a long-term strategic development plan, supporting the tackling of health inequities in the country (I.R.Iran Expediency Council 2009).

Iran's Fourth 5-year Economic, Social and Cultural Development Plan 2005-2010 (Article 89) requires the MOHME to design a system of health care services at the minimum required standards in all the country, based on service grading and rationalizing, in line with the needs of the various areas in the country (Management and Planning Organization of Iran 2004). In 2005, Iran became a partner in activities promoted by the WHO global Commission on the Social Determinants of Health (CSDH) (MOHME 2008). The MOHME of Iran signed an agreement with the SDH Secretariat in WHO in late 2005 to collaborate in the ongoing development of a strategy focusing on health equity and using the SDH as a framework for policy and action in the country (MOHME 2008) .

2.9. Addressing health inequities

In order to create the organizational space and capacity to act effectively on health inequities, training of policy-makers and practitioners, and focusing on social determinants in public health research, are necessary (Marmot et al., 2008). In this respect it is recognized that understanding and measurement of health inequity is an essential platform for action to reduce unfair disparities at both global and national level (Marmot et al., 2008). An equity gauge can be a useful tool for this purpose. Three pillars of the equity gauge are (a) to analyze, understand, measure, and establish inequities; (b) to promote changes in policy, programmes, and planning; and (c) to support the role of the poor and marginalized as active participants in change rather than passive recipients of aid or help (Riley et al., 2007; Patanwala et al., 2011). The underlying causes of health inequity need to be understood, and evidence is needed on what types of intervention work best to reduce the problem (McNamara et al., 2010). Multidisciplinary and interdisciplinary studies on social factors influencing health are necessary to provide evidence on what works to reduce health inequities (Marmot et al., 2008).

Action across all sectors of government is required for the promotion of equity; however, the health system is considered as a good place to start setting up structures and support that encourage action on health equity (Riley et al., 2007; Marmot et al., 2008). The

Commission on Social Determinants of Health recommends that the health sector should follow the social determinants of health approach and expand its policy and programmes in health promotion, disease prevention and health care (Marmot et al., 2008). Reallocating public expenditure funding across the social determinants of health including health care is essential to address health equity (Diderichsen 2004; Gugushvili 2007; Marmot et al., 2008). Adequate financing of health care and equitable allocation across population groups and regions is an effective action in this regard (Bhalotra 2007; Bokhari et al., 2007; Anyanwu and Erhijakpor 2009; Gani 2009). In this thesis, in part one, I provide evidence and establish some health inequities across the provinces of Iran; then, for action on health inequities, I consider equitable health care resource allocation as a useful action for reduction of health inequities across the provinces.

2.10 .Summary

In this section I have described the ethical and political background that underlies the monitoring and promotion of health equity in general and in the context of this study. Equity in health was considered as an ethical principle grounded in principles of distributive justice, namely, maximizing principles, egalitarian principles, and need principles. I decided to follow mainly the need principle in this study to assess health inequities, and to develop resource allocation models for the allocation of health resources across the provinces of Iran as this principle considers the health of disadvantaged groups in the community; the groups that are evidenced to have greater need for health care but receive less health care resources and services (Whitehead 1991; Diderichsen 2004; Marmot et al., 2008). The definition of health equity by Braveman and Gurskin (2003) as "*the absence of systematic disparities in health (or in the major social determinants of health) between social groups who have different levels of underlying social advantage/disadvantage—that is, different positions in a social hierarchy*"(P 3) was considered to underlie the measurement of health inequities across the provinces as undertaken in this study. Compared to other definitions, this concept does consider the social justice implications of health inequalities; it is also considered to be more practical to apply for the measurement and operationalisation of health equity. The definition of equity in health care by Starfield (2001) as "*absence of* *enhanced access for socially, demographically, or geographically defined population groups with greater health need*" (P 1), which considers the vertical principles, will be considered to underlie the development of equitable health care resource allocation models as undertaken in part two of this study. In political terms, the structure of the Iranian government was shown to mainly take a collectivism perspective. Having this perspective, the government is responsible to provide and implement health policies in a way that produces the greatest collective benefits to all the Iranian citizens; thus the view provides appropriate support for adoption of the social justice principle and promotion of health equity in the country. Evaluation of actions on health inequities showed that action across the entire sectors of government is an appropriate approach for reduction of health inequities and health systems are considered a good place to start (Marmot et al., 2008). This justifies the objectives of this study as the assessment of health inequities across the provinces of Iran; and the development of resource allocation models for the equitable distribution of public spending, which is thought to contribute to reduction of health inequities (Bhalotra 2007; Bokhari et al., 2007; Anyanwu and Erhijakpor 2009; Gani 2009).

3. The approach (framework) and methodological issues in measuring health inequities

3.1. Introduction

There are different frameworks, approaches and methods for measuring and establishment of health inequities in communities. In this chapter, first I evaluate the main frameworks and methodological issues described in the literature and identify an approach to apply for the measurement and establishment of health inequities across the provinces of Iran which is the aim of this study. Having the framework, potential equity perspectives for measuring health inequities are evaluated and the appropriate perspectives to use in this study are identified. Then, the social groups of concern in respect of inequity are described and the main social groups to use for the inequity measurement are determined. Aspects of health in respect of inequity and the related indicators are identified in the next section. Then, the sources of data used for the evaluation and measurement of health inequities are described. Thereafter I will evaluate the methodological implications associated with the measurement of health inequities, including measuring the inequalities univariately or bivariately, at individual-level or population-level, effect or total impact, and absolute or relative, and identify the appropriate option to follow in this study. Finally, indicators introduced for the measurement of health inequities in the literature are evaluated and appropriate indicators to use for quantification of the health inequities in this study are determined.

3.2. The approaches (frameworks) to assess health inequities

To address inequities in health, they need to be measured and assessed in order to provide appropriate evidence for planning how to tackle them. Different frameworks and strategies have been introduced that describe the steps needed to be taken and methodological issues to be considered for the assessment and measurement of health inequities. Kunst et al., (1994) defined socioeconomic inequalities in health as "*differences in the prevalence or incidence of health problems between individual people of higher and lower socioeconomic status*" (P 1) and proposed a four step strategy (framework) for the evaluation of inequalities in health: (i) evaluation of the available data; (ii) gathering additional data if necessary; (iii) interpretation and presentation of data; (iv) developing a policy response to the results. The strategy provides guidelines on choosing appropriate data for the inequality measurement including the source of data, sample size and bias, validity, statistical power, and relevance of the data (Table 3.1 below). This framework also mentions the methods that need to be considered in measuring and interpreting health inequities, such as whether to measure the inequities in relative or absolute terms, to consider effect or total impact, and using simple or sophisticated inequality indicators. Developing a policy response is the final step suggested in this strategy.

Table 3-1 Frameworks suggested for measurement of health inequities

Kunst et al.	Braveman and Gruskin
(i) Evaluation of the available data: - sources of data (formal admin., survey) - the informative value of data - sample size and potential bias - internal and external validity (representativeness) - precision (statistical power) - relevance and validity of comparisons over time **(ii) Gathering additional data if necessary:** - collecting additional data - generating new data **(iii) Interpretation and presentation of data:** - relative or absolute differences - effect or total impact - checking the results for bias (consulting policymakers) - simple or sophisticated measurement **(iv) Develop a policy response to the results**	- Define the related social groups - Determine the concerns, information and aspects related to equity in health - Identify sources of data on the social groups and health concerns and related indicators - Identify indicators of health status, major determinants of health, and health care for the inequity measurement - Describe the current patterns of avoidable social inequalities in health and its determinant - Describe the trend of the patterns over time - Generate an inclusive process of considering the policy implications of the patterns and trends - Develop a strategic plan for implementation

Source: Kunst et al., (1994); Braveman and Gruskin (2003)

Braveman and Gruskin (2003) introduced an eight-step framework for health inequity assessment and monitoring (Table 3.1 above). Identifying the social groups of concern for health inequities is the first action to be taken in this framework. In the next step, the aspect of health, including health outcome or health care, that may be different in the best and worst subgroups of the social groups is identified. The source of data, indicators of health (health status and health care) and also social factors are determined in the next steps. Then, the approach suggests presenting the current patterns of health inequalities as well as the trend over time health inequalities in relation to the social factors. This is followed by describing the policy implications of the current patterns and trends of health inequities. Developing a strategic plan for the reduction of health inequities is the final step suggested in the framework. Compared to Kunst et al.'s strategy, this approach provides more detail on the overall steps to guide the assessment and monitoring of health inequities and the development of strategies to deal with the health inequities. However, it does not give enough guidelines on the concepts and methods of measuring health inequities.

Keppel et al. (2005) describes six methodological points (Table 3.2 below) to consider where health disparities are to be measured. Determining a "reference point" for the inequality measurement is the first issue to consider. A reference point is the value from which the distances of cases (e.g. the health rates in the subgroups) are estimated. This can be the minimum or maximum score in the variable; or the overall or average of the figures in the variable. Whether to measure the inequalities in "relative" or "absolute" terms, using favorable or adverse measures, by individual groups or summary measures, measuring the effect or total impact, and order inherent in the domains are the other methodological issues suggested to be considered when measuring inequalities in health (these methods are described in the related sections following in this chapter).

Table 3-2. Frameworks suggested for measurement of health inequities

Keppel et al.	Asada
	(i) Defining health inequity
- Selection of a “reference point	- health equity as equality in health
	- health inequality as an indicator of general injustice
- “Relative” or “absolute” measurement of the disparities	
	(ii) Deciding on measurement strategies:
- Favourable” or “adverse” measure	- equity perspectives in health
	- unit of time (e.g. life time)
- Individual groups or “summary measure”	- unit of analysis (e.g. individuals or groups)
- Weight component groups?	(iii) Quantifying health inequity information:
	- inequality indicators
- Order inherent in the domains	- comparison (effect or total impact)
	- absolute or relative differences
- Measuring the “effect” or “total impact	- individual-level or aggregate-level
	- sensitivity to the mean
	- sensitivity to the population size
	- subgroup considerations

Sources: Carr-Hill et al. (2005), Keppel et al. (2005), Asada (2005)

Asada (2005) introduced a framework (Table 3.2 above) for measuring health inequities that suggests different steps to conceptualise the moral aspect of health inequality, and emphasises the logical consistency from conception to quantification. The framework is based on three steps: (i) defining health inequity; the health inequalities associated with socioeconomic status or inequalities in health caused by factors amenable to human interventions have been adopted (Starfield 2001; Braveman and Gurskin 2003) as the main concept of health inequity; (ii) deciding on measurement strategies to operationalise a chosen concept of equity; trying to reflect the moral considerations of health inequity measurement through the choice of the health measurement, the unit of time, and unit of health inequity analysis; (iii) quantifying health inequity information; this suggests six methodological issues that need to be consider when measuring inequities in health, including identifying the inequity indicator, whether to measure the effect or total impact, absolute or relative, individual or aggregate level, sensitivity to the mean and population size (Table 3.2 above).

The frameworks and strategies described above provide appropriate information on the steps and methods that need to be considered in the measurement and assessment of health inequities. In the next section the main approaches and methods which are selected for this study are described, including determining the equity concept and perspectives for the inequity measurement, social groups of concern for inequity, aspects of health in relation to inequity, health status and health care measures, sources and characteristics of data, univariate or bivariate measurement, individual or group level, effect or total impact, relative or absolute measures, and the type of inequality indicators. Appropriate methods for measuring the health inequities across the provinces of Iran are chosen.

3.2.1. The equity perspectives for measuring health inequities

Equity in health is considered as a very broad discipline accommodating quite diverse and disparate considerations (Sen 2002). The notion of inequity in health as inequalities related to socioeconomic status is the most popular adopted concept of health inequity (Whitehead 1991; Macinko and Starfield 2002; Whitehead and Dahlgren 2007). Two important factors influencing decisions on a strategy for the measurement of health inequities are the choice of determinants of health and the reason for this choice (Asada 2005). Having said that, Asada (2005) describes different perspectives of health equity that can be considered in measuring inequities in health. One perspective is to consider "*the minimally adequate level of health that is useful for any life plan*" (P 2) as the base for the health need. The main concern in this perspective is "*whether each person enjoys the minimally adequate level of health regardless of how each person realizes her health*" (P 2). There is no concern about health above this level as it assumes the people based on their preferences and conceptions of good life may trade off health with other goods (Hofrichter et al., 2010). Sen's capability approach (Robeyns 2003) and Norman Daniels's normal species functioning (Daniels 1996; Hofrichter et al., 2010) can be considered as examples of the view of the minimally adequate level of health.

In another perspective the "*average health of the worst-off group*"(Asada 2005, P 2) (e.g. life expectancy of the lowest quintile income group) is considered as the equity objective. This approach is consistent with Rawls' theory of justice, implying that, inequities in the community are justifiable if they bring increased benefits for the entire community and if the most disadvantaged people (the worst-off group) in the society are no worse off due to any inequality (Rawls 1971). The last and most popular perspective is the view of inequity as systematic, pervasive, or structural inequalities (Starfield 2001; Macinko and Starfield 2002; Braveman and Gruskin 2003; Whitehead and Dahlgren 2007). In this view, the correlation between health and socioeconomic status would be the focus for the measurement of health inequities (Asada 2005). Measuring health inequities based on each of the above perspectives may lead to different results.

In chapter two, the concept of equity by Braveman and Gurskin (2003) was adopted for measuring health inequities; this concept is based on the "systematic, pervasive, or structural inequalities". In chapter 5, I measure the health inequities across the provinces based on this perspective as well as the perspective of "equity as appropriate average health of the worst off group" (Asada 2005, P 2). The results from the two perspectives are compared to see how the magnitude and pattern of health inequities changes when they are measured based on different equity perspectives. By measuring inequities based on the systematic association, we, in fact, measure the "effect" of socioeconomic factors on the health measures; and by measuring based on the view of "equity as appropriate average health of the worst off group" (Asada 2005, P 2), we measure the "total impact" of the socioeconomic factors on the health measures (Mackenbach and Kunst 1997; Carr-Hill et al., 2005). In addition, different inequity indicators will be used for the measurements. (These will be described below in the related sections.)

3.2.2. Social groups in respect of health inequities

Based on the definition of health equity by Braveman and Gurskin (2003) health inequities are the health disparities between social groups who have different levels of underlying social advantage/disadvantage. Thus, *more and less advantaged social groups* are groups of people defined by differences that place them at different levels in a social hierarchy which are usually derived by wealth, power, and/or prestige. In this regard, the socioeconomic groups defined by measures of income, wealth, occupational class, and/or educational level, ethnic or religious groups, or groups defined by gender, geography, age, disability, or sexual orientation, are considered as the main social advantaged/disadvantaged groups (Braveman and Gurskin (2003). The social characteristics of economic activity (e.g. employed, unemployed distinctions), expenditures or consumption, urban versus rural residence, health insurance coverage (public, private, and sub-types), marital status (e.g. female-headed households), household status (e.g. household size), and housing conditions (e.g. overcrowding) have also been used as markers of socioeconomic differences for health inequity assessment (Braveman 1997; Carr-Hill et at., 2005)

The choice of social factor (group) to use for the health inequity assessment is important as it can affect the results (Braveman and Gruskin 2003; Asada 2005). Kunst et al., (1994) state that the three indicators of income level, occupational class, and level of education are the most important socioeconomic factors influencing health and health inequity; and therefore are appropriate for the inequity assessment. In addition, the social groups used for the inequity assessment can be different in different societies or even in different levels of geographical areas. In more affluent countries, the people of a low socioeconomic position, and thus of concern for health inequity, are those with poor education, unemployment and job in security, lack of amenities, unsafe neighborhoods, and poor working conditions (Marmot et al., 2008). In less affluent countries, in addition to these, disadvantaged groups are those facing a considerable burden of material deprivation and vulnerability to natural disasters.

In most European countries, health inequities have been measured between social groups determined based on educational attainment or occupation position (Avlund et al., 2003; Lofmark and Hammarstrom 2007; Theodossiou and Zangelidis 2009; Faeh and Bopp 2010). In the USA, racial/ethnic group is the most common group used to measure health inequities (Geronimus 2001; Williams and Jackson 2005; Wingate and Alexander 2006; Okunseri et al., 2008).In the United Kingdom, seven categories of occupation-based social class identified by the National Statistics Socioeconomic Classification have been used to evaluate health inequalities (Doran et al., 2004; Drever et al., 2004).

In Iran, some studies have been conducted to explore health inequalities across the social groups of concern in regard to inequities (Hosseinpoor et al., 2005; Hosseinpoor et al., 2006; Moradi-Lakeh et al., 2007; Khosravi et al., 2007a; Montazeri et al., 2008; Nedjat et al., 2010; Donyavi et al., 2011). In most of the studies health inequities have been measured base on the social characteristics of household income and wealth, education, unemployment, and urban/rural residency. Hosseinpoor et al., (2005) evaluated inequities in Iran and across the provinces using the characteristics of economic assets, housing condition (overcrowding), and enjoying safe drinking water. Khosravi et al., (2007) investigated the mortality inequities between men and women across the provinces.

There is no specific way for identifying social groups and subgroups for the inequality assessment. In practice, the existing knowledge and evidence on who is likely to be at risk of poor health or access to health care, the aim of the study, and data availability form the basis for determining the less and more advantaged social groups for an inequity assessment (Braveman 1997; Carr-Hill et al., 2005; APHO 2008; O'Donnell and World Bank 2008). Evaluation of health inequities between geographical areas is a common and useful approach for addressing health inequities; as geographical area has been considered to be an important social factor influencing the health status and access to health care of the residents (Keels 2008; Marmot et al., 2008; Schempf et al., 2009). In addition, health-related geographical areas are usually coterminous with the administrative and political distinctions such as province, districts, and sub-district (e.g. city, town, village and neighborhood); this coincidence provides appropriate opportunity for addressing health inequities as dealing with inequities needs an intersectoral cooperation (Braveman 1997; Mehrdad 2009).

There are concerns that the type of classification and the size of the geographical areas can affect the results of health inequity measurements (Braveman 1997). For example, the inequities measured using administrative divisions may differ from those that result where health-related areas have been determined based on other geographical or socioeconomic characteristics. However, findings from the study by Stafford et al. (2008) in the UK showed that there was no substantive differences in health inequalities estimated through three different geographical classifications identified based on the administrative (Census wards), physical features of environment (e.g. roads, railway lines, and parklands), and socioeconomic homogeneity of residents boundaries. There is also concern around the heterogeneity of the population where the geographical subdivisions are too large (Stafford et al., 2008). Larger geographical areas are usually less homogeneous than smaller ones in terms of the socioeconomic characteristics of the population, environment and political processes (Stafford et al., 2008). This can lead to missing appropriate information on the health inequities which can lead to incorrect policies being enacted for tackling the inequities. On the other hand, in areas of very small size the estimation of statistically valid indicators that can appropriately reflect the characteristics of the areas might be impossible.

In this study I aimed to measure the health inequities between the provinces of Iran. This choice is based on the availability of data and the context in the country. The provinces are the first administrative and political distinctions for public planning and resource allocation in most sectors including the health sector; in addition, the health system is established consistent with the administrative divisions in geographical terms. These features are supportive for the measuring and documentation of, and for dealing with, the health inequities in the country (Braveman 1997; Ollila 2011).The health inequities between the provinces are measured by estimating the relationship between the socioeconomic characteristics and health measures in the provinces. This approach is based on the adopted definition of health equity given by Braveman and Gurskin (2003). In addition, assessment of health inequalities in relation to the socioeconomic factors across geographical areas is considered as a vertical approach (Sutton 2002) which is considered to be an appropriate way to document health inequities (Sutton 2002; Hosseinpoor et al., 2005; Pearce and Dorling 2006). Braveman et al., (2000) also stated that: "*studying geographical variation in relation to socioeconomic and other social conditions could provide important insights into population's distribution of health*" (P 1).

I measure the health inequities using the social characteristics of rural residency (proportion of rural population), general income (GDP per capita), education (literacy rate), economic activity (unemployment rate), housing conditions (overcrowding indicated by number of people per room), and family status (household size). These indicators were selected based on their appropriateness for the inequity assessment described in the above literature. In addition, it is thought that this combination of indicators covers the main social advantage/disadvantage characteristics in the provinces, thus the results can provide appropriate information on the main health inequities between the provinces. Further, there is appropriate data available on the selected indicators, in particular in the Iran Census conducted in 2006.The inequities are measured and established by estimating the relationship between the social indicators and health measures in the provinces. (The international and national literature on the association between the selected social factors and health as well as some related methodological points is described in chapter 4).

3.2.3. Aspects of health and health care in respect of inequity

The definition of health equity by Braveman and Gurskin (2003)considered health and health care (as one of the social determinants of health) in regard to health inequities. Dimensions of health status (mortality and morbidity), health care access and utilization, quality of health care, and health care financing (public expenditure, out-of-pocket, insurance premium) are the main aspects of health considered for the inequity assessment. Quantifying the association between these dimensions of health status and health care with the geographic, demographic and socioeconomic characteristics of the populations is the concern of health equity assessment (Braveman and Gruskin 2003; O'Donnell and World

Bank 2008). The objective of this study is to measure and establish the inequities related to aspects of health outcomes including mortality and morbidity as well as to health care access across the provinces of Iran. This provides appropriate information on different dimensions of health inequities in Iran. The main indicators and related methodological issues are described in the following sections. (An overview of the mortality, morbidity and health care access in the context of Iran and across the provinces is described in chapter 4.)

3.2.3.1. Health outcome indicators for the inequity measurement

The concept of "health status" refers to the physical and psychological capacities as well as social and personal resources which are necessary for everyday life and can be represented at both individual-level and group-level (Starfield 2001). Individual-level health is usually reflected by the sum of many separate weighted indicators, or a summary measure such as disability-adjusted life years (DALYs) or disability-adjusted life expectancy (DALEs) that reflects the manifestations of individual indicators (Murray 1994). Population health is the nature of the distribution of health throughout the population which is usually reflected by mortality and morbidity measures (health outcomes).

Overall mortality is one of the main measures of population health; it is usually expressed by age and gender, and can be measured through indicators of "all-cause mortality", "cause-specific mortality", and years of potential life lost (YPLL) (Merrill 2009; United States-EPA 2011). The all-cause mortality counts the total number of deaths due to any cause within a specified year. The all-cause mortality is often reflected by measures of standardized mortality rates (SMRs), life expectancy, infant mortality, mortality under-5, and maternal mortality (Merrill 2009). SMRs are straightforward for interpretation and standardizing mortality data by age and sex can remove the effects of these two obvious confounding variables (Kunst and Mackenbach 1994). Life expectancy is defined as "*the average number of years an individual of a given age is expected to live if current mortality rates continue*"(Webb et al., 2005, P 54). Life expectancy is a common summary measure of mortality as it represents a summary of mortality rates in all age groups (U.S. DHHS 2010). It is not influenced by the age-structure of the population and as it is described as years of life it can be easily interpreted by policy makers. However, it is not a realistic measure but a hypothetical one, so it cannot take into account the effect of changes in incidence and treatment of illnesses in the future (U.S. DHHS 2010).

Infant mortality, mortality under-5, and mortality in populations aged 15-60 years are three main age-related mortality measures, distinguishing premature mortality from mortality in old ages (Merson et al., 2006). Infant mortality is strongly sensitive to socioeconomic conditions but is not a comprehensive measure of health status (Webb et al., 2005). Under-5 mortality rates estimate the number of newborn babies that die before reaching their fifth birthday, measured as a rate per 1,000 live births, and estimate the overall health and well-being of a society (Khosravi 2008).

The cause-specific mortality measures count the number of deaths due to a particular cause in a specified year (United States-EPA 2011). Ranking the causes of death can provide a description of the relative burden of cause-specific mortality. Mortality conditions can be expressed by causes of death grouped into relevant classifications to provide sufficient and reliable information for analysis and intervention (Murray and Lopez 1997b). There are three broad cause-of-death categories identified by Murray and Lopez (Murray and Lopez 1997a); “Group I” includes mortalities caused by communicable, maternal, prenatal, and nutritional conditions; “Group II” includes non-communicable diseases (cancer and mental health illnesses); and “Group” III includes ‘injuries’.

The summary measure of DALYs was developed and used to consider both quantity and quality of life in one indicator for comparison between social groups and geographical areas (Anand and Hanson 1997). This measure takes into account the effects of both mortality and morbidity in the populations (World Bank 1993; Murray 1994). DALYs is *"the sum of the years lost due to premature death and healthy years lost through disability*" (Webb et al., 2005, P 56). This indicator is useful for comparison among less and more privileged groups, as it can compensate for the loss of information when mortality is used (Ljung et al., 2005).

Morbidity conditions are often caused by communicable and non-communicable diseases and injuries. The main communicable diseases are HIV/AIDS, TB, and malaria. Non-communicable diseases are now the main cause of morbidities in the world (Kishore and Michelow 2010). Non-communicable diseases are considered as the main cause of disabilities. Children's malnutrition and psychological problems are also prevalent non-communicable diseases. These problems are often reflected by indicators such as children's growth and nutritional problems, disabilities, risk factors of hypertension, diabetes, rates of tobacco use, and high serum cholesterol, and also hospital episodes, self-reported health, psychological measurements, and lifestyle and risk taking behaviours (Braveman 1997; Gulliford et al., 2004; Carr-Hill et al., 2005; Khang et al., 2008).

Methodological issues such as statistical power, occurrence and reporting of cases in the estimation of outcomes are important considerations in the choice of the mortality and morbidity indicator for health inequity measurement (Carr-Hill et al., 2005; Khosravi et al., 2007a). Statistical power is the probability that a study will obtain a statistically significant effect (Rubin 2010). For example, a power of 80 percent (or 0.8) means that a survey or study (when conducted repeatedly over time) is likely to produce a statistically significant results 8 times out of 10. Statistical power will be weak where the occurrence or number of deaths in the area (e.g. district) in question during one year is low. However, aggregation of data on a particular indicator over a few years, or combining indicators of different conditions in some cases can raise the statistical power, although it may make the interpretation of policy implication more difficult (Braveman 1997).

It is likely that the number of deaths, in particular in poor populations, is under-reported (WHO 2006a). Underreporting can be due to administrative problems with the death registration system or because of the tedious process of registration and ignorance of requirements by the families, as well as disincentives such as asking for a registration fee. Some methods such as Brass Completeness techniques have been used to estimate the undiagnosed and unregistered deaths occurring in a region or country (Khosravi et al., 2007a). In this technique the under-reported deaths are estimated by age, sex and cause of death and more accurate rates are recalculated. For example, Abdalla and Shaheen (2007) estimated adult death under-reporting in Sudan using the *Brass Completeness method*; and showed that only 4.4% of deaths were registered and registration completeness was higher for male deaths (6.5%) than for female deaths (2.8%), indicating a wide gap in the mortality information.

All-cause mortality measures such as infant and under-5 mortality, maternal mortality, adult male and female mortality, and life expectancy at birth have been proposed and used to assess health inequities (Braveman 1997; Marmot 2005; Houweling et al., 2007). In this study, we used three premature mortality indicators, including under-5 mortality rates and mortality in both men and women aged 15-60 years, for health inequity measurements across the provinces in chapter 5. These three measures together can reflect the magnitude of early deaths in a large part of the population in the provinces. Compared to other mortality measures, the results from the inequity measurement of these premature mortality measures may be more useful for health policymaking at national level.

In morbidity, different measures including children's growth and nutritional status, rates of tobacco use (risk factor of non-communicable disease), disability, hypertension, diabetes, and high serum cholesterol in adults have been suggested and used for inequity measurement (Braveman 1997; Gulliford et al., 2004; Koster et al., 2004; Carr-Hill et al., 2005; Espelt et al., 2008). In this study, five indicators of morbidity are used to measure health inequities across the provinces of Iran: diabetes rate, proportions of high blood pressure, high cholesterol in the population aged over 15, low weight in children, and depression rates (chapter 5). The three chronic health problems of hypertension, hypercholesterolemia and diabetes have been considered as the main risk factors of ischemic heart disease and cerebrovascular accidents; these health problems together with depressive and psychotic disorders have been shown to be among the 10 main causes of both mortality and morbidity in the country of Iran (Naghavi 2004). Low weight in children is mainly due to malnutrition which is a widespread problem in developing countries (O'Donnell and World Bank 2008). The description of morbidity in chapter 3 showed wide variation in the five selected indicators across the provinces of Iran. (An overview of the health outcome indicators in the context of Iran and across the provinces is described in chapter 4.)

3.2.3.2. Health care indicators for the inequity measurements

Healthcare systems (including access to and utilization of health care) are considered as vital social determinants of health (Marmot et al., 2008). However, there is often inequity in health care access and utilization in relation to health status (Shi et al., 2003; Starfield et al., 2005) on one hand, and in association with other socioeconomic determinants of health (Heck and Parker 2002) on the other hand, particularly in developing countries. Based on the WHO (2005), in low- and middle-income countries, due to lack of access to and utilization of prenatal care more than half a million women are dying due to problems related to pregnancy and delivery. Similarly in the United States, compared to the whites, minority groups are more likely to be diagnosed with late-stage breast cancer and colorectal cancer (Marmot et al., 2008).

The health care system including access, uptake, and quality of preventive, curative and palliative interventions, whether directed at individuals or populations, can influence health status and differences in the health of populations (WHO 2000). It has also been shown that primary care can be more influential than medical care in improving overall health status and bridging the health gaps among populations regardless of the time, level of geographical area (state, county or local area), or type of health outcomes (Shi 1999; Shi et al., 2003; Starfield et al., 2005). Some reasons for this are considered to be: (i) primary care is more accessible than specialty care in both organizational and psychological terms; (ii) secondary care is more expensive than primary care and financially less accessible for less affluent people; (iii) in terms of required financial resources, primary care is less intensive than specialty care which makes it more adaptable and capable of responding more quickly to changing societal health needs. All of the above show that, compared to specialty care, primary care is related to a more equitable distribution of health in populations.

Access (to health services) is defined as "*the experiences and perceptions of people as to their ease in reaching health services or health facilities in terms of location, time and ease of approach*" (Starfield 2001, P 1). Access to health care is reflected by personnel (physician, nurse, midwives), physical (hospital, health centre, and rehabilitation centre), and financial (public expenditure, health insurance) indicators (Braveman 1997). Utilisation (uptake) is the experience of people as to their receipt of health care services of different types (Starfield 2001). Utilisation or actual receipt of health care happens when the financial, geographical, physical, linguistic, cultural, knowledge and educational barriers are removed (Braveman 1997). Certain groups of people can be precluded from receiving available primary and secondary health services because of the barriers (Sareen et al., 2007; Bakeera et al., 2009; Lin et al., 2009). However, as mentioned above barriers to the up-take of primary care can have greater effects on health and health inequalities.

Measurement of utilisation is the main method for capturing or establishing the effect of the potential barriers. However, some issues such as preferences or freely choosing not to seek certain services by certain groups of people are considered as limitations for the measurement of actual utilisation (Mooney et al., 1991; Bertakis et al., 2000). Health care utilisation can be represented by inpatient indicators such as hospital episodes and outpatient services indicators such as number of GP visits, immunization coverage, reproductive health care coverage (antenatal care, safe delivery, contraceptive prevalence), availability of essential drugs and access to health referral services (Braveman 1997).

There are a variety of primary and secondary healthcare indicators, in terms of both access and utilization, including infant immunization coverage, antenatal care coverage, safe delivery care coverage, contraceptive prevalence rates, GP, specialist and dentist visits, and inpatient episodes which have been suggested and used for inequity assessment (Braveman 1997; Allin 2006; Moradi-Lakeh et al., 2007; More et al., 2009; Feng et al., 2011). In this study, four indicators were used for the inequity measurement: hospital delivery (giving birth in hospital), prenatal care (pregnant women visited at least two times), vaccination rates in children under 1 (injected determined routine vaccines of diphtheria, whooping cough, tetanus, rubella and hepatitis B) and the percentage of the population who used modern contraceptives. These measures reflect mainly the use of primary health services in Iran, indicating a more real access to the health services across the country. Primary care has been shown to have a bigger influence on health and health inequalities than secondary care

(Shi et al., 2003; Starfield et al., 2005). (An overview of the health care access indicators in the context of Iran and across the provinces is described in chapter 4.)

3.2.4. Data

The choice of data to represent the social inequalities in health is based on certain standard scientific and ethical criteria such as validity, reliability, as well as ethical and cultural acceptability (Braveman 1997; Hayward 2008; CIESIN and UNICEF 2006). This requires, for example, that the data source(s) for the indicators are of acceptable quality. There are often two main sources of routine and non-routine data that can be used for inequity measurement. Health information systems (HIS) and censuses are considered the main sources of routine data, and in respect of non-routine sources, household surveys have been found to be important (Braveman 1997; O'Donnell and World Bank 2008). Data from the HIS often include administrative health services information (e.g. hospital records), epidemiological or surveillance data, and vital events (e.g. birth and death registration). In this study the sources of data for measuring of health inequities across the provinces were mainly the vital registration system, the Census 2006, and the demographic and health survey in 2000.

3.2.4.1. Vital registration

Vital registration data, including mainly data on births, deaths, marriages and divorces, are recorded by the civil registration systems by law to meet the specific needs of individuals and governments (United Nations 1998). The vital recorded data are also used for the updating of census data in the years in-between the censual years (United Nations 1998). Under-reporting of births and deaths, in particular in disadvantaged populations, and incomplete coverage of the population are two problems with these records (WHO 2010a); thus, completeness of the data on the registered births and deaths is crucial. Another issue with the data on births and deaths recorded is that they are often not timely and update to date (PAHO 2003).

In this study, the information on the mortality measures was extracted from the study called the “Mortality Profile in 29 provinces (except Tehran) of Iran”, conducted by Iran’s Ministry of Health and Medical Education in 2004 with the data basically from the Death Registration System, on which completeness study was conducted by Khosravi et al., (2007). A new death registration system was initiated by the MOHME in 1997 starting in one province (Bushehr) as a pilot and extending to 29 provinces in 2004 (Statistical Center of Iran 2007). In this system information on deaths is gathered and integrated from three different sources, namely hospitals, cemeteries and the National Organization for Civil Registration across the provinces. Despite the improvement in this death registration system, there have been problems with it, such as not covering the province of Tehran consisting of 13.4 million people (19% of the national population), and also considerable under-reporting of deaths in the districts because some deaths which occur in rural areas are not reported (Khosravi et al., 2007b). Khosravi et al., (2007a) conducted an investigation of completeness on the provided data on mortality in the Death Profile report and estimated the completeness of the data (using Brass Completeness method) on mortality in children under-5, mortality in adult men and women, and life expectancy at birth at the provincial level. The mortality rates for the province of Tehran were estimated using the data from the death registration system operated by the Deputy of Research and Technology of the Ministry of Health and Medical Education in 2001. In addition, the mortality data on the three provinces of North Khorasan, South Khorasan and Khorasan Rasavi (created in 2004) were amalgamated and the mortality measures were estimated on the original province of Khorasan. The data on the mortality indicators in this study are from the study by Khosravi et al., (2007a).

3.2.4.2. The Census

A census collects data on all the individuals and families in a country. In most countries, the national statistical agencies are usually responsible for conducting the population and housing census. The universality, individual enumeration, simultaneity, ability to output data on small-scale unit areas, and defined periodicity are five main characteristics of a census (Michel et al., 2008). A census is usually conducted in an interval period of five or ten years and collects data on age, sex, marital status migration, fertility and mortality, education and employment. As a result, there is a wide range of useful data in the census that can be used for research in health (O'Donnell and World Bank 2008). A census is also different from a survey in that it collects data on all individuals while surveys collect more detailed information on a small sample of the population.

In this study, data on the demographic and socioeconomic factors, including the total country population, population groups, urban/rural population, population growth rate, population density, migration, literacy rates, unemployment, overcrowding and household size, were abstracted from the census 2006 which was undertaken by the Statistical Centre of Iran at the end of autumn 2006. A large number of items on the demographic, socioeconomic as well as housing characteristics of the population in the country are gathered and processed through the census; and the collected crude data are provided at national, provincial, and district levels (Statistical Centre of Iran (Farsi) – http://www.amar.org,ir/nofoos1385/default-763.aspx).

3.2.4.3. Demographic and Health Survey (DHS)

The demographic and health surveys (DHS), the Living Standard Measurement Surveys (LSMS) related to the World Bank, and the Community-based Monitoring Systems of children's nutritional status and immunization coverage (UNICEF) are among the main non-routine data that can be used for inequity assessment (Braveman 1997). The DHS was introduced by the collaboration of the U.S. Agency for International Development and some governmental organizations of developing countries in 1984 to provide information and analysis on the population, health, and nutrition of women and children in those countries (O'Donnell and World Bank 2008). The DHS collects and disseminates information on a range of health indicators including fertility, family planning, maternal and child health, gender, HIV/AIDS, malaria and nutrition (Braveman 1997). The vast range of information in the DHS and also a relatively high quality of design and data make it appropriate to use in the investigation of inequalities in health at national and provincial level.

For this study, information on the morbidity and healthcare utilisation indicators was gathered from the “Profile of Health in Iran” report published by the Ministry of Health (Health Ministry of Iran 2003). This report includes the results of several surveys, conducted by different Bureaus in the Ministry, including the 2000 Demographic and Health Survey (DHS), the Health and Disease Study (1999), the Reproductive Age Mortality Survey (RAMOS) (1997), the Study of Households’ Knowledge and Performance in Family Planning (1997), and the Anthropometry and Nutrition Indicators Survey (ANIS) (1998). The DHS in Iran (2000) was conducted by the Family Health and Population Unit of the Health Ministry in collaboration with the Statistical Centre of Iran and Civil Registration Organization. The sample size was 114,000 households with 4,000 households from each province (half rural and half urban households). The aim of the study was to provide information on the demographic and socioeconomic characteristics of the population, as well as mortality and morbidity indicators at national and provincial level.

3.2.4.4. Other sources of data

Information on the GDP per capita indicator was gathered from the “National and Regional Accounts” conducted by the Statistical Centre of Iran in 2006 (Statistical Centre of Iran 2006). In this study the GDP was estimated by the defined different sectors in the country and at both national and provincial level. Oil and gas is mainly produced in three provinces of Khuzestan, Bushehr and Kohgiloyeh & Boyer-Ahmad. However, it is necessary to mention that the mark value due to oil and gas has usually national economic effects rather than provincial effects. In other words, the oil and gas activities in the oil producing provinces would in reality affect all the provinces in the country. However, the related economic added value from oil and gas has been included in the GDP of the oil producing provinces. This can indicate an unreal GDP in these provinces and affect the results of analysis. Therefore, the value added due to the oil and gas was excluded from the total GDP in the oil producing provinces and the GDP was estimated without the market value from the oil and gas sector.

3.2.4.5. Validity of data

Data used to measure health inequity should meet two main criteria of external and internal validity. To have external validity or representativeness, the data should include both men and women and also cover all age groups or at least a very substantial part (e.g. 15-74 years) (Kunst et al., 2001). Further, the geographical area of study must not be only a specific region or city or some part of the working population such as civil servants or employees of specific companies. The data should also include all relevant sub-groups such as people lacking social or health insurance, foreigners or the institutionalized population. There is internal validity in data when socioeconomic indicators and health measures can be linked at individual level (Kunst and Mackenbach 1994). Where the health indicator is a mortality measure the study should be a longitudinal or linked cross-sectional study. To have precision or statistical power the health interview survey must include fairly large respondents (more than 5000) and a fairly large number of deaths (more than 1000) registered (Kunst and Mackenbach 1994).

As described above, the data for this study were mainly extracted from the 2006 Census, DHS, and vital registration records. These are amongst the most well-known sources of data and surveys conducted for providing appropriate data for both the government and private sectors. They are conducted with appropriate studied methodologies, covering both males and females, different social and age groups, as well as different regions in the country (external validity). In internal validity terms, the census data are among the most robust of any research data because of the methodology of querying every individual in a country rather than relying upon sampled data. I also used data on the mortality measures which are basically from the death registration system; however, the death rates have been corrected for under-reporting by Khosravi et al. (2007a) which has made the data more reliable. The data from the DHS were extracted from a large sample size of 114,000 households from both urban and rural areas using the appropriate sampling method.

3.2.5. Univariate or bivariate measurement

There are two main approaches or distribution concepts considered in the measurement of health inequalities: univariate and bivariate approaches (Wolfson and Rowe 2001). In the univariate method, distribution of health is considered as one of the characteristics of individuals like other attributes such as income, gender, and ethnicity that can differ between individuals. The inequality is intended to illustrate the dispersion of health within the population where some individuals have high health and others have low health. In the univariate approach, pure health inequality is measured regardless of the other socioeconomic characteristics of individuals (Sahn 2009). In this approach the distribution of a health indicator is usually measured by the statistical techniques of central tendency, dispersion and inequality (Regidor 2004a). Univariate or pure health inequalities are of interest for national comparisons between countries (Murray et al., 1999).

The use of the univariate approach has been criticized by some authors (Wagstaff et al., 1991; Wagstaff 2000). They believe that univariate measures do not truly reflect the socioeconomic inequality in health because ranking populations based on univariate and bivariate measures could lead to different results. But others such as Regidor (2004a) state that such criticisms cannot be justified as these are two different matters and used for different purposes. On the other hand, others such as Ferrie et al., (2002) prefer the use of univariate rather than bivariate measures. They give the reason that evaluation of health disparities between different values of socioeconomic characteristic is not a scientific matter as it involves a moral judgment, in this case on the inequality in health, which is assumed to be inequitable. Unlike the pure health inequalities which were considered to be of interest for national comparisons, social classes are not easily comparable between countries (Murray et al., 1999).

In the bivariate approach health inequalities are measured across a variety of socioeconomic characteristics of individuals or populations, which is the so-called gradient or socioeconomic approach to health inequalities (Sahn 2009). In this approach, the association between a variable of demographic or socioeconomic characteristic with health is quantified to determine the effect of the variable on the health of the population (Regidor 2004a). The attention is focused at least on two characteristic variables of an individual (or sub-group) in the population; one health indicator and one socioeconomic measure such as education or income (Wolfson and Rowe 2001).

The assessment of health inequalities in terms of bivariate distribution in relation to other socioeconomic characteristics is essential for health inequity measurement, as it can give some clues as to the socioeconomic determinants of inequalities in health. The results from bivariate analysis can be useful for planning possible interventions and equitable resource allocation (Wolfson and Rowe 2001). The WHO (2000) also considers the assessment of health inequalities in bivariate terms, but at individual level in relation to the socioeconomic status of the population.

As the aim in this study is measurement of health inequities (moral aspect of the inequalities) across the provinces, we follow the bivariate approach. From the literature it can be concluded that univariate and bivariate measurements can respectively represent horizontal and vertical inequities. By using the bivariate approach, we measure vertical inequities in health status and health care across the provinces, which have been found in the literature to be a more effective way to reduce health inequities.

3.2.6. Individual-level or group-level measurement

One debate on the strategies of measuring inequalities in health is the question of whether inequalities should be measured at individual-level (health inequalities) or at group-level (social group health differences) (Asada 2005; Keppel et al., 2005). The individual level or micro level in terms of health is where the characteristics of "individuals" (as opposed to groups) is considered and used for the measurement of health inequalities, while the aggregate or macro level is the level at which the characteristics of population groups are used for the inequality measurements (Culyer 2001). Health inequality at individual-level refers to variation in health status indicators across individuals in a population, while social group health differences refer to health status differences among the biological, socioeconomic or geographical subgroups of the population (Murray et al., 1999).

The WHO (2000) adopted the individually-based approach for the measurement of health inequalities. The given reason is that the final aim of equity in health and health care is to reduce and if possible eliminate the inequities among individuals in the community. Further, considerations such as being a natural complement to measuring average level health in a population, identifying the individuals with lowest levels of health without defining social groups, being easy to compare health inequalities between the populations or for the same population over time, and being considered as an object of scientific process, have been stated as the advantages of measuring health inequality at individual level (Murray et al., 1999).

However, many authors have criticised the individual-level approach recommended by the WHO and supported group-based measurement of health inequalities (Braveman et al., 2000; Almeida et al., 2001; Asada and Hedemann 2002). It is believed that measuring health inequalities at individual level does not reflect health variations across subgroups of the population. Further, it does not provide enough information on the difference between the advantaged and disadvantaged subgroups that can be used by policy makers to develop appropriate equitable health policies and plans (Asada and Hedemann 2002). Health inequalities across individuals may be due to factors of chance and genes; these types of individual level inequalities are not always considered to be important and unfair (Kawachi et al., 2002; Farrell et al., 2008). In addition, measuring inequality at individual level using some health measures such as annual mortality rates is not meaningful (Murray et al., 1999), because the proportion of the dead population contains all the information on both the aggregate-level and distribution across individuals. Finally, the results from individual-level measurement do not clearly indicate whether or not the measured inequalities are inequitable, and cannot present a conceptual view of fairness in terms of resource allocation (Almeida et al., 2001).

Most of the studies on health inequalities are on the health differences across social groups rather than individuals, giving moral importance to health inequalities in association with social inequalities (Wagstaff et al., 1991; Whitehead 1991; Wilkinson 1997; Black and Krishnakumar 1998; Marmot 2005; Marmot et al., 2008). The justification is that health inequalities in social groups are important as the groups with lower health status have disadvantages in social positions such as income and education. Some authors also believe that social position is the key determinant of health, and because of that, measuring social group health differences is more important (Navarro 1998). Wagstaff et al., (1991) believe that only those health inequalities that are associated with other socioeconomic inequalities are meaningful to measure. Mackenbach and Kunst (1997) are in favour of measuring social health differences because socioeconomic inequalities in health are considered unfair and cause higher burdens of disease for disadvantaged social groups (Mackenbach and Kunst 1997). Measuring health inequalities at population level provides information to determine whether the inequalities are unfair or unjust (Gakidou and King 2000). Finally, unlike the individually-based approach, the aggregate-based measurement of health inequalities provides information on the population groups and areas in the community that can be appropriate for policy making and financing in health and health care.

In this study, we follow the group level approach as the aim is the measurement of health inequities or moral aspects of health inequalities across the provinces of Iran which are considered as social sub-groups of concern. In addition, most available information is at aggregate-level and there is a lack of information at individual-level nationally, in particular at provincial level.

3.2.7. The "effect" or "total impact" measurement

When measuring health inequities it is important to distinguish whether the aim is to measure the “effect” of changes in socioeconomic status on health status, or the “total impact” on the health of the whole population by taking into account the distribution of socioeconomic characteristics within the population (Carr-Hill et al., 2005). A measure of “effect” is given, for example, by calculating a ratio of mortality rate in a population with primary school education (low socioeconomic status) with mortality rate in a population with university education (high socioeconomic status). This approach is consistent with the ethical perspectives of “*systematic relationship between the pattern of social conditions and health outcomes*” and the “*minimally adequate level of health*” for all the social subgroups (Sen’s capability function) (Asada 2005, P 2). In the latter, the minimum level of health can be the average health across the social sub-groups. The effect will be larger where the relationship between the social conditions and health indicators is larger.

An index of “total impact” is obtained when, for example, a ratio is calculated of the mortality rate in the population quintile with the lowest education level and the mortality rate in the population quintile with the highest education level (Mackenbach and Kunst 1997). In fact, in the “total impact” measurement, both the effect of decreasing socioeconomic status on health and the magnitude of inequalities in the socioeconomic status within the populations are considered (e.g. by taking into account the population size of the groups with lower socioeconomic status) (Kunst and Mackenbach 1994). This approach is consistent with the ethical perspective of “*average health of the worst off group*” (Rawls’ theory of Justice) (Asada 2005, P 2).

The total impact will be larger when there is a wider inequality between the highest and lowest social groups and when there is a larger inequality across the groups with the lower socioeconomic status. Therefore, the total impact will be larger when the effect of one year education on mortality is larger as well as when the difference in the level of education between the highest and lowest quintiles is larger. The difference between the low birth weight levels in two populations with different monthly income levels (e.g. £900 and £1800) is a measure of effect. A measure of total impact would combine the difference in low birth weight levels in the two income level groups with the data on the extent of income inequality in the population to estimate the impact of this inequality on the health of the whole population (Mackenbach and Kunst 1997). The impact will be higher when the income inequality is higher.

It is recommended that a combination of the two measures be used and a judgment made by comparing the results (Mackenbach and Kunst 1997). However, the aim of the study and the adopted measurement strategy determine which approach to follow. As described previously (section 4.2.4), decisions on the use of these two approaches are based on the ethical view (strategy) adopted for the assessment of health inequities. In the case of adopting "inequity as the systematic, pervasive, or structural inequalities", the focus would be on the correlations between health and socioeconomic determinants of health, and the "effect" approach would be appropriate to follow(Mackenbach and Kunst 1997). On the other hand, where the view of the "average health of the worst-off group" is adopted, the "total impact" approach seems to be the appropriate one. In this study, I consider both the "effect" and "total impact" approaches for the measurement of the health outcomes and health care inequities across the provinces of Iran. The results from the two types of measurement are compared to indicate how applying the different equity perspectives and consequently different approaches of measurement may lead to different results.

3.2.8. Relative or absolute measures

Health inequalities should be measured in both absolute and relative terms (Carr-Hill et al., 2005; Houweling et al., 2007; Marmot et al., 2008). The differences between the mortality of the highest and lowest socioeconomic groups is considered as an absolute inequality; while the mortality rates of the lowest socioeconomic groups as a ratio to that of the highest is a relative inequality (Kunst and Mackenbach 1994). The relative measure is more understandable than the absolute; however, both measures are important as in some cases, for example, a 50% higher rate of a rare disease can be less important than a 10% higher rate of a prevalent disease. Measurement using both measures provides a better understanding of the magnitude of the inequalities, in particular when the comparisons would be over time, across geographic areas, populations, or indicators (Carr-Hill et al., 2005). The relative measurement enables a comparison of inequalities across different indicators regardless of their units; which is not possible in the absolute measurement. However, where both the relative and absolute measures are used for the inequality measurement, it is important to consider the overall level of health-related outcomes as they may empirically affect the magnitude of both relative and absolute socioeconomic inequalities (Houweling et al., 2007).

In this study, we measure the health inequities in both absolute and relative terms; results from the absolute measurement will provide information on the magnitude of the disparities as well as the significance of the relationship between the health indicators and the socioeconomic factors. Results from the relative measurement provide information to compare the magnitude of health inequities across the different health indicators. The two types of results will reflect the health inequities and provide information to design appropriate equity-oriented policies.

3.2.9. Inequality indicators for measuring inequity

Different classifications of inequality measures have been introduced to measure inequalities in health. Machenbach and Kunst (1997) introduced a classification of inequality indicators based on three different important aspects including (i) relative or absolute measurement of health differences; (ii) measurement of an "effect" of lower socioeconomic status, or of the "total impact" of socioeconomic inequalities in health upon the health status of the population; (iii) simple versus sophisticated measures (Table 3.3 below).

Table 3-3. Summary measures for magnitude of socioeconomic inequalities in health

Degree of sophistication	Indices of effect	Indices of total impact	
		No inequalities = everyone has health of high socioeconomic status	**No inequalities= everyone has health of average socioeconomic status**
Simple	Rate ratio of lowest versus highest group	Population-attributable risk	Index of dissimilarity
	Rate difference of lowest versus highest group	Population-attributable risk (absolute version)	Index of dissimilarity (absolute version)
Sophisticated	Regression-based index of relative effect	Regression-based population attributable risk	Relative index of inequality
	Regression-based index of absolute effect	Regression-based population attributable risk (absolute version)	Slope index of inequality

Source: Kunst, and Mackenbach, Measuring socioeconomic inequalities in health- p 51, WHO, 1994.

Regidor (2004a) introduced a classification of the inequality indicators divided into four groups. The first is indicators in a strict sense or those that measure inequalities in univariate terms such as Gini Coefficient, and the Index of Dissimilarities (Table 3.4 below). These indicators take full advantage of the information on all subjects or population groups but their disadvantage is that they overlook socioeconomic status (Schneider et al., 2005b). However, the Gini coefficient is not sensitive to variations in the magnitude of inequality in mortality of populations aged over 15 years. Moreover, the form of inequality may not be understandable because of insufficient information on the coefficient, in particular, where it is not presented by the corresponding curve. The index of dissimilarity also cannot show the direction of the relationship between socioeconomic factors and health indicators. Furthermore, it may presuppose redistribution of mortality or burden of disease that is not acceptable from an ethical standpoint (Schneider et al., 2005b).

Table 3-4. Classification of inequality indicators by Regidor (2004)

Classification	Inequality indicator
Measures in strict sense	- Gini index - The index of dissimilarity
Measures of association	- Regression Coefficient - Pearson's correlation coefficient - Absolute difference in frequencies - Frequency ratio with polymous socioeconomic variables - Frequency ratio between the uppermost and lower most categories of polytomous socioeconomic variables - Frequency ratio with dichotomous socioeconomic variables - Frequency ratio with continuous socioeconomic variables - Odds ratio
Measures of impact	- Population attributable proportion
Indicators based on ranking of socioeconomic variable	- Concentration index - The slop index of inequality - The relative index of inequality

Regidor (2004a,b) Measures of health inequalities: part I, Part II

The second group of inequality indicators are measures of association (Table 3.4 above). "*These measures compare the level of health or the frequency of the health event for different values or categories of the socioeconomic variable to be studied, using relative differences- ratios- and absolute differences*"(Regidor 2004a, P 3). However, how individuals are distributed in each group is not considered by these indicators. For example, the magnitude of inequality of mortality rates in relation to some particular socioeconomic indictor are the same in two provinces when the mortality rates are similar but the number of population may vary largely in the two provinces. Regression coefficient, correlation coefficient and odds-ratios are the main indicators in this category (Table 3.4 above).

The fourth group are those that measure health inequalities based on ranking of groups or individuals according to socio-economic factors such as the Slope/Relative Index of Inequality and Concentration Index. Wagstaff (1991) stated that among the indicators only the RII and the concentration index meet the necessary requirements for the measurement of the inequalities; they reflect the socioeconomic dimension of inequalities in health, use information on the entire population, and are sensitive to redistribution of the population among different social groups. The concentration index incorporates the socioeconomic dimension, but shares the other disadvantages noted for the Gini coefficient. However, there is no particular method of choice of an inequality indicator to use for inequity measurement: the researcher's perspective on socioeconomic inequalities in health, the aim of the study and technical issues are the main factors for choosing an indicator for the inequality measurement (Mackenbach and Kunst 1997).

Choosing an inequality indicator for the inequity measurement is based on the equity perspective adopted for analysis (Asada 2005). In this study we follow the ethical perspective of "inequity as systematic, pervasive, or structural inequalities in health" in which the focus is on the correlations between health and socioeconomic determinants of health, as well as "average health of the worst-off group" (Rawls' theory of justice). For the first perspective we need to use inequality indicators appropriate to measure the relationship between health indicators and socioeconomic factors, or the "effect" of socioeconomic factors on the health indicators. These indicators have been categorised as the "effect" measurement inequalities in the classification by Kunst, and Mackenbach(1994) (Table 3.3 above), or in the "measures of association" in the categorisation by Regidor(2004a, b) (Table 3.4 above). Thus, in this study, the indicators of "regression coefficient" (absolute and relative) and the Slope Index of Inequality (SII) in both absolute and relative terms are used to measure respectively the “effect” and “total impact” inequalities of the socioeconomic factors influencing the health outcomes and health care across the provinces of Iran.

Both the “regression coefficient” and “SII” are based on statistical regression techniques (Regidor 2004b). Regression models and regression using percentiles (RII) are the best to satisfy criteria such as validity, precision, and flexibility (Schneider et al., 2005b). Based on the *validity* criterion, the indicators should measure both the direction and the strength of the association between socioeconomic level and health. In *precision* terms, the indicators should make it possible to calculate confidence intervals for the estimates, especially when working with small samples. In order to increase precision it is important to take into account information on all the socioeconomic groups. Calculation of confidence intervals for measures such as the Gini coefficient and the Index of Dissimilarity is complex because they require a considerable amount of numerical computation. An indicator has flexibility when it is able to estimate both absolute and relative inequality and control for the effect of confounding factors (Regidor 2004b; Schneider et al., 2005b); in addition, it is desirable to be able to control for the effect of confounding factors, which is possible using regression models. The Gini index could also control the effect of confounding factors if used in a stratified approach.

The “regression coefficient” can be based on the statistical techniques of regression models (e.g. linear, Poisson, logistic regression) (Schneider et al., 2005a) and is often used to evaluate the relationship between one continuous dependent variable and one independent variable or predictor (usually continuous) (Pallant 2007). Regression coefficients reflect the magnitude and direction of variation in a dependent variable (health variable) when the independent variable (socioeconomic factors) would change by 1 unit. The equation for a simple linear regression is:

$$y = a + bX + e$$

In the equation, “a” represents the starting point or the intercept. “b” refers to the amount of change per unit change in the independent variable and is called the regression coefficient. The error term (e) is the sum of the deviations of each actual observation from a model regression line. It is the term in a model regression equation that accounts for the unexplained difference between the actual values of the independent variable and the value predicted by the regression equation. It is a measure of how accurately the regression model reflects the actual relationship between the independent and dependent variable. The error term implies that whether the model can be improved by entering another independent variable that explains some or all of the difference (Bartley et al., 2004; Field 2005). The error term in a model might be very large when the relationship is not significant. The regression coefficient is able to take into account all the social groups, and indicate how health indicators vary according to the social groups (Regidor 2004b). This indicates absolute variation of the health variable in relation to socioeconomic factors. The relative value of a regression coefficient represents the proportion of increase in the average of the health variable (dependent) for each unit of increase in the socioeconomic variable (independent).

Multiple linear regression is often used to evaluate the relationship between one continuous dependent variable and a number of independent variables or predictors (Pallant 2007). This statistical technique is based on correlation, but allows a more sophisticated exploration of the interrelationship among a set of variables (Pallant 2007). Multiple linear regressions allow the dependent variable to be explained by independent variables accounting for the correlation/interdependence between those variables. It indicates how much of the variance in the dependent variable can be explained by the independent variables; in fact, it gives us an indication of the relative contribution of each of the independent variables (socioeconomic factors) to the dependent variable (health indicator) (Field 2005). Many studies of health inequality include multiple linear regressions and attempt to explain a health or disease measure through variables of socioeconomic status.

The SII is based on ranking groups or individual subjects according to their socioeconomic characteristics (Wagstaff et al., 1991). The SII is defined as the slope of the regression line showing the relationship between a health indicator and its relative rank in the socioeconomic distribution (Schneider et al., 2005a). It is interpreted as the absolute effect on health of moving from the lowest socioeconomic group through to the highest, reflecting the socioeconomic dimension of inequality in the health indicator considering information on the entire population (Munoz-Arroyo and Sutton 2007). In fact, the SII indicates the absolute inequality in the "total impact" of a socioeconomic factor on a health status indicator as it considers all populations in the sub-groups. In this respect, it is sensitive to the population number and consequently the average position of the lowest socioeconomic group which is the concern of Rawls' theory of Justice where it is related to the "average" health of the worst-off group"(Asada 2005). Larger population size in the worst-off group will reflect a larger average rate, resulting in a larger score of the SII or absolute inequality. To estimate SII, the relative position of each socioeconomic group in the population socioeconomic hierarchy is determined and entered in the regression models as a continuous variable, which theoretically ranges from 0 to 1 (Regidor 2004a).

The relative index of inequality (RII) describes the gradient of the SII which is based on the ranking of groups or individual subjects according to their socioeconomic characteristics (Marmot 2010). It reflects the socioeconomic dimension of inequalities in health, considering information on the entire population, and is sensitive to redistribution of the population among different social groups. Both indicators consider the population size, and are sensitive to average health status (Schneider et al., 2005b). The RII describes the gradient of health observed across the deprivation scale, relative to the mean health of the whole population (Marmot 2010). Higher values of the SII and RII indicators will indicate greater inequality between the groups.

3.3. Summary

In this chapter I discussed the main frameworks for the assessment and measurement of health inequities introduced in the literature, and identified the main approaches and methods that are used for measuring inequities in this study. Evaluation of the equity perspectives led to the adoption of the two equity perspectives of "*systematic or structural inequalities are inequitable"* and *"the average health of the worst-off group*" (Asada 2005, P 2) to underlie the inequity measurement; and to see how health inequities are different where they measured based on different concepts. The main aspects of health in respect of inequity were evaluated, and mortality, morbidity, and health care access were chosen to use for the inequity measurement in this study. In this regard, mortality measures of the death rates in children under-5, and mortality in men and women aged 15-60 years, as well as morbidity indicators of diabetes, hypertension, high serum cholesterol, depression rates, and children's growth and nutritional status were identified for the inequity measurement. In addition, the health care access measures of hospital delivery, vaccination in children under-1, antenatal care, and the use of modern contraceptives were determined as the health care measures for further analysis. The sources of data including the death registration system, the 2006 census, and the DHS were described as the main sources of information for this study. The socioeconomic data were abstracted from the 2006 census except for the GDP indicator which was from a study by the Statistical Centre of Iran called "Annual Domestic Growth in Iran (Statistical Center of Iran 2006b). The mortality information were originally from the death registration system, with a completeness conducted on by Khosravi (2008). Morbidity variables were collected from the Health Profile in Iran (2003), consisting different surveys, mainly the DHS conducted in Iran in 2000. After evaluation of the main methods for the measurement of health inequities, I adopted measurement in terms of both "effect" and "total impact", relative and absolute, in aggregate level (vs. individual level), and bivariate (vs. univariate). Two inequality indicators of "linear regression" and "the SII" were selected to measure the inequities respectively in "effect" and "total impact" terms. In chapter 4, I described the overall pattern of the main elements in regard to health inequities, including the social factors (groups), health care access, and health outcomes (mortality and morbidity), in the context of Iran and across the provinces. Then, the health inequities are measured and presented in chapter 5.

4. Descriptive overviews of the social factors and aspects of health in regard to inequity in Iran

4.1. Introduction

In this section, I evaluate the three inequity related domains in the context of Iran and across the provinces with a focus on the social factors and health measures chosen for the inequity measurement in this research. Some demographic and geographic characteristics (often called social determinants of health) in the national and provincial context are described at the beginning to provide an appropriate background for better understanding of the health inequities which are measured and established in chapter five. In this regard, I first describe the key geographic and socioeconomic factors of the area of residence, population migration, population growth rate, population density, population age groups as well as the socioeconomic factors of income/asset, general income, educational level, unemployment, housing quality and household size at national and provincial level. This is followed by the presentation of an overview of the health care access (including the access indicators considered for the inequity measurement) in the country context and among the provinces. Finally, the current context of health status including mortality and morbidity (including the selected indicators) in the country and across the provinces is described.

4.2. Geographical factors

4.2.1. Area of residence

The daily conditions in which people live have a strong impact on health equity; place of residence (province, cities, towns, urban-rural, slum….) can affect people's health and chances of leading flourishing lives (Marmot et al., 2008; Karunakaran and Biggs 2011).Geographical variation in access to health care and health outcomes are considered a profound ethical concern (Rice and Smith 2001), and geographical classification is considered an important tool for policy-making and planning to promote health and the appropriate distribution of health resources across areas (Braveman 1997). One main reason for this is a rethinking of the importance of the social factors affecting health status including the geographical area individuals live in (Diez Roux 2001). The socioeconomic characteristics of geographical areas, as well as individual factors, can independently affect population health (Gould and Jones 1996; Shouls et al., 1996; Ministry of Health and Medical 1998; Mitchell et al., 1998; Ministry of Health and Medical 2001).

For the promotion of health equity it is essential communities and neighborhoods have access to basic goods, are designed to promote good physical and psychological well-being, to be socially cohesive and protective of the natural environment (Marmot et al., 2008). For this, health and health equity need to be placed at the heart of governance and planning. Health equity between areas can be promoted by addressing the policies and processes that caused rural poverty and migration as well as appropriate investment in the development of specific areas.

For administrative and political purposes, Iran is divided into 30 main geographical areas or provinces and there are districts and sub-districts (wards) determined under the provinces (Table 4.1 below). Based on Iran's 2006 Census, there are 366 districts under the provinces which include 889 Wards (Bakhsh) with 1016 cities/towns and 2400 rural wards. The province of Tehran, with around 19% (13,400,000 inhabitants), has the largest population size, and Ilam, with 0.8% (546,000 inhabitants) has the smallest population among the provinces (Statistical Center of Iran 2007). The health system in Iran has been mostly established consistent with the administrative geographical classification, and most of the health policies and plans as well as allocation of health resources are implemented according to the administratively determined provinces and districts in the country.

Table 4-1.Geographic factors influencing health status in the provinces of Iran

	Total pop	% of total	% Urban pop	% Rural Pop	%Annual PGR/yr	Fertility (births/ woman)	Migration (100,000 people)
Ardebil	1204410	1.7	58.4	41.6	0.5	1.85	-56
Bushehr	886267	1.3	65.2	34.8	1.8	2.22	15
Charmahal	857910	1.2	51.6	48.4	1.2	2.26	-18
East Azarbayjan	3603456	5.1	66.7	33.3	0.8	1.87	-143
Esfahan	4559256	6.5	83.3	16.7	1.5	1.56	69
Fars	4336878	6.2	61.2	38.8	1.3	1.84	-34
Gilan	2404861	3.4	53.9	46.1	0.7	1.44	24
Golestan	1617087	2.3	49.2	50.8	1.3	2.24	28
Hamedan	1703267	2.4	57.6	42.4	0.2	1.76	-90
Hormozgan	1403674	2.0	47.1	52.9	2.8	2.56	0
Ilam	545787	0.8	60.7	39.3	1.1	2.1	-11
Kerman	2652413	3.8	58.5	41.5	2.8	2.3	-26
Kermanshah	1879385	2.7	66.8	33.2	0.6	2.15	-119
Khorasan Razavi	5593079	7.9	68.2	31.9	1.7	2.25	31
Khuzestan	4274979	6.1	67.2	32.8	1.3	2.38	-109
Kohgiloyeh	634299	0.9	47.6	52.4	1.5	2.42	-15
Kurdestan	1438543	2.0	59.5	40.5	0.7	2.01	-59
Lorestan	1716527	2.4	59.4	40.6	0.8	2.1	-69
Markazi	1349590	1.9	69.1	30.9	0.9	1.59	6
Mazanderan	2920657	4.1	53.2	46.8	1.2	1.48	34
North Khorasan	811572	1.2	48.4	51.6	1.0	2.52	-25
Qazvin	1143200	1.6	68.1	32.0	1.7	1.75	2
Qom	1040681	1.5	93.9	6.1	2.0	2.2	23
Semnan	589742	0.8	74.7	25.3	1.6	1.65	8
Sistan&Baluchestan	2405742	3.4	49.6	50.4	3.4	3.56	-70
South Khorasan	636420	0.9	51.3	48.7	1.7	2.67	-10
Tehran	13413348	19.0	91.4	8.7	2.6	1.53	616
West Azarbyjan	2873459	4.1	60.3	39.7	1.4	2.29	-26
Yazd	990818	1.4	79.7	20.3	2.0	2.05	39
Zanjan	964601	1.4	58.0	42.0	0.7	1.89	-16
Country	**70472846**	**100.0**	**68.5**	**31.5**	**1.6**	**1.96**	-

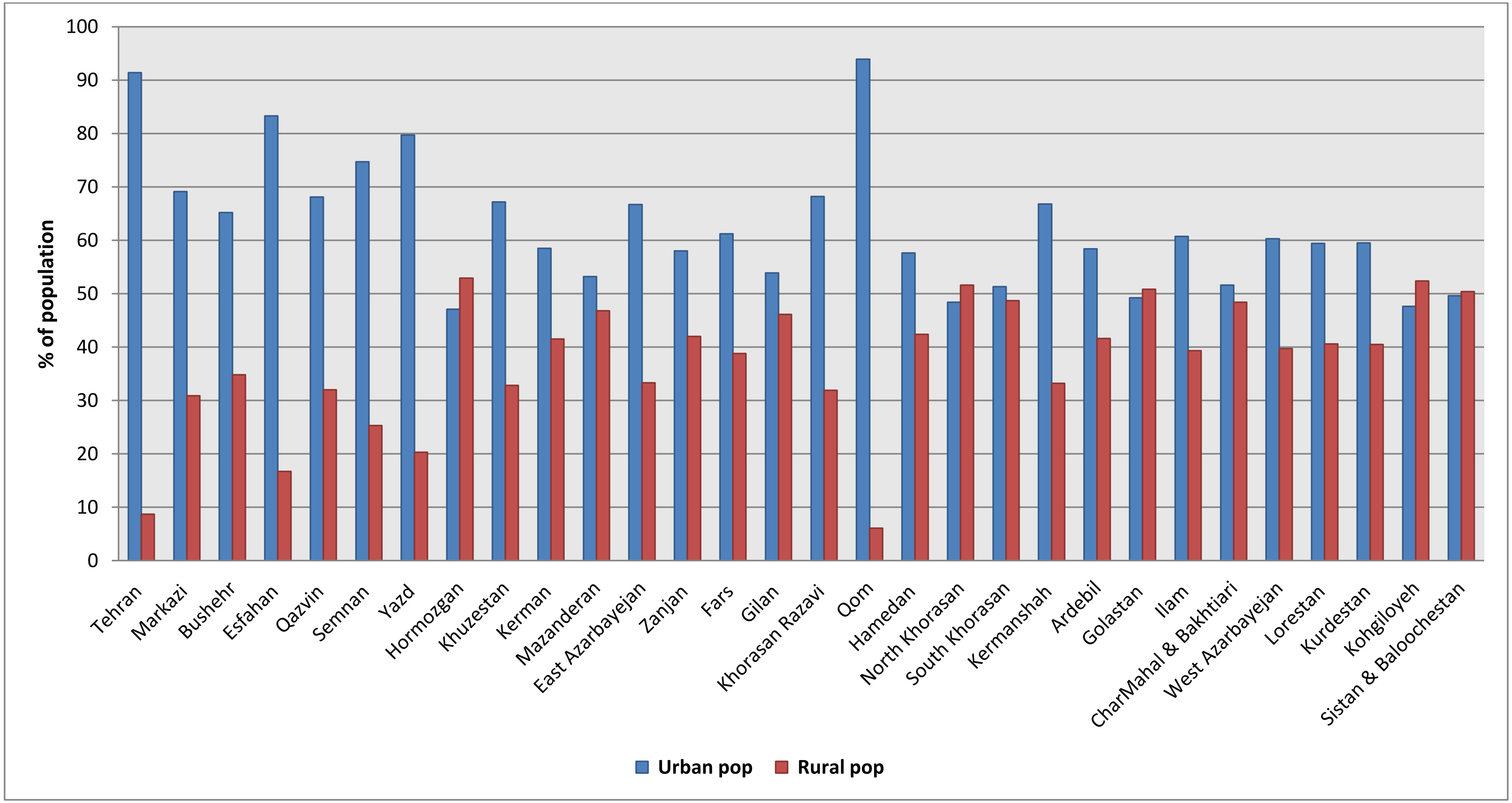
Source: The 2006 Census of Iran; PGR: population growth rate

4.2.2. Urban/rural split

Living in urban or rural areas has been documented to affect the health of populations differently (Hartley 2004). Living in urban areas offers many opportunities and higher living standards to urban citizens. However, urban environments can concentrate health risks and reshape population health problems from infectious diseases and under-nutrition towards non-communicable diseases, violent, accidental injuries, and deaths and impact from environmental disaster (Robertson et al., 2010; Smith et al., 2010). Urbanization has been increasing In Iran in past decades; in a period of less than fifty years the proportion of urban residents has increased from 33% in 1960 to over 68% in 2006. Based on the 2006 census, 68.5% of the Iranian people were in urban areas across the country; the majority of urban citizens live in big cities in the more affluent provinces such as Tehran (17.4%), Khorasan Razavi (5.4%), Esfahan (5.4%), Khuzestan (4.1%), Fars (3.8%), and East Azarbayjan (3.4%). The smallest percentage of urban population live in the cities in Kohgyloyeh (0.4%), South Khorasan (0.5%), and Ilam (0.5%) which are among the less affluent provinces (Table 4.1 above). Around 32.5% of the urban population was living in provinces located in the best-off quintile; which is more than two times larger than the figure (14.9%) in the worst-off quintile.

The proportion of people living in urban areas (compared to the rural area) varies markedly between different provinces (Figure 4.1 above). The highest rates of urbanization were related to Qom (93.9%), Tehran (91.4%), Esfahan (83.3%), Yazd (79.7%), and Semnan (74.7%); which are mainly among the more affluent provinces (Figure 4.1 below). On the other hand, Sistan & Baluchestan (50.4%), Golestan (50.8%), North Khorasan (51.6%), Kohgyloyeh (52.46%), and Hormozgan (52.9%) had the smallest share of urban population; which were mainly among the worst-off provinces. The urban population (Table 4.2 below) also found to be positively related to GDP per capita (B= 0.592, RS= 0.35, P< 0.001); indicating higher urbanization in the provinces with higher economic status. Living in urban areas also had significant positive association with literacy (B= 0.645, RS= 0.42, P< 0.000); and significant negative association with proportion of unemployed people (B= -0.398, RS= 0.16, P< 0.033), household size (B= -0.451, RS= 0.20, P< 0.012). This implies, in Iran, provinces with larger number of urban citizens have higher level of education and smaller household size.

Figure 4-1: Proportion of urban and rural population in the provinces (ranked by GDP per capita)



Rural areas have traditionally constituted the most disadvantaged parts of Iran due to lower health status, income/expenditure, literacy rate, access to modern amenities and political power among the rural households (Mehryar et al., 2005). Access to healthcare services, telecommunication and educational facilities, sources of information, advice and counseling services were demonstrated to be lower in rural areas and the cost of providing services was higher in rural areas compared to urban ones (Naghavi and Jamshidi 2005). In 2000, the annual crude birth rate and population growth rate in rural areas were respectively 1.84 birth/1000 pop and 1.45%, which were higher than those in urban areas with respectively 15.2 birth/1000 pop and 1.11% (EMRO 2006). The total fertility rate was around 1.5 times larger in the rural areas than the urban and the share of economical dependency ratio (share of population with no earning and dependent in others; mainly women and children) in rural areas was 73%, which was higher than that in urban areas (54.3%).

Based on Merrier et al. (2005), in 2000, around 83% of rural pregnant women received at least one antenatal care visit, which was lower than the figure for urban women (94.8%). Birth delivery at home in rural women was 25.3%; a much higher rate than that for women in urban areas, at 5.2%. Based on Iran's DHS (2000) neonatal mortality in rural areas was 20.6/1000 live births, which is higher than in urban areas with 17 deaths per1000 live births. Infant mortality (28 vs. 33) and under-5 mortality rates (34.6 vs. 36.8) were also slightly higher in rural areas than in urban. Health insurance coverage in urban women aged 15-49 was 62% which was around twice that in the rural areas with 33%. With respect to formal education, the illiteracy rate in rural women aged 15-49 (56%) was over three times higher than that in urban areas (16%). Normal et al., (2004)found a larger rate of mental health disorders in the rural dwellers (21.3%) than in urban people (20.9%) in Iran.

There has been a remarkable decline in the share of rural population (and consequently an increase in urban population) in Iran in the past three decades (Abbasi-Shavazi et al., 2009). The share of people living in rural areas was 57% in 1976; decreased to 38.3% in 1996 (Mehryar et al., 2005) and further to 31.5% in 2006 (Statistical Center of Iran 2007). This reduction is mainly due to the movement of the rural population to urban areas and also the re-defining of rural areas as small towns by the amalgamation of villages and their provision with more public services and investment in their living standards. The urban population in Iran is settled in some 1016 cities, while the rural population is living in around 60,000 villages scattered across the country (Statistical Centre of Iran 2006a). This shift causes lower levels of provision of public services, such as public transportation, access to health care and education facilities for the rural population by the government.

The information showed variation in the proportion of people living in rural areas in the different provinces in Iran (Table 4.1, Figure 4.1 above). Hormozgan (52.9%), Kohgyloyeh (52.4%) and North Khorasan (51.6%), Golestan (50.8%), and Sistan & Baluchestan (50.4%) had the largest percentages of rural population; these provinces are mainly among the less affluent provinces. Qom (6.1%) and Tehran (8.7%), Esfahan (16.7%), and Yazd (20.3%), which are among the less affluent provinces, have the lowest proportion of rural population (Table 4.1 above). Living in rural areas (Table 4.2 below) was negatively related to GDP per capita (B= -0.603, RS= 0.36, P< 0.001); in fact, proportions of rural residents were larger in the provinces with lower economic status. Rural population also had significant negative association with literacy (B= -0.645, RS= 0.42, P< 0.000); and significant positive association with unemployment (B=0.431, RS= 0.19, P< 0.013) and household size (B= 0.467, RS= 0.22, P< 0.033). This indicates that provinces with a larger percentage of rural population had more unemployment and larger household size.

Table 4-2. Relationships between the social factors across the provinces

		Urban household income	Rural household income	GDP	literacy	Unemployment	Overcrowding	Household size	Urban Pop.	Rural Pop.	Pop GRT	Fertility
Rural household income	B	.751**	1									
	Pave	.000										
GDP per capita	B	.350	.295	1								
	Pave	.058	.113									
Literacy	B	.472**	.400*	.753**	1							
	Pave	.008	.029	.000								
Unemployment	B	-.295	-.288	-.538**	-.606**	1						
	Pave	.121	.130	.003	.000							
Overcrowding	B	-.054	-.066	-.491**	-.584**	.668**	1					
	Pave	.776	.730	.006	.001	.000						
Household size	B	-.186	-.127	-.560**	-.595**	.683**	.685**	1				
	Pave	.325	.504	.001	.001	.000	.000					
Urban Pop	B	.243	.287	.592**	.645**	-.398*	-.128	-.451*	1			
	Pave	.196	.124	.001	.000	.033	.500	.012				
Rural Pop	B	-.242	-.287	-.592**	-.645**	.398*	.128	.450*	-1.000**	1		
	Pave	.198	.124	.001	.000	.033	.501	.013	.000			
Pop GRT	B	-.051	-.214	.240	-.009	.059	.092	.144	.148	-.148	1	
	Pave	.790	.255	.201	.962	.763	.628	.447	.434	.436		
Fertility	B	-.443*	-.525**	-.540**	-.684**	.481**	.517**	.725**	-.426*	.426*	.507**	1
	Pave	.014	.003	.002	.000	.008	.003	.000	.019	.019	.004	
Net Migration	B	.532**	.299	.602**	.516**	-.327	-.283	-.394*	.479**	-.478**	.384*	-.311
	Pv	.002	.109	.000	.003	.083	.129	.031	.007	.008	.036	.095

B= Correlation coefficient; Pv = P-value ; ** Correlation is significant at 1% level; * Correlation is significant at 5% level;

4.2.3. Population growth rate and migration

Population growth rate (PGR), which is the "*annual average rate of change of population size, for a given country, territory, or geographic area, during a specified period*" (PAHO/WHO 2011, P 1), can affect access to and need for health care as well as health status. PGR is mainly a result of new birth and migration. Fertility rate (number of birth/women) is an important factor that affects the birthrate and overall the annual PGR in a region. Based on the information, total fertility rate in Iran was 2.96 in 1996 decreased to 1.96 in 2006 and 1.9 in 2010. The information in 2006 showed a variation of the fertility rate across the provinces (Table 4.1). The highest fertility rate was related to Sistan & Baluchestan (3.56), South Khorasan (2.67), Hormozgan (2.56), North Khorasan (2.52), and Kohgyloyeh (2.42); and the lowest related to Gilan (1.44), Mazanderan (1.48), Tehran (1.53), Esfahan (1.56), and Markazi (1.59). The fertility rate had a significant negative association with GDP per capita (B= -0.540, RS= 0.29, P< 0.002), indicating lower rates of fertility in the more affluent provinces.

The flow of migration across the country is mainly from rural areas to urban areas, from disadvantaged provinces to advantaged ones, and refuges from neighbouring countries. Information in 2006 showed a variation of net migration across the provinces in Iran. East Azarbayejan (-143 people/100,000), Kermanshah (-119), and Khuzestan (-109) were the provinces with largest number of emigration rate. On the other hand, Tehran (616), Esfahan (69), and Yazd (39) had the highest immigration rate (Table 4.1). There was also a significant positive relationship between the net migration and GDP per capita (B= 0.602, RS= 0.36, and P< 0.000) in the provinces (Table 4.2 above), implying higher rates of immigration from the worst-off provinces to well-off ones.

Refugees from neighbor countries including Afghanistan and Iraq also affected the population size and other socioeconomic factors in some provinces in Iran. There were 2,563,827 refugees consisting of around 4% of the population in Iran in 2001, from which

2,355,427 were Afghan and 202,878 were Iraqi refugees (International Consortium for Refugees in Iran 2003), and in 2009, there were some 1,024,000 Afghan refugees registered in Iran (UN Refugee Agency 2011). They live in almost all major cities in Iran but the largest communities are found in Khorasan, Sistan & Baluchistan, Tehran, Kerman, Fars, Markazi and Semnan. The information gathered by the International Consortium for Refugees in Iran (ICRI) during its regular field visits indicates that the most vulnerable Afghan refugees live in Sistan & Baluchistan and Khorasan, although those in other provinces are of poor economic status and have lower education levels compared to the native population and are facing difficulties, such as legal/security problems and unemployment (United Nations in the Islamic Republic of Iran, 2003). The results from the study by Basseri et al., (2010) showed the cross-border traffic of Afghani people was an important factor in the incidence of malaria in the Baluchistan area of Iran; 24-36% of malaria in this area occurred among the Afghani refugees. The greatest number of Iraqi refugees (700,000) arrived in Iran following the Halabja crisis. In 2009 almost 44,000 Iraqi registered as refugees in Iran; the largest number live in Khuzestan province, followed by Tehran and Qom (ICRI, 2011). Kurdish refugees are scattered between the north western provinces of Kermanshah, Kurdestan and West Azerbaijan.

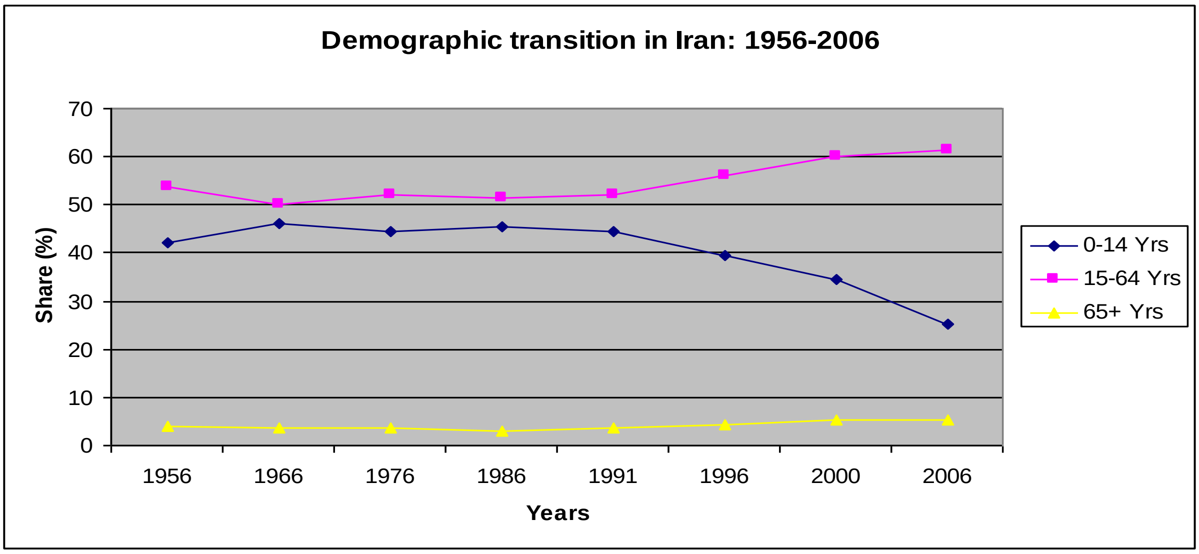
Based on the 2006 Census, the total population growth rate was 1.6% with a wide range of population growth rates across the provinces. The highest rates were in the provinces of Sistan & Baluchistan (3.4%), Hormozgan (2.8%), Kerman (2.8%) and Tehran (2.6%). Given the high rate of emigrated population from the provinces of Sistan & Baluchistan (-70 people/100000) and Kerman (-26 people/ 100,000) the population growth rate in these provinces is mainly due to new births. The high growth rate in Tehran can be seen as a result of both new births and the high number of immigrated population (616 people /100,000) to this province. On the other hand, the provinces of Hamedan, Ardebil, Zanjan, and Gilan with respectively 0.2%, 0.5%, 0.7%, and 0.7 % had the lowest growth rates among the provinces. Given the high emigrated population from these provinces (except Gilan), their lower population growth rate appears to be as a result of the high number of the population who emigrated from these provinces. Population growth rates (Table 4.2 above) in the provinces were significantly related to both fertility (B= 0.507, RS= 0.26, P< 0.004) and immigration (B= 0.384, RS= 0.15, P< 0.036) in the provinces. The population growth rate was positively related to GDP per capita (B= 0.240, RS= 0.06, P< 0.201); but the association was not significant.

4.3. Demographic factors

Age and gender categories are two key demographic factors that are known to strongly affect mortality and morbidity and consequently need for health care (Martens et al., 2005; Tang et al., 2007; McMunn et al., 2009). Three main age/sex groups of children, women in childbearing age, and the elderly have been considered as the main vulnerable population groups to ill health (Okojie 1994; Mendoza-Sass and Béria 2001; McIntyre et al., 2007; Layte et al., 2009); thus, the size of populations in these groups is an important factor influencing the need for health care and health resources in the areas and regions.

There have been significant challenges in the demographic pattern of the population in Iran over the past three decades (Figure 4.2 below). Due to the suspension of the family planning programme by the government immediately after the revolution in 1979, there was a huge rise in the birth rate and household size leading to a rapid increase in the population (from 34 million in 1979 to 56 million in 1991) and a changing age structure to a younger demographic profile (UN 2003). Given the rapid population increase, there was a revival in the family planning programme in 1989 leading to a significant fall in the fertility rate which dropped to the replacement level (Figure 4.2)(replacement level is defined as the level of fertility at which the population starting to exactly replace itself from the current generation to the next). Although the baby-boom period was short, the resulting age structure increased the adult population from 52% in 1991 to around 70% in 2006. These phenomena caused socioeconomic effects in the country so that the different levels of educational system in the country shouldered a heavy burden because of the baby-boomers entering school from 1984; in addition, the current unemployment crisis became worse as a result of their entering the labour market, and the impact of the increased population on the housing market is also already being felt, as noted by Mehryar and Ahmad-Nia (2004).

Figure 4-2. Demographic transition in Iran – 1956-2006



Source: Mehryar and Ahmad-Nia, 2004- Statistical Centre of Iran, The 2006 Census of Iran Report, 2007

There was a non-significant increase in the proportion of the older population over the period from 1956 to 2006. The percentage of the population aged 65 and above was around 3% (1 million people) in 1986, increasing to 4.4% in 1995, and to 5.2% (3.5 million) in 2006; it is expected to rise to 6.55 in 2020 (EMRO 2006). This phenomenon can indicate a positive aspect in terms of representing an improvement in life expectancy in Iran; however, this demographic transition sees an increasing burden of chronic non-communicable diseases such as cancer, and heart related problems and osteo-degenerative diseases (Naghavi 2006). In addition, a major percentage of the elderly population, in particular old women, would be illiterate and unemployed (no income) which poses particular challenges in social, economic, and welfare realms in the country (EMRO 2006).

Based on the Census (2006), 7.8% of the population in Iran was aged under-5 years, 17.3% aged 5-14 years, 69.7% aged 15-65 years and 5.2% aged over 65 years (Table 3.3 below). Women aged 15-49 years consist 30.1% of the total population (Table 4.2 below). There was also variation of the age/sex groups across the provinces. In the under-5 age group, the highest rates were related to Sistan & Baluchestan (13.1%) and Hormozgan (10.0%), South Khorasan (9.0%), and Kohgyloyeh (8.9%) (Table 4.3 below); given the GDP per capita, the provinces were among the less affluent ones. The lowest rates related to Gilan (5.8%), Tehran (6.8%), Mazanderan (6.4%) and (Esfahan 6.9%); that are among the provinces with higher economic status. This implies that a larger proportion of children in the provinces may be related to the lower economic status. The GDP per capita showed negative relationship with proportion of population under-5 (B= -0.297, RS= 0.09, P< 0.088) across the provinces; although the association was not significant (Table 4.2 above).

Table 4-3. Percentage of population age groups in the provinces of Iran – 2006

	Pop under-5 yrs %	Pop 5-14 yrs %	Pop 15-64 yrs %	Pop >65 yrs %	Female 15-49 Yrs %
Ardebil	7.6	18.6	68.2	5.6	30.1
Bushehr	8.7	17	70.3	4.1	28.9
Charmahal	8.3	18.9	67.8	5	30.1
East Azarbayejan	7.2	15.9	70.6	6.3	29.9
Esfahan	6.9	15.2	22.1	5.6	30.6
Fars	7.3	16.6	70.9	5.2	30.8
Gilan	5.8*	15.5	71.5	7	30.5
Golestan	8.3	18.9	68.5	4.3	30.7
Hamedan	6.9	17.2	69.6	6.3	30.3
Hormozgan	10	20.9	65	4.1	28.2
Ilam	7.6	17.8	70.1	4.5	30.9
Kerman	8.9	19.4	28.3	4.7	29.2
Kermanshah	7	17.4	24.4	5.4	30.2
Khorasan Razavi	8.5	18.6	67.7	5.2	29.6
Khuzestan	8.7	19.9	67.7	3.8	29.6
Kohgiloyeh	8.9	20.1	66.8	4.3	30.2
Kurdestan	7.7	18.6	68.5	5.3	29.8
Lorestan	7.7	18.6	68.7	5	30.2
Markazi	7	16.2	70	6.9	30.2
Mazanderan	6.4	14.9	72.7	6	31.3
North Khorasan	8.6	20.8	65.7	4.9	29.5
Qazvin	7.6	16.7	70.6	5.1	30.5
Qom	8.5	17.9	69.1	4.5	29.9
Semnan	7.2	15.4	71.3	6	30.0
Sistan & Baluchistan	13.1	25.8	58.2	3	26.3
South Khorasan	9	19.3	64.4	7	27.7
Tehran	6.8	14.6	73.6	4.9	31.1
West Azarbayejan	8.3	19.2	67.4	5.1	29.2
Yazd	8.2	16.2	69.9	5.8	29.0
Zanjan	7.5	17.8	68.8	6	30.4
Country	**7.8**	**17.3**	**69.7**	**5.2**	**30.1**

Source: The 2006 Census of Iran

The proportion of the elderly varied across the provinces; the highest rates of population aged 65 and over were in Gilan (7.0%), South Khorasan (7.0%) and Markazi (6.9%), East Azarbayejan (6.3%), and Hamedan (6.3%). The provinces of Sistan & Baluchestan (3.0%), Khuzestan (3.8%), Hormozgan (4.1%), and Bushehr (4.1%) had the lowest percentage of older people (Table 4.3 above). There were also differences in the proportion adult women (aged 15-49 yr) across the provinces with the largest rates in Mazanderan (31.3%), Tehran (31.1%), and Ilam (30.9%) and the lowest rates in Sistan & Baluchestan (26.3%), Hormozgan (28.2%), and Bushehr (28.9%) (Table 4.3 above). This information implies that proportions of the elderly population and women of childbearing age are higher in the more affluent provinces. There was a positive relationship between the GDP per capita with women of childbearing age (B= 0.123, RS= 0.026, P< 0.408) and the older population (B= 0.3, RS= 0.09, P< 0.126); however, the association was not significant (Table 4.2 above). Overall, the number of children was higher in the worst-off provinces; while the proportion of the women of childbearing age and the elderly was higher in the well-off provinces.

4.4. Socioeconomic factors

4.4.1. Income/ assets

Income is considered as one of the main determinants of poor health, the social gradient in health, and the marked health inequities between and within countries (Marmot et al., 2008; Marmot 2010). There are three mechanisms through which income is related to health: (i) through a country's gross national product (GNP); (ii) the income of individuals; (iii) income inequalities among rich nations and among geographical areas (Marmot 2002). The causal relationship between income and health also occurs through the direct influence on the material conditions needed for biological survival and the influence on social participation and opportunity to control life context (Marmot 2002).Wealth is also one of the determinants of inequity in the conditions of daily living and consequently systematic inequity in health (Marmot et al., 2008). Household wealth is defined as the "*total assets owned by a family minus its household debts*" (Hewlett et al., 2002, P 73). The association between household wealth and good health status has been evidenced in many studies (Hong et al., 2006; Carter et al., 2009; Laaksonen et al., 2009). Household wealth/asset is stated to be an appropriate alternative to use instead of income, where there is a lack of data on income and expenditure in the community (Braveman 1997). Household assets reflect the accumulative economic status of households over time and compensate for the problems involved in defining household income such as falling household income due to the head of household becoming unemployed or sick and also under-reporting the income of family members (Feinstein 1993).Household wealth or economic assets can be identified by some properties related to living conditions such as water supply, sanitary facilities, presence of electricity within a household and type of housing measures (overcrowding) or by ownership of a home, size or number of rooms in the household, ownership of land or ownership of possessions such as bicycle, cars, radios and refrigerators (Braveman 1997).

In 2009, the average income for an Iranian household living in urban areas was 106.2 million rial (£2654) and the figure for rural households was 59.3 million rial (£1483), indicating an income in urban areas around twice that in rural areas (Statistical Centre of Iran 2011). There was also variation of urban and rural household income across the provinces. Tehran, Mazanderan, Kohgyloyeh, and Fars with respectively 132.3 (£3307), 118.2 (£2954), 116.6 (£2914), and 111.7 (£2794) million rial had the highest average urban household income, and South Khorasan, Zanjan, Sistan & Baluchistan, and Kerman the lowest, with 74.5 (£18.62), 77.3 (£1932) and 79.5 (£1987) and 80.1(£2002) million rial respectively. In rural areas Mazanderan, Ardebil, Tehran, Khuzestan, and Qazvin had the highest household income with respectively 87.9 (£2199), 78.5 (£1963), 74.5 (£1862), 74.4 (£1861), 74.3 (£1859)million rial; and the lowest income related South Khorasan, Sistan & Baluchistan and Hormozgan, and Kerman with 36.1 (£903), 39.3 (£982), 39.8 (£995), 42.7 (£1068)million rial respectively (Statistical Centre of Iran 2011). These findings also indicate differences in both urban and rural household income across the provinces. Urban household income (Table 4.2 above) had a significant positive relationship with literacy (B= 0.472, RS= 0.22, P< 0.008) but non-significant association with GDP per capita (B=0.350, RS= 0.12, P< 0.058), unemployment (B= -0.295, RS= 0.09, P< 0.121) and household size (B= -0.186, RS= 0.03, P< 0.325). Rural income had also significant relationship with literacy (B= 0.400, RS= 0.16, P< 0.029) but non-significant association with GDP per capita (B= 0.295, RS= 0.09, P< 0.113), unemployment (B= -0.288, RS= 0.08, P< 0.130) and household size (B= -0.127, RS= 0.02, P< 0.504).

4.4.2. Economic growth- Gross Domestic Product (GDP)

Economic growth with good social policy and equitable distribution of benefits presents the opportunity to provide resources to invest in the improvement of people's lives and to promote health equity in particular in developing countries (Marmot et al., 2008; Taylor 2009). GDP is the main indicator of national or regional economic growth and status. It is defined as "*the total market value of all final goods and services produced in a country in a given year, equal to total consumptions, investment and government spending, plus the value of exports, minus the value of imports*"(Brakman et al., 2006, P 10).

GDP is used as an aggregate indicator to reflect the economic status and growth rate at national and provincial level in Iran. Table 4.4 (below) shows the overall contribution of different sections to the overall GDP in Iran in 2006. The revenue from oil and gas encompasses the largest share (20.6%) of the total GDP in the country. The overall retail sector (incorporating car and other goods repairing), with 13.3%, includes the highest share of GDP after oil and gas products. The value added from industrial works with 12.9% was in third place (Statistical Center of Iran 2006b). The contribution of health and welfare to GDP is 3.1% (it is different from the share of health expenditure as a percentage of GDP described in page 180 §3); and the figure for education is 4.7%.

Table 4-4. Total and sectional value added in Iran (GDP) - 2006

Activity	value added (million rial)	Share %
Oil and gas	492,726,666	20.6
Overall selling, retailing, and car and repairing goods	316,912,844	13.3
Industrial works	307,145,451	12.9
Housing, rent and business services	259,946,194	10.9
Agriculture and hunting	210,171,580	8.8
Transport, storage and communication	169,883,675	7.1
public services and municipality	128,692,641	5.4
Construction (residential and other)	116,635,049	4.9
Education	112,760,242	4.7
Health and welfare	74,500,029	3.1
Banking and insurance	65,999,804	2.8
Providing water, electricity and gas	56,047,413	2.3
Other public services	37,760,886	1.6
Hotel and restaurants	18,657,004	0.8
Mining	16,534,323	0.7
Fishing	4,574,765	0.2
Total	**2,388,948,566**	**100**
Tax on import	**-7,909,404**	
Gross domestic product (GDP)	**2,381,039,162**	

* Source: Statistical Centre of Iran (2006), the Results of National and Regional Accounts.

In 2006, the overall GDP per capita in Iran was 33.8 million rial; however, there was a wide variation in the income per capita across the provinces (Statistical Centre of Iran, 2006). Figure 4.3 (below) illustrates the provinces in Iran categorized into three groups of low, medium, and high GDP per capita. The highest GDP per capita related to the provinces of Tehran (43.5 million rial) and Markazi (37.2 million rial) and the lowest figures related to Sistan & Baluchestan (9.7 million rial), Kohgiloyeh (15.4 million rial), and Kurdestan (15.7 million Rial) (Table 4.5 below). Provinces such as Khorasan Razavi (20.7%), Yazd (29%), (Fars (21.8%), and Qom (20.6%) are among those with medium GDP per capita. GDP per capita

(Table 4.2 above) had significant positive relationship with literacy (B= 0.753, RS= 0.57, P< 0.000) and urbanization (B= 0.592, RS= 0.35, P< 0.001); and a significant negative relationship with unemployment (B= -0.538, RS= 0.29, P< 0.003), household size (B= -0.560, RS= 0.31, P< 0.001), and rural population (B= -0.603, RS= 0.36, P< 0.001). This implies that provinces with higher economic status had higher level of education and proportion of urban population but lower number of unemployed people and rural population.

Figure 4-3: Inequalities of economic status across the provinces

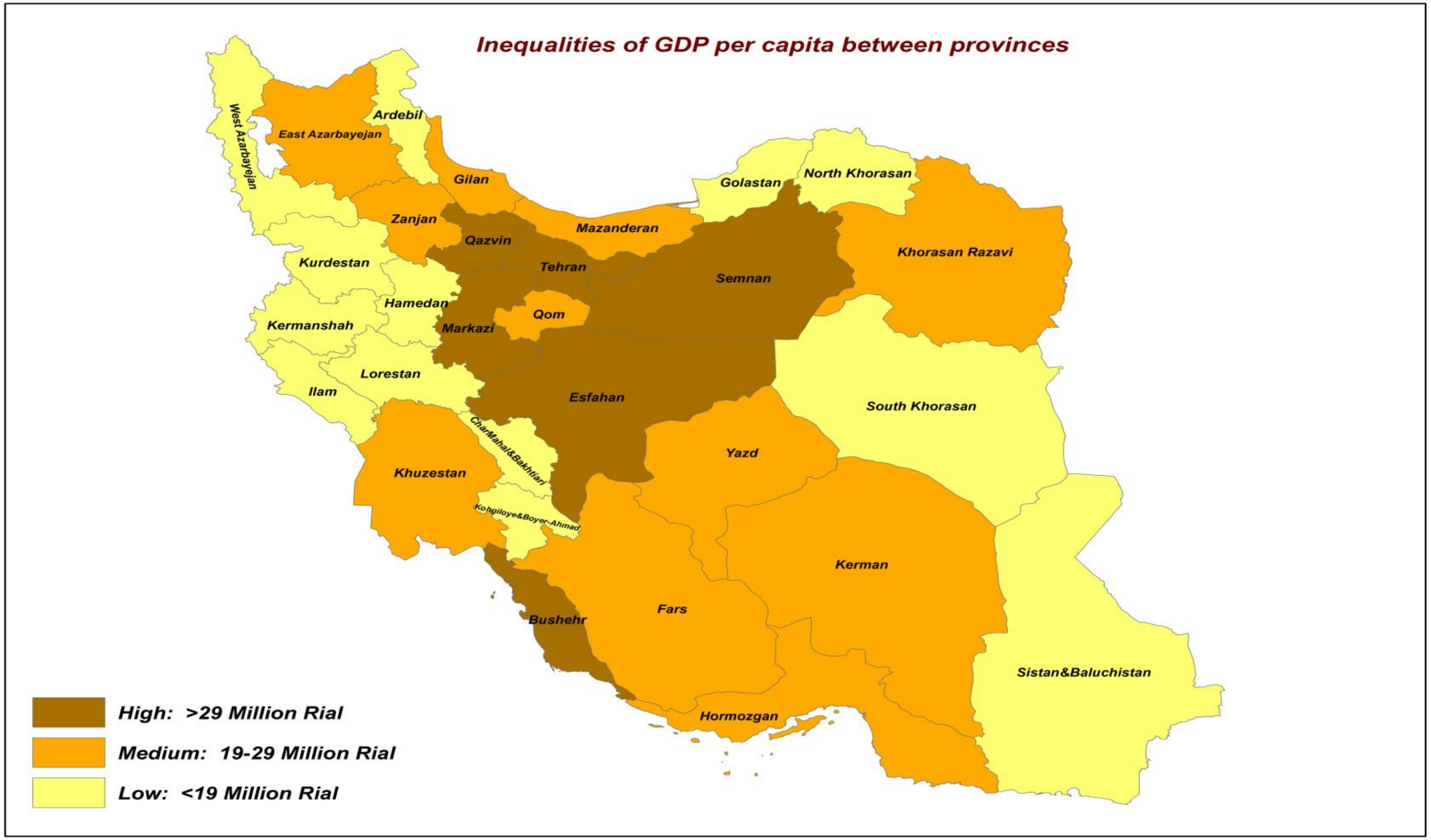


Table 4-5. Socioeconomic indicators in the provinces

	GDP/cap (million Rial)[a]	Literacy rate %	Unemployment %	Overcrowding (people/room)	Household size (average people in household)
Sistan & Baluchistan	9.7	68	31.5	1.56	5.11
Kohgiloyeh	15.4	81.6	19.6	1.35	5.01
Kurdestan	15.7	77.5	20.2	1.27	4.26
Lorestan	16.2	81.1	29.1	1.37	4.47
West Azarbayejan	16.5	77.8	8.9	1.33	4.38
Charmahal	17.1	82.5	18.0	1.16	4.41
Ilam	17.7	81.9	27.2	1.5	4.89
Ardebil	18	80.1	11.4	1.41	4.36
Golestan	18	82	12.4	1.18	4.25
Kermanshah	18.2	82.1	23.2	1.35	4.22
South Khorasan	18.6	81.1	16.3	1.09	4.47
Hamedan	19.1	82.6	12.3	1.19	3.98
North Khorasan	19.1	79.1	8.0	1.11	4.06
Qom	20.6	86.1	8.1	1.31	3.99
Khorasan Razavi	20.7	86.2	8.2	1.14	3.87
Gilan	20.8	83.1	14.9	1.12	3.59
Fars	21.8	86.6	11.3	1.09	4.24
Zanjan	23	81.7	9.4	0.95	4.09
East Azarbayejan	23.2	81.6	9.6	1.29	3.95
Mazanderan	26	85	10.9	1.04	3.73
Kerman	26.3	82.8	21	1.23	4.31
Khuzestan	28.5	83.6	19.3	1.38	4.93
Hormozgan	28.8	82.4	12.2	1.19	4.06
Yazd	29.0	88.1	7.9	1.19	3.82
Semnan	31.2	88.6	8.4	0.98	3.68
Qazvin	31.4	85.9	10.8	1.1	3.88
Esfahan	31.7	87.5	10.5	1.0	3.72
Bushehr	31.9	86.4	9.0	1.15	4.66
Markazi	37.2	83.9	10.4	1.2	3.71
Tehran	43.5	91.3	8.4	1.15	3.6
Country	**33.8**	**84.61**	**12.8**	**1.4**	**4.03**

Sources: the 2006 Census of Iran; [a] Statistical Centre of Iran (2006); Provinces are ranked based on the GDP per capita.

4.4.3. Unemployment

Unemployment is an important socioeconomic factor affecting health and health equity (Waddell and Burton 2006; Benach et al., 2007; Marmot et al., 2008; Marmot et al., 2010). High levels of unemployment have been an economic challenge in Iran in the past two decades. During 1986-1996, the unemployment rate decreased from 14.2% to 9.1% but again rose to 14.6% in 2000, mainly because the increased population in the 1980s entered the labour market (Statistical Centre of Iran 2004).

In 2010, around 13.5% of the population aged 10 and over in Iran were unemployed with the highest rate of 30.8% in those aged 20-24 and the lowest in those aged 65 and over. The unemployment rate in men was 11.9% and in women 20.5%; in urban areas 15.3% and in rural areas 9.1%. High unemployment rates among the young population is mainly as a result of the baby-boom that happened in 1980s which led to a rapid rise in the young population which is now in the age group that need a job; this has put a burden on government to provide job opportunities for the young population. In 2006, the total unemployment rate in Iran was 12.8%, around 2% lower than in 2000 (14.7%) (Statistical Centre of Iran 2006c). The highest percentages of unemployed were found in the provinces of Sistan & Baluchestan, Lorestan, and Ilam with respectively 31.5%, 29.1%, 27.2%, and Kermanshah (23.2%) which were among the most affluent provinces; the provinces of Yazd (7.9%), North Khorasan (8.0%), Qom (8.1%), Tehran (8.4%), and Semnan (8.4%) had the lowest percentages of unemployed (Table 4.5 above); these provinces are among the provinces with the high and medium economic status. This can imply that unemployment can be related to lower economic status in the provinces.

The Iranian government has taken actions to provide job opportunities for the unemployed and schemes to support them at the time of unemployment. An unemployment insurance law was legislated by the Iranian government in 1990; two organizations -the Social Security Organization and Labour and Social Affairs Ministry - are obliged to administer this law. The scheme covers all the labours working under the Social Security Law but does not cover the retired, people with disabilities and free workers (World Law Guide 2012). The insurance premium is 3% of the wage which should be paid by the employer. A six month payment in advance is needed to be eligible to be paid in case of becoming unemployed. The scheme included appropriate support, however, it has been accompanied with many problems and challenges as it is considered to be idealistic and difficult to apply in many cases (Pour Abbas 2006).

Unemployment (Table 4.2 above) had a significant negative relationship with literacy (B= -0.606, RS= 0.37, P< 0.000); and GDP per capita (B= -0.538, RS= 0.29, P< 0.003), and urban population (B= -0.398, RS= 0.16, P< 0.033); and a significant positive relationship with household size (B= 0.683, RS= 0.47, P< 0.000), and living in rural areas (B=0.431, RS= 0.19, P< 0.013). This implies that the provinces with higher unemployment rates had lower level of education, economic status, and urbanization; but these provinces had larger household size and proportion of rural population.

4.4.4. Education

Educational attainment is widely seen as an appropriate guide to social position and a robust determinant of health and health inequalities (Lleras-Muney 2001; Marmot et al., 2008; Silles 2009; Strand et al., 2010), with higher educational attainment being linked to economic prosperity and positive health outcome. Iran spent around 5.5% of its GDP and 20% of the government's annual public spending on education in 2006, while the world average was 4.5% in the same year (World Bank 2007b). Half of the spending goes to public education which is entirely free at primary level. In addition, education and training consume approximately 2% of Iranian families' income (Statistical Center of Iran 2007). Given that, there has been a considerable promotion in public education in Iran during the past three decades. According to the WHO (2009), adult literacy in Iran was 73.1% in 1990 and this increased to 84.7% in 2007. The net primary school enrolment of children aged six and over increased from 85% to 97% in the same period. The proportion of pupils who reach grade 5 increased from 87.1% in 1990 to 89.1% in 2002. Literacy rates in males and females aged six and over were respectively 71.4% and 51.9% in 1986, rising to 88.7% and 80.3% in 2006. The figures for rural and urban areas were 48.2% and 73.1% respectively, increasing to 75.9% and 88.3% over a similar time. Tehran had the highest literacy rate (78.2%) in 1986 and also in 2006 (91.3%). During the same period the rate in Sistan & Baluchestan (the lowest) increased from 36% to 68% (Olyaee Manesh et al., 2009).

Based on the census 2006, the overall literacy rate in children aged six and over in Iran was 84.6% with variation across different regions in the country (Table 4.5 above). The provinces of Tehran (91.3%), Semnan (88.6%), Yazd (88.1%), Esfahan (87.5%), and Bushehr (86.4%) enjoyed the highest percentage of literacy in the population aged 6 years and above; these provinces were found to have the highest GDP per capita (Table 4.4), and are considered to be among the most affluent provinces. On the other hand, Sistan & Baluchestan (68%), Kurdestan (77%), West Azarbayejan (77.8%) and North Khorasan (79.1%) had the lowest literacy rates among the all provinces; these provinces are indicated to be among the least affluent provinces. These findings can imply that level of education is associated with the economic status across the provinces.

Literacy (Table 4.2 above) was found to have positive significant relationships with GDP per capita (B= 0.753, RS= 0.57, P< 0.000) and proportion of urban population (B= 0.645, RS= 0.42, P< 0.000); but negative significant associations with overcrowding (B= -0.584, RS=, P< 0.001), unemployment (B= -0.606, RS= 0.37, P< 0.000), and rural population (B= -0.645, RS= 0.42, P< 0.000). In fact, educational level was higher in the provinces with higher economic status and urbanization; but lower in those with higher overcrowding, unemployment, and rural population.

4.4.5. Housing conditions

Housing as one of the daily conditions in which people live has a strong impact on health and health equity (Wilkinson and Marmot 2003; Marmot et al., 2008). Access to adequate housing and shelter is a basic need for healthy living but a big challenge facing cities (UNESCO 2006; Wellesley Institute 2010). Poor quality housing has been characterized by overcrowding, damp and mould growth, lack of basic facilities, housing type and tenure (Office of the Deputy Prime Minister 2004). Overcrowding is measured by the number of people per dwelling, number of people per room, or persons per bedroom (Office of the Deputy Prime Minister 2004). The number of people per room in household is the indicator used in this study in the context of Iran.

In Iran information on some characteristics of housing including overcrowding, access to facilities such as electricity, piped water, piped gas, fixed telephone, kitchen, and central heating is gathered through the census (Statistical Center of Iran 2007). Based on the census 2006, around 7% of urban households and 31% of rural households in Iran did not have access to a bathroom in their houses. Around 5% of households in urban areas and 19% in rural areas were deprived of piped water at home. A small number of households, mainly in the urban areas in the country, had central heating (5.1%), and around 16% of rural households did not have a kitchen in their home (Table 4.6 below).

Table 4-6. Housing facilities in households in Iran

	Total	Urban areas	Rural areas
People/room	1.4	1.2	1.5
Electricity %	99.3	99.7	98.3
Fixed telephone %	78.9	85.4	62.8
Piped Water %	91.2	95.3	80.9
Piped gas %	65.8	83	22.8
Central heating %	5.1	7	0.5
Kitchen %	94.1	98.1	84
Bath room%	86	92.9	68.9
Toilet %	99.7	100	99.1

Source: The 2006 Census of Iran

Based on the above information the average number of people per room in households (overcrowding index) in Iran was 1.4 people with an index of 1.5 for rural areas and 1.2 for the urban. The average number of people per room in Iran is lower than the figure in countries such as Pakistan (3), India (2.7), and Kuwait (1.7) but higher than that in Turkey (1.3), South Korea (1.1), and Cuba (1) (NationMaster Encyclopedia 2011). The information on housing conditions indicates a wide difference in the overcrowding index across the country (Table 4.5 above). The highest index was related to the provinces of Sistan & Baluchestan, Ilam, Ardebil and Khuzestan with respectively 1.56, 1.5, 1.41, and 1.38 people per room in household; these provinces are among those with the lowest economic status. The provinces of Zanjan (0.95), Semnan (0.98) and Esfahan (1.0) had the lowest overcrowding index; these provinces are considered to be among the most and medium affluent provinces. Overcrowding (Table 4.2 above) was shown have negative significant relationships with literacy (B= -0.584, RS=, P< 0.001) and GDP per capita (B= -0.491, RS= 0.24, P< 0.006); but positive significant association with unemployment (B= 0.668, RS= 0.45, P< 0.000) and household size (B= 0.685, RS=0.47, P< 0.000). These results indicate that overcrowding was lower in the provinces with higher economic status and level of education; but higher in the provinces with larger number of unemployed people and household size.

4.4.6. Family status (household size)

Household size, which is calculated "*as the ratio between the number of people (adult and children) living in private households and the number of households of each different category*" (OECD Family Database 2011, P 1), is an important aspect of family status that may influence health and health inequity (Ferrie et al., 2002; Biggs et al., 2010; Biggs et al., 2010; Pasricha and Biggs 2010). In Iran, there have been considerable changes in household size in the past three decades; the average household size was 5.0 in 1976; increased slightly to 5.1 in 1986; then, it decreased to 4.8 in 1996 and 4.0 in 2006; the figure in 2011 was 3.55. In urban areas the household size decreased from 4.9 to 3.48; and in rural areas from 5.5 to 3.73, indicating larger household size in urban areas than rural but the same decline during the period. The reduction in household size was mainly as a result of the decline in fertility over the period. Total fertility was 6.23 in 1986; which dropped to 2.51 in 1996, a 60 percent decline in only one decade. By 2006, the total fertility reduced to 1.88, below the replacement level. Other factors such as increase in age of marriage for girls and boys, increased divorced rates, and high rates of urbanization are considered as important factors for the reduction of household size in the country (Agajanian 2012).

Information (Table 4.above) from the Census 2006 indicates variation of household size across the provinces of Iran; the largest index was related to Sistan & Baluchestan (5.11), Kohgyloyeh (5.01), Khuzestan (4.93), and Ilam (4.89) which were mainly among the less affluent provinces. The smallest index was related to Gilan (3.56), Tehran (3.6), and Semnan (3.68), which are among the more affluent provinces. This implies that household size may be related to lower economic status in the provinces. Household size (Table 4.2 above) had a negative significant relationship with literacy ($B= -0.595$, $RS= 0.35$, $P< 0.001$) and GDP per capita ($B= -0.560$, $RS= 0.31$, $P< 0.001$); but a positive association with living in rural area ($B= 0.540$, $RS= 0.29$, $P< 0.013$) and unemployment ($B= 0.683$, $RS= 0.47$, $P< 0.000$). In general, provinces with larger household size had lower economic status and educational level but higher rates of unemployment and proportion of people living in rural areas.

4.5. Health care access and utilization in Iran

According to the WHO (2008), Iran had around 9 physicians, 2 dentists, 2 pharmacists, and 16 midwives and nurses per 10,000 people in both public and private sectors in 2006. With this number of health personnel, Iran could, in general, provide coverage higher than the EMR countries[1], but the coverage was lower than for middle income countries and also the global average (Table 4.7 below).

Table 4-7. Health care facilities in Iran and other countries 2006 (number/10,000 pop)

	Iran	**EMR countries**	**Middle- income countries**	**Global**
Physicians/	9	10	21	13
Dentists	2	2	6	3
Pharmacists	2	3	6	4
Nurses and midwives	16	15	41	28
Public health workers	1	<1	6	-
Community health workers	4	3	-	1
Laboratory health workers	3	2	4	3
Hospital bed	17	14	42	30

Source: World Health Statistics , 2008

Information (Table 4.8 below) also indicates that, in 2006, there were 120,580 hospital beds, 6582 urban health centres, 2560 rural centres, 17,151 health houses, and 1,073 private polyclinics established in Iran by the year 2006. Around 67.8% of the beds came differ under the MOHME, 10.7% the Social Security Organization, and 11.6% were run by the private sector (EMRO 2006), indicating that the government is the main provider of hospital services in Iran. The hospital bed index showed a figure of 1.7 beds/1000 people, reaching the overall target set up by the government in the Third Development Plan. There is a lack of data on

[1]Yemen, Sudan, Somalia, Afghanistan, Qatar, Lebanon, Kuwait, Tunisia, Iran, Libya, Syria, Bahrain, UAE, Oman, Saudi Arabia, Pakistan, Jordan, Egypt, Somalia, Djibouti, Iraq, Morocco

the utilization of hospital services, but hospital occupancy rates are believed to be below 60% in the state and SSO hospitals (EMRO 2006).

Table 4-8. Health care facilities in Iran – 2006

	Estimated Number	N/10,000 pop	Estimated Pop/centre	Targeted number
Health Houses	17151	7.9	1,266	1,500
Rural Health Centres	2560	0.85	11,765	9,000
Urban Health Centres	6582	0.75	13,333	10,000
Private Polyclinics	1073	-	-	-
Hospital bed	120580	17	588	17

Source: EMRO, 2006 - The Country Annual Statistics , 2007

Despite reaching the target for the country as a whole, there was wide variation in bed indexes across the provinces. The highest index related to Yazd with 2.5 beds per 1000 people; Sistan & Baluchestan, with 0.89 bed/1000 people, had the lowest index among the provinces (below). In general, two thirds of the provinces had a bed index lower than the target (1.7) and only a quarter of the provinces had a bed index equal to or higher than the target.

Table 4-9. Health care facilities in the provinces of Iran- 2006

	Hospital bed /1000 Pop	Urban centre /10,000 Pop	Rural centre/ 10,000 Pop	Health House /1000 Pop
Ardebil	1.36	1.32	1.12	1.04
Bushehr	1.55	1.39	1.1	0.73
Charmahal	1.44	1.65	1.68	0.71
East Azarbayejan	1.69	1.26	0.88	0.89
Esfahan	1.81	1.55	1.55	0.84
Fars	1.73	1.3	1.17	0.63
Gilan	1.59	1.44	0.88	0.86
Golestan	1.34	1.31	1.16	0.7
Hamedan	1.88	1.33	1.19	0.79
Hormozgan	1.2	1.59	1.27	0.64
Ilam	1.6	1.51	1.44	0.95
Kerman	1.28	1.67	1.15	0.72
Kermanshah	1.55	1.18	1.11	1.06
Khorasan	1.51	1.47	1.00	0.76
Khuzestan	1.71	1.19	0.94	0.64
Kohgiloyeh	0.9	1.39	1.39	0.99
Kurdestan	1.5	1.00	1.42	1.01
Lorestan	1.27	1.23	1.03	0.90
Markazi	1.47	1.17	1.75	1.00
Mazanderan	1.57	1.68	1.43	0.88
North Khorasan	-	-	-	-
Qazvin	1.33	1.18	1.18	0.75
Qom	1.42	1.3	1.26	0.93
Semnan	2.16	1.41	1.88	0.92
Sistan	0.89	1.2	0.95	0.68
South Khorasan	-	-	-	-
Tehran	2.41	0.96	0.84	0.27
West Azarbayejan	1.3	1.14	1.12	0.8
Yazd	2.5	1.44	2.14	1.05
Zanjan	1.49	1.29	1.53	1.02
Country	**1.7**	**1.26**	**1.15**	**0.77**

Source: Annual Statistics of Iran 2007; Health house: is the basic unit of the rural health care structure, with responsibility for family health and wellness, census taking, public education, disease monitoring and control, environmental health, and the collection and reporting of health data.

With a target population per health house of a maximum of 1,500 people, the country as a whole reached the target with a figure of 1,266 people per health house; however, there is variation in the index across the provinces. Kermanshah had the largest index (1.06 health house /1,000 people) and the lowest was related to Tehran (0.27) (Table 4.8 above). In the cases of urban and rural health centres, the determined targets were not reached. In addition, the distribution of both the urban and rural centres varied across the provinces; for the urban centres, Mazanderan had the highest index with 1.68 centres for 10,000 people, and the lowest index related to Tehran with 0.96 urban centres for 10,000 populations. In the rural centres, the highest index was related to Yazd (2.14 rural centre/10,000) and Tehran with 0.84 had the lowest index (Table 4.9 above).

The information also showed considerable differences on the use of hospital delivery (births), vaccination, antenatal care, and modern contraception use among the provinces of Iran (Table 4.10 below). The overall percentage for hospital delivery in the country was 83.6%; however, there were diverse rates across the provinces. The highest rate of hospital delivery was related to Tehran (95.2%) and the lowest related to Sistan & Baluchestan (29.7%). The information implies that 16.4% of the births were outside of hospital settings mainly happening at home. Sistan & Baluchestan, Hormozgan, and Kohgiloyeh had the highest rates of delivery out of hospital setting (respectively 60.3%, 44.4%, and 41.1%); the lowest figures related to Tehran (4.8%), Mazanderan (4.9%), Qom (5.7%), and Esfahan (5.8%). In fact hospital delivery was higher in the provinces with higher economic status; while, giving birth out of hospital is higher in the less affluent provinces.

Table 4-10. Health care utilisation in the provinces of Iran

	Hospital delivery (%)	**Vaccination** (%)	**Antenatal care** (%)	**Modern contraceptive Use** (%)
Ardebil	68.6	87.5	74.0	66.4
Bushehr	82.5	94.9	94.2	50.8
Charmahal	82.2	97.0	90.9	65.6
East Azarbyjan	85.1	92.7	81.9	58.2
Esfahan	94.2	92.5	88.3	56.1
Fars	78.6	97.7	88.3	56.1
Gilan	93.3	94.5	90.4	49.8
Golestan	77.3	96.2	84.2	57.9
Hamedan	89.4	92.4	84.8	63.8
Hormozgan	55.6	71.8	59.7	44.8
Ilam	77.9	91.4	83.7	66.7
Kerman	71.4	87.1	66.6	51.9
Kermanshah	87.5	89.6	84.4	67.5
Khorasan	77.3	92.4	72.7	50.2
Khuzestan	81.1	81.3	78.5	58.4
Kohgiloyeh	58.9	90.2	78.9	57.9
Kurdestan	74.4	89.7	86.1	69.9
Lorestan	72.6	86.1	77.4	63.9
Markazi	89.9	97.0	84.9	57.6
Mazanderan	95.1	92.6	93.1	53.0
North Khorasan	-	-	-	-
Qazvin	88.7	93.9	78.1	57.9
Qom	94.3	98.6	71.2	45.6
Semnan	90.9	100	89.4	53.4
Sistan	29.7	73.5	44.2	36.4
South Khorasan	-	-	-	-
Tehran	95.2	91.1	78.2	54.1
West Azarbyjan	69.1	84.8	74.5	62.2
Yazd	90.7	97.8	87.5	54.6
Zanjan	76.8	92.6	66.4	63.6
Average	**79.6**	**91.0**	**79.7**	**56.9**
Country	**83.6**	**89.7**	**-**	**-**

Source: Iran Health Profile 2003

Table 4.10 (above) indicates that overall,89.7% of the children under-1 aged in Iran were immunized against polio, TB, HB, measles, diphtheria, whooping cough and tetanus. However, the percentages for immunisation varied among the provinces. Semnan with a rate of 100% had the highest rate of vaccination and the lowest rate related to Hormozgan with 71.8%. There was also wide variation in the rates of pregnant women who received antenatal care in the provinces (Table 3.10 above); the highest figure related to Bushehr (94.2%) and the lowest to Sistan & Baluchestan with 44.2%. The use of modern contraceptives (e.g. oral pills, condoms, intrauterine devices, sterilization, and implants) also differed across the provinces; from 36.4% in Sistan & Baluchestan to 69.9% in Kurdestan.

Looking at the influence of social conditions on access to health care, Morris et al. (2005) in a study in the NHS found considerable disparities in the use of the health services in populations in association with level of income, ethnicity, employment status and education; there was a lower use of secondary care such as hospital services by less affluent people and minor ethnic groups. Veugelers (2003) found that the use of specialist services by people of lower socioeconomic status (e.g. lower income and education) in Nova Scotia (Canada) was lower than those of higher status. The results from a study conducted in the Ministry of Health by Naghavi and Jamshidi (2005)on the utilisation of health care in Iran showed that utilisation of health services was related to the age, gender and socioeconomic characteristics such as education, marital status, employment and health insurance; age was the most important predictor of utilization, and then gender. Financial barriers and time constriction were the main obstacles to service utilization. In a study by Moradi-Lakeh et al. (2007) on safe neonatal delivery and its determinants in Iran, it was revealed that women with higher economic status had a better chance of delivering in an appropriate place such as a hospital or labour centre and by a skilled attendant. There was also a strong association between safe delivery and education attainment of pregnant mothers. Hosseinpoor et al., (2007), in a study in Iran, indicated that people living in remote rural areas were less likely to seek outpatient services than those in the main rural and urban areas, and the people with higher economic status, those with health insurance, housewives, retirees and pensioners were more likely to use outpatient services than other groups. These finding show the effects of gender and other socioeconomic conditions on the use of health care services

4.6. Health outcomes in Iran

The different health outcomes including mortality and morbidity measures that can be influenced by social determinants of health were described in chapter 3. In this section the current pattern of mortality and morbidity in Iran and across the provinces is presented based on the available information.

4.6.1. All cause-mortality by age and gender in Iran

Based on the WHO (2009), in 2004, the age-standardized mortality in Iran (687 deaths per 100,000 populations) was lower than in the EMR countries (790), but lower than the figure for the EUR countries (590) and global (612) (World Health 2009). Based on the information in Table 3.8, the infant mortality and under-5 mortality rates in Iran were respectively 29 and 33 deaths/1000 live births, which were around half of those in the WHO's EMR countries and also smaller than the global figures. But these death rates were around twice the rates in the European Region Countries (EURC). The mortality in the Iranian population aged 15-60 years (131deaths/100,000) was much less than that in the EMRC and the Global rate (Table 4.11 below).

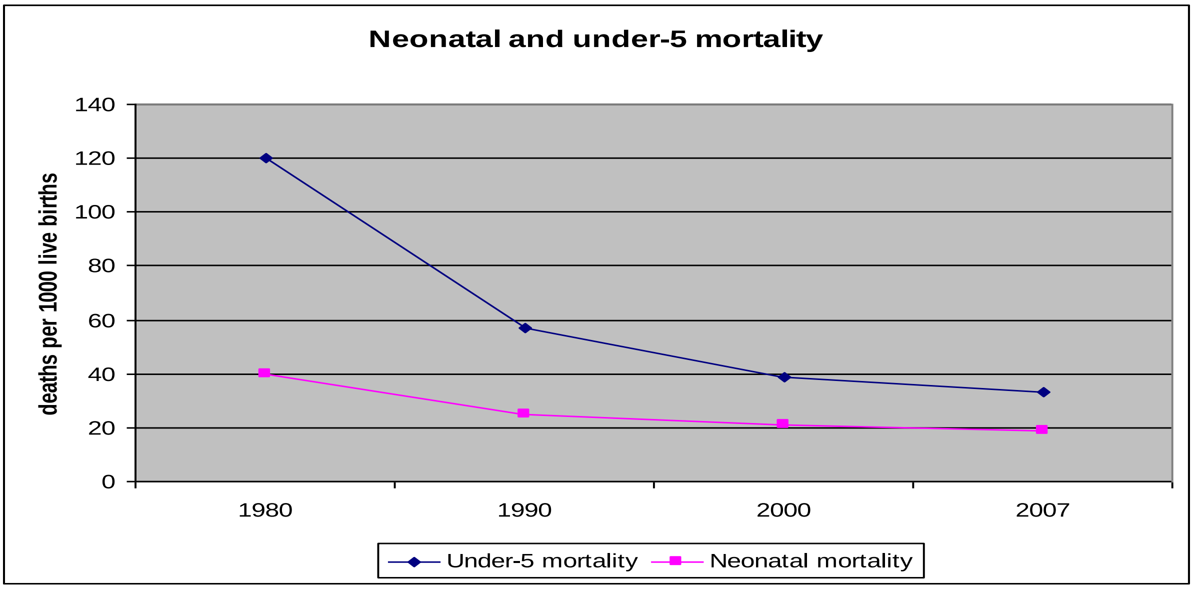
Table 4-11. Mortality in Iran and other regions in the world- 2007

	Iran	EMR Countries	European Region	Global
Life expectancy at birth (yrs)	72	64	74	68
Healthy life expectancy(yrs)	61	56	67	59
Infant mortality rate/1000 live births	29	60	13	46
Mortality under-5 /1000 live births	33	82	15	67
Adult mortality (15-60)/100,000 pop	131	203	159	183

Source: World Health Statistics, 2009

There has been a significant reduction in infant mortality and mortality under-5 in Iran in the past three decades mostly due to the positive aspects of socioeconomic development such as the rising education level and urbanization as well as extending the primary health networks across the country, and in particular in rural areas (Figure 4.2 below). Figure 4.4 also indicates the trends of infant mortality rate and mortality in children under-5 years from 1980 to 2007 in Iran. The infant mortality rate decreased from 40 deaths per 1000 live births in 1980 to 25 in 2007. In addition, the under-5mortality decreased significantly from 120 deaths per1000 live births to 33 in the same period.

Figure 4-4. Trends in infant and under-5 mortality in Iran- 1980-2007



Source of data: WHO. 2006 – WHO, 2009

The evidence indicates that infant mortality rates were greater in rural areas than urban and for males than for females, but the difference was not significant; while mortality under-5 was slightly higher in urban areas (36.8) than in rural areas (34.6). Maternal mortality which is "*the death of women during pregnancy, childbirth, or in the 42 days after delivery*" is one of the important health indicators embodied in the Millennium Development Goals (MDGs) (Hogan et al., 2010, P 1). This mortality measure can be affected by household income and education level as well as expenditure on health services (Magadi et al., 2001; Buor and

Bream 2004). There has been a significant reduction in maternal mortality in the past four decades in Iran; it reduced from 237 per 100,000 live births in 1974 to 37.4 in 2007 (Ministry Health 2010). This improvement was because of the socioeconomic development as well as the family planning policies implemented in the country and delivery centres established, in particular in the rural areas (Mehryar et al., 2005; Olyaee Manesh et al., 2009). However, maternal mortality (2002-2004) in rural areas was 54.5 deaths/100,000 live births (WHO 2009), which were over twice as large as in urban areas with 24.3 (Table 4.12 below).

Table 4-12. Age/gender and urban/rural split of mortality indicators in Iran

Indicator	Urban*	Rural*	Male**	Female**
Life expectancy at birth (Yrs)	-	-	70	74
Healthy adjusted life expectancy (Yrs)	-	-	60	62
Infant mortality rate /1000 live births	27.7	30.2	33	25
Mortality under-five/1000 live births	36.8	34.6	34	31
Adult mortality (15-60)/100,000 pop	-	-	140	100
Maternal mortality/100,000 live births	24.3	54.5	-	-

* Urban and Rural data are 2002-2004 (Health System Profile of Iran, 2006) - ** Male and female data 2007 (World Health Statistics, 2009).

Hosseinpoor et al. (2005) reported that there were significant differences in neonatal mortality by income; they found infant mortality to be lower in households with higher income in the whole country as well as in the provinces. In another study Hosseinpoor et al, (2006) found that water and sanitation infrastructure, wealth and education as well as the health system function were the most important determinants of infant mortality in Iran (Table 4-13 below). The highest mortality rates for under-5s related to Sistan & Baluchestan (47 deaths/1000 live births), Kurdestan (46), Kohgiloyeh & Boyerahmad (42), and Ilam (40) and the lowest rates related to Tehran (25), Gilan (25), Esfahan (26), and Yazd (27). The mortality rate in the province with the highest rate (Sistan & Baluchestan) was twice that of the lowest (Tehran).

Table 4-13. Mortality rates in the provinces of Iran

	Mortality under-5/ 1000 live births	Male mortality (deaths/100,000)	Female mortality (deaths/100,000)	Male life expectancy at birth (yrs)	Female life Expectancy at birth (yrs)
Ardebil	35	185	129	68.2	72.2
Bushehr	33	186	124	68.2	72.5
Charmahal	34	181	127	68.5	72.3
East Azarbyjan	33	177	126	68.7	72.4
Esfahan	26	162	121	70.9	72.7
Fars	30	188	122	68.4	73.0
Gilan	25	191	123	68.7	73.5
Golestan	36	192	126	67.7	72.4
Hamedan	35	179	126	68.4	72.4
Hormozgan	34	196	127	67.7	72.3
Ilam	40	203	126	66.9	71.9
Kerman	36	218	132	66.7	72.0
Kermanshah	37	196	130	67.6	72.0
Khorasan	39	190	124	67.6	72.0
Khuzestan	32	176	125	68.9	72.7
Kohgiloyeh	42	183	127	67.6	71.6
Kurdestan	46	193	130	66.9	71.2
Lorestan	38	201	126	67.6	72.1
Markazi	32	175	125	68.9	72.6
Mazanderan	32	170	123	69.2	72.8
North Khorasan	-	-	-	-	-
Qazvin	29	167	123	69.5	73.2
Qom	29	164	123	69.5	73.0
Semnan	29	175	120	69.2	73.2
Sistan	47	211	131	65.9	70.9
South Khorasan	-	-	-	-	-
Tehran	25	149	117	70.8	73.8
West Azaryjan	38	186	129	67.9	71.9
Yazd	27	164	122	69.9	73.3
Zanjan	36	184	127	68.0	72.1

Source: Mortality Profile in Iran 2004; Khosravi et al., 2007

According to the WHO (2009), in 2007, the mortality rate in men aged 15-60 years was 140 deaths per 100,000 which was significantly higher than that in women, with 100 deaths per 100,000. There was also a wide variation of adult mortality in both men and women in the provinces in 2004; the highest mortality rates for both men and women related to the province of Kerman with respectively 218 and 132 deaths/100,000, and the lowest rates related to Tehran with 149 and 117 deaths/100,000 people respectively in men and women (Table 4.13 above).The evidence indicates that mortality was higher in men than in women in all the provinces; in addition, the range of mortality in men (69 deaths) was significantly wider than that for women (15 deaths) across the provinces. In other words, men have higher mortality and larger variation of mortality across the provinces than women.

The evidence indicates a significant increase in life expectancy at birth in Iran from 55.7 years in 1976 to 72 years in 2006 (WHO 2006a; WHO 2009). In 2006, the life expectancy in men (71.7 years) was found to be 2 years lower than that in women (73.6 years) (Ministry Health 2010). Based on the WHO (2009), in 2007 the average life expectancy at birth in Iran was 72 years which was higher than that in the EMR countries (64 years) and also the global figure (68%), but less than that in the EURC (74 years). There was also variation in male and female life expectancies across the provinces; Tehran had the highest life expectancies in both men (70.8years) and women (73.8 years), and the lowest rates related to Sistan & Baluchestan with 65.8 years in men and 70.8 years in women (Table 4.13 above).

4.6.2. Cause specific mortality

The ten top causes of mortality in Iran, abstracted from the two studies of the Study of Burden of Disease in 3 Provinces (2001) and Mortality Pattern in 23 Provinces (2003) conducted by Naghvi in the Health Ministry of Iran, are presented in Table 4.14 (below). Based on this information, ischemic heart diseases, disasters, traffic injuries, and cerebrovascular events are the top four causes of death in Iran (Naghavi 2003). As a result of the epidemiologic and demographic transition in Iran, non-communicable and chronic diseases now cause a higher burden of disease in the country.

Table 4-14. Ranked top ten causes of mortality/ morbidity in Iran							
Mortality/100,000 Pop		Mortality (YLL)[a]/100,000 Pop		Morbidity (YLDs %)[aa]		Mortality & Morbidity DALYs %	
Ischemic Heart Diseases	108.5	Disasters (with Bam earthquake)	1858	Traffic injuries	18.9	Traffic injuries	17.1
Disasters (with Bam earthquake)	61.3	Traffic injuries	1247	Depressive Disorders	11.3	Ischemic Heart Diseases	8.7
Traffic injuries	47.8	Ischemic Heart Diseases	929	Osteoarthritis	8.9	Depressive disorders	6.1
Cerebrovascular disease (CVD)	45.0	Cerebrovascular events	335	Falls	5.8	Osteoarthritis	4.5
Cerebrovascular events	16.6	Prematurity and Low birth Weight	247	Substance Abuse	5.5	Diabetes mellitus	4.2
Other cardiac diseases	15.6	Other cardiac diseases	163	Infertility	5.4	Cerebrovascular events	3.8
Other CVD	15.1	Burns	157	Psychotic disorders	4.4	Falls	3.6
Stomach cancers	11.5	Other cardiovascular diseases	153	Rheumatoid arthritis	4.4	LBW	3.5
Prematurity and low birth weight	7.5	Respiratory and vesicle disorders (neonatal)	117	Cataract	3.9	Substance abuse	3.1
Diabetes mellitus	7.4	Hypertension and it's disorders	116	Diabetes mellitus	3.3	Other unintentional injuries	3.0

Sources: 1- Mohsen Naghavi, Mortality Pattern in 23 Provinces. Ministry of Health & Medical Education, 2003, [Farsi]. 2- Mohsen Naghavi, Study of Burden of Disease in 3 Provinces. Ministry of Health & Medical Education, 2001 [Farsi]. Cited by EMRO, 2006; [a]YLL= years life lost; [aa]YLDs = years lived with disability

4.6.3. Morbidity

Morbidity conditions are often caused by communicable and non-communicable diseases and injuries. The main communicable diseases are HIV/AIDS, TB, and malaria. Non-communicable diseases are now the main cause of morbidities in the world (Kishore and Michelow 2010). Non-communicable diseases are considered as the main cause of disabilities. Children's malnutrition and psychological problems are also prevalent non-communicable diseases. These problems are often reflected by indicators such as children's growth and nutritional problems, disabilities, risk factors of hypertension, diabetes, rates of tobacco use, and high serum cholesterol and also hospital episodes, self-reported health, psychological measurements, and lifestyle and risk taking behaviours (Braveman 1997; Gulliford et al., 2004; Carr-Hill et al., 2005; Khang et al., 2008).

4.6.3.1. Communicable diseases

Communicable diseases were the most important causes of mortality and morbidity in Iran until 3 decades ago; however, their prevalence reduced greatly from 1971 (Naghavi 2004). The information (Table 3.15 below) shows changing the role of communicable diseases on mortality in the province of Tehran in 1971 and the 18 provinces in 2001. Tehran is often found to have better health status among all the provinces in Iran; bearing that in mind, there has been a significant decrease in the number of deaths due to infectious diseases over the past three decades in Iran. Mortality due to upper respiratory infectious disease was 62 deaths/100,000 pop in 1971 while the figure for 18provinces was 4.8 in 2001. Similarly, mortality from infectious gastroenteritis was 46 deaths/100,000 in Tehran (1971) and 0.69 deaths in the 18provinces. The reduction in other infectious illnesses was also significant, and the prevalence of chicken pox was entirely eradicated over the period.

Table 4-15. Changing the causes of death in Iran- 1971-2001 (deaths/100,000)

Cause of death	1971 (Tehran)	2001 (18 provinces)
Communicable diseases		
Upper respiratory infection	62	4.8
Infectious Gastroenteritis	46	0.69
Meningitis and encephalitis	12	0.76
Tuberculosis (TB)	9	1.2
Measles	5	0.02
Tetanus	2.5	0.03
Chicken pox	2.6	0.00
Diphtheria	1	0.02

Source: Naghavi, (2004) Health Profile Transition in the Iranian Community [Farsi]. Health Ministry of Iran

In 2004, there were 13.3 deaths per 100,000 populations due to communicable diseases in Iran; while the total number of deaths due to all diseases (crude death rate) was 436 deaths per 100,000 people (Naghavi and Jamshidi 2005). This implies that infectious illnesses were the cause of only 3% of all deaths in the country. These findings indicate the epidemiological transition of the burden of disease from communicable illnesses to non-communicable ones in Iran.

Information on the prevalence of the main infectious diseases in Iran, in 2007, shows that the highest prevalence was related to HIV/AIDS with 163 cases per 100,000 pop aged 15 and over (WHO 2009). There were a total of 15,712 cases of malaria, 4,071 of tuberculosis, 267 of whooping cough, and 133 measles cases reported in the country (WHO 2009). The prevalence of malaria and TB were higher in some bordering south-east provinces such as Sistan & Baluchistan and Hormozgan and also the provinces with higher numbers Afghan refugees such as Khorasan and Tehran. Despite the significant reduction in communicable diseases, they are considered as important health problems in the provinces where their prevalence is considerable. In addition, HIV/AIDS as an emerging, and tuberculosis as a re-emerging, infectious disease is important in terms of the provision of preventive and treatment services.

4.6.3.2. Non-communicable disease

Based on the WHO (2009), in 2004, around 93% of the total deaths in Iran were due to the non-communicable diseases of cancer, cardiovascular diseases, and injuries. The global figure was around 85%, indicating a higher burden of non-infectious problems in Iran. Information (Table 4.16 below) indicates that hypertension, diabetes, heart problems, prematurity and low birth weight, and psycho-depressive problems were among the main causes of disabilities in Iran. Hypertension was indicated to be the cause for 13% of mortality and 4.4% of DALYs in the world with higher figures for more affluent countries (WHO 2002). The rate of hypertension in the population over 15 years in Iran (Table 4.15) was 11.5%. The figure for females (11.9%) was slightly higher than for males (11.1%) and in urban areas (11.7%) compared to rural areas (11.3%).

Table 4-16. Prevalence of non-communicable diseases in Iran- 2002-2004

	Overall	Male	Female	Urban	Rural
Diabetes mellitus (%)*	2.3	-	-	2.9	1.2
Hypertension (%)*	11.5	11.1	11.9	11.7	11.3
Cholesterol > 240 mg/dl (%)*	11.1	9.4	12.4	12.4	8.9
Abnormal birth weight (%)**	9.8	8.5	10.3	8.3	11
Stunting (%) **	14.8	16.8	13.9	11	21.8
Wasting disease (%)**	5.4	5.1	4.7	5.6	4.8

* - Country Cooperation Strategy for WHO and I.R. Iran, 2005-2009. - (data 2002-2004).**- Health System Profile in I.R. of Iran, 2006- (data 2002-2004). Cited by EMRO, 2006.

There was also a large range of hypertension rates across the provinces (Figure 4.5 below). The highest rates related to the provinces of Yazd (19.3%), Markazi (18.9%), and Qazvin (15.9%), and the provinces of Qom (7.1%), Bushehr (7.5%), and Sistan & Baluchestan (7.9%) had the lowest hypertension rates (Table 4.17 below).

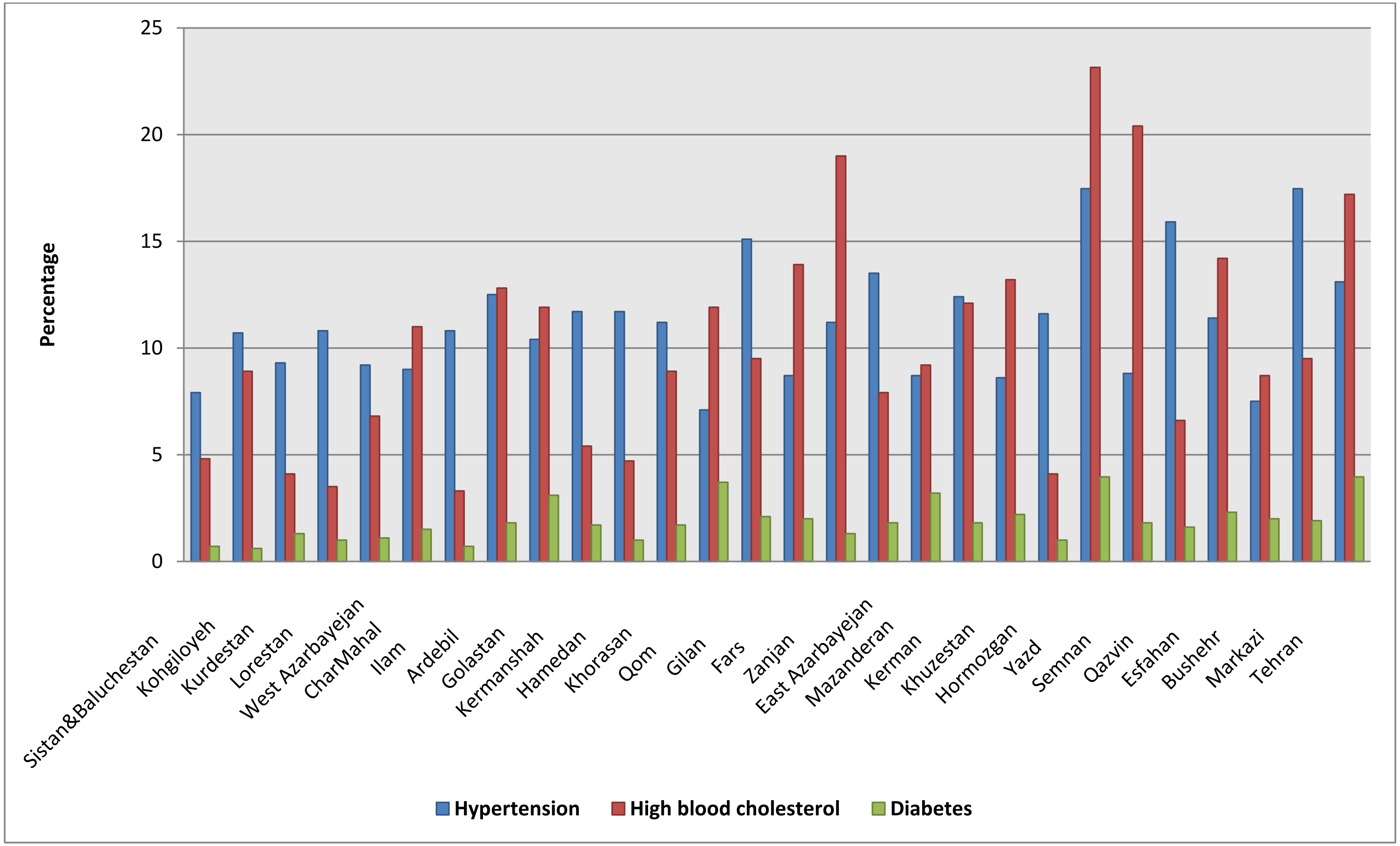
Table 4-17. Prevalence of non-communicable diseases in the provinces of Iran

	Hypertension >15Yrs (%)	High cholesterol >15Yr (%)	Diabetes (%)	Low weight under 5 (%)	Depression (%)
Ardebil	12.5	12.8	1.8	6.4	27.1
Bushehr	7.5	8.7	2	8.8	24.4
Charmahal	9	11.0	1.5	16.8	39.4
East Azarbyjan	13.5	7.9	1.8	6.5	27.7
Esfahan	11.4	14.2	2.3	10.6	15.9
Fars	8.7	13.9	2	11.3	24.1
Gilan	15.1	9.5	2.1	6.8	17.7
Golestan	10.4	11.9	3.1	4	11.4
Hamedan	11.7	4.7	1	11.4	36.9
Hormozgan	11.6	4.1	1	23.8	23.9
Ilam	10.8	3.3	0.7	11.7	15.3
Kerman	12.4	12.1	1.8	16	21
Kermanshah	11.7	5.4	1.7	9.6	22.8
Khorasan	11.2	8.9	1.7	13.7	21.6
Khuzestan	8.6	13.2	2.2	11.4	26.1
Kohgiloyeh	10.7	8.9	0.6	17.6	31.3
Kurdestan	9.3	4.1	1.3	11.5	22.4
Lorestan	10.8	3.5	1.0	10.1	18.6
Markazi	18.9	9.5	1.9	7.1	20.5
Mazanderan	8.7	9.2	3.2	6.5	13.2
North Khorasan	-	-	-	-	-
Qazvin	15.9	6.6	1.6	8.2	22.4
Qom	7.1	11.9	3.7	5.1	25.3
Semnan	8.8	20.4	1.8	9.1	17.6
Sistan	7.9	4.8	0.7	25.8	40.8
South Khorasan	-	-	-	-	-
Tehran	13.1	17.2	4.1	7.2	18.4
West Azarbyjan	9.2	6.8	1.1	8.6	14.3
Yazd	19.3	32.5	4.7	12.9	10.5
Zanjan	11.2	19	1.3	12.4	29.2
Average	11.3	10.6	1.9	11.1	22.3
Country	11.5	-	-	-	21

Source: Health Profile in Iran (2003)

Hypercholesterolemia is an important modifiable risk factor for cardiovascular disease which is a main cause of death. Hypercholesterolemia is defined as "*a fasting serum total cholesterol 240 mg/dL or if the subject was being treated with lipid-lowering medication or dietary modification*" (Halcox et al., 2002, P 3). Based on the Health Ministry of Iran (2003) the overall rate of high blood cholesterol in Iran was 11.1%, with a higher rate in women (12.4%) than in men (9.4%) and in urban areas (12.4%) than in rural (8.9%). There was also a range of hypercholesterolemia across the provinces (Figure 4.5 below) with the highest rate in Yazd (32.5%) and the lowest rates in Ilam (3.3%) and Lorestan (3.5%) (Table 4.17 above).

Figure 4-5: Inequality in the coronary risk factors across the provinces



Diabetes, which "*is a condition where the amount of glucose in blood is too high because the body cannot use it properly*" (Diabetes UK 2011, P 1), is a common chronic health condition. Diabetes is a main risk factor for ischemic heart problems which is globally an important cause of death (Zimmet et al., 2001). The International Diabetes Foundation (IDF) (2009) estimated around 285 million people were affected by diabetes in 2010 worldwide and the greatest burden of diabetes was in the low and middle income countries. It is also estimated that 330 million people in the world will have diabetes in 2025. Bachmann et al. (2003) stated that the burden of morbidity due to diabetes was larger in populations with lower levels of education and income. Diabetes is also a prevalent life-long health condition in Iran. Based on the Health Ministry of Iran (2003) the overall diabetes rate in Iran was 2.3%; with the figures of 2.9% in urban areas and 1.2% rural areas. There was also a range of diabetes rates across the provinces (Table 4.17; Figure 4.5 above); the highest rates related to the provinces of Yazd (4.7%) and the lowest rates related to Kohgiloyeh & Boyer-Ahmad (0.6%), indicating a large variation of the prevalence of diabetes across the provinces.

Depression is an important worldwide morbidity because of its high prevalence over life course (2-15%) and also its relationship with substantial disability (Moussavi et al., 2007). Depressive disorders are also indicated to be among the top causes of morbidity in Iran (Noorbala et al., 2004; Shadloo 2011). According to the Health Ministry (2003), the prevalence of depression in the population aged 15 years and over in Iran was 21%. Noorbala et al., (2004) found the same results in a study with a sample population of 35,014 people across the country. There was also a wide variation of rates of depression across the provinces; with the highest rate in Sistan & Baluchestan (41.1%), and the lowest rate in Golestan (10.5%) (Table 4.17 above).

Children's nutrition and growth indicators such as low weight are important indicators representing health status in children (de Onis and Blossner 2003). Murray and Lopez (1997b) found out that 15.9% of DALYs worldwide were associated with malnutrition in childhood. Malnutrition is the predisposing factor for one out of every two deaths due to the main causes of mortality in children under 5 including pneumonia, diarrhea, low birth weight, asphyxia, and HIV and malaria in developing countries (Van de Poel et al., 2008). Low birth weight, stunting (lack of enough growth and development) and wasting disease (gradually become very thin and weak) are also three prevalent morbidities in the neonates and children under 5 in Iran (EMRO 2006). Based on the Health Ministry of Iran (2003) information found, the proportion of abnormal birth weight in baby boys and girls was 8.5% and 10.3% respectively in Iran. This percentage was 11% in rural areas and 8.3% in urban areas (Table 4.17 above). The information also shows a wide range of low weight rate in children, from 4% in Golestan to 25.8% in Sistan & Baluchestan. A study by Majlesi et al., (2001) in the province of Lorestan showed 7.7% malnutrition among children under-five.

4.7. Summary

In this chapter I evaluated the main factors in regard to health inequity including the social factors underlying more and less advantaged groups, health care access (as one of the social determinants of health), and health status in the context of Iran. Through evaluation of the international literature the strong relationship between the social factors and health demonstrated in previous studies was presented. Considerable differences in the social factors across the provinces were identified. For the majority of factors, the provinces of Tehran, Esfahan, Semnan, Yazd, Mazanderan, East Azarbayjan, and Qazvin were shown to be of higher social position. On the other hand, provinces such as Sistan & Baluchestan, Kurdestan, Kohgyloyeh & Boyerahmad, Lorestan, Ilam, and West Azarbayejan were showed to be at a lower social position. The differences in social factors can lead to inequities in health across the provinces; thus, in chapter 5 I will measure the relationship between the social indicators and health care and health outcome measures to show the health inequities between the provinces. Given the literature, the context in Iran, and availability of data, I considered the social factors of education (illiteracy rates), general income (GDP per capita), unemployment, household size, rural residency, and overcrowding (number of people per room) for the measuring and establishment of health inequities across the provinces (in chapter 5). These factors will to some extent cover the different drivers of health inequity including wealth, power, and prestige; and consider the social justice implications (the main concern of inequity) (Braveman 2005) in this study.

Access to health care was considered as an aspect of health care and also one of the social determinants of health (Braveman and Gruskin 2003; Marmot et al., 2008). Evaluation of the access to health care in the context of Iran showed considerable differences in access to health services across the provinces. For example, hospital bed indexes and giving birth in hospital were high in the more affluent provinces of Yazd, Tehran, Semnan, and Esfahan, but lower in Sistan & Baluchestan, Kohgyloyeh, Lorestan, and West Azarbayejan which were considered to be among the less affluent provinces. Therefore, in chapter 5 I will measure and demonstrate inequities in health care access between the provinces using the measures of hospital delivery, children vaccination coverage, antenatal care, and the use of modern contraceptives. These measures were chosen based on the availability of data; in addition, they cover predominantly the primary care services which are considered to have larger impact on health inequities (Shi et al., 2003; Starfield et al., 2005)and are financed mainly by public resources (WHO 2006b).

Investigation of mortality also showed considerable differences in mortality indicators between specific age groups across the provinces, with the highest rates of mortality mainly in the provinces with lower socioeconomic status. Therefore, I decided to use the measures of mortality under-5, and mortality in adult men and women for the inequity measurement. Evaluation of morbidity also showed variation of the morbidities between men and women, and urban and rural areas as well as the provinces in the country. Wide variations were shown in the prevalence of diabetes, high blood cholesterol, and hypertension across the provinces with the higher rates in more affluent provinces. For example, the prevalence of these illnesses was shown to be higher in provinces such as Tehran, Esfahan, Semnan, and Yazd, which are richer provinces. Rates of low weight in children were higher in poorer provinces such as Sistan & Baluchestan, Charmahal, Kohgyloyeh, and Hormozgan. In light of this, the indicators of diabetes, high blood cholesterol, hypertension, depression (in Pop over 15 years), and low weight in children were considered appropriate to use for the inequity measurement in chapter 5.

5. Measuring and establishment of health inequities across the provinces

5.1. Introduction

The main methods for measuring the health inequities across the provinces were identified in chapter 3. The main aspects in regard to health inequities including: the socioeconomic factors, health care and health outcomes in the context of Iran and across the provinces were described in chapter 4. In this chapter, I measure and establish the health inequalities in relation to socioeconomic factors across the provinces. For this, first an overall approach of the inequity measurement is described; then the results of analysis are presented. The discussion and main conclusions follow in the next section. The action for reduction of the health inequities is described at the end of the chapter.

5.2. Approaches to measuring of health inequities across the provinces

Looking at the previous chapter, the populations in the provinces of Iran are considered as the geographical sub-social groups of concern for health inequity. The six socioeconomic indicators of illiteracy rate; GDP per capita; unemployment; overcrowding (quality of housing); proportion of rural population; and household size were chosen for the measurement of inequities in health outcomes and utilisation of health care across the provinces. The rates of mortality under-5, mortality in adult men and women (aged 15-60 years) as well as the morbidity indicators of diabetes rate; high blood cholesterol, hypertension and depression rates (aged 15 years and over), and low weight in children under-5 were selected as the health outcome indicators to measure their potential inequalities in relation to the six socioeconomic indicators. The measures of hospital delivery, antenatal care, vaccination rate under-1, and the use of modern contraceptives were used as the health care utilisation indicators to measure their inequalities in association with the socioeconomic indicators.

Two inequality indicators of regression coefficient (relative and absolute) and slope/relative index of inequality (SII, RII) are used to measure respectively the "effect" and "total impact" of the socioeconomic indicators on the health status (mortality and morbidity) and health care utilisation measures. The regression coefficients were estimated through the statistical technique of linear regressions using SPSS (version 16). The regression coefficient indicates the "absolute" inequalities of the health indicators in relation to the socioeconomic factors. In other words, the regression coefficient is the absolute magnitude of change in the health measure (dependent variable) when the socioeconomic factor (independent variable) changes by 1 unit.

The relative health inequalities in effect terms in this study were measured by estimation of relative values of the regression coefficients. The relative value is the proportion of change in the average of the health variable (dependent) for each unit of increase in the socioeconomic variable (independent) (Bartley et al., 2004). For calculation of the relative values, first, a log transformation was performed on the health variables (dependent) using SPSS; then the regression coefficients between the transformed variables and the socioeconomic indicators were estimated; the exponent of the regression coefficients were estimated using Excel software. Finally, the relative values were calculated by reducing the exponent of the regression coefficient from 1.0, multiplied by 100 (Regidor 2004b). The resulted relative values indicate the relative health inequalities; the larger values indicate larger relative inequalities.

Slope Index of Inequality (SII) is one regression-based indicator of socioeconomic disparities in health. This index not only takes into account the differences in health across all the socioeconomic groups, but also takes into consideration the distribution of socioeconomic groups in the population. To estimate SII, the relative position of each socioeconomic group in the population socioeconomic hierarchy is determined and entered in the regression models as a continuous variable, which theoretically ranges from 0 to 1 (Regidor 2004b).

We used the SII to measure the "absolute" total impact of the socioeconomic indicators on the health measures. For this, the Excel programme introduced by the Eastern Region Public Health Observatory (ERPHO) was used to calculate of the SII inequality (ERPHO 2011). The results were presented with the related p-values and confidence intervals (CI). The relative inequalities were estimated by calculation of the relative index of inequality (RII). The RII was calculated by dividing the SII scores by the mean score of the health indicators multiplied by 100. Higher value of RII indicates greater variation (relative inequality) in the health indicators in relation to the socioeconomic factors.

A multiple regression technique was used to identify the main predictors of the health outcomes (mortality and morbidity) measures and health care utilisation indicators in the provinces. Multiple regression is often used to evaluate the relationship between one continuous dependent variable and a number of independent variables or predictors (usually continuous) (Pallant 2007). This statistical technique is based on correlation, but allows a more sophisticated exploration of the interrelationship among a set of variables (Pallant 2007). In general, multiple regression indicates how much of the variance in the dependent variable can be explained by the independent variables; in fact, it gives us an indication of the relative contribution of each of the independent variables (socioeconomic factors) to the dependent variable (health indicator) (Field 2005). I used "Enter" option in SPSS (V. 16) to explore which of the socioeconomic indicators explain significantly the largest variance in the health indicators; in other words, I identified which of the socioeconomic factors were the strongest predictor of health status and health care in the provinces.

There are assumptions underlying the regression techniques that need to be considered when they are to be used, including sample size, colliniarity and singularity, outlier scores, normality and linearity. There is no consistent answer in the literature on how large a sample size should be for a reliable equation in a regression analysis. Osborne (2000) states that 15 subjects per predictor are needed for a reliable equation (P 72). VanVoorhis (2007) suggests the formula of $N > 50 + 8m$ (m= number of independent variables). Alternatively, Tabachnick and Fidell (2007) suggested that the number of subjects should be at least 5k. In this study, the subjects are 28-30 provinces, including all the population in Iran.

Collinearity exists when the independent variables are highly correlated (r ≥ 0.8 - 0.9) and singularity occurs when one independent variable is actually a combination of other independent variables (e.g. when both subscale scores and the total score of a scale are included) (Field 2005). Multiple regression does not like both collinearity and singularity in independent variables (Pallant 2007). Collinearity in a model can also be investigated using the Tolerance and VIF tests (Field 2005). Tolerance is 1-R squared for each variable and a tolerance less than 0.1 can show collinearity. VIF (Variance Inflation Factor) is just the inverse of the Tolerance value (1 divided by Tolerance). VIF values above 10 can indicate collinearity (Pallant 2007).

In this study, I checked the potential multicollinearity by estimating correlation coefficients between the variables (Table 5.1 below). The results indicated that none of the correlation coefficients was larger than 0.8, indicating no potential risk for multicollinearity between the socioeconomic factors (independent variables).

Table 5-1. Interrelationship between the socioeconomic variables

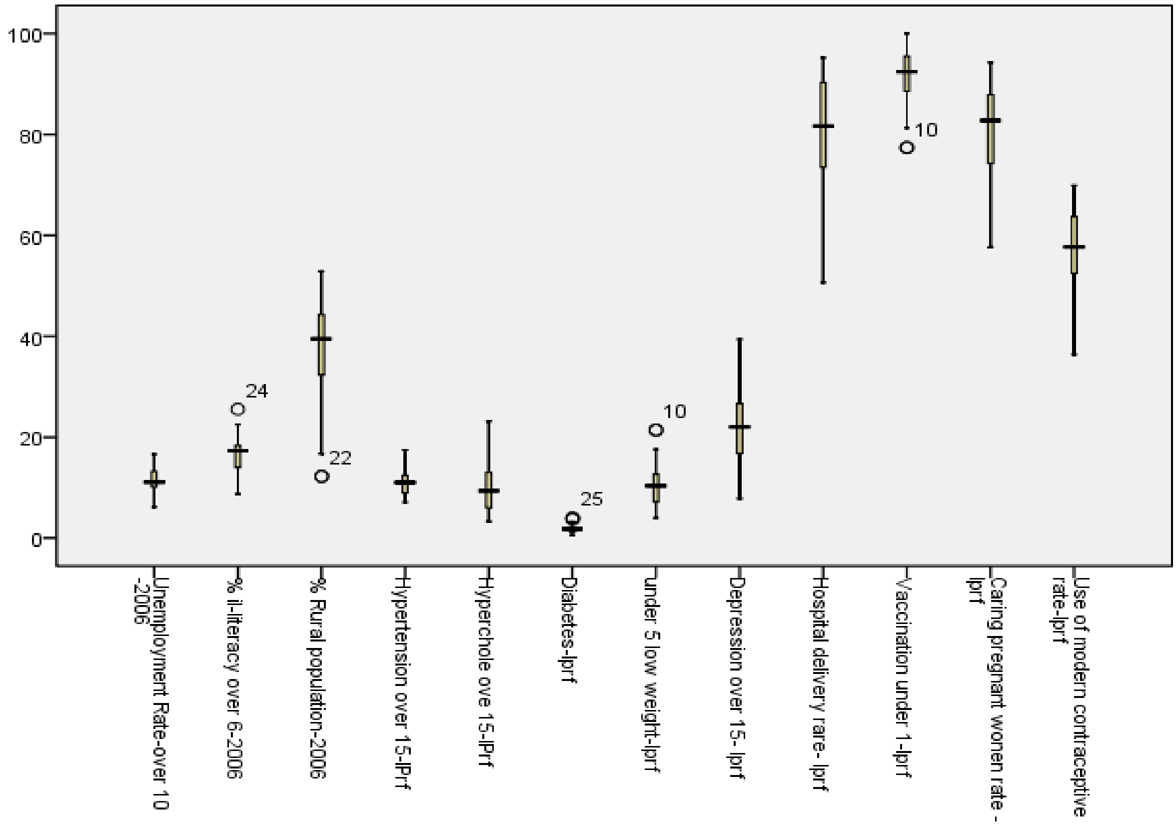
	Illiteracy	**GDP**	**People/room**	**Rural Pop.**	**Unemployment**	**Household size**
Illiteracy rate	1.000					
GDP per Capita	-.787**	1.000				
People per room	.626**	-.539**	1.000			
Rural population	.683**	-.603**	.212	1.000		
Unemployment	595**	-.563**	.682**	.431*	1.000	
Household size	586**	-.566**	.719**	.467*	.681**	1.000

**. Correlation is significant at the 0.01 level (2-tailed). *. Correlation is level significant at the 0.05 (2-tailed).

Outliers are “data points that are out on their own either very high or very low or away from the main cluster of points” (Pallant 2007, P 128). Outliers are worth investigating as they can affect some analysis. They can be checked using histograms, box plots, and z-scores; histograms show potential outliers if some data points are sitting outside the distribution tails. In box-plot diagrams the outliers are signed by stars on the related diagram. By taking absolute values of z-scores, in a normal distribution it is expected about 5% to have absolute values greater than 1.96 (or 2 for convenience), and 1% to absolute values greater than 2.58, and none to be greater than about 3.29 (Field 2005). The results from the box plot indicated some outlier values in the variables were related to two provinces of Tehran and Sistan & Baluchestan. There were the same results when z-scores were estimated.

Field (2005) suggested three ways of dealing with the outliers: (i) to remove the case; (ii) transform the data; (iii) change the score (P 78). Removing the case entails deleting the data from the subject that contributed to the outlier; this should be done if there are good reasons for that. I used the approach of “changing the outlier scores” to recode the outliers in this study as the results from other methods did not change the outliers so as to improve appropriately the normality of the variables. In addition, I found that any transformation (e.g. log or route square) of data can inappropriately affect the magnitude of the regression coefficients, leading to mis-measurement of the inequalities. Therefore, the new scores were estimated by the related mean plus/minus 2 standard deviation (variation or dispersion exists from the average, or expected value) in the variables. Figure 5.1 (below) shows the situation of the variables after replacing the outliers.

Figure 5-1- The normality of variables after replacing the outlier values



Normality and linearity of the variables were checked from the residuals scatterplots which were generated as part of the multiple regression procedure (Pallant 2007). Residuals are differences between the obtained and predicted dependent variable scores (Pallant 2010). The normality of the variables was checked using a histogram (subjective) and the statistical tests of Skewness and Kurtosis and Kolmogorov-Smirnov (objective) (Field 2005, P 94). The test showed abnormal distribution for the same cases including outliers but there were appropriate results when outliers were changed to the scores close to other values (Table 5.2 below). The data is normally distributed where the statistics are not significant.

Table 5-2. Test of normality after rescaling the outliers

	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	**df**	**Sig.**	**Statistic**	**df**	**Sig.**
GDP per Capita	.136	28	.197	.947	28	.165
Illiteracy over 6	.132	28	.200*	.975	28	.710
Members per room	.125	28	.200*	.980	28	.845
Rural population	.138	28	.182	.928	28	.054
Household size	.104	28	.200*	.938	28	.097
Unemployment	.085	28	.200*	.980	28	.843
Mortality under 5	.084	28	.200*	.969	28	.544
Mortality in men	.073	28	.200*	.992	28	.999
Mortality in women	.107	28	.200*	.981	28	.875
Hypertension over 15	.143	28	.146	.931	28	.065
High cholesterol over 15	.127	28	.200*	.939	28	.104
Diabetes	.166	28	.046	.900	28	.011
Low weight under-5	.141	28	.166	.929	28	.057
Depression over 15	.075	28	.200*	.969	28	.560
Hospital delivery	.116	28	.200*	.925	28	.045
Vaccination under-1	.146	28	.133	.924	28	.045
Antenatal care	.141	28	.161	.943	28	.133
Modern contraception	.104	28	.200*	.967	28	.497

a. Lilliefors Significance Correction- *. This is a lower bound of the true significance.

5.3. The results from the regression and SII analysis of the mortality measures

5.3.1. Mortality under-5

The results from the effect analysis (regression coefficient measurement) showed significant relationships between mortality under-5 and the six socioeconomic indicators of the illiteracy rate, GDP per capita, unemployment, overcrowding, rural population, and household size across the provinces (Table 5.3 below). The impact analysis (the SII measurement) indicated significant variation of the mortality under-5 in relation to the unemployment, overcrowding, and rural, but the variation in relation to illiteracy, GDP per capita, and household size was not significant.

Table 5-3. Socioeconomic inequalities in mortality under-5 in the provinces

Effect (regression)	B	95% CI (L)	95% CI (U)	P-value
Illiteracy	1.309 (RS= .68)	.948	1.670	.000*
GDP per Capita	-.536 (RS=.52)	-.744	-.328	.000*
Unemployment	.530 (RS=.41)	.273	.787	.000*
Overcrowding	2.220 (RS=.35)	9.98	34.41	.001*
Rural pop	.300 (RS=.36)	.139	.462	.001*
Household size	9.142 (RS=.49)	5.364	12.92	.000*
Total impact (SII)	**SII**	**LB**	**UB**	**P-value**
illiteracy	-16.9	-22.0	-11.8	2.9
GDP	-17.6	-22.3	-12.9	3.3
Unemployment	-11.3	-18.5	-4.1	0.0*
Overcrowding	-9.9	-17.5	-2.4	0.0*
Rural pop	-14.0	-20.4	-7.7	0.0*
Household size	-15.5	-21.3	-9.7	9.4

B = Regression coefficient; RS= the square values of R indicating the variance explained by the independent variable; CI (L) = Lower confidence interval; CI (U) = Upper confidence interval; P-value = the significance of the regression coefficient; Significant level is *5%.

The results (Table 5.3 above) from the regression analysis (effect) indicated significant positive association between the mortality under-5 and illiteracy rates (B= 1.3, RS= 0.68, P< 0.000), unemployment (B= 0.53, RS= 0.41, P< 0.000), overcrowding (B= 2.22, RS= 0.35, P< 0.001), rural population (B= 0.3, RS= 0.36, P< 0.001), and household size (B= 9.1, RS= 0.49, P< 0.000) across the provinces. In fact, when there was one unit increase in the illiteracy, unemployment, overcrowding, rural population, and household size, the children's death rates increased respectively by 1.3, 0.5, 2.2, 0.3, and 9.1 deaths per 1000 live births. There was significant negative association between mortality under-5 and GDP per capita (B= -0.53, RS= 0.49, P< 0.000); under-5 mortality rates decreased by 0.53 deaths/1000 live births when the GDP per capita increased by 1 unit.

The results from the impact analysis (SII measurement) showed significant variation of mortality under-5 in relation to unemployment (SII= -11.3, P< 0.000), overcrowding index (SII= -9.9, P< 0.000), and rural population (SII= -14, P< 0.000). In fact, mortality under-5 rates in the provinces with higher unemployment, overcrowding, and rural population were respectively 11.3, 9.9, and 14 deaths/1000 live births larger than the mortality rates in the provinces with lower socioeconomic factors. Mortality under-5 also varied in relation to illiteracy rates (SII= -16.9, P< 2.9), GDP per capita (SII= -17.6, P< 3.3), and household size (SII = -15.5, P < 9.4); however the variations were not significant.

5.3.2. Mortality in adult men

The results from the regression analysis (effect) indicated significant relationships between mortality in adult men and the socioeconomic indicators of illiteracy rate, GDP per capita, unemployment, overcrowding, rural population, and household size in the provinces (Table 5.4 below). The SII measurement (total impact measurement) showed variation of the male mortality in relation to the socioeconomic indicators; however, the variations were not significant.

Table 5-4. Socioeconomic inequalities in mortality in adult men (SII, RII)

Effect (regression)	B	95% CI (L)	95% CI (U)	P-value
Illiteracy	2.941(RS=.47)	1.683	4.199	.000*
GDP per Capita	-1.242 (RS=.38)	-1.880	-.604	.000*
Unemployment	1.549 (RS=.48)	.897	2.202	.000*
Overcrowding	46.328 (RS=.21)	9.898	82.758	.015*
Rural pop	.923 (RS=.46)	.523	1.322	.000*
Household size	19.879 (RS=.32)	8.072	31.686	.002*

Total impact (SII)	SII	LB	UB	P-value
illiteracy	-51.1	-67.8	-34.3	1.3
GDP	-50.7	-67.6	-33.7	1.7
Unemployment	-49.0	-66.7	-31.3	5.7
Overcrowding	-21.9	-46.9	3.1	0.1
Rural pop	-52.3	-68.4	-36.2	4.6
Household size	-46.2	-65.1	-27.3	3.2

B = Regression coefficient; RS = the square values of R indicating the variance explained by the independent variable; CI (L) = Lower confidence interval; CI (U) = Upper confidence interval; P-value = the significance of the regression coefficient; Significant level is *5%

The results (Table 5.4 above) from the effect analysis (regression coefficients) showed significant positive association between mortality in adult men and illiteracy (B= 2.94, RS= 0.47, P< 0.000), unemployment (B= 1.55, RS= 0.48, P< 0.000), overcrowding index (B= 46.3, RS= 0.21, P< 0.015), rural population (B= 0.923, RS= 0.46, P< 0.000), and household size (B= 19.87, RS= 0.32, P< 0.002); when the illiteracy, unemployment, and rural population increased by 1% the mortality in men increased respectively by 2.94, 1.55, and 0.92 deaths/100,000 populations. Male mortality also increased by 46.3 and 19.7 deaths/100,000 populations respectively with one unit increase in the overcrowding and household size. There was also significant negative relationship between male mortality and GDP per capita (B= -1.24, RS= 0.38, P<0.000); where the GDP per capita increased by 1 unit, the mortality decreased by 1.24 deaths/100,000 populations.

The results (Table 5.4 above) from the impact analysis (the SII measurement) indicated variation of the male mortality in relation to illiteracy (SII= -51, P < 1.3), GDP per capita (SII= -50.7, P< 1.7), unemployment (SII= - 49, P < 5.7), overcrowding (SII= -21.9, P< 0.1), rural population (SII= -53.2, P< 4.6), and household size (SII= -46.2, P< 3.2); however, in the all cases, the variation was not significant.

5.3.3. Mortality in adult women

The findings (Table 5.5 below) from the effect analysis (regression coefficient) showed significant relationships between mortality in adult women and the socioeconomic indicators of illiteracy rate, GDP per capita, unemployment, overcrowding, rural population, and household size in the provinces. The impact analysis (the SII measurement) showed variation of female mortality in relation to the socioeconomic indicators; however, the variations were not significant except in the case of overcrowding.

Table 5-5. Socioeconomic inequalities in mortality in adult women

Effect (regression)	B	95% CI (L)	95% CI (U)	P-value
Illiteracy	.848 (RS= .77)	.660	1.036	.000*
GDP per Capita	-.304 (RS=.45)	-.440	-.168	.000*
Unemployment	.290 (RS=.33)	.123	.457	.001*
Overcrowding	13.06 (RS=.33)	5.468	20.647	.002*
Rural pop	.191 (RS=.39)	.095	.287	.000*
Household size	4.63 (RS=.34)	2.007	7.254	.001*
Total impact (SII)	**SII**	**LB**	**UB**	**P-value**
illiteracy	-13.8	-16.2	-11.3	9.0
GDP	-11.5	-15.4	-7.6	2.2
Unemployment	-10.8	-15.1	-6.6	1.6
Overcrowding	-8.3	-13.4	-3.2	0.0*
Rural pop	-11.1	-15.2	-7.0	7.8
Household size	-11.8	-15.6	-8.1	7.0

B= Regression coefficient; RS = the square values of R indicating the variance explained by the independent variable; CI (L) = Lower confidence interval; CI (U) = Upper confidence interval; P-value = the significance of the regression coefficient; Significant level is *5%.

The findings (Table 5.5 above) from the regression coefficients measurement (effect analysis) showed significant positive relationships between mortality in adult women and the socioeconomic factors. By increasing one unit in illiteracy, unemployment, rural population, and female mortality increased respectively by 0.84 (RS= 0.77, P< 0.000), 0.29 (RS= 0.33, P< 0.001), and 0.19 (RS= 0.39, P< 0.000) deaths/100,000 population. One unit increase in overcrowding and household size also increased mortality in women by 13.0 (RS= 0.33, P< 0.002) and 4.63 (RS= 0.34, P< 0.001) deaths/100,000 populations respectively. There was also a significant negative relationship between female mortality and GDP per capita (B= -0.30, RS= 0.45, P< 0.000); when GDP per capita increased by 1 unit, female mortality decreased by 0.3 deaths/100,000 populations across the provinces.

The results (Table 5.5 above) from the impact analysis (the SII measurement) indicated significant variation of female mortality in relation to overcrowding (SII= -8.3, P< 0.000); mortality in women in the provinces with the highest overcrowding index was 8.3 deaths/100,000 populations higher than in the provinces with the lowest number of people per room. Female mortality also varied in relation to illiteracy (SII = -13.8, P < 9), GDP per capita (SII= -11.5, P< 2.2), unemployment (SII= - 10.8, P< 1.6), rural population (SII= -11.1, P< 7.8), and household size (SII= - 11.8, P< 7); however, none of the variations was significant.

5.3.4. Results from the comparison of inequities using different mortality measures

The results (Table 5.6 below) from the comparison of the mortality measures through the relative measurements of the effect (RB) and impact (RII) analysis showed different magnitude of the relative changes and variations in the three measures of mortality in children, and adult male and female mortality.

Table 5-6. The relative inequalities of mortality in relation to socioeconomic

	Effect (RB)		Impact (RII)	
	RB	P.V (B)	RII	P.V (SII)
Mortality under-5				
Illiteracy	3.87	.000*	-49.6	2.9
GDP per capita	-1.59	.000*	-51.7	3.3
Unemployment	1.51	.000*	-33.2	0.0*
Overcrowding	88.89	.001*	-29.2	0.0*
Rural Population	0.9	.001*	-41.1	0.0*
Household Size	30.87	.000*	-45.3	9.4
Average	**21.3**	**-**	**41.7**	-
Mortality in men				
Illiteracy	1.61	.000*	-27.8	1.3
GDP per capita	-0.7	.000*	-27.6	1.7
Unemployment	0.8	.000*	-26.7	5.7
Overcrowding	28.27	.015*	-11.9	0.1
Rural Pop	0.5	.000*	-28.5	4.6
Household Size	11.63	.002*	-25.2	3.2
Average	**7.3**	**-**	**24.6**	-
Mortality in women				
illiteracy	0.7	.000*	-	9.0
GDP per capita	-0.2	.000*	-9.2	2.2
Unemployment	0.2	.001*	-8.6	1.6
Overcrowding	10.96	.002*	-6.6	0.0*
Rural Pop	0.2	.000*	-8.8	7.8
Household Size	3.77	.001*	-9.4	7.0
Average	**2.7**	**-**	**7.1**	-

RB = Relative regression coefficient; RII= relative index of inequality; * P -value is significant at 5% level.

The largest average change was related to mortality under-5 (RB= 21.3, RII= 41.7) when the socioeconomic indicators changed. Male mortality had the largest average change (RB= 7.3, RII= 24.6) in relation to the socioeconomic measures after mortality under-5. The lowest average change was related to female mortality (RB= 2.7, RII= 7.1). These results show that children have larger death inequality in relation to socioeconomic indicators than adults; and the mortality inequality is larger in men than in women across the provinces.

5.4. Results from the inequality measurement of morbidity

5.4.1. Diabetes

The results (Table 5.7 below) from the effect analysis showed a significant relationship between diabetes rates and the socioeconomic factors, except for overcrowding, across the provinces. The impact measurement also indicated significant variation in diabetes in relation to the socioeconomic indicators except in overcrowding and rural populations (Table 5.7).

Table 5-7. Socioeconomic inequalities in diabetes

Effect (regression)	**B**	**95% CI (L)**	**95% CI (U)**	**P-value**
Illiteracy	-.175 (RS=.44)	-.254	-.096	.000*
GDP per Capita	.064 (RS=.27)	.021	.106	.005*
Unemployment	-.073 (RS=.29)	-.120	-.027	.003*
Overcrowding	-2.113 (RS=.12)	-4.469	.243	.077
Rural pop	-.051 (RS=.38)	-.078	-.025	.000*
Household size	-1.158 (RS=.29)	-1.896	-.420	.003*

Total impact (SII)	**SII**	**LB**	**UB**	**P-value**
illiteracy	2.94	2.09	3.79	0.00*
GDP	2.75	1.79	3.70	0.00*
Unemployment	2.41	1.32	3.50	0.00*
Overcrowding	1.09	-0.30	2.49	0.12
Rural pop	2.47	1.40	3.54	6.38
Household size	2.49	1.43	3.55	0.00*

B = Regression coefficient; RS = the square values of R indicating the variance explained by the independent variable; CI (L) = Lower confidence interval; CI (U) = Upper confidence interval; P-value = the significance of the regression coefficient; Significant level is *5%.

Table 5.7 (above) indicates that the diabetes indicator had a significant negative relationship with illiteracy (B= -0.17, RS= 0.44, P< 0.000), unemployment (B= -0.08, RS= 0.29, P< 0.003), rural population (B= -0.05, RS= 0.38, P< 0.000), and household size (B= 1.16, RS= 0.29, P< 0.003). In fact, by one unit increase in illiteracy, unemployment, rural population, and household size indicators, the diabetes rates decreased respectively by 0.17%, 0.08%, 0.05%, and 1.16% across the provinces. There was significant positive association between diabetes and GDP per capita (B= 0.064, RS= 0.27, P< 0.005); a one unit increase in the GDP per capita increased diabetes rates by 0.06%. The results also showed a negative relationship between diabetes and the overcrowding index (B= -2.11, RS= 0.12), however, the association was not significant (P< 0.077).

Table 5.7 (above) indicates that using the impact measurement there was significant variation in the diabetes rates in relation to illiteracy (SII = 2.94, P < 0.000), GDP per capita (SII= 2.75, P< 0.000), unemployment (SII= 2.4, P< 0.000), and household size (SII= 2.49, P< 0.000). These indicate that diabetes rates in the provinces with the largest rates of illiteracy, unemployment, and household size were respectively 2.94%, 2.4%, and 2.49% lower compared to the provinces with the lowest rates of socioeconomic indicators. The prevalence of diabetes in the provinces with highest GDP per capita was 2.75% higher than in the provinces with lowest general income. The diabetes rates also varied in relation to overcrowding (SII= 1.09, P< 0.12) and rural population (SII= 2.47, P< 6.38); however the variations were not significant.

5.4.2. High blood cholesterol

The results (Table 5.8 below) from both the effect and impact measurements showed respectively significant associations and variation in high blood cholesterol in the six socioeconomic indicators.

Table 5-8. Socioeconomic inequalities in high blood cholesterol

Effect (regression)	B	95% CI (L)	95% CI (U)	P-value
Illiteracy	-.893 (RS=.37)	-1.359	-.428	.001*
GDP per Capita	.327 (RS=.23)	.084	.570	.010*
Unemployment	-.413 (RS=.29)	-.672	-.154	.003*
Overcrowding	-18.066 (RS=.27)	-.672	-.154	.003*
Rural pop	-.228 (RS=.24)	-.390	-.066	.008*
Household size	-4.591(RS= .15)	-9.086	-.096	.046*
Total impact (SII)	**SII**	**LB**	**UB**	**P-value**
illiteracy	12.54	8.40	16.68	0.00*
GDP	11.84	7.38	16.30	0.00*
Unemployment	9.55	4.26	14.83	0.00*
Overcrowding	6.39	0.38	12.39	0.04*
Rural pop	10.41	5.40	15.42	0.00*
Household size	8.20	2.57	13.84	0.01*

B = Regression coefficient; RS = the square values of R indicating the variance explained by the independent variable; CI (L) = Lower confidence interval; CI (U) = Upper confidence interval; P-value = the significance of the regression coefficient; Significant level is *5%.

The findings (Table 5.8 above) showed significant negative relationship between high blood cholesterol and illiteracy (B= -0.89, RS= 0.37, P <0.001), unemployment (B= -0.413, RS= 0.29, P< 0.003), overcrowding (B= -18.0, RS= 0.27, P < 0.003), rural population (B= -0.228, RS= 0.24, P< 0.008), and household size (B= -4.59, RS= 0.15, P< 0.046). In fact, by one unit increase in each of the illiteracy, unemployment, overcrowding, rural population, and household size indicators, high cholesterol rates decreased respectively 0.89%, 0.41%, 18.0%, 0.23%, and

4.59% across the provinces. The high cholesterol indicator had a significant positive relationship with GDP per capita (B= 0.064, RS= 0.23, P< 0.005); one unit increase in GDP per capita increased the high blood cholesterol rates by 0.33%.

The results (Table 5.8 above) from the impact measurement showed significant variation of high blood cholesterol rates in relation to illiteracy (SII= 12.54, P < 0.000), GDP per capita (SII= 11.84, P< 0.000), unemployment (SII = 9.55, P < 0.000), overcrowding (SII= 6.39, 0.04), rural population (SII= 10.41, P < 0.00), and household size (SII= 8.2, P< 0.01). In fact, the high cholesterol rates in the provinces with the highest rates of illiteracy, unemployment, overcrowding, rural population, and household size were respectively 12.5%, 9.5%, 6.4%, 10.4%, and 8.2% higher than the provinces with the lowest socioeconomic factors. High cholesterol in the provinces with highest GDP per capita was 18.8% higher than the provinces with lowest general income.

5.4.3. Low weight in children under-5

The results (Table 5-9 below) from the regression analysis (effect) showed significant relationships between low weight in children under-5 and unemployment, rural population, and household size, but non-significant relationships with illiteracy, GDP per capita, and overcrowding. Similarly, the impact analysis indicated significant variation of the low weight in children under-5 in relation to unemployment, rural population, and household size, but the variation in relation to illiteracy, GDP per capita, and overcrowding was not significant.

Table 5-9. Socioeconomic inequalities in low weight in children under-5

Effect (regression)	**B**	**95% CI (L)**	**95% CI (U)**	**P-value**
Illiteracy	.418 (RS=.11)	-.061	.897	.084
GDP per Capita	-.157 (RS=.07)	-.386	.073	.173
Unemployment	.301 (RS=.21)	.065	.537	.014*
Overcrowding	6.357 (RS=.05)	-5.390	18.103	.276
Rural pop	.171 (RS=.19)	.027	.316	.022*
Household size	4.860 (RS=.22)	1.155	8.564	.012*
Total impact (SII)	**SII**	**LB**	**UB**	**P-value**
illiteracy	-4.73	-10.01	0.55	0.08
GDP	-5.01	-10.25	0.23	0.06
Unemployment	-6.28	-11.29	-1.27	0.02*
Overcrowding	-2.42	-7.95	3.11	0.38
Rural pop	-6.11	-11.15	-1.06	0.02*
Household size	-6.94	-11.81	-2.07	0.01*

B = Regression coefficient; RS = the square values of R indicating the variance explained by the independent variable; CI (L) = Lower confidence interval; CI (U) = Upper confidence interval; P-value = the significance of the regression coefficient; Significant level is *5%.

The results (Table 5.9 above) from the regression measurement showed a significant positive association between rates of low weight in children under-5 and unemployment (B= 0.30, RS= 0.21, P< 0.014), rural population (B= 0.17, RS= 0.19, P< 0.022), and house hold size (B= 4.86, RS= 0.22, P< 0.012). This result indicates that when unemployment, rural population, and household size indicators increased by one unit, the rate of low weight in children under-5 increased respectively by 0.3%, 0.17%, and 4.8% across the provinces. Low weight in children had positive relationships with illiteracy (B= 0.418, RS= 0.11, P< 0.084) and overcrowding (B= 6.35, RS= 0.05, P< 0.276), and a negative association with GDP per capita (B= -0.157, RS= 0.07, P< 0.173); but the relationships were not significant.

The results (Table 5.9 above) from the impact measurement indicated large variation in rates of low weight in children under-5 in relation to unemployment (SII= -6.28, P< 0.02), rural population (SII= -6.11, P< 0.02), and household size (SII= -6.94, P< 0.01). This implies that in the provinces with highest indicators of unemployment, rural population, and household size, children's low weight rates were respectively 6.2%, 6.1%, and 6.9% larger compared to provinces with the lowest rates of the socioeconomic indicators. The low weight indicator also varied positively in relation to illiteracy (SII= -4.73, P< 0.08) and overcrowding (SII= -2.42, P< 0.38), and negatively in relation to GDP per capita (SII= -5.0, P< 0.06); however, none of the variations was significant.

5.4.4. Hypertension

The results (Table 5.10 below) from the regression measurement indicated that among the socioeconomic indicators only household size had a significant relationship with the hypertension rates across the provinces. Based on the SII measurement, hypertension had significant variation in association with GDP per capita, rural population, and household size.

Table 5-10. Socioeconomic inequalities in hypertension

Effect (regression)	**B**	**95% CI (L)**	**95% CI (U)**	**P-value**
Illiteracy	-.167 (RS=.05)	-.472	.138	.271
GDP per Capita	.145 (RS=.16)	.011	.280	3.53
Unemployment	-.086 (RS=.05)	-.246	.073	.276
Overcrowding	-2.702 (RS=.02)	-10.022	4.619	.455
Rural pop	-.045 (RS=.03)	-.142	.053	.354
Household size	-3.170 (RS=.26)	-5.411	-.929	.007*
Total impact (SII)	**SII**	**LB**	**UB**	**P-value**
illiteracy	2.13	-1.03	5.28	0.18
GDP	3.59	0.67	6.52	0.02*
Unemployment	2.76	-0.31	5.83	0.08
Overcrowding	1.06	-2.18	4.29	0.51
Rural pop	3.01	-0.02	6.04	0.05*
Household size	5.24	2.75	7.73	0.00*

B = Regression coefficient; RS = the square values of R indicating the variance explained by the independent variable; CI (L) = Lower confidence interval; CI (U) = Upper confidence interval; P-value = the significance of the regression coefficient; Significant level is *5%.

Based on the regression measurement (Table 5.10 above), there was significant negative association between hypertension rates and household size (B= -3.17, RS= 0.22, P< 0.007). In fact, hypertension rates across the provinces increased around 3.2% when the household size decreased by one unit. Hypertension rates also had negative relationships with illiteracy (B= -0.167, RS= 0.05, P< 0.271), unemployment (B = -0.86, RS= 0.05, P< 0.276), overcrowding (B = -2.7, RS= 0.02, P< 0.455), rural population (B= -0.045, RS= 0.03, P< 0.354), and a positive association with GDP per capita (B= 0.145, RS= 0.16, P< 3.5); but the association was not significant in all the cases.

Based on the results from the impact measurements, there was significant negative variation of the hypertension indicator in relation to the rural population (SII= 3.0, P< 0.05) and household size (SII= 5.24, P< 0.00). This shows that the provinces with the highest rates of rural population and those with larger household size had respectively 3.0% and 5.2% lower prevalence of hypertension compared to respectively the provinces with the lowest number of rural population and smaller household size. There was also variation of hypertension with illiteracy (SII= 2.13, P< 0.18), unemployment (SII= 2.76, P< 0.08), and overcrowding (SII= 1.06, P< 0.51); but none of the variations were significant.

5.4.5. Depression

The results (Table 5-11 below) from the effect analysis indicated relationships between rates of depression and the socioeconomic indicators except for GDP per capita; however, none of the relationships were significant. There was variation of the depression rates in association with the socioeconomic factors, but in all the cases variations were non-significant.

Table 5-11. Socioeconomic inequalities in depression

Effect (regression)	B	95% CI (L)	95% CI (U)	P-value
Illiteracy	-.104 (RS=.00)	-1.016	.807	.816
GDP per Capita	.000 (RS=.00)	-.429	.428	.997
Unemployment	-.168 (RS=.02)	-.640	.304	.471
Overcrowding	-7.893 (RS= .02)	-29.274	13.489	.455
Rural pop	.074 (RS=.01)	-.213	.360	.603
Household size	.650 (RS=.00)	-6.880	8.181	.860
Total impact (SII)	**SII**	**LB**	**UB**	**P-value**
illiteracy	-2.83	-11.73	6.08	0.52
GDP	-1.16	-10.13	7.80	0.79
Unemployment	-2.95	-11.85	5.94	0.50
Overcrowding	-1.84	-10.78	7.11	0.68
Rural pop	-0.47	-9.44	8.51	0.92
Household size	-4.28	-13.09	4.53	0.33

B = Regression coefficient; RS = the square values of R indicating the variance explained by the independent variable; CI (L) = Lower confidence interval; CI (U) = Upper confidence interval; P-value = the significance of the regression coefficient; Significant level is *5%.

The effect analysis (Table 5.11) showed negative relationships between depression and illiteracy (B= -0.104, RS= 0.00, P< 0.816), unemployment (B= -0.168, RS= 0.02, P< 0.471), and overcrowding (B= -7.89, RS=0.02, P< 0.455). Depression had also positive relationships with rural population (B= 0.074, RS= 0.03, P< 0.603) and household size (B= 0.650, RS= 0.00, P< 0.860). However, none of the relationships were significant. There were no associations between depression rates and GDP per capita (B= 0.000, RS= 0.00, P< 0.997) across the provinces.

The results (Table 5.11) from the impact analysis also showed variation of depression in relation to illiteracy (B= -2.83, P< 0.52), GDP per capita (B= -1.16, P < 0.79), unemployment (B= -2.95, P< 0.50), overcrowding (B= -1.84, P< 0.68), rural population (B= -0.47, P< 0.92), and household size (B= -4.28, P < 0.33). However, none of the inequalities were significant.

5.5. Socioeconomic inequalities in health care utilisation

5.5.1. Hospital delivery

The results (Table 5-12 below) from both the regression analysis (effect) and SII measurement (impact) showed significant relationships between hospital delivery and all the socioeconomic indicators.

Table 5-12. Socioeconomic inequalities in hospital delivery

Effect (regression)	**B**	**95% CI (L)**	**95% CI (U)**	**P-value**
Illiteracy	-2.403 (RS=.50)	-3.363	-1.444	.000*
GDP per Capita	.861 (RS=.29)	.324	1.399	.003*
Unemployment	-.877 (RS=.25)	-1.496	-.259	.007*
Overcrowding	-42.400 (RS=.28)	-69.799	-15.000	.004*
Rural pop	-.710 (RS=.44)	-1.032	-.388	.000*
Household size	-19.681(RS=.50)	-27.667	-11.696	.000*
Total impact (SII)	**SII**	**LB**	**UB**	**P-value**
illiteracy	29.507	18.344	40.671	0.000*
GDP	27.481	15.507	39.456	0.000*
Unemployment	21.623	7.834	35.412	0.003*
Overcrowding	19.78	5.55	34.02	0.010*
Rural pop	27.324	15.291	39.356	0.000*
Household size	31.599	21.408	41.789	0.000*

B = Regression coefficient; RS = the square values of R indicating the variance explained by the independent variable; CI (L) = Lower confidence interval; CI (U) = Upper confidence interval; P-value = the significance of the regression coefficient; Significant level is *5%.

Based on the effect analysis, there were (Table 5-12 above) significant inverse relationships between hospital delivery and illiteracy (B= -2.4, RS= 0.50, P< 0.000), unemployment (B= -0.877, RS= 0.25, P< 0.007), overcrowding (B= -42.4, RS= 0.28, P< 0.004), rural population (B = -0.710, RS= 0.44, P< 0.000), and household size (B= -19.68, RS= 0.50, P< 0.000). Giving birth in hospital decreased respectively 2.4%, 0.87%, 42.4%, 0.71%, and 19.6% when there was an increase of 1 unit respectively in the illiteracy, unemployment, overcrowding, rural population, and household size. Hospital delivery had a significant positive association with GDP per capita (B= 0.861, RS= 0.29, P< 0.003); the hospital delivery increased 0.86% when GDP per capita increased by 1 unit.

The results (Table 5.12 above) from the SII analysis showed significant inverse variation of hospital delivery in relation to illiteracy (SII= 29.5, P< 0.000), unemployment (SII= 21.6, P< 0.000) overcrowding (SII= 19.7, P< 0.010), rural population (SII= 27.3, P< 0.000), and household size (SII= 31.6, P< 0.000). In fact, giving birth in hospital in the provinces with the largest rates of illiteracy, unemployment, rural population, overcrowding index, and household size was respectively 29.5%, 21.6%, 19.7%, 27.3%, and 31.6% lower in than the provinces with the smallest scores of the socioeconomic indicators. Hospital delivery varied significantly in direct association with GDP per capita (SII= 27.48, P< 0.000); giving birth in hospital was around 27.5% higher in the provinces with the largest income than in the provinces with the lowest income per capita.

5.5.2. Vaccination under-1

Results from the regression analysis (Table 5.13 below) showed significant relationship between the vaccination under-1 and the socioeconomic indicators except for GDP per capita across the provinces. The SII measurement (impact analysis) indicated significant variation of the vaccination rates in association with illiteracy, unemployment, overcrowding, and household size, but non-significant variation in relation to GDP per capita and rural population.

Table 5-13. Socioeconomic inequalities in vaccination under-1

Effect (regression)	B	95% CI (L)	95% CI (U)	P-value
Illiteracy	-.977 (RS=.35)	-1.509	-.445	.001*
GDP per Capita	.202 (RS=.07)	-.098	.502	.178
Unemployment	-.449 (RS=.27)	-.744	-.155	.004*
Overcrowding	-21.746 RS=.31)	-34.743	-8.749	.002*
Rural pop	-.209 (RS=.16)	-.400	-.018	.033*
Household size	-6.963 (RS=.26)	-11.652	-2.275	.005*
Total impact (SII)	**SII**	**LB**	**UB**	**P-value**
illiteracy	7.796	1.250	14.342	.021*
GDP per capita	2.946	-4.217	10.110	.406
Unemployment	6.963	0.267	13.660	.042*
Overcrowding	11.219	5.538	16.900	.000*
Rural pop	3.658	-3.452	10.768	.300
Household size	8.642	2.271	15.013	.010*

B = Regression coefficient; RS = the square values of R indicating the variance explained by the independent variable; CI (L) = Lower confidence interval; CI (U) = Upper confidence interval; P-value = the significance of the regression coefficient; Significant level is *5%.

Results from the effect analysis (Table 5.13 above) showed significant inverse relationships between vaccination under-1 and illiteracy (B= -0.977, RS= 0.35, P< 0.001), unemployment (B= -0.449, RS= 0.27, P< 0.004), overcrowding (B= -21.7, RS= 0.31, P< 0.00), rural population (B= -0.209, RS= 0.16, P< 0.033), and household size (B= -6.96, RS= 0.26, P< 0.005). Immunization rates decreased respectively by 0.98%, 0.45%, 21.7%, 0.2%, and 6.9%, when illiteracy, unemployment, overcrowding, rural population, and household size increased one unit respectively. There was a positive relationship between the vaccination rate and GDP per capita (B= 0.202, RS= 0.07), however, the association was not significant (P< 0.178).

The impact analysis (Table 5.13 above) indicated significant inverse variation of vaccination in relation to illiteracy (SII= 7.79, P< 0.021), unemployment (SII= 6.96, P< 0.042), overcrowding (SII= 11.21, P< 0.00), and household size (SII= 8.64, P< 0.010). In fact, immunization rates in the provinces with respectively the highest illiteracy, unemployment, overcrowding, and household size were respectively 7.8%, 6.9%, 11.2%, and 8.6% lower than in the provinces with the lowest magnitude of the socioeconomic factors. There was also variation of the vaccination indicator in association with GDP per capita (SII= 2.94, P< 0.406), and rural population (SII= 3.65, P< 0.30); however, the variations were not significant.

5.5.3. Antenatal care

The regression analysis (Table 5.14 below) showed that antenatal care had significant association with illiteracy and overcrowding, but non-significant association with GDP per capita, unemployment, rural population, and household size. The SII measurement showed significant variation of antenatal care only in relation to overcrowding, but the variation was not significant in association with the other socioeconomic indicators.

Table 5-14. Socioeconomic inequalities in antenatal care

Effect (regression)	B	95% CI (L)	95% CI (U)	P-value
Illiteracy	-1.14 (RS=.18)	-2.121	-.156	.025*
GDP per Capita	.261 (RS=.04)	-.237	.759	.291
Unemployment	-.327 (RS=.05)	-.878	.224	.234
Overcrowding	-23.52 (RS=.15)	-47.390	.343	.053
Rural pop	-.155 (RS=.03)	-.492	.181	.352
Household size	-6.362 (RS=.08)	-14.94	2.214	.139
Total impact (SII)	**SII**	**LB**	**UB**	**P-value**
Illiteracy	8.532	-2.835	19.898	0.135
GDP per capita	4.943	-6.764	16.650	0.393
Unemployment	0.597	-11.276	12.470	0.918
Overcrowding	12.576	1.836	23.315	0.023*
Rural pop	3.544	-8.246	15.333	0.542
Household size	8.592	-2.768	19.951	0.132

B = Regression coefficient; RS = the square values of R indicating the variance explained by the independent variable; CI (L) = Lower confidence interval; CI (U) = Upper confidence interval; P-value = the significance of the regression coefficient; Significant level is *5%.

Based on the effect analysis (Table 5.14 above), there were significant negative relationships between antenatal care and illiteracy (B= -1.14, RS= 0.18, P< 0.025) and overcrowding (B= -23.5, RS= 0.15, P< 0.053). Antenatal care increased respectively 1.14% and 23.5% when there was an increase of 1% in illiteracy and overcrowding increased by one unit. There were also negative relationships between antenatal care and unemployment (B= -0.327, RS= 0.05, P< 0.234), rural population (B= -0.155, RS= 0.03, P< 0.352), and household size (B= -6.36, RS= 0.08, P< 0.139); but none of the associations were significant. The relationship between antenatal care and GDP per capita (B= 0.261, RS= 0.04) was positive but non-significant (P< 0.291).

The results from the impact analysis (Table 5.14 above) showed significant inversed variation of antenatal care in association with the overcrowding index (SII= 12.57, P< 0.023). In fact, in the provinces with the largest overcrowding index, antenatal care was around 12.6% lower than in the provinces with the smallest overcrowding index. Antenatal care also varied in relation with illiteracy (SII= 8.53, P< 0.135), GDP per capita (SII= 4.94, P< 0.393), unemployment (SII= 0.597, P< 0.918), rural population (SII= 3.54, P< 0.542), and household size (SII= 8.59, P< 0.132); however, in the all cases the variation was not significant.

5.5.4. Modern contraceptive utilization

The results (Table 5-15 below) from the regression analysis showed relationships between the use of modern contraceptive and the socioeconomic factors. The impact analysis also indicated variation of the use of modern contraceptives in relation to socioeconomic factors. However, all the relationships and variations in both the effect and impact measurements were not significant.

Table 5-15. Socioeconomic inequalities in the use of modern contraceptive

Effect (regression)	**B**	**95% CI (L)**	**95% CI (U)**	**P-value**
Illiteracy	.380 (RS=.03)	-.476	1.236	.370
GDP per Capita	-.202 (RS=.04)	-.602	.198	.310
Unemployment	.136 (RS=.02)	-.315	.587	.540
Overcrowding	3.414 (RS=.00)	-17.133	23.961	.735
Rural pop	.047 (RS=.00)	-.227	.321	.726
Household size	1.446 (RS=00)	-5.709	8.600	.681

Total impact (SII)	**SII**	**LB**	**UB**	**P-value**
Illiteracy	-5.133	-13.905	3.639	0.240
GDP	-3.704	-12.592	5.184	0.399
Unemployment	-3.436	-12.341	5.470	0.435
Overcrowding	-4.059	-12.922	4.804	0.355
Rural pop	0.858	-8.148	9.864	0.846
Household size	-4.248	-13.097	4.601	0.333

B = Regression coefficient; RS = the square values of R indicating the variance explained by the independent variable; CI (L) = Lower confidence interval; CI (U) = Upper confidence interval; P-value = the significance of the regression coefficient; Significant level is *5%.

There were positive but non-significant relationships (Table 5.15 above) between the use of contraceptive and illiteracy (B= 0.380, RS= 0.03, P< 0.370), unemployment (B= 0.136, RS=0.02, P< 0.310), overcrowding (B= 3.41, RS= 0.00, P< 0.735), rural population (B= 0.047, RS= 0.00, P< 0.726), and household size (B= 1.44, RS= 0.00, P< 0.681); and also a negative non-significant relationship with GDP per capita (B= -0.202, RS= 0.04, P< 0.310).

The SII measurement also indicated variation in the use of modern contraceptive with illiteracy (SII= -5.133, P< 0.240), GDP (SII= -3.704, P< 0.339), unemployment (SII= -3.436, P< 0.435), overcrowding (SII= -4.059, P< 0.355), rural population (SII= 0.858, P< 0.826), and household size (SII= -4.248, P< 0.333), but none of the variations were significant (Table 5.15 above).

5.6. Results from the multiple regression of the health indicators against the socioeconomic variables

5.6.1. Mortality

The results (Table 5.16) from the multiple regression between mortality under-5 and the six socioeconomic variables indicated that the illiteracy rate describes 39.2% variance of the mortality under-5 (R= 0.626, RS= 0.392, P< 0.011), which is the largest among the all socioeconomic variables. The household size described 12.1% variance of the under-5 mortality rate (R= 0.348, RS= 0.121, P< 0.065), which is the largest after illiteracy; however, the contribution was not significant.

The unemployment rate explained the largest variance (20%) of the mortality in men in the provinces (R= 0.448, RS= 0.201, P< 0.030). Rural population describes 11.6% variance of the male mortality (R= 0.341, RS= 0.116, P< 0.115), which is the largest after unemployment but is not significant. The illiteracy rate also described 73.3% of the mortality rate in women, which is the largest among the socioeconomic variables (R= 0.856, RS= 0.733, P< 0.001) and included the largest contribution to the female mortality.

Table 5-16. Contribution of socioeconomic factors in mortality

Model	B	RS	Beta	P-value
Mortality under-5				
Illiteracy	0.993	0.39	0.626	0.011
GDP per Capita	-0.068	0.01	-0.091	0.613
Unemployment	0.1	0.01	0.12	0.468
Overcrowding	-6.374	0.03	-0.17	0.417
Rural population	-0.031	0.00	-0.061	0.731
Household size	4.561	0.12	0.348	0.065
Mortality in men				
Illiteracy	0.832	0.04	0.194	0.471
GDP per Capita	-0.077	0.00	-0.038	0.857
Unemployment	1.003	0.20	0.448	0.03*
Overcrowding	-7.6	0.01	-0.075	0.76
Rural Pop.	0.462	0.17	0.341	0.115
Household size	0.567	0.00	0.016	0.94
Mortality in women				
Illiteracy	0.828	0.73	0.856	0.001*
GDP per Capita	0.044	0.01	0.097	0.58
Unemployment	0.028	0.00	0.056	0.729
Overcrowding	-0.759	0.00	-0.033	0.869
Rural population	0.011	0.00	0.035	0.838
Household size	0.82	0.01	0.103	0.561

B = Regression coefficient; Beta (R) = correlation coefficient between the dependent and independent variables; RS = the square values of R indicating the variance explained by the independent variable; P-value= the significance of the regression coefficient; Significant level is *5%.

5.6.2. Morbidity

The results (Table 5.17 below) from the multiple regression analysis indicated that among the socioeconomic variables, household size explained the largest variance (79.2%) of hypertension (R= -0.890, RS= 0.792, P< 0.003). After household size, the measure of overcrowding explains the highest (37.1%) variance of the hypertension variable (R= 0.609, RS= 0.371), however, it was not significant (P< 0.062). The overcrowding index described the largest variance (20%) of the high blood cholesterol rate, but it was not significant (P< 0.151).

Table 5-17. Multiple regression on morbidity indicators

Model	**B**	**RS**	**Beta**	**P-value**
Hypertension				
Illiteracy over	0.025	0.00	0.033	0.924
GDP per Capita	0.187	0.26	0.514	0.069
Unemployment	0.039	0.01	0.097	0.698
Overcrowding	11.183	0.37	0.609	0.062
Rural population	0.086	0.12	0.351	0.201
Household size	-5.699	0.79	-0.890	0.003*
Diabetes				
Illiteracy over	-0.158	0.36	-0.601	0.060
GDP per capita	-0.017	0.02	-0.137	0.574
Unemployment	-0.035	0.07	-0.255	0.259
Overcrowding	2.364	0.14	0.380	0.183
Rural population	-0.01	0.01	-0.119	0.621
Household size-	-0.657	0.09	-0.303	0.223

B = Regression coefficient; Beta (R) = correlation coefficient between the dependent and independent variables; RS = the square values of R indicating the variance explained by the independent variable; P-value = the significance of the regression coefficient; Significant level is *5%.

The illiteracy variable explained the largest variance (36.1%) of diabetes (R= -0.601, RS= 0.361, P< 0.060). Household size described 17.6% variance of the low weight in children under-5 (R= 0.420, RS= 0.176, P< 0.171); however none of the explained variations were significant.

5.6.3. Predictor of health care utilization

Household size (Table 5.18) described 22.2% variance of hospital delivery (R= - 0.471), which was the largest among the socioeconomic variables (P< 0.030). After household size, the illiteracy rate (RS= 0.162) and rural population (RS= 0.116) describe respectively 16.2% and 11.6% variance of hospital delivery, but the correlations were not significant (P< 0.126, P< 0.101). The illiteracy measure and GDP per capita explain respectively 46.6% (R= -0.683, P< 0.013) and 45.6% (R= -0.675, P< 0.009) variance of the vaccination variable. Illiteracy describes the largest variance (43.4%) of antenatal care, however it is not significant (P< 0.114).

Table 5-18. Contribution of socioeconomic indicators to the hospital delivery rare

Model	B	RS	Beta (R)	P-value
Hospital delivery				
Illiteracy rate	-1.362	0.16	-0.403	0.126
GDP per Capita	-0.326	0.04	-0.205	0.317
Unemployment	0.263	0.02	0.149	0.427
Overcrowding	-6.245	0.01	-0.078	0.74
Rural population	-0.365	0.12	-0.341	0.101
Household size	-13.163	0.22	-0.471	0.03*
Vaccination under-1				
Illiteracy rate	-1.122	0.47	-0.683	0.031
GDP per Capita	-0.52	0.46	-0.675	0.009
Unemployment	-0.146	0.03	-0.17	0.439
Overcrowding	-10.087	0.07	-0.259	0.35
Rural population	-0.083	0.03	-0.16	0.5
Household size	-1.603	0.01	-0.118	0.623

B = Regression coefficient; Beta (R) = correlation coefficient between the dependent and independent variables; RS = the square values of R indicating the variance explained by the independent variable; P-value = the significance of the regression coefficient; Significant level is *5%.

5.7. Discussion

5.7.1. Socioeconomic inequalities in the premature mortality

The findings indicated significant relationships between the three premature death indicators of mortality under-5 and mortality in adult men and women and all the socioeconomic indicators in across the provinces. Illiteracy was shown to be the strongest predictor of mortality in children and of female mortality; and unemployment was the strongest predictor of male mortality across the provinces.

5.7.1.1. Premature mortality (mortality in children, male, female)

The relationship between premature mortality (mortality in children, adult males and females) and education found in this study is consistent with the literature. Hosseinpoor et al., (2006) found that mother's education had a contribution of around 21% to infant mortality in Iran. Similarly, Sastry (2004) found substantial associations between the mother's education and under-five mortality in a 21 year longitudinal study in the state of São Paulo, Brazil. Halldrsson et al, (2000), found substantial inequalities of mortality in younger children and adolescents in relation to education, occupation, and family income in Nordic countries. The study by Oloo (2005) in developing countries also revealed a negative relationship between the socioeconomic status, in particular literacy, and mortality rate in children under-five. Abuqamar, et al., (2011) stated that infant mortality had an inverse relationship with literacy in the Arab countries. The findings by Kateja (2007) indicated an inverse association between female literacy and infant and maternal mortality. In a study on 70 countries that participated in the World Health Survey,Samir and Lentzner (2010)found that an increase in formal education was related to lower levels of death in both younger and older adults.

The findings of this study showed strong association between premature mortality and GDP per capita or general income. The findings by Houweling et al., (2005) from 43 developing countries indicated a higher number of deaths in children under-5 in the countries with lower gross domestic product (GDP) than those with higher general income. Wamala et al., (2006), in a study on 52 countries mainly from western and sub-Saharan Africa countries, also indicated a large inequality in both child and adult mortality in relation to socioeconomic status including income. Hosseinpoor et al., (2006) stated that household income contributed the largest share (36.2%) to the inequality in infant mortality in Iran. Similarly, Blakely et al. (2003) found that mortality was twice as high in children living in households with the lowest level of education and income. However, Danny et al., (2007) stated that income inequality was a significant predictor of infant mortality but this relation was weaker in children aged 2-14 years and disappeared in the population aged above 65 years; which is considered as working age. They argued that most studies have shown the highest influence of income inequality on mortality in people aged 15-64 years. In general, the role of income in premature mortality is not simple, as it is measured in different ways and at different individual, household, and population levels; and the effect of income on mortality may be different at different ages.

The findings of this study showed a significant relationship between unemployment and mortality in children and male and female mortality. In addition, unemployment was shown to be the strongest predictor of mortality in men across the provinces. However, there is conflict on the impact of unemployment on mortality rates in the literature. A large body of research has shown that unemployment is associated with higher risk of mortality. Tukiendorf et al., (2007) indicated that infant mortality was strongly related to unemployment. Phil et al., (2006) found that overall mortality in children in England and Wales reduced over the past two decades, except in families that have been in long-term unemployment. Gerdtham and Johannesson (2003) stated that unemployment significantly increases the risk of suicides and the risk of dying from “other diseases” (all diseases except cancer and cardiovascular) by nearly 50%. Martikainen and Valkonen (1996) also found a relationship between unemployment and higher mortality in re-employed and unemployed with a larger relationship with the latter. In a study in Japan Yamasaki et al., (2008) indicated that unemployment was significantly related to the age-adjusted mortality in both males and females.

On the other hand, Jin et al (1995) found a direct association between unemployment and rates of overall mortality and morbidity due to cardiovascular disease and suicide; but they emphasized that the causal relationship would not be considered straightforward because of existing likely mediating and confounding factors. A study in India showed that mortality in infants and young children was lower in the families with the lower rates of unemployed mothers (Kishor and Parasuraman 1998). Martikainen et al. (2007) stated that the effects of unemployment on mortality are modest and individual-level studies may thus overestimate the causal effects of unemployment on mortality because of confounding factors. Ariizumi,(2010) found that unemployment had higher impact on subjective rather than objective health status; reporting that poor health increased by 1.17% in the unemployed population when it was measured based on subjective measures (self-reported health), while it decreased by 0.1% when measured by objective indicators. The evidence across the EU indicates that the sensitivity of populations to mortality at the time of economic crises was substantially varied, depending partly on level of social protection (Wahlbeck and Mareike 2009). However, research showed that the above biases are not entirely satisfactory, supporting the adverse effect of unemployment on health (Heinrich and Scholz 2009).

This study showed significant associations between the premature mortality measures and overcrowdingacross the provinces. The relationship between overcrowding and mortality has been indicated in other studies but the evidence is limited (Office of the Deputy Prime Minister 2004). A study in Scotland in 1980s showed a strong relationship between the incidence of stillbirth, deaths and overcrowded housing conditions (Harker 2006). Findings of the study by Antunes and Waldman (2001) on the distribution of mortality-related to tuberculosis in Sao Paulo, Brazil, from 1994 to 1998, showed a significant relationship between household overcrowding and TB deaths. Cage and Foster (Cage and Foster 2002) in a study in Glasgow and Edinburgh found a significant relationship between infant mortality and overcrowding (Cage and Foster 2002). Household overcrowding has been shown to have a strong independent relationship with female mortality, irrespective of housing tenure (Fox and Goldblatt, 1982, cited by the Office of the Deputy Prime Minister, 2004). The SMR was much higher in women who lived in houses with 1.5 persons per room or more than those who lived at a density of less than 0.75 persons per room. Generally, evidence indicates an association between overcrowding and mortality, however, the evidence is limited.

There was also a strong relationship between living in a rural area and mortality in children, and in adult males and females. These findings are consistent with the literature. Hosseinpoor et al., (2006) indicated that living in rural areas would contribute around 14% in the inequality in infant mortality across the provinces of Iran, confirming the finding of this study. A study in China on older adult mortality using 15 years of mortality data from the China Health and Nutrition Survey indicated that death rates in the rural areas were 30% higher than in urban areas (Zimmer et al., 2007). Lahey et al., (2007) found that, after controlling for confounding factors, overall mortality and mortality due to HIV were higher in rural areas compared to urban areas and patients with HIV who lived in rural areas had higher mortality rates than urban patients with HIV. Abrams et al. (2011) showed that mortality due to chronic pulmonary disease was higher in rural areas than in cities in the USA. Palacio-Mejia et al. (2003) found that cervical cancer mortality was significantly related to living in rural areas. Similarly, Coory and Badde (2005) showed that deaths due to prostate cancer were significantly higher in rural areas compared to urban areas. Overall, despite the differences in the definition and nature of rural areas in different regions and countries, all the studies have evidenced a strong association between premature mortality and living in rural areas.

The findings of this study also indicated that premature mortality was significantly related to household size. The relationship between household size and mortality in children has been also shown in other studies; however, the relationship is not simple. Manun'ebo et al,

(1994) found a positive association between the children's death due to diarrhea and household size in sub-Saharan Africa. Salih Mahfouz et al., (2009) stated that family size had significant effect on infant and under-five mortality in Malakal town, Southern Sudan. Burstrom, et al (1999) found a significant direct relationship between the risk of overall death and large household size controlling for other risk factors in Stockholm. The results from a study by Wong et al., (2001) in Wales and England indicated that household size was strongly related to the rates of mortality due to myocardial infarction in the age group 45-54.9 years that were associated with chronic infection.

On the other hand, some researchers have found mixed results. For instance, Mahadevan et al. (1985) found that household size was negatively correlated with child mortality among Harijans, but not with other groups in a district in the south-central region of India. Bawah (2001) suggested a non-linear relationship between child survival and household size, stating that children who lived in very large households were experienced lower mortality than those in medium-size households. Finally, the findings by Ogbe (2010) in the Delta State, Nigeria, indicated that household size was not predictive of maternal or child mortality. Despite the inconsistent and contradictory findings, most research has supported the association between the premature mortality and household size.

5.7.1.2. Comparison of mortality inequalities in the age-gender groups

The finding of study showed that the socioeconomic factors can differently influence mortality in age and gender groups. Inequalities in child mortality were larger than inequalities in adult mortality and those in male mortality were larger than those in female mortality (Table 5.6). This implies that the effect of the socioeconomic factors on children's health is larger than on adult health; and men's health is more affected by the social factors than women's.

The higher influence of socioeconomic status on male mortality than mortality in females has been shown in many studies; however, the differences are not the same in all cases. Saurel-Cubizolles et al., (2009) showed that educational inequalities in the all-cause mortality as well as mortality due to cancer, accident and suicide were larger in men than women. Mackenbach et al., (1999) in a study on Nordic countries indicated that women with different levels of education had smaller rates of death than men with both high and low levels of education. The results from the study by McDonough et al., (1999) revealed that income inequality in mortality was larger among men than women. Duthé and Pison, (2008) in a study on the rural population in Mlomp, Senegal, monitored for twenty years, indicated that mortality in men ages 15-60 was much higher than the female mortality. However, Wamala et al., (2006) in a study in New Zealand found that absolute inequalities in mortality on average over the 1980s and 1990s for both men and women by education were similar in Sweden and New Zealand.

5.7.2. Socioeconomic inequalities in morbidity

The results of this study showed associations between morbidity and socioeconomic status; however, the relationships were different for different morbidity indicators. The coronary risk factors of diabetes, high blood cholesterol, and hypertension (only with household size) had significant inverse association with lower socioeconomic factors. There was direct association between child malnutrition (low weight in children) and lower socioeconomic status. We did not find any significant relationship between depression and socioeconomic factors in this study.

5.7.2.1. Inequities in coronary risk factors' inequities

The study findings indicated significant inverse associations between coronary risk factor indicators and low socioeconomic status. These results are consistent with findings from some other studies, in particular from developing countries. However, in many cases the findings contradict the results from the global studies and those from developed countries.

The significant inverse association between coronary risk factors of diabetes, high cholesterol, and hypertension with lower socioeconomic status found in this study is consistent with findings from some other studies, in particular from middle-income countries. A study by the Ministry of Health (2010)in Iran showed that diabetes rates in the rural population of the provinces with higher literacy rates, such as Semnan (4.28%), Esfahan (3.8%), and Mazanderan (4.7%), were higher than in the provinces with lower educated people such as Sistan & Baluchestan (1.5%), Lorestan (1.7%), Kurdestan (0.73%). Singh et al., (1998) indicated that the prevalence of diabetes in urban north India was higher than for rural subjects in the same ethnic group, suggesting that sedentary lifestyle was a risk factor of diabetes. Yang et al., (2010), in a study on a population aged 20 years and older from 14 provinces and municipalities in China, found that the prevalence of diabetes was higher among urban residents than in rural dwellers (11.4% vs. 8.2%). However, Bays et al., (2007) indicated that smaller household size was independently related to a higher likelihood of type 2 of diabetes which may be because of differences in factors such as diet, lifestyle habits, access to medical and/or diabetes care and limited family support.

Significant socioeconomic inequalities in hypercholesterolemia have been also demonstrated in the international literature. Based on the WHO Region of Europe, around 54% of Europeans and 48% of Americas have high cholesterol; while the figure for the African and South East Asian countries is respectively 22.6% and 29.0% (Global Health Observatory 2008). This may indicate a direct relationship between the socioeconomic status and the higher prevalence of hypercholesterolemia, confirming the finding of this study. The finding is also consistent with the information from the Ministry of Health (2010), indicating higher levels of blood cholesterol in the provinces with lower illiteracy rates such as Mazanderan (214 mg/dl), Yazd (208 mg/dl), and Tehran (204 mg/dl) compared to the provinces with lower levels of blood cholesterol like Hamedan (183 mg/dl), Kurdestan (191 mg), and Lorestan (201 mg/dl). Yu et al., (2002) also showed that high cholesterol was directly associated with occupation, education, and income, in particular in men.

However**,** in many cases, findings from the global studies and research from developed countries would contradict the findings of this study. For example, in the report 'Closing the gap in a generation', Marmot et al., (2008)stated that 80% of people with diabetes were living in low- and middle income countries. In a study by Larrinaga et al., (2005) using data from the Canadian National Diabetes Surveillance System and the 2001 Canadian Census respectively, it was revealed that low income was related to higher prevalence of diabetes. From a survey conducted among 61 general practitioners (GPs) on people older than 24 years. Rabi et al., (2006)found that, despite the greater use of health services, the prevalence of known Type 2 diabetes was higher in patients of lower socio-economic status especially among women of lower socio-economic status. Marty et al., (2005) found that higher prevalence of Type 2 diabetes was related to lower education, income, and occupation; in particular low educational attainment was a significant predictor of incident Type 2 diabetes. In a study on 395 diabetes patients at a U.S. public hospital, Schilling et al., (2006) found that literacy would mediate the association between education and glycolic control in a low-income population involved in diabetes. Chaturvedi et al., (1996) found that better educated men and women with diabetes had healthier lifestyles.

The inverse association between high blood cholesterol and unemployment in this study contradicts findings from other studies. In a review study in Canada on 46 studies in the 1980s and 90s, it was found that unemployment was associated with high blood pressure and elevated cholesterol and triglycerides; community disruption, greater behavioural risks, and stress were considered as the possible mechanisms for this (Trades Union Congress

2010). Mattiasson et al., (1990) found that unemployment at area-level was related to the higher glycosylated haemoglobin, triglycerides, and total cholesterol with grater association for women than men.

Based on the findings of this study, hypertension had a strong inverse association with household size, but non-significant associations with the other socioeconomic factors. Smaller household size was the significant predictor of high blood pressure across the provinces. Larger family size was associated with lower blood pressure rates in the provinces. However, the literature shows that the impact of socioeconomic status on hypertension is complicated and unclear and in some cases contradictory. In a review study in Canada on 46 studies in the 1980s and 90s, it was found that household size was associated with high blood pressure (Jin et al., 1995). Fernald and Adler (2008) in a study in Mexico found that the women in the low-income rural population were more likely to have higher blood pressure than those with the higher economic status. Vargas et al., (2000) found a significant independent association between education and hypertension incidence among younger but not older non-Hispanic White men and women. Grotto et al., (2008) stated that low socioeconomic status was related to higher blood pressure. They described association between high blood pressure and education, occupation, urban or rural dwelling as well as individual, local or national economic conditions; however, they argued that the associations in latter cases were complicated and at times somewhat contradictory. This may be also the case for the findings of this study as the data used were aggregate-level data at provincial level.

Overall, the findings showed direct association between the coronary risk factors or lifestyle-related diseases and high socioeconomic status across the provinces of Iran. These results challenge standard assumptions about the relationship between the socioeconomic factors and health. The epidemiologic and demographic transition can be explained as the reason for the overall increase in the global burden and diverse pattern of the lifestyle-related health problems in various regions, including the country of Iran (Naghavi 2004). The rapid economic and social development has made the time of transition to an older population to be sharply shorter in developing countries (Gaziano et al., 2010).

The findings of this study indicated a positive relationship between the GDP per capita and coronary risk factors. Rates of diabetes, high blood cholesterol, and hypertension were higher in the more affluent provinces than the less affluent provinces. This finding is not consistent with findings in developed countries (as described before) and may be a bias due to the way that the data on morbidity problems were collected; for example, higher access of the richer urban people to health care with subsequently greater reporting of morbidity issues in the more affluent provinces; although, the data on morbidities are from a survey in Iran (not reports from the health centers) which increases the accuracy of the finding. In addition, the result is consistent with the results of other studies in Iran and other developing countries, indicating higher prevalence of coronary risk factors in urban populations mainly because of less physical activity and unhealthy nutrition of the urban residents as well as the lack of appropriate preventive care programmes (Esteghamati et al., 2009).

For example, the study by the Ministry of Health (2010)in Iran showed that diabetes rates in the rural population of the provinces of Semnan (4.28%), Esfahan (3.8%), and Mazanderan (4.7%), which are among the richer provinces, were higher than that in Sistan & Baluchestan (1.5%), Lorestan (1.7%), Kurdestan (0.73%), that are among the provinces with lower economic status (Table 4.4). Esteghamati et al (2008) reported a higher prevalence of diabetes, high blood cholesterol, and hypertension in urban areas than rural areas in Iran. Findings of a study by Azimi-Nezhad et al., (2008) in Khorasan in Iran also showed that the prevalence of diabetes type II was higher in the urban population than rural dwellers. In other developing countries, Singh et al., (1998) indicated that the prevalence of diabetes in urban north India was higher than for rural subjects in the same ethnic group, suggesting that sedentary lifestyle was a risk factor of diabetes. Yang et al., (2010), in a study on a population aged 20 years and older from 14 provinces and municipalities in China, reported that the prevalence of diabetes was higher among urban residents than in rural dwellers

(11.4% vs. 8.2%). A study in Sri Lanka also showed a greater number of risk factors for cardiovascular disease in urban areas than rural areas (Boutayeb and Boutayeb 2005).

5.7.2.2. The inequities in low weight in children

The findings of this study revealed direct associations between low weight in children and lower socioeconomic status, but the association was only significant with unemployment, rural population, and household size. It was not significant with illiteracy, GDP per capita, and overcrowding.

The finding showed strong direct relationships between the children's low weight and living in rural areas, unemployment, and household size which is consistent with other studies in the literature. The effect of living in rural areas on child malnutrition has been shown in many studies, although some of the studies have related the effect to confounding factors. For example, Abtahi et al., (2008) found that the prevalence of wasting among children under-five in Iran in the rural areas (14%) was larger than that in urban areas (10%). They argued that wasting, especially in the rural areas, was a major nutritional problem in the country. Menon et al., (2000), in a study using data from the DHS for 11 countries, indicated that the prevalence of stunting was higher in the rural areas than urban areas. Fetso (2007) found considerable urban-rural differentials of child malnutrition; however, urban-rural gaps were removed after controlling for community socioeconomic status, household wealth and maternal education. Smith et al., (2005) stated that a series of more favorable socioeconomic conditions, in turn leading to better caring practices for children and their mothers, is responsible for the lower urban malnutrition. Despite these findings most research in the field of child malnutrition has shown differences between rural and urban areas (Fotso 2007).

Kidane (2010) showed moderate under-nutrition and acute malnutrition were associated with household size. Large households tend to spend much less on food, compared to smaller households. The mean weekly expenditure among households with six members is a meager US$5. As much as 50% of farming households do not own land and depend on wood for energy needs. Access to clean water, modern toilet facilities, and electricity is very poor, especially among large households. Getting out of the poverty trap implies reducing fertility and vice versa. Salim et al.,(2005) found a significant direct association between the number of malnourished children and the family size. The incidence of malnutrition in a family of 3-4 members was 41.67%, while that in a family of 9-11 members was 91.66%. Wagner et al., (1985) stated that early marriage and rapid birth of the first child was more frequent in larger families with higher perinatal morbidity and mortality because of higher rates of low birth weight. Khan Khattak and Ali (2010) described a strong relationship between malnutrition and family size, and child number in the family in rural areas; they argued that the children on average were at the risk of malnutrition due to large family size and lower income.

The findings of this study did not show strong associations between low weight in children and illiteracy, general income, and overcrowding. These findings are not consistent with findings from global and non-global studies. The results from a study by El-Ghannam (2003) on a sample from 191 countries showed significant relationships between illiteracy, unemployment and malnutrition in the countries of Sub-Saharan Africa, Asia, and American; and inverse associations between GNP and household income with child malnutrition in majority of the countries in all world regions. In a study in Iran, Nojomi et al., (2004) found that most children with underweight, stunting, and wasting belonged to mothers who had low literacy and no history of measles vaccination and breast-feeding. Moestue and Huttly (2008) stated that child nutrition was positively and independently associated with mothers', fathers' and grandmothers' education in India and child nutrition was associated with the proportion of literate mothers in the community, adjusting for parental education and other confounders. In Vietnam, Ali et al., (2005) found that mother's literacy status had a strong association with the malnutrition of the children <3 years of age in respect of being underweight in particular in rural areas. Similarly, Miller and Rodgers (2009)stated that mother's education was strongly inversely associated with stunting (low height-for-age) after controlling for household composition and environmental factors. Wamani et al. (1999) also showed that mothers' education was the only independent predictor of stunting, with children of non-educated mothers significantly more likely to be stunted compared to those of mothers educated above primary school level.

The non-significant association between general income and malnutrition is also not consistent with some previous studies. Zere and McIntyre (2003) in a study in South Africa found that household income, indicated by per capita household expenditure, was related to the malnutrition (stunting, underweight and wasting) in children aged under five years. The results from the study by Van de Poel et al., (2008) on socioeconomic inequality in childhood malnutrition in developing countries indicated that stunting and wasting disproportionately affected those of poor economic status and was not related to the average malnutrition rate. Monteiro et al., (2010) in a study on the declining national prevalence of stunting in Brazil from 1996 to 2007 found that the gaps between poor and wealthy families with malnourished children under 5 were reduced in relation to the income and access to education. Zere and McIntyre (2003) described considerable pro-rich inequalities in the distribution of stunting and underweight in South Africa with the highest among the Coloured children and metropolitan areas.

A study in Ghana showed that children's malnutrition and low weight was related to poverty, maternal education, and regional characteristics (Van de Poel et al., 2007). The study also argued that malnutrition is a multi-sectoral problem and the factors associated with average malnutrition rates may not be the same as those associated with socioeconomic inequality in malnutrition. These factors may be also the reasons for the lack of significant association between the malnutrition indicator and some of the socioeconomic factors resulted in this study.

5.7.2.3. Inequities in depression

The findings of this study showed that depression was not strongly related to socioeconomic factors across the provinces, in both effect and impact terms. This finding contradicts the results from other studies in the literature. For example, Chevalier and Feinstein (2004) indicated that education could significantly reduce the risk of depression in both adult men and women. They argued that the positive effect of education was presented over lifetime accounting for family characteristics and work. Negative relationships between household income and depression were indicated by Miech et al. (2000) and Costa-Font and Gil (2008). Melgar and Rossi (Melgar and Rossi 2010) found higher prevalence of depression in the cases of unemployment, being a woman, divorced, and widowhood. Probst et al., (2006) revealed that living in rural areas had significant direct association with depression in adult population. Wilkinson (1999) state that overcrowding was related to psychological symptoms including depression. Lorant et al. (2003) also found an inverse association between education and income with depression. However, they stated that some factors, such as the way the mental disorder is assessed, how the socioeconomic indicators are defined and measured as well as contextual features of time and region can influence the results. This may be also the case for the lack of significant association between the prevalence of depression and socioeconomic factors indicated in this study.

5.7.3. Inequities in health care access

The findings of this study showed significant relationships between health care utilisation indicators of hospital delivery, vaccination in children, and antenatal care and socioeconomic factors. However, the results did not show a significant association between the use of modern contraceptive and the socioeconomic status.

The significant relationship between the use of health services and socioeconomic factors found in this study has been evidenced in other studies. Moradi-Lack et al, (2007) in a study in Iran found that the mother’s educational level had the highest contribution for giving birth in a safe place such as a health delivery center or hospital; the same results were described by Kunst and Houweling (2001). The significant associations between parent's educational attainment and children immunization coverage were showed by Munthali (2007), Odusanya et al. (2008),Som et al. (2010), Semali (2010), and Despoina (2011). Lauridsen and Pradhan (2011)found that household income and state domestic product (GDP) had direct relationship with full immunisation coverage at the national level.

Yanping et al. (2010) found that giving birth at home (compared to delivery in hospital) was higher in rural areas than urban areas in China. Shaikh and Hatcher (2005) showed significant relationships between household size and the use of health care; they found that families of large size used services less than families of small size. Results from the study by Chakraborty et al., (2003) showed a u-shaped association between household size and the use of health care for complications during the pregnancy. The percentage of women who sought care from health professionals such as a doctor or nurse to treat complications decreased from 30.3% in women with less than four family members to 23.2% among mothers with four to six family members; then increased again to 33.6% in women with seven or more family members.

The association between the antenatal care and educational attainment has been evidenced in the literature. Findings by Alexander et al., (2005) in a study in Nigeria showed that socioeconomic factors were consistent determinants of the use of maternal health care and education was consistently a significant predictor of service utilization. Kateja (2007) stated woman’s literacy had strong association with the use of reproductive and maternal health services. He argued that literacy increases women’s capability to access to health services, to obtain a job, increases their exposure to information, and leads them to improve their health. Chakrabory et al., (2003) stated a direct effect of education on the utilization of health care which was through increased autonomy and decision making power, higher ability to acquire and process new information, and changing attitudes towards health problems and health services. The results from the study by Munthali (2007) in Hiti showed that the education levels of both mothers and their partners was a dominant predictor of prenatal care use. The results from a study in Bangladesh also confirmed the importance of mother's education in explaining the utilization of health care services; female education retained a net effect on maternal health service use, independent of other women's background characteristics, household's socioeconomic status and access to healthcare services (Odusanya et al., 2008). The results by Alexander et al., (2005) in a study in Hiti showed that mothers in rural areas who decided to seek care still fell slightly below the four visits recommended by the World Health Organization. Longer travel times and greater distances to health centers in rural areas constituted barriers to repeated visits.

Cooper et al., (2006) stated that accessibility to health care was closely associated with per capita income, especially in countries with a lack of both an organized health system and public health insurance, as in Cuba. In Iran, Hosseinpoor et al., (2007), in a study using data from a nation-wide Iranian health survey conducted in 2003, showed that more affluent populations were more likely to use outpatient care than the less affluent people. Hajzadeh (2010)showed that household wealth and area of residence (urban/rural) were the main contributors of hospital admissions, general practitioner visits, specialist visits, dentist visits, any visit to a medical practitioner, and ambulatory care visits in Iran.

The findings of this study showed no significant relationship between the use of modern contraceptives and the socioeconomic factors of illiteracy, GDP per capita, unemployment, overcrowding, rural population, and household size. These findings contradict the results of many studies in the literature. For example, Bagheri and Nikbakhesh (2010)found that women's level of education and the occupation of women were the most significant factors influencing contraceptive use in Khuzestan, Iran. Osemwenkha (2004) found that family planning and the use of modern contraceptive were significantly related to female education, in particular in rural areas in Nijeria. Similarly, Fikree et al. (2001) found significant direct relationship between the use of modern contraceptive by women and their educational attainment and living in an urban area. Furthermore, Benefo (2006) found a strong association between the woman’s interest in limiting fertility and using modern contraception and the percentage of educated women in the community in Ghana.

Overall, the use of health care can be determined by a variety of factors including demographic factors of age and gender, socioeconomics of education, income, and family structure, health care financing, organization of health services, ecological factors such as distance to health services and cultural factors. The findings of this study showed significant association between the use of health care and the socioeconomic factors across the provinces of Iran in majority of cases. The lack of significant relationship between the use of modern contraceptive and the socioeconomic factors may be due to the effect of the other determinants of health care utilization. For example, the country of Cuba with low income per capita has managed to ensure access to high quality health care services for the whole of the population (Cooper et al., 2006), indicating the role health system management and infrastructure on access to health services (Virtanen et al., 2006).

5.7.4. Comparing the results from the “effect” and “impact” measurement

In this chapter we measured the inequities in health outcomes (mortality and morbidity) and health care utilization across the provinces of Iran based on two different perspectives of “inequity as the systematic, pervasive, or structural inequalities in health” and “the average health of the worst-off group”. These two equity perspectives were operationalized by following respectively the “effect” and “impact” approaches; and the inequities were quantified respectively using the “regression coefficient” and “the SII” inequity indicators. In the majority of cases, the findings showed inequities in the health indicators measured through the both approaches, however, in some cases there were different results from the “effect” and “impact” measurements. Looking at the results from the mortality measures, there were significant inequities of mortality under-5 measured using both the “effect” and “impact” approaches (Table 5.3, P 107), while the inequities in the male and female mortality were significant based only on the “effect” measurement but were non-significant based on the “impact” measurement.

In the majority of cases for morbidity inequities there were similar results from both the “effect” and “impact” measurements; however, in some cases they showed different results. The “effect” measurement indicated significant inequities in the diabetes rates in relation to overcrowding and rural population, while the results from the impact measurement showed non-significant inequities (Table 5.2). There were also significant inequities of hypertension in association with the GDP per capita, rural population, and household size in effect terms, but in the impact measurement the inequities were significant only in relation to household size. There were the same results from the two approaches in the measured health care inequities.

In methodological terms, the difference can be due to the sensitivity of the SII to the number of populations in the provinces located in the worst quintiles. In the case of mortality, the population of the provinces located in the last quintile was much less than the population size of the provinces in the best quintile. To conclude, these findings imply that the magnitude and pattern of socioeconomic inequities in health may be reflected differently when they are measured based on different equity perspectives and by different inequity indicators (Mustard and Etches 2003; Carr-Hill et al., 2005; APHO 2008; Khang et al., 2008)

5.8. Conclusion

5.8.1. Conclusion on the methodology of health inequity measurement

Equity in health was considered as a very broad discipline accommodating quite diverse and disparate considerations. It is defined and conceptualized based on diverse ethical views and measured using several inequality indicators. From the results of this study it is concluded that measuring health inequalities based on different equity perspectives and different inequality indicators can lead to reflection of different results.

5.8.2. Conclusion on the health inequity measurement

The findings of this study showed large inequalities of health outcomes and utilization of health services in relation to the socioeconomic factors across the provinces of Iran:

- There is a strong relationship between the socioeconomic status and premature mortality across the provinces of Iran. There is wide inequality of premature death (mortality in children under-5 and in adult men and women) in relation to illiteracy, GDP per capita, unemployment, overcrowding, rural residency, and household size across the provinces of Iran. The magnitude of the socioeconomic inequalities in the mortality in children was much wider than the inequalities in the adult mortality, and the inequalities in male mortality were larger than for female mortality. Illiteracy was shown to be the strongest predictor of mortality in children and adult women; and unemployment was the strongest predictor of mortality in adult men across the provinces. Inequity in the premature mortality measures indicates that, appropriate policies need to be made and actions to be taken by the government to reduce the inequities across the provinces.

- There is strong direct relationship between the risk factors of heart coronary disease (diabetes, high cholesterol, and high blood pressure) and socioeconomic status across the provinces; the higher rates of morbidity problems are related to higher socioeconomic status. This confirms the effect of the demographic and epidemiological transition on the health status in Iran. Therefore, the chronic diseases due to the demographic and epidemiologic transitions are now among the important considerations of health inequities in Iran that needs to be considered in the equity-oriented policies of the health system.

- There is no significant association between socioeconomic status and depression across the provinces; this was not considered to be consistent with findings of other studies. Factors, such as the way mental disorder are assessed, how socioeconomic indicators were defined and measured as well as the contextual features of time and region may have influenced the information provided in the original study. As a conclusion, more research is necessary to confirm the findings of this study.

- Low weight in children was not significantly related to the educational level and gross domestic product across the provinces. This is not consistent with the literature which indicates a strong association between the children's low weight with the education and general income. This may be because children's low weight, mainly due to malnutrition, is a multi-sectoral problem and the factors associated with average malnutrition rates may not be the same as those associated with socioeconomic inequality in malnutrition. In addition, the time difference between the data on the low weight in children and deprivation factors in terms of time of collection may be another factor that influenced the relationship. However, more research needs to be conducted in the context of Iran to confirm the result of this study.

- There are large inequalities in health service access in association with socioeconomic factors across the provinces. Household size is the strongest predictor of hospital delivery; larger household size was strongly related to the lower use of hospital services for giving birth. Illiteracy is the strongest predictor of children's immunization across the provinces. Larger rates of illiteracy were associated with lower rates of vaccination in children. The inequity identified in access to health services across the provinces requires appropriate policies to be made and actions taken by the government to bridge the gap between the provinces.

- The findings of this study showed no significant relationship between the use of modern contraceptives and socioeconomic factors in the provinces. This finding was considered to contradict the results of other related studies in Iran and other countries. The can be because of other factors such as age, family planning worker, general practitioners, cultural issues and psychological wellbeing of women (Qazi et al., 2010). The difference in the time of providing the data and the different sources of the information can be another factor in this regard. Therefore, more research is necessary to evaluate the effect of additional factors on the use modern contraceptives to confirm/reject the findings of this study.

The above health inequalities are considered as health inequities as they are systematically and structurally related to the socioeconomic factors (Asada 2005; Whitehead and Dahlgren 2007). The mortality across the provinces increased with decreasing social position, the coronary risk factors increased with decreasing socioeconomic factors, and the use of health services increased by increasing the socioeconomic status. The inequalities have systematic patterns; the differences are not distributed randomly, but show a consistent pattern across the provinces. In addition, the inequalities are also considered as inequities as they are produced socially and therefore are modifiable and remediable (Whitehead and Dahlgren 2007).

The inequalities are considered to be inequitable regarding the equity perspective of "the average health of the worst-off group" which is consistent with Rawls' theory of justice, implying that inequalities in the community are justifiable if they bring increased benefits for the entire community and if the most disadvantaged people in the society are no worse off due to any inequality. The inequalities measured by the impact approach showed large differences between the average health in the groups of provinces with the lowest socioeconomic status when measured in proportion to the average health in the provinces with the highest socioeconomic status. The average mortality under-5 in the provinces with the highest unemployment, living in rural areas, and overcrowding was significantly larger when measured in proportion to the average children's mortality in the provinces with the highest socioeconomic measures. The provinces with the largest overcrowding index had significantly larger average mortality in women compared to the provinces with the lowest overcrowding. In the majority of cases, the average rates of diabetes and high blood cholesterol in the provinces were significantly higher in the provinces with the highest socioeconomic status than those in the provinces with the lowest socioeconomic status. The provinces with the lowest socioeconomic status had significantly higher average rates of hospital delivery and vaccination in children under-1. In all the cases, there is considerable difference between the average health of the worst-off group and the average health of the best-off group, which is considered inequitable.

5.9. Action on the reduction of health inequities across the provinces

In part one of this study I measured and identified the main health inequities across the provinces of Iran. To tackle health inequities action across all sectors of government is required; however, the health system is considered as a good place to start setting up structures and support that encourage action on health equity (Riley et al., 2007; Marmot et al., 2008). The Commission on Social Determinants of Health recommends that the health sector should follow the social determinants of health approach and expand its policy and programmes in health promotion, disease prevention and health care (Marmot et al., 2008). There are different elements in health systems that can contribute to a reduction of inequities in health and promote health equity leadership (governance and policy), structure, health information system, inter-sectoral collaboration, strategy and policy, health system reform, health financing system, and health resource allocation (WHO 2008b).

Reallocating public expenditure to fund across health care is considered essential to addressing health equity (Marmot et al., 2008). Adequate financing of health care and equitable allocation across population groups and regions is an effective action in this regard (Bhalotra 2007; Bokhari et al., 2007; Anyanwu and Erhijakpor 2009; Gani 2009). For addressing equity in health, access to comprehensive health services with appropriate coverage in the all regions is essential. Allocation of health resources between populations and areas based on need, for example, allocating budgets between geographic areas on the basis of formulae that weight population numbers according to need rather than on the basis of historical expenditure patterns, is considered an appropriate action. Despite political and informational challenges, these methods have been shown to be effective even in low-income countries.

Therefore, in part two of this study, I will describe an overview of the health system in Iran and focus on the equitable allocation of financial resources on health care as an effective tool for reducing health inequities across the provinces. I will explore alternative needs-based resource allocation models for equitable distribution of public expenditure among the provinces.

6. Overview of health system and resource allocation in Iran

6.1. Introduction

The findings from the investigation of health inequities in the first part of this thesis showed considerable inequities in health outcomes and health care access across the provinces of Iran. Appropriate actions need to be taken on socioeconomic factors for reduction of the health inequities. Action through health systems was considered as an appropriate way to be taken (Marmot et al., 2008); and equitable allocation of health budget between geographic areas evidenced to contribute to the reduction of health inequities (Bhalotra 2007; Bokhari et al., 2007; Anyanwu and Erhijakpor 2009; Gani 2009). The main concern of equitable resource allocation is often the distribution of public expenditure across the geographical areas and population groups in the communities. Public spending is one of the main sources of funding health care systems (Aaron 1992; WHO et al., 2010). In addition, other elements such as the structure and administration of health systems can impact the process of resource allocation, and thus the equity objective of health systems (Smith 2008a; Rice and Smith 2001).

Therefore, in this chapter I first present an overview of the health care delivery and administration system in Iran. This is followed by an investigation of the current sources of funding the health system, in particular public (government) spending on health which was considered as the main source in regard to the equity in resource allocation. Then, current methods of health resource allocation in Iran are evaluated to see how the current mechanisms of resource distribution may be inequitable. Finally, the actual government spending on health care across the provinces is investigated to indicate to what extent the current expenditure is consistent with the ill-health (or need for health care) in the provinces.

6.2. The health care delivery system

The Islamic Republic of Iran adopted the Alma Ata declaration (WHO 1978) and redesigned its public health system based on the PHC criteria after the Islamic Revolution in 1979 (WHO 2009). The aim was to strengthen the health system towards promotion of health equity in the country. The health system focused mainly on primary care services which are shown to work effectively in the promotion of public health and reduction of health inequities (WHO 2007). An extensive network of PHC facilities was developed in the country with good coverage in most rural areas, but in urban areas, the public PHC network remains patchy and underdeveloped; the urban citizens are served by private general practitioners, philanthropic organizations, specialists operating as PHC physicians, and private and non-governmental hospitals (World Bank 2007a). The underlying policy for the primary health network system was to provide easy access to health care, in particular primary and preventive services (Javanparast et al., 2011); priority of preventive care over treatment, of rural and deprived areas, of general practice over specialized medical care, and outpatient care over inpatient care were the important policies agreed upon for implementation in the new system (Khosravi et al., 2007a). These policies were implemented by expanding the health network by establishing health houses and rural health centres in rural areas, and health posts and urban health centres in urban areas, that provide primary health care to the majority of people in the country (Javanparast et al., 2011).

Expansion of access to PHC in rural areas has enabled Iran to successfully promote overall health status, reducing infant and under-5 mortality rates as well as maternal death due to pregnancy in the rural areas and in the country as a whole (World Bank 2007a). However, evidence shows weaknesses and challenges in both the function and model of the current PHC system. The public PHC network is stuck in managing problems of the past, and is not adequately reformed to meet the changing the health needs due to the increasing burden of disease caused by the rapid demographic and epidemiological transition (Sheikhattari and Kamangar 2010; Moghadam et al., 2011). In addition, despite the increasingly urban immigration in the country, the urban primary care model has remained underdeveloped, leading to little impact on managing care at cost-effective levels of service (Sharifi 2009). Finally, there is a lack of comprehensive regulated and organizational supervision and evaluation of the performance and quality of the health services in all of the health system (EMRO 2006). The insufficiencies in the structure of the health system may act as barriers to the reduction of health inequalities between geographic areas as well as demographic and social groups in the country.

In 2011, Iran's government started to implement a plan called "Family Physician and Referral System" with the aim of promoting health equity in the cities and across the country (Ministry of Health and Ministry of Cooperative 2011). This plan aims to provide basic health services and reduce financial barriers for all the citizens in both urban and rural areas. The plan is being implemented in cooperation with private health professionals, in particular physicians working in the private sector. A health team headed by a general practitioner is responsible for providing primary and some secondary health services for a population between 500 to 2500 people living in the area. The primary services are delivered free of charge and there is only cost sharing for some treatment services. It is compulsory for the people registered with the general practitioner to be insured by one of the health insurance companies in the country and to pay some share of the costs for certain secondary services. In general, this plan is a major reform in the health system in terms of provision and financing of health services and it is expected to have considerable impact towards the promotion of health equity in the country.

In Iran there is a quite large private health sector including private providers, community-based organizations, wholesalers and retailers of health or health-related commodities, private company clinics or health education programs, and private health insurance companies (Islam 2007). The private sector is mainly concentrated in the urban areas, providing mostly secondary and tertiary care services beside the public health system (Mehrdad 2009). The whole pharmaceutical industry and drug distribution system as well as a large share of laboratory and diagnostic facilities is controlled by the private sector (EMRO 2006). The sector has control of 7.4% of health care centers, 10.2% of hospital beds, 37.8% of medical laboratories, 27.5% of rehabilitation centers and 90.6% of drugstores (WHO

2006b). For out-patient services most people can access private services delivered by private GPs, health centers, and medical laboratories available mostly in the cities (Mehrdad 2009). In-patient services are expensive and mainly only affordable for the more affluent people (WHO 2006b).

There is disagreement on the contribution of the private sector in reaching the equity objective in health systems (Mindell et al., 2008; Yoong et al., 2010); there is more consensus that the private sector does not contribute to equity in health (Derrett et al., 2009; Zikusooka et al., 2009; Grignon et al., 2010). In Iran, there is a lack of information on the private health sector and how it is influencing health equity; however, the above information shows that financial and physical barriers to the use of private services exist for people of low economic status and those in remote and rural areas. This implies that the private sector may not make an appropriate contribution to a reduction of health inequities in the country.

6.3. The health system administration

Leadership and governance (stewardship), which is "*ensuring strategic policy frameworks exist and are combined with effective oversight, coalition building, regulation, attention to system-design and accountability*" (WHO 2007, P vi), is arguably the critical building block of any health system that may affect promotion of health and health equity as it influences all parts of a health system (WHO 2008b). As a stewardship responsibility, the central government should monitor progress towards policy objectives and revise policy guidelines as appropriate, and allocate resources appropriately to lower levels of the health system, but also consider thoughtfully the importance and the role of sub-national levels in health care management, delivery, and resource reallocation (Munga et al., 2009; The Global Fund 2011).

In terms of health system administration in Iran, there is the Ministry of Health and Medical Education (MOHME) at the top of the health system which is responsible for exercising governance, policy-making, planning, financing and developing the health care programmes (Mehrdad 2009), indicating quite a highly centralized health system in Iran. At the provincial level, there are the Medical Science and Health Services Universities (MS&HSU), which are responsible for planning, managing and supervision of the District Health Centres, general and specialty hospitals, and allocation of resources to the health programmes; this is beside their responsibility for the training of health professionals. In each province there is usually one Medical University governing the health system in the province; however, in some larger provinces such as Tehran there is more than one medical university, with responsibility for health services in the catchment areas as well as for medical education (Majdzadeh et al., 2010). The Universities work under the MOHME, and the health policy and monitoring functions over the provincial level are guided by the Ministry. Despite the recent measures of provincial deconcentration, the universities have little authority to allocate resources based on the need for health care within the provinces (Abolhallaj 2006; WHO 2006b). At the district level, there are District Health Networks working under the Universities; the Networks are responsible for implementing and managing the primary and medical health programmes in the districts (EMRO 2006) and comprise district health centers, urban and rural health centers, health posts and health houses which deliver mainly primary care and some particular treatment services (Zolala and Haghdoost 2011).

In 2005, the 4th Development Plan was approved, allowing the medical universities to receive global budgets from the national government and to determine their own resource allocation within the respective provinces (EMRO 2006). The Medical Science Universities were authorized a measure of management autonomy in developing their own systems of financial and human resource management for the health services in the province. The plan was in fact a functional decentralization action or devolution to increase the efficiency and equity in providing health services across the country. However, the process of decentralization was not successful enough and subsequently the MOHME program determined that allocations to the universities would continue by the Ministry (WHO 2009). The Ministry also exercises a health policy guidance role and a monitoring function over the provincial level, implying that the health system is still centralised. There is disagreement on the impact of decentralisation on equity in health and health care (Bossert et al., 2003; Jimenez-Rubio et al., 2008); however, a centralised health system has been shown to be supportive for addressing health inequities in many cases (McKee et al., 2007; Munga et al., 2009).

6.4. Health care expenditure in Iran

There are five main sources of funds in health care systems including: public expenditure (government-based funding), social health insurance, private health insurance and out-of-packet payments, and external sources such as grants or loans from international donors (Gottret and Schieber 2006; Drouin 2007). A fair health financing system raises adequate funds for health from the diverse sources, in ways that ensure people can use needed services, and are protected from financial catastrophe or impoverishment related to the payment for them (WHO 2007). A mixed source of funds is an essential factor when considering the principles of equity in health care financing (WHO et al., 2010). The extent to which the different financing sources can help in the redistribution of income and wealth in the community formulates the equity in health care financing (James and Savedoff 2010). The amount of income redistribution is indicated by the progressivity of the contributions, with the relative impact of each funding method in the progressivity (Staines et al., 2010).

Based on the WHO (2009), in 2006, the total expenditure on health as a percentage of gross domestic products in Iran was more than 6% which is higher than that for the East Asia and Pacific Region (3.6%) and the East Mediterranean Region (4.1%) but less than the figure for the European Region (8.8%) and the global figure (9.7%). The total per capita expenditure on health in Iran is US$ 689, which is also higher than that for the East Asia and Pacific ($104) and East Mediterranean ($271) Regions, but lower than the global average (US$863) (WHO 2009). Health care in Iran is funded through three main sources: public (government) expenditure, social health insurance, and out-of-pocket payment (WHO 2006b). The social health insurance funds include the prepayments and the share paid by the government. In

2009 around 42% of health care expenditure was through public spending and the remaining 58% was through out-of-pocket payments (WHO 2010b). Private health insurance and external sources are two minor sources for health care financing in Iran, covering around 1% of the annual health budget in the country (WHO 2009).

6.4.1. Public expenditure

Public expenditure on health care is defined as "*the health expenditure incurred by public funds at national, regional and local government level*" (Gilkeson 2009, P 1). Public expenditure has been shown to be a progressive source of funds for health care (Yu et al., 2008; Amakom 2010) which contributes to improving equity in access to health care and health outcomes (Bhalotra 2007; Bokhari et al., 2007; Martin et al., 2008; Anyanwu and Erhijakpor 2009; Gani 2009). Public funding for health is the only source that can be directly controlled by the government and is the main source of finance for the health services used by the poor; therefore, it plays an important role in the promotion of equity in health care access and financing (Sapru 1991).

In 2009, public expenditure was shown to account for 41% of total spending on health in Iran (Ministry of Health and Ministry of Cooperative 2011). It was larger than the figure for the South-East Asia Region countries (37%) but less than that for the African countries (49.3%), East Mediterranean Region (50.9%), and average global figure (59%) (WHO 2010b). The general government expenditure on health was around 10.5% of the total government spending on the public sector which is less than the global average figure (11.5%). The main source of public expenditure in Iran is from the oil and gas export revenue (Health Ministry 2008) which accounts for about 40% of Iran’s national government income (Ilias 2010). Spending through the oil revenue is considered to be a progressive source of financing for health as it incurred no cost sharing and prepayment for the citizens (Hajizadeh and Connelly 2009). Tax is the second source of public expenditure in Iran. Like many other countries the tax system in Iran operates on two types of direct and indirect taxes (Arabmazar 2005). Direct tax is usually paid by individuals, households or companies while indirect tax is commonly levied on transactions and goods called value-added tax (Arabmazar 2005); therefore, indirect tax is mainly on consumption rather than on overall income. Direct tax is evidenced to be progressive and in line with the equity objective; while indirect tax has been shown to be a regressive source of revenue, not being in line with the equity objective of the public sector including the health sector (Arabmazar 2005; O'Donnell et al., 2008; Yu et al., 2008). The average share of tax in the government budget in the past 30 years has been around 30%, of which around 50% was indirect tax (Arabmazar 2005; O'Donnell et al., 2008).

6.4.2. The social health insurance

"Social health insurance schemes are generally understood as health insurance schemes provided by governments to their citizens, especially to low and middle income populations" (Acharya et al., 2010, P 2). These schemes protect patients through "risk pooling" and "cross-subsidization (Social Security Department 2007). "Cross-subsidization" refers to the sharing of risk between individuals with different risk classification (Monahan 2008). For example, when young and old workers pay the same health insurance premium, the risk is cross-subsidized, with the young workers subsidizing the coverage of the older workers (Monahan 2008). Social health insurance has been shown to be a quite progressive source of funding for the health care, particularly in low and middle income countries (O'Donnell et al., 2008). In addition, characteristics such as transparency, being more acceptable to the public and protection from political interference are other merits of health care funding through social health insurance (Mossialos and Dixon 2002).

More than 90% of the Iranian citizens are covered by public health insurance (Mehrdad 2009). Health insurance accounts for 20% of the health care funds in the country (Hajizadeh and Connelly 2009). There are several insurer companies each with a different benefits package, co-payments and referral systems including: the Medical Services Insurance Organization (MSIO), the Social Security Organization (SSO), the Armed Forces Medical Services Organization, and the Imam Khomeini Relief Foundation (IKRF) (Schieber and Klingen 1999; Hajizadeh and Connelly 2009 ; World Health Organization 2010).The companies are now being supervised and managed by the Ministry of Cooperative, Labour and Social Welfare and the High Council for Health Insurance which is made up of seven health related ministers, headed by the president, is responsible for making the overall policies, setting fee schedules for payment of providers and changes to the social insurance provisions in the schemes (EMRO 2006).

The MSIO provides coverage for around 40% of the population, mainly government employees, students, and rural dwellers (Mehrdad 2009). In 1995, the Public Medical Service Insurance Coverage Act (PMSICA) was introduced by the government, remitting the MSIO to increase the coverage to provide health insurance for a range of citizens including civil servants, village dwellers, the self-employed, people with disabilities, decamping tribes, and university students (Hajizadeh and Connelly 2009). In 2000, the Urban Inpatient Insurance Scheme was introduced by the government to subsidize inpatient health care for the urban population who would not hold any health insurance. This led to an approximate 10% increase in the coverage of the Iranian population. In 2005, it was legislated by the government to extend coverage to 30% of the rural population; they now have insurance for primary-through-tertiary health care services (Hajizadeh and Connelly 2009).

Participation is compulsory for people who are eligible for the MSIO scheme; however, premiums for villagers are paid by the government (Rashidian 2010) which is a large subsidy to compensate for the deficit of the Public Health Insurance Scheme. Government employees pay 30% of the premium and the remaining 70% is paid by the government. In 2009 the approach to the premiums charged was improved by the MSIO changing the rate from a fixed rate for every insured individual towards a proportion of payroll (Rashidian 2010); which is considered a vertical approach to equitable health care funding in the country. Coverage for services such as diagnostic and treatment services at both outpatient and inpatient level, that are not covered by the primary care, is provided by the MSIO (EMRO 2006). There are co-payment schedules for these services; patients need to pay 30% of tariffs for outpatient and 10% for inpatient services in the public sector as well as for the private clinics and physicians who have a contract with the MSIO.

The Social Security Organization (SSO) covered 28 million Iranian citizens for health insurance in 2008 in addition to its responsibility for providing retirement pensions, as well as benefits for unemployment, maternity, work injury, disability, and marriage grant(World Health Organization 2010). The SSO provides insurance mainly for employees in the private sector, the self-employed and temporary workers in the public sector and their dependents. The contribution to the Social Security Organization (SSO) is 30% of the earnings of the insured individuals with 20% percent being paid by the employer, 7% by the employee and 3% by the government (EMRO 2006). This contribution is for the variety of social security benefits as well as for health services.

The Armed Forces Medical Services Organization is the health insurer for almost 2.5 million members of the military and their dependents (World Health Organization 2010). There is a prepayment by the militaries; military families are not charged where they are treated in the specific hospitals and health centers related to the army, but there is some cost sharing when they refer to other public hospitals or private sector. The Imam Khomeini Relief Foundation provides free health insurance for the needy people with almost 2.1 million people under this scheme.

Despite the strengths of the social insurance schemes in Iran, there are concerns related to the universality of the coverage, multiplicity of the financing schemes, variation in the benefits and services provided by the schemes, and the fact that contribution to the schemes is not based on ability to pay in some cases (Abolhallaj 2006; Ibrahimipour et al., 2011). The rural population insured by the MSIO is only eligible for in-patient care (WHO 2006b). This indicates that the package of services is provided based on the financial strengths of the scheme rather than the participants' need for health care (EMRO 2006). The diversity in the health insurer companies and different sources of funds in the schemes causes limitations on risk pooling across different groups within the population (WHO 2006b; Ibrahimipour et al., 2011). For example, there are four types of funds, including government employees, the self-employed, rural population and others (e.g. students) in the MSIO, which are managed separately. Promotive and preventive care services are not usually covered by the schemes and coverage is mainly for curative care services. Coverage of many preventive services such as screening for chronic illnesses can reduce final costs and payments in the insurance schemes (Cohen et al., 2008). Ability to pay is not the basic factor for the contribution in many cases and the premium is set according to the level of coverage and previous spending; in addition there is a high-level of co-payment in the schemes (Ibrahimipour et al., 2011).

6.4.3. Out-of-pocket payments

Out-of-pocket payment is a direct payment by individuals or households for a health service when seeking care from either formal or informal providers (Manzi et al., 2005). It is the result of co-payments (formal cost sharing), deductibles or maximum reimbursements, or simply exclusion of health services from a benefit package (direct payment in the private sector) (Petrelli et al., 2010). Informal payments are services paid through pooled revenue but the providers demand informally additional payments for delivering services (Olaniyan and Lawanson 2010).

However, in the case of inability to pay, access to the necessary services is not usually possible; in addition, there is usually no possibility of risk pooling in out-of-pocket payments (Kanavos et al., 2010). Thus, out-of-pocket payments have the highest risk of catastrophic and impoverishing costs for the families who are not covered with other funding schemes (Drouin 2007). Catastrophic cost has been defined as 10% of household consumption or income, or 40% of non-food household consumption expenditure (Heeley et al., 2009). This is often true of the poor population in particular in low and middle-income countries (Kanavos et al., 2010). Out-of-pocket payment on health care ranges between 50 and 80% of total health expenditure in many African and Asian countries; for example, in 2006, the share of out-of-pocket payment in total spending was 70% in Cambodia, 77% in Burundi, 58% in Bangladesh, and 82% in Congo (Drouin 2007). Out-of-pocket payments are indicated to be a regressive form of health care funding (Kanavos et al., 2010). They are more regressive than social health insurance and even private health insurance contributions to health systems (Khosravi et al., 2007a).

Out-of-pocket payment expenditure accounts for 58% of the expenditure on health care in Iran (WHO 2010b) which is higher than the global (40.4%) and the East Mediterranean countries (44.5%) figures (WHO 2009). The majority of out-of-pocket payment is paid to the private sector, in particular for private hospital services by mainly the rich and non-insured people (EMRO 2006). There is also a high co-payment for health services insured by the insurance companies; patients have to pay 10% of the national tariffs as co-payment for inpatient and 30% for outpatient services (WHO 2006b). The high rate of out-of-pocket payments causes a high financial burden on poorer households in the country. In 2008, around 2.3% of Iranian people were facing catastrophic costs of health care as a result of direct payment for health services (Nekoei Moghadam et al., 2012). Moradi (2011) showed that household expenditure on health care in Iran from 1997 to 2007 was regressive with inappropriate out-of-pocket payment by poorer people in both urban and rural areas. Hajizadeh and Connelly (2009) also found that the consumer co-payments in the country from 1995 to 2005 were regressive, indicating a high out-of-pocket payment by the Iranian citizens.

6.5. The resource allocation for health care and equity

6.5.1. Levels and current methods of resource allocation

Resource allocation in health care is defined as the process by which available health resources are distributed between competing uses which are individuals, populations, or agencies at different levels of the health care system (Wright et al., 1998). Health resources are usually allocated from the national level (macro level) to the institutional/hospital level to the patient/physician level (micro level) (Ardal et al., 2006). The Henry J. Kaiser Family Foundation (2004) describes three main levels of resource allocation in health systems. In Level 1 resources are allocated to health versus other social needs. At this level, the main concern is how to allocate the funds among the competing sectors and programs such as education, health and social security. In Level 2, resources are distributed within the health sector among the healthcare programs and geographical regions. The concern in this level is whether to spend more funds on medical care or primary care, or which region or group of people in the country needs more health care and consequently more expenditure. In Level 3 resources are allocated among individual patients; where there are a large number of people in need of health care, the doctors should determine who the priority is. For example, which patient should get the next available heart transplant, etc. (Asadi-Lari et al., 2003).

Equitable resource allocation is considered as an ethical issue and a contributor to equity in health care and health outcomes (Jamison et al., 2006). Fair distribution of health funds is a main objective of many health systems around the world (Ardal et al., 2006; McIntyre et al., 2007). Resource allocation is equitable when health care resources are distributed among the competing users (e.g. regions) based on the need for health care (Diderichsen 2004; Asthana and Gibson 2008). Equity in health care resource allocation can be based on horizontal or vertical principles (Ong et al., 2009). Based on the horizontal principle populations with equal need would receive the same amount of financial resources; the vertical principle implies that populations with unequal need should receive an unequal but equitable amount of financial resources (Ong et al., 2009).

There are three main mechanisms of resource allocation in public health care that are described in the literature including: (i) distribution of budget based on negotiation and pluralistic bargaining (agreement); (ii) incremental budgeting (historical president); and (iii) allocation according to the need for health care (Petrou and Wolstenholme 2000; Zere et al., 2007; Smith 2008a). These approaches emphasize respectively political, maintenance, and equity concerns of distributing health funds in the health care systems.

Based on the pluralistic bargaining (negotiation) approach, health policy-makers, politicians and other influential groups of people such as urban populations usually affect the distribution of public health resources (Pearson 2002). Health organizations are often required to set priorities and distribute resources within the constraint of limited financial resources; however, in many cases the decision makers rely on historical or political resource allocation processes as they may not be well skilled to make explicit rationing decisions (Mitton and Donaldson 2004). Further, debate and bargaining may be a preferred approach for resource allocation where the analytical tools and ethical principles that are used to allocate healthcare resources have a multiplicity nature and are difficult to apply (Petrou and Wolstenholme 2000).

However, this method of resource allocation is under question; for example, who are the appropriate participants in the bargaining process (e.g. members of the medical profession, representatives of patient groups or members of the general public); what are the criteria by which decisions are made; how can the decisions made at the macro level be translated into clinical decisions at the micro level (Petrou and Wolstenholme 2000). This approach is also vulnerable to political favoritism and can be unsustainable in the longer term, although it may provide a short-term solution to the resource allocation problem (Pearson 2002). It is also supposed to be partisan and unfair as the “need” is not considered as the base for the health expenditure in this approach (Stevens 2008).

In the incremental budgeting approach, the past pattern of allocation is used as the basis for distribution of public health resources and expenditures on the health regions and programmes (Smith 2008a). The share for regions or programmes is the figure for the previous year plus or minus some percentage (e.g. 10%) considering the overall defined health care budget for the relevant year. The main aim in this approach of resource allocation is usually that the existing health care facilities are provided with funds so that the current services are not disrupted (Gugushvili 2007); this indicates that health resources are not allocated based on the health care need. Therefore, it may prevent governments reacting to changes and implementing new and equitable polices (Okorafor and Thomas 2007). In addition, as historically, health care facilities are often concentrated in certain areas receiving more resources, allocation based on the past patterns can lead to wider health inequalities (Asante and Zwi 2009). Finally, this form of resource allocation is arbitrary and it does not provide incentives for the efficient use of resources (Smith 2008a).

Resource allocation by need is the process in which financial resources are distributed across the individuals or populations based on the need for health care (Diderichsen 2004; Kephart and Asada 2009). This method is considered as the most ethical and equitable mechanism for the allocation of financial health care resources (Zere et al., 2007). Gugushvili (2007) believes that among all the alternative approaches of resource allocation in integrated health systems the method of needs-based resources distribution is the best suited to meet the principle of equal treatment of equals. There is also a broad measure of support for the notion that health care ought to be financed according to the ability to pay and distributed according to need (Sutton et al., 2002). Given that, allocation of resources on the basis of population’s need is considered as the most influential and universally appraised code for health care resource distribution. (This approach will be discussed in the next chapter).

6.5.2. Health care resource allocation In Iran

In Iran, in a fiscal year, the budget for health sector is determined out of the public national budget (Abolhallaj 2004). The national annual budget is "a statement of government priorities over the next year, including financial allocations in relation to competing priorities and also the manner in which revenue is to be raised" (Payne 2009 , P 16). The Plan and Budget Organization (now the President Deputy for Strategic Planning and Supervision) is responsible for preparing the budget circular. The Budget Bill is provided on the sectors and programmes and also government bodies at national and provincial level in different current and capital parts. The current budget for each agency is determined based on an historical incremental mechanism and bargaining (Abolhallaj 2006). The capital budget for each agency is determined based on the necessary funds to finish the existing development projects underway and the projects that have been planned to begin in the following year (Abolhallaj 2006).

The Bill provided by the Cabinet is evaluated by the Parliament; usually there some changes in the overall ceiling as well as the ceiling for the sectors and agencies. After legislation of the Budget Bill in Parliament it is sent to the executive government for implementation. In this step the national agencies may need to do some modification in the share of sub-national bodies because of the changes made by the Parliament.

The current budget for each of the Medical Science Universities (with one university in each province except some large provinces with two or more universities) is determined based on certain factors such as number of staff, number of administrative buildings, vehicles and other equipment. The recurrent budget usually consists of around 85% of the total public expenditure which is fixed and for which there is limited place for bargaining. The remaining 15% is for capital investment (Abolhallaj 2006); this is the part of the public expenditure that leaves space for negotiation and political bargaining. Therefore the capital expenditure for each province is determined based on the funds necessary to finish the establishments currently being built and those that have been planned for construction in the following year subject to the available budget (Abolhallaj 2006).

In the provinces the current health budget is directed into two main health programmes, for primary care and medical care (Abolhallaj 2006). In the primary care programme expenditure is mainly for the wages of the staff working in the rural Health Houses, urban and rural health centres, the administrative personnel working in the provincial and district Health Networks, as well as the costs for the providing medications used in the health centres, water and electricity, petrol for vehicles, and repairing vehicles and buildings. The expenditure on the medical care programme is mainly for the wages of the staff and health professionals working in the government hospitals and clinics as well as the bills for general running of the establishments. Payments for part of the cost in this programme are through the specific revenues by the hospital and clinics which are mainly payments by the social health insurance schemes and out-of-pocket payments by patients (Abolhallaj 2006).

The above process shows that the public health budget in Iran is mainly allocated based on historical incremental and political bargaining. As discussed previously, these mechanisms of resource allocation are considered to be unfair and may perpetuate the existing inequities in health care and health outcomes across the provinces.

6.6. Evaluation of the government expenditure in relation to the need for health care in the provinces

6.6.1. The approach

Among the resource allocation approaches, need-based spending was considered to be the most equitable method of resource allocation for health care as it consider the need for health care rather than the previous expenditure and stakeholders' incentives (Diderichsen 2004; Kephart and Asada 2009). Factors including population size, demographic composition, mortality, and socioeconomic factors are considered as the main indicators that indicate the need for health care (described in chapter 7). This section will evaluate the relationship between the need factors and actual health expenditure by the Iranian government (2002 – 2005) to demonstrate whether the current expenditure is consistent with the need for health care in the provinces?

The consistency of actual health budget with need is investigated by evaluating the relationship between per capita expenditure with the need factors of mortality and socioeconomic factors. Measures of mortality under-5, mortality in adult males and females across the provinces as well as socioeconomic indicators of illiteracy, GDP per capita, unemployment, rural population, overcrowding and household size (described in chapter 4) are the need indicators that were used for the evaluation. Inequity is measured using the estimation of the correlation coefficient which indicates the relationship between the government expenditure with the demographic, mortality and deprivation measures (Regidor 2004b). Data on the government expenditure on health from 2002-2005 were collected from the Unit for Budget in the Ministry of Health; an annual average was estimated by summing the total expenditure in the period and dividing by four, the number of years in the period (Table 6.1 below). The average is used for further analysis.

Table 6-1. Per capita health public expenditure in the provinces in 2002-2005 (million rial)

	Total expenditure
Ardebil	0.1099
Bushehr	0.1369
Charmahal	0.1441
East Azararbayejan	0.1009
Esfahan	0.0894
Fars	0.0978
Gilan	0.1142
Golestan	0.0941
Hamedan	0.1067
Hormozgan	0.1282
Ilam	0.1661
Kerman	0.102
Kermanshah	0.1078
Khorasan	0.0849
Khuzestan	0.0914
Kohgiloyeh	0.1305
Kurdestan	0.1164
Lorestan	0.099
Markazi	0.1048
Mazanderan	0.1149
Qazvin	0.0764
Qom	0.0547
Semnan	0.1431
Sistan & Baluchestan	0.1227
Tehran	0.0601
West Azarbayejan	0.0946
Yazd	0.1284
Zanjan	0.1141

6.6.2. Results

6.6.2.1. Demographic factors

The results of this evaluation showed no significant relationship between the actual expenditure and demographic factors across the provinces (Table 6.2 below). The actual budget was positively related to the population under-5 (R= 0.148, RS= 0.022, P< 0.448) and negatively related to the women aged 15-49 (R= 0.205, RS= 0.042, P < 0.297), and population aged 50 and over (R= 0.138, RS= 0.019, P < 0.488). However, none of the associations were significant. This implies that the health expenditure in the provinces is not consistent with the number of people in the age/sex groups.

Table 6-2. Relationship between the demographic factors and actual expenditure

	R	RS	P-value
Population Under-5	0.148	.022	.448
Women aged 15-49	0.205	.042	.297
Population 50 and over	0.138	.019	.488

R= Correlation coefficient; RS= rout square; P-value = the significance of the regression coefficient; significant level is *5%.

6.6.2.2. Mortality

There was a positive but not significant relationship between the actual expenditure and mortality indicators across the provinces (Table 6.3 below). The actual budget was related to the mortality under-5 (R= 0.332, RS= 0.11, P< 0.083), male mortality (R= 0.412, RS= 0.17, P< 0.0.030); but the associations were not significant. There was a significant positive relationship between the actual budget and male mortality (R= 0.265, RS= 0.07, P< 0.165). This indicated that the health budget in the provinces was only in line with the mortality in men; but not consistent with the children and women's mortality.

Table 6-3. Relationship between actual expenditure and mortality

	R	R square	P-value
Mortality under 5	0.332	0.11	0.083
Mortality in men 15-60	0.412	0.17	0.030
Mortality in women 15-60	0.265	0.07	0.165

R= Correlation coefficient; RS= rout square; P-value= the significance of the regression coefficient; significant level is *5%.

6.6.2.3. Morbidity

The results (Table 6.4 below) showed a negative relationship between the actual expenditure and hypertension (R=-0.302, RS= -0.091, P< 0.646), high cholesterol (R= -0.214, RS= 0.046, P< 0.274); however, neither were significant. There was a significant negative relationship between the actual expenditure and diabetes (R= -0.495, RS= 0.245, P< 0.007). Results showed a positive significant association between the expenditure and low weight in children (R= 0.449, RS= 0.202, P< 0.016). This information implies that the health expenditure is only consistent with the children's low weight; provinces with higher rates of low weight in children received higher per capita expenditure. The negative significant association between the health budget and diabetes indicates that the expenditure is inversely distributed with the prevalence of diabetes in the provinces. In fact, provinces with higher rates of diabetes have received a lower per capita expenditure.

Table 6-4. Relationship between actual expenditure and morbidity

	R	**R square**	**P-value**
Hypertension over 15	-0.302	-0.091	0.646
High blood cholesterol over 15	-0.214	0.046	0.274
Diabetes	-0.495	0.245	0.007*
Under 5 low weight	0.449	0.202	0.016*

R= Correlation coefficient; RS= rout square; P-value = the significance of the regression coefficient; significant level is *5%.

6.6.2.4. Socioeconomic factors

The findings (Table 6.5 below) showed a positive relationship between the actual budget with rural population (R= 0.486, RS= 0.236, P< 0.009), household size (R= 0.370, RS= 0.137, P< 0.053), illiteracy (R= 0.261, RS= 0.068, P< 0.182), low GDP per capita (R= 0.762, RS= 0.058, P< 0.218), and unemployment (R= 0.341, RS= 0.0116, P< 0.077), overcrowding (R= 0.118, RS= 0.014, P< 0.544). However, the association was only significant with those living in rural areas. In fact, provinces with the higher rates of rural population received higher per capita expenditure.

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Table 6-5. Relationship between the actual expenditure and socioeconomic factors

	R	RS	P-value
Proportion of rural population	0.486	0.236	0.009*
Household size	0.370	0.137	0.053
Illiteracy rate over	0.261	0.068	0.182
Low GDP per capita	0.762	0.58	0.218
Unemployment	0.341	0.116	0.077
Members of household per room	0.118	0.014	0.544

R= Correlation coefficient; RS= rout square; P-value= significance of the regression coefficient; significant level is *5%.

6.6.2.5. Discussion

The results of this study show that health expenditure in the provinces was not consistent with the number of people in the age/sex groups of children under-5, women of childbearing age, and the elderly. Previous studies have indicated that these three groups have higher needs for health care (Okojie 1994; Mendoza-Sass and Béria 2001; McIntyre et al., 2007; Layte et al., 2009). The findings in the first part of this study (Table 4.3) showed variations in the proportions of these age groups across the provinces, with larger rates of children in the provinces with lower socioeconomic status and a larger proportion of adult females and the elderly in provinces with higher socioeconomic status. This indicates an opposite direction of need for health care across the provinces due to the differences in the age/sex groups. The negative relationship between the actual expenditure and proportion of women of childbearing age and the elderly indicates that the pattern of distribution of the expenditure between the provinces is opposite to the proportion of the adult females and the elderly in the provinces. Overall, the current health expenditure across the provinces is not consistent with the demographic need in the provinces.

The finding in this section showed that among the mortality measures, the actual expenditure had only significant association with the male mortality. In fact the allocation health expenditure was consistent with male death rates in the provinces but not similarly in line with mortality in children under-5 and adult females. The results from the first part of this study showed variations of the mortality indicators across the provinces univariately and in relation to the socioeconomic factors. The rates of the mortality indicators were larger in less affluent provinces; in addition, there was the largest variation in mortality under-5; then in the male mortality; and the lowest variation was related to the female. In fact, the highest need arises from mortality in children; then from mortality in men and women respectively. However, the health expenditure in the provinces is only in line with the mortality in men; but not with that of children and in women.

The finding showed negative relationships between the actual expenditure and coronary disease risk factors of hypertension, high blood cholesterol, and diabetes; this indicates that the distribution of health expenditure is not consistent with the inequality of the risk factors across the provinces. As was indicated in the first part of this study, prevalence of the coronary risk factors were higher in the more affluent provinces. In addition, there was the largest inequality in diabetes across the provinces; followed by high blood cholesterol and hypertension. In fact, the different morbidities require different levels of need for health care in the provinces. However, the current health expenditure is consistent with none of the morbidities. Provinces with the higher rates of diabetes and high cholesterol received lower health expenditure. The health expenditure was consistent with the inequality in the low weight in children under-5 in the provinces. The rates of children's low weight were shown to be higher in the less affluent provinces. Overall, in terms of morbidities, in majority of cases the current expenditure is not in line with the need rising from the morbidities in the provinces.

The findings of this study showed positive relationships between the actual expenditure and socioeconomic factors. However, the association was only significant with the number of people living in rural areas; in fact, the allocation of health expenditure is consistent with the proportion of rural population and the related need for health care in the provinces. The findings of the first part of this study showed inequalities in illiteracy, low GDP per capita, unemployment, household size, and overcrowding across the provinces. The differences between the deprivation factors indicate different levels of need for health care in the provinces. On the other hand, the current budget is not consistent with the inequalities in the deprivation factors except the rural population size living in the provinces. The consistency of the health expenditure with the rural population may be due to the health policy of the Iranian government in the past three decades and extending the PHC system to cover majority of the rural and remote areas in the country; however, the system in urban areas particularly in big cities is incomplete and patchy(EMRO 2006). Therefore, a large part of the health budget has been spent to develop this policy and the other need indicators were not considered appropriately in the allocation of health funds to the provinces.

6.6.2.6. Conclusion

Evaluation of the relationship between the current health budget and different need indicators showed that the distribution of health expenditure was consistent with a limited number of need indicators. The health budget was in line only with the mortality in men, low weight in children, and rural population; but it was not consistent with the age/sex structure, mortality in children and women, prevalence of the coronary risk factors (diabetes, high cholesterol, and hypertension), or deprivation indicators. Overall, the allocation of health budget across the provinces is not appropriately distributed to cover all the need rising from the different domains of demographic composition, ill-health, and low socioeconomic status. The literature on the process of resource allocation in Iran (section 6.5.2) also showed that the public health funds are being distributed across the provinces mainly based on the historical incremental method and political bargaining. These methods are showed to be an inequitable way for allocation of health resources. Having the inconsistency of the health expenditure and the need for health care in the provinces, identified in this study, as well as the current inequitable mechanism of health resource allocation in the country, show that it is necessary to move towards an equitable method of resource allocation across the provinces of Iran. Needs-based resource allocation is considered as an appropriate method to apply in this regard (Rice and Smith 2001b; McIntyre et al., 2002; Asante et al., 2006 a; PBRA Team 2009). Consequently, the next three chapters will try to develop a needs-based formula for reallocation of the public health budget across the provinces.

6.7. Summary

In this chapter I first evaluated the health care delivery and administration systems in Iran to see how they are supportive for the promotion of equity in health in general and for equitable allocation of health resources in particular. The health care delivery system was shown to be originally established based on the Alma Ata declaration (1978) focusing on the extension of primary care facilities and services to Iran's citizens, in particular those living in rural areas. In administrative terms the health system was shown to be centralized, with the Ministry of health making health policies at national level and the Medical Science Universities being responsible for implementation of the policies in the provinces and districts. Despite some insufficiencies, the health delivery and administrative system were found to be supportive for the equitable allocation of health resources and the reduction of health inequities. Evaluation of the sources of funds for the health system in Iran showed that the largest share of spending (58%) on health care in Iran was through out-of-pocket payment and that public expenditure forms the smaller share of spending on health, at 42%; this figure is less than the global average and considered to be unfair and inequitable. The current allocation of health resources in the public health system of Iran was shown to be predominantly based on historical instrumentalism and political bargaining, and not based on the need for health care, and thus is considered to perpetuate the current health inequities in the country. Evaluation of the government expenditure on health showed that the actual health budget in the provinces was not consistent with the need indicators of different domains; thus, not in line with the need for health services in the provinces. Therefore, in the next chapters I will explore alternative needs-based resource allocation models for equitable allocation of public expenditure to contribute with the reduction of health inequities among the provinces of Iran.

7. Literature on needs-based resources allocation

7.1 Introduction

Equity in health care resource allocation is considered as one of the elements of health systems that can contribute to the promotion of equity in health care and health outcomes (Marmot et al., 2008; WHO 2008b). In this regard, equitable allocation of health budgets across geographic areas using needs-based formulae is becoming increasingly popular (Rice et al., 2000; McIntyre and Anselmi 2012). The theoretical basis for needs-based resource allocation formula is that the need for health services is not necessarily equal in populations of equal size and the characteristics of the population are the basis to drive the relative need in the populations (Birch et al., 1993; Birch et al., 1996; Ministry of Health and Ministry of Cooperative 2011). Such a formula allows one to estimate the relative need for health services in each geographic area, using indicators such as population size, demographic composition, levels of ill-health and socio-economic status (Birch et al., 1993; Eyles and Birch 1993; Asante et al., 2006 a; McIntyre et al., 2007; Ministry of Health and Ministry of Cooperative 2011; Rice and Smith 2001). Taking these characteristics into account, the formula provides an appropriate magnitude of the resources and financial capacity of the local institutions such as local governments, local administrations and health authorities to fulfill their objectives. A resource allocation formula is, in fact, able to identify prospectively the budget of local agencies through mathematical rules that provide enormous scope for ensuring that funding is aligned with equity policies and objectives of national health systems (Ong et al., 2009). In other words, health resource allocation by formula attempts to resolve budget inequities that generally occur across areas within a region or country (McIntosh et al., 2010).

Smith et al. (2001) described five main justifications for the increasing intendancy to use of resource allocation by formula: (i) being considered fair and non-partisan by the distributor: considering all the recipients of funds in the same way is a particular characteristic of a formula, which causes the outcomes of the resource distribution to be more acceptable to the recipients; (ii) being funded equally and securing equity objectives is considered important by the recipients of the expenditures in many cases; (iii) if the relative needs of patients are not recompensed appropriately, the recipients of the funds may seek to serve less needy patients; (iv) explicit criteria which are used in the funding formulae will enable the stakeholders to have informed opinions around the resource allocation mechanisms; and (v) other current forms of resource allocation (e.g. incremental budgeting and pluralistic bargaining) can be affected by political pressures and precedents which are difficult to diffuse in the long term. Moreover, issues such as challenges in identifying the right level of funds on a sub-national level (such as technical difficulties to determine the best method of allocation), incentives for the local agencies to influence the level of funds, political reflections, and problems in monitoring equity in allocation of public funds at local level are forcing national governments towards using funding formula for the allocation of health care resources (Smith 2008a).

Geographical area is usually the unit for resource allocation decisions in most health systems, and therefore the basis for the formula funding (Rice and Smith 2001b; McIntyre et al., 2002; Asante et al., 2006 a; PBRA Team 2009). A number of rationales have been used to justify geographical-based resource allocation. It has been demonstrated that the characteristics of geographical areas or “area effects” as well as other socioeconomic characteristics can contribute to health and health inequalities (Ricketts 2004). In addition, geography can influence the health of individuals through the effects on the production of health care and utilisation of health services (Subramanian et al., 2002). Therefore, equitable allocation of health budgets through a geographic needs-based resource allocation can be useful to reduce inequities due to the area effects. Further, equitable distribution of health funds across geographical areas can improve previously inappropriate distribution of health facilities and establishments in the areas (Sepehrdoust 2009 ; Ahmad Kiadaliri et al., 2011). In addition, using the geographic-based resource allocation approach it is possible to compensate for the differing costs of health services across the areas (Smith 2008a). Moreover, allocation of health resources based on geographic areas is an important method in the implementation of both principles of horizontal (equal healthcare access) and vertical equity (equal health outcomes) in health (McIntyre et al., 2002; Sutton et al., 2002).

Geographic-based resource allocation has also the potential to incorporate both equity and efficiency objectives of health systems (Mossialos and Dixon 2002). For example, allocation of a larger share of the health budget to geographical areas with higher need for health care can increase efficiency in the use of health services (Diderichsen 2004).

To develop a needs-based formula, it is important to have an operational definition of equity at the beginning (Zere et al., 2007). In other words, defining what a needs-based approach is expected to achieve is an important first step in developing a resource allocation formula based on need (Østerdali et al., 2006). Different concepts of health care equity were described in chapter 2, and the definition by Starfield (2001) as the "*differences in access to health services for equal health need and/or absence of enhanced access for socially, demographically, or geographically defined population groups with greater health need*" (P 1) was adopted to underlie the development of resource allocation models in this study.

A growing number of countries have introduced geographic needs-based resource allocation formulae to break the unfair historical methods of resource allocation (Rice et al., 1999; McIntyre et al., 2002; EQUINET 2003). England was the first country to adopt needs-based resource allocation by establishing the Resource Allocation Working Party (RAWP) in the NHS in 1976 (Gordon et al., 2001; Asthana and Gibson 2008). The aim for RAWP was achieving equal opportunity of access to health care for people at equal need regardless of where they live (Department of Health 1976). Introducing RAWP was in fact establishing a system of allocating resources which would be responsive to the health needs of the population as well as identifying and correcting inequalities in the existing pattern of resource distribution across the NHS areas. The formula was aimed to allocate NHS resources for hospital and community health services on the basis of population size, age and sex composition, morbidity and unavoidable cost of health services in the areas (PBRA Team 2009). Since 1999 a second aim has been to contribute to the reduction in avoidable health inequalities (Sutton et al., 2002).

In Italy a needs-based resource allocation model was developed with the aim of reducing health outcome inequities across the geographical areas in the country (Watson and Ovseiko 2005). McIntyre et al., (2002) developed alternative needs-based resource allocation models for redistribution of health budget across the districts in South Africa. Zere et al., (2007) studied a needs-based resource allocation model in Namibia based on the concept of equity in health care as “equal access to a basic package of services for equal need”. They reported that a vertical approach could be more useful to apply because of the wide socioeconomic inequalities in the country; however, the principle of horizontal equity was used as it seemed to be more pragmatic and politically acceptable in the context of Namibia.

Most of the formulae try to meet the health care needs of populations using weighted capitation which secures distribution of resources according to the principle of equal opportunity of access to health care for all people of equal need taking into account the demographic composition, ill-health and socioeconomic factors across geographic areas (Hauck et al., 2004). These factors are considered as the main proxies of need for health care in a region or community (EQUINET 2003; McIntyre and Anselmi 2012).

7.2. The need for health care

The notion that health care should be allocated on an equitable basis according to the “needs” of the population underlies most approaches to public health system resource allocation. However, “need” is a normative concept and has been defined in different ways. There are four main concepts of health need in the literature including: need as medical necessity; need as burden of disease; need as comparative health deficit; and need as capacity to benefit from health care (Charles et al., 1997; Asadi-Lari et al., 2003; Ardal et al., 2006).

Need as medical necessity is “what physicians and hospitals do” or what an expert authority says is a need. In other words, the "medically necessary service" is one that a patient needs in order to avoid negative health consequences (Charles et al., 1997). The Canada Health Act in 1984 adopted this definition for identifying the services that must be paid for by the health insurance organizations in Canada; having this, all hospital services that are "medically necessary and required" are paid for by the organisations (Madore 2005). However, the problem with this concept is that all the need for health care in community is not reflected through the needs of individual patients who visit health professionals (Asadi-Lari et al., 2003). Many patients may not refer to a general practitioner to receive health services as they believe that the services are not helpful. Further, some patients such as those with mental problems may not be aware of their problems in order to seek health care (Marshall et al., 2010). Therefore, this definition is not considered as a perfect concept of need for health care as it may perpetuate current practices rather than guiding practices to meet expected needs (Ardal et al., 2006).

In the concept based on the burden of disease, need is determined by the magnitude of the health problem or ill-health (Ardal et al., 2006). The burden of disease is the size of population health problems and overall burden of illness which has emerged by aggregating all burdens estimated for individual illnesses (Murray et al., 2010). Summary measures such as quality-adjusted life years (QALYs), disability-adjusted life years (DALYs) and health-adjusted life years (HALYs) are considered as the common summary measures for the estimation of the burden of disease (Smith 2008a). The “existing burden of disease” is the scale of need to health care when resources are to promote the principle of equal opportunity of access for equal needs (Murray et al., 2010). However, this definition of need is problematic because it ignores the limits of what is medically possible (Hauck et al., 2004). For example, where there is no effective treatment for an illness, the severity of illness is not considered for the need for health care.

The concept of “comparative health deficit” suggests a comparison to some standard (e.g. average for the chosen indicator) (Ardal et al., 2006). In this case, usually the current state is compared with a determined target for health. In other words, are we better or worse than others? (Smith et al., 2001). Comparative need is a subjective need and determined by comparing populations based on certain indicators; it often substitutes as a gauge of unmet need in the absence of an absolute standard. It is underpinned by the concept of equal allocation of resources. But the subjective expression of need can become endless and may also be “irrational” or socially unacceptable (Ardal et al., 2006).

Health need is also defined as the “capacity to benefit” or “ability of people to benefit from health care provision” (Ardal et al., 2006). This is an economic approach concept of need, implying that an individual or population has “need” only if a capacity to benefit from health care service exists (Asadi-Lari et al., 2003). This concept addresses the outcomes to be achieved by allocating resources on the basis of need wherein only those things about which something can be done are considered as a need, and among the things that can be done, those that could produce the most benefit are selected (Ardal et al., 2006). Therefore, there would be no benefit from an intervention that is not effective, and resources should be allocated to interventions such as disease prevention, health protection and enhancement, or the postponement of death which are considered to be effective in producing benefit; and consequently the most benefit will be produced (John et al., 1998).

There are different conditions of capacity to benefit in health service jurisdictions: when a population already has good health the capacity to benefit from health care is limited; where two populations have the same health levels but one of them is more amenable, it has more capacity to benefit; the level of health in two populations may be the same, so they have the same capacity to benefit (Mooney and Houston 2004). Therefore, it not just the severity of illness but treatability of the illness that affects the capacity to benefit from health services; and identifying need with capacity to benefit may bias against people who need expensive treatment (Smith 2008a). One point here is that, when individuals with the same need have the same capacity to benefit from the care services, equity and efficiency are not in conflict; in this case both objectives would advance with the same resource allocation (Denier 2007). In any other definitions of need, equity may conflict with efficiency.

Most of the developed needs–based models have sought to be based on the two broad concepts of “the general burden of disease in the population” and “capacity to benefit’ from resources (Sutton 2002; Sutton et al., 2002; Zere et al., 2007; Rice and Smith 2001). It is believed that this approach based on the burden of disease employs a block contractual system with little uncertainty about the expected level of available sources for health care intervention and restricted prospects for opportunistic behaviour by medical staff (Marini and Street 2007). However, both concepts of capacity to benefit and general burden of disease are difficult to measure and to use in resource allocation formulae and a formula is developed using a combination of demographic composition, mortality as a proxy for level of ill-health (because it is easy to measure), and socioeconomic factors.

7.3. The need indicators

It is difficult to directly measure the needs for health care in a population, therefore proxy measures have generally been used for health need measurement (PBRA Team 2009). There are no gold standard proxies that perfectly show the need for health care in communities; this often creates challenges in choosing need indicators for developing needs-based resource allocation formulae (Ardal et al., 2006). Need indicators may create perverse incentives for the local authorities to be affected (Department of Health 2008); for example, population sizes may be exaggeratedly reported or mortality rates may be increased by not treating the sick; self-reported health measures can inappropriately affect the indicators and consequently the model of resources allocation (Pearson 2002). In addition, the indicators should meet other requirements to be appropriate to use as proxies of need in developing resource allocation models. There are seven main criteria (Table 7.1 below) that should be met by need indicators, including being universally recorded, verifiable, consistent, free from perverse incentives, not vulnerable to manipulation, being consistent with confidentiality requirements as well as being plausible determinants of service needs (Smith 2008a; PBRA Team 2009; Rice and Smith 2001).

Table 7-1. Assessment of Usefulness of Variables for Capitation Purposes

	Demography	Ethnicity	Employment /Disability	Geographical location	Mortality	Morbidity	Social factors
Universally recorded	++	+	? +	++	++	_ _	?+
Consistent	++	+	++	+	+	_	?+
Verifiable	++	+	+	+	+	_	?+
No incentives for gaming	++	+	?	++	+	_ _	_
Not vulnerable to manipulation	++	+	+	++	+ +	_ _	_
Confidentiality respected	++	+	_	+	+	_ _	?
Plausible	_	_	Disability	_ _	?-	++	_

Source: Rice et al. 2001a; the signs of (++), (+), (-) and (--) may indicate that meeting the criteria the variable is high, moderate, weak and very weak. (?) means that meeting the criterion by the indicator is not clear.

Several variables including demography, ethnicity, employment/disability status, geographical location, mortality, and morbidity and social factors have been proposed as the main variables to reflect the need for health care (Diderichsen 2004; Rice and Smith 2001). It has been found that demographic indicators as well as ethnicity, geographical location, and mortality (Table 8.1) meet most of the required criteria to be appropriate proxies of need for health care (Rice and Smith 2001); these indicators had only limited plausibility in explaining health care utilization. On the other hand, morbidity data would perform poorly on most criteria. Ardal et al., (2006) also described nine types of need indicator that can be used for the measurement of health care need including: health services utilisation, mortality measures (SMRs, life expectancy, DALY), health-adjusted measures (morbidity, disability and self-assessed health), health risk factors, deprivation, economic burden of disease, demographics, stakeholder perceptions and community indicators. Utilisation indicators are usually used as a scale for selection and weighting the potential need indicators (Sutton et al., 2002). Diderichson (2004) states that age, with greater weight for births and population aged over 75 years, is the main need factor used for capitation payment in high income countries, and socioeconomic and morbidity-related factors are considered as less important factors except for psychiatric care and community care; while in low and middle income countries, populations under five, poverty indicators and rural population have the highest frequency of use as need factors in the development of needs-based funding formulae.

Measures of service utilization are inappropriate to apply as indicators of need. This is because the utilization of health care services is the outcome of a complex interaction of many factors such as supply, geographical availability of services, practice availability, care effectiveness and political-economic structure (Asthana and Gibson 2008). Therefore, use of health services may not be consistent with distribution of relative levels of need for care in the population (Carr-Hill et al., 2005). Utilization can be influenced inappropriately by factors such as unmet need, which is where people in need are not using the health services, and unjustified utilization, which is usually due to supplier-induced demand (Allin et al., 2010). Further, in some cases populations with the same need may have different utilisation of health care when there are different supplies of resources, or populations with the same utilisation may have different needs (Ardal et al., 2006). As a result, existing health inequalities and inefficiencies within the system may be perpetuated when utilisation indicators are used as health care needs indicators to inform geographic allocation of health budgets.

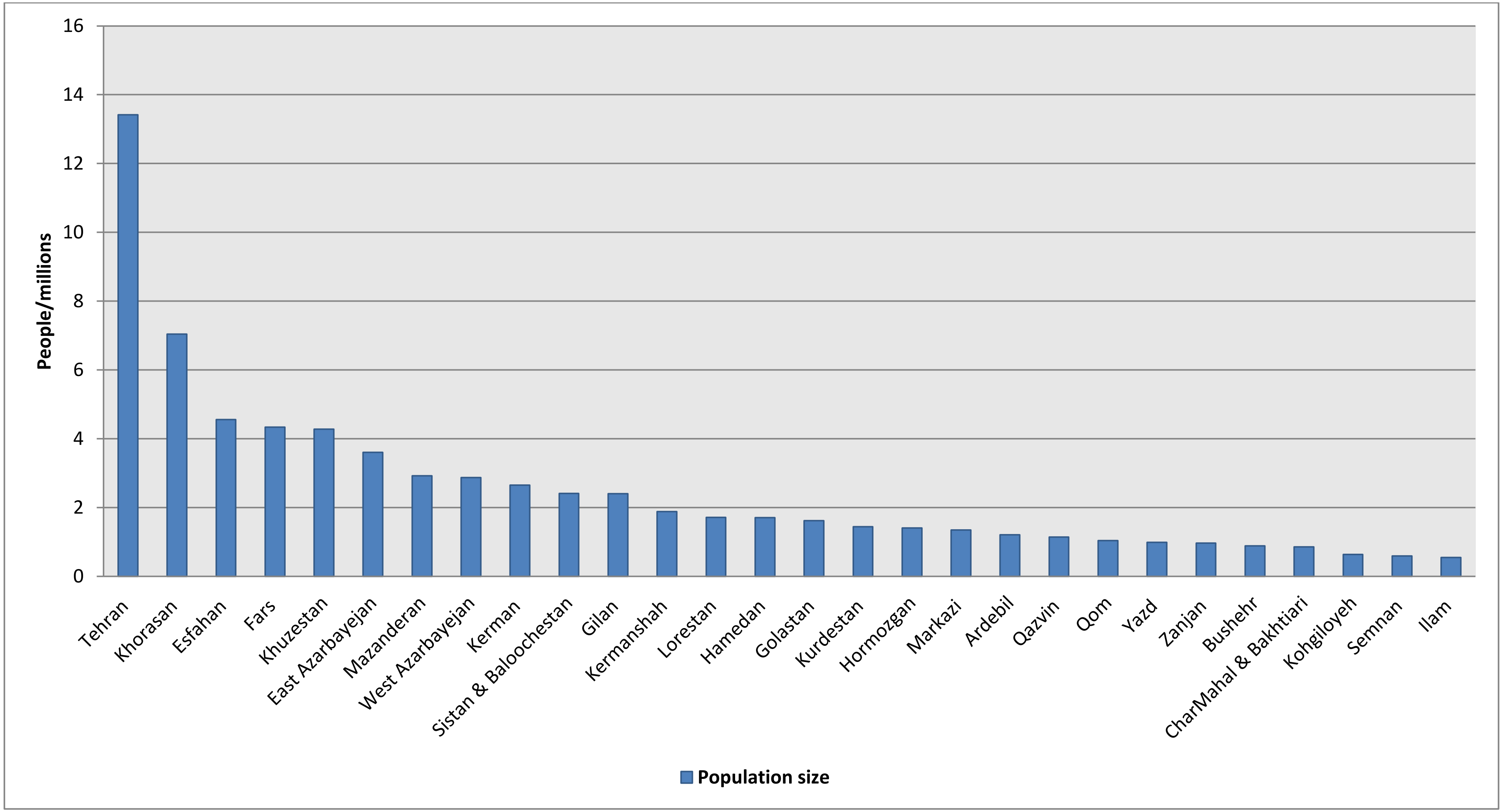
In general, there are diverse indicators of need for health care as described above; but, because of the underlying criteria and assumptions, the lack of research evidence on appropriate need factors, lack of dependency and legitimacy of the need factors, and lack of suitable and relevant data on the potential need indicators, there are severe limitations and controversy on the choice of need indicators to inform distribution of health funds (Newbold et al., 1998; Smith 2008a). However, indicators of population size, demographic composition, mortality and socioeconomic status (deprivation) are the most commonly used indicators as a proxy of need in developing needs-based resource allocation formulae (McIntyre et al., 2002; Zere et al., 2007; Rice and Smith 2001). Population size is often weighted by age and sex structure, mortality levels, socioeconomic status (deprivation), ability to pay for health care costs, and dependence on public expenditure on health services, to capture the real need (McIntyre and Anselmi 2012).

7.3.1. The population size

It is the characteristics of individuals that determine their need for health care. Therefore, population size within a geographic area is the first important indicator of need for health services to include in a resource allocation formula (EQUINET 2003; Oliveira and Bevan 2003; McIntyre et al., 2007; PBRA Team 2009). There are often two forms of official resident population statistics including estimates of past populations (mainly from census) and projected populations. Projections are considered more appropriate to use for resource allocation purposes (Oliveira and Bevan 2003). However, the size of population may change due to new births and migration which is an implication in the population projection in particular where the change is rapid (Buxton and Klein 1978).

The population size is considered as an important indicator of need for health care in the context of Iran because of the wide variation in the size of the population across provinces. Based on the census 2006, the total population in Iran is 70,472,846 people. However, there are a wide range of population sizes across the provinces; the smallest size of population is related to Ilam with 545,787 people and the largest related to Teheran with over 13 million people (Figure 7.1 below). The variation population across the provinces indicate differences in the need for health care across the provinces. Given GDP per capita as the indicator of economic status, there was around 33% of the population living in the provinces located in the best-off quintile; while 15% live in the provinces of worst-off quintile. As mentioned in chapter 4 (section 4.2.3), population size in the provinces is affected by the fertility rate and net migration in the provinces. In addition, some provinces such as Tehran, Khorasan, Sistan & Baluchestan, and Kurdestan, are hosting Afgan and Iraqi refugees. These phenomena can affect the number of population in the provinces over time.

Figure 7-1: Population size in the provinces



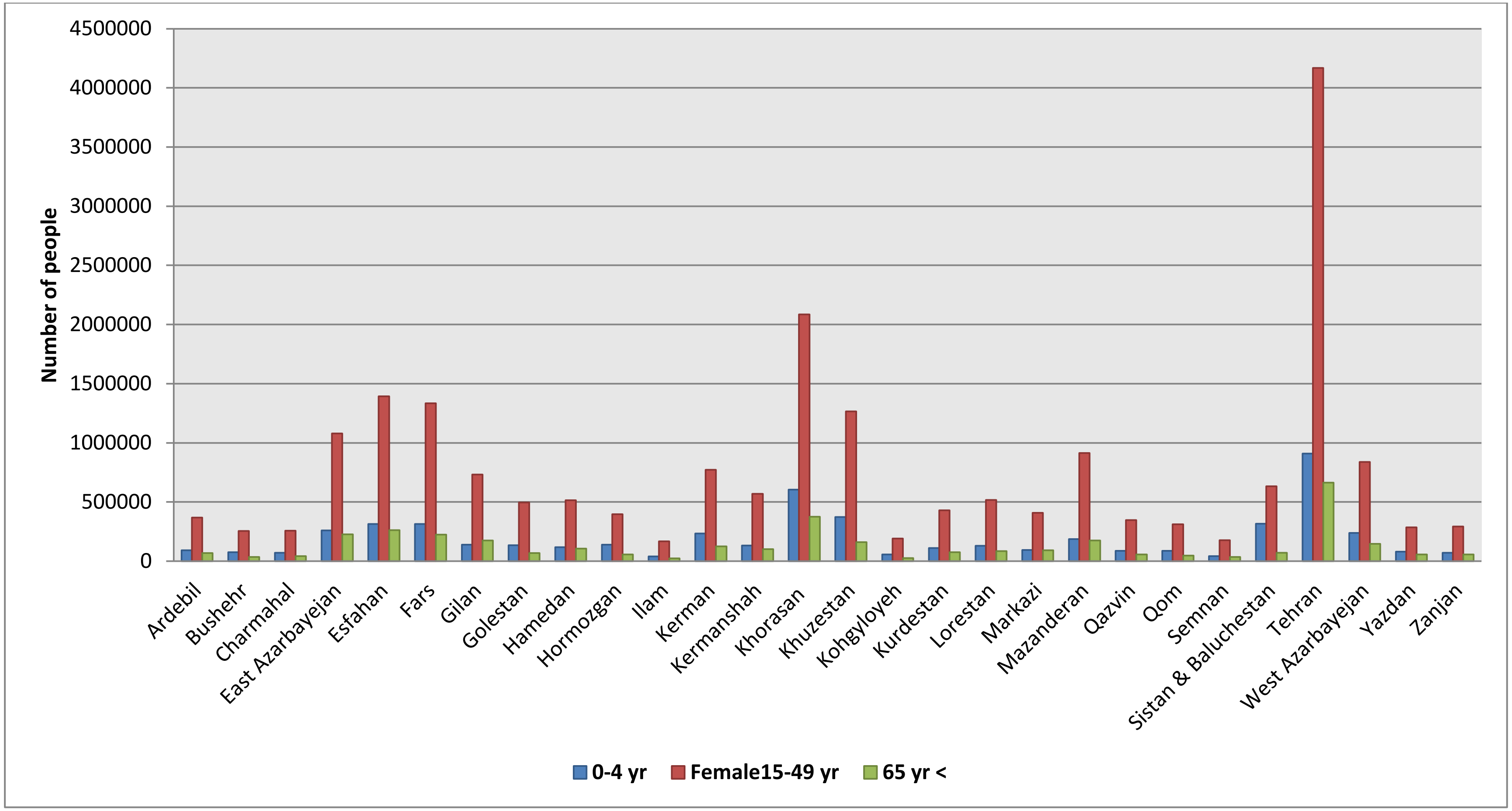
7.3.2. Demographic indicators

Demographic composition of the population in a region or country, particularly age and gender characteristics, is considered an important factor to be adjusted for in the estimation of the relative need for health care in order to inform geographic allocation of health resources (Rice et al., 1999; EQUINET 2003; PBRA Team 2009). This is because there is a close relationship between age/sex and the need of health care; for example, young children, women of childbearing age, and the elderly have been shown to have higher need for health care (Okojie 1994; Mendoza-Sass and Béria 2001; McIntyre et al., 2007; Layte et al., 2009).

It is the national use of health services that are used for adjustment in resources allocation models. For example, RAWP acknowledged that demographic characteristics influence the need for health care and weighted the population of each area according to its national use of health services by age and sex groups (Smith 2008b). By weighting the population by demographic composition, RAWP took into account the variations in the use of health resources by the different age and sex groups. The age and sex structure was accounted for in the form of national utilisation rates for each age and sex group (Staines et al., 2010). In the UK formula that was reviewed in 2006, the 18 age bands within the health trusts were adjusted by the national utilization of health services in the trusts (Department of Health 2008). In South Africa, McIntyre et al., (2012) used age/sex composition adjusted by the national utilization of health services in each group as a factor of need to be included in the health resource allocation formula. Children under-5 was selected as a measure of the demand for child care; females aged 15–49 as an indicator of the increased need for health care experienced by females, mainly in relation to childbearing; and people aged 65 or over as a measure of the need for care of the elderly. Age group under-5, female population, and elderly population (70 years and old) were used to measure need for health care across areas in Ghana by Asante et al., 2006.

Demographic composition is also an important indicator of need in the context of Iran. The information (chapter 4, section 4.3 and Table 4.2), indicated variations in the proportion of people in the three age/sex groups of children under-5, women of childbearing age, and the elderly; that indicated higher need for health care. Figure 7.2 (below) illustrates how the number of people in the age/sex varies across the provinces. Overall, the number of people in the age/sex groups was higher in the provinces with the largest population size. The largest number of children under five was located in Tehran, Khorasan, Khuzestan, Sistan & Baluchestan, and Fars; and the smallest in Ilam, Semnan, Kohgiloyeh, Charmahal, and Zanjan. There is nearly the same ranking of the provinces for the women of childbearing age and the older population with slight differences compared to the children under-5. The variation in the age/sex groups' population can reflect different levels of need for health care in the provinces; thus, the adjustment for the demographic composition would affect the amount of budget directed to the provinces.

Figure 7-2: The number of population in the age/sex group across the provinces



7.3.3. Level of ill-health in the population

Ill-health including mortality and morbidity is considered as an important proxy of need for health across a region or geographical areas (Birch and Eyles 1991; Oliveira and Bevan 2003; McIntyre et al., 2007; Smith 2008b). In terms of morbidity, measuring the prevalence or incidence of specific morbidity indicators is the main approach to identify the need for health care as morbidity directly indicates the state of ill-health in the population (WHO 2000; Kephart and Asada 2009). Prevalence of some chronic diseases such as diabetes, cardiovascular problems, and arthritis as well as incidence of acute morbidity such as injury or gastrointestinal and respiratory infection are examples of appropriate morbidity indicators for the measurement of need for health care (Manitoba Centre for health Policy and Evaluation, cited by Ardal, 2006). Case recorded data on morbidity such as ischemic heart disease, osteoarthritis, cancer and psychoses were used in combination with socioeconomic factors as proxies of need to develop population-based resource allocation in Stockholm County in Sweden (Andersson et al., 2000). Long-lasting illness such as nervous, circulatory and respiratory morbidities were used as need indicators in the NHS resource allocation formula reviewed in 2001 (Sutton et al., 2002). Self-reported health, which is the perception of individuals of their health relative to the health of their peers, is also considered as an appropriate summary measure of morbidity and a reliable and valid measure of need for health care as it has a close relationship with many other health indicators (Asante et al., 2006 a); and it is also independent of the utilisation of health services (WHO 2000).

However, the use of morbidities as proxy of need is not popular because of technical problems. For example, data on the morbidity cases may be severely biased by differences in the efficiency of record-keeping across institutions and regions, in particular when health services are fragmented and there is an unequal access health (Smith 2008a). In addition, morbidity indicators may not cover all health conditions for which people have health care need (PBRA Team 2009); this may underestimate the need for health care resources in areas with greater need. Further, there are always limitations in the frequency, timing or availability of morbidity data for entire populations and regions that creates limitations for measuring health need through morbidities (Vallejo-Torres et al., 2009). There are the same limitations on the production and use of morbidity data to inform health resource allocation in the context of Iran.

Mortality is a commonly chosen to indicate need for health because of characteristics such as familiarity, reliability and ease of data collection (Sutton et al., 2002; Oliveira and Bevan 2003). Mortality rates have high sensitivity to differences in socioeconomic status; they reflect the effects of social and health experiences of people living in an area (Diderichsen 2004). Measures of SMR, life expectancy, DALYs, and age/sex specific mortality indicators have been used as need indicators to inform resource allocation for health. For example, standardized mortality rate (SMR) has been used in RAWP for the allocation of health resources among NHS-related areas in the UK in 1974 (Smith 2008b). Crude and standardized mortality measures were also used as a proxy of need in the capitation schemes in Belgium, Scotland, Northern Ireland, New Zealand, New South Wales, Norway and Italy (Ardal et al., 2006). Adjustment for life expectancy at birth was proposed for use as a criterion for the reduction of avoidable health inequalities in the revised formula in the UK in 1999 (Sutton et al., 2002).

However, SMR may be biased by the number of deaths in older population; in areas with larger number of the elderly (Carr-Hill and Sheldon 1992; Jones and Swerdlow 1998). In addition, it may not reflect the additional needs for some services such as mental health in the provinces (Gordon et al., (2001). Life expectancy at birth may also not be a perfect need proxy as it does not take into account the effect of disabilities due to non-fatal diseases (Sutton et al., 2002). There have been methodological criticisms of the development of DALYs and concerns around using the indicator as the basis for resource allocation. For example, there is a conceptual and technical basis in the estimation of DALYs including age-adjustment and discounting (Hauck et al., 2004). Furthermore, the DALYs framework is not able to make a distinction between individuals or groups who are not similar in socioeconomic status such as income (Anand and Hanson 1997); therefore, allocating resources by aggregate DALY-minimization is not considered to be equitable. There is always a lack of data on the DALY that is a challenge for application of this indicator. In Iran, at the time of data collection, there was a lack appropriate data on the SMRs and DALYs particularly at provincial level.

Age/sex-specific mortality ratios are other indicators that have been considered for use as proxy indicators of need for health resource allocation; these measures can cover the need due to premature deaths in young and middle age and sex groups (Rice and Smith 2001). These measures can be considered as appropriate indicators to guide health resource allocation in the context of Iran as there is appropriate information on these measures in particularly at provincial level in the country. Table 4.13 (section 4.6.1) shows information on three measures of mortality unde-5, and mortality in adult male and female. As described, there were wide variations in the mortality measures in relation to the socioeconomic factors across the provinces; with the largest variation and relationship in the rates of under-5 mortality and the lowest in the mortality in adult females. Data on the premature mortality measures is estimated and updated by the MOHME; thus, always accessible to use for the resource allocation model.

7.3.4. Socioeconomic status

Socioeconomic status is often used as an indicator of the relative need for health care and health resource allocation in combination with mortality (Birch and Eyles 1991; Rice et al., 1999; McIntyre et al., 2002; Zere et al., 2007). This is because mortality in itself does not give a full perspective on ill-health; it only reflects the level of ill-health that leads to death and does not show the level of ill-health that requires health services but does not necessarily lead to death. In addition, socioeconomic status or deprivations are considered as a proxy of need as there is a strong relationship between socioeconomic factors and ill-health (Marmot et al., 2008; Abuqamar et al., 2011). The results from the first part of this study also showed a strong relationship between socioeconomic status and premature mortality across the provinces of Iran. Moreover, socioeconomic indicators are difficult to be manipulated by stakeholders (Diderichsen 2004). However, the relationship between the social status and need for health care is not mechanistically straightforward (Blackwell et al., 2009).

Many different socioeconomic indicators are used as proxies of need for adjustment in the health care resource allocation models in different countries, for example: homelessness & educational attainment (New South Wales), unemployment (Belgium, the Netherlands and Stockholm, England), welfare status (Alberta, New Zealand and Northern Ireland), marital status (Norway, Stockholm), family structure (Norway), housing quality (Belgium), housing tenure and social class (Stockholm), cohabitation (Stockholm, Northern Ireland), income (Finland) (Rice et al., 1999; Smith 2008a).

Socioeconomic factors have been used to develop deprivation-based indexes for the allocation of health resources in many countries. For example, in the UK the Jarman index, was developed in 1983 using indicators of unemployment, overcrowding, lone pensioners, single parents, children under-5, low social class, one year emigrants, and those born in new commonwealth countries. This index was used in the review of RAWP formula in 1988, in order to give additional funds to people living in deprived areas (Testi et al., 2004). The Swedish UPA Index was created using indicators including children under-5, persons in one-parent families, elderly persons living alone, unemployed, persons living in crowded households, unskilled, those who have moved house in the last year, and persons of minority ethnic origin for distribution of funds among general practices in the most deprived areas in Sweden (Bajekal et al., 1996).

In South Africa, indicators of unemployment, population living in poor housing conditions, no access to piped water, poor toilet facilities, no access to clean energy sources, illiteracy in household heads and households headed by a female were used to develop alternative composite socio-economic indexes for inclusion in a resource allocation formula across the districts (McIntyre et al., 2002). In Namibia, a deprivation index was developed using household assets, including having electricity, radio, television, refrigerator and motorcycle by household as well as the source of drinking water and type of toilet facility, for equitable allocation of health resource across the provinces (Zere et al., 2007). Asante et al., (2006 a) used illiteracy, unemployment, overcrowding, no electricity, no piped water, no toilet, mud-house, and wood-fuel to create a composite socio-economic index in Ghana.

Socioeconomic factors, as proxy indicators of need, are important to use for health resource allocation in the context of Iran. Several socioeconomic factors including educational level (literacy), GDP per capita, unemployment, overcrowding, rural population, and household size (these were evaluated in chapter 4). These socioeconomic indicators were strongly related to premature mortality across the provinces. There were also variations in the factors across the provinces indicating differences in the need for health care. There is appropriate information on these factors that can be abstracted from the census that is conducted every five years in Iran.

7.3.5. Weighting the need factors

As mentioned, none of the above factors of need alone can reflect the need for health care in the regions or geographical areas. On the other hand, the impact of the different need factors on need for health care is not the same. Therefore, giving a set of weights which reflects the importance of each of the need indicators is an important concern in creation of the health needs-based resource allocation formula (Pearson 2002; Diderichsen 2004; PBRA Team 2009). There is no 'golden rule' on what weights should be given to the need factors. In some cases the weighting of need factors has been based on some kind of empirical analysis (Diderichsen 2004); regression of the potential need indicators against the utilization or costs of health care is one way used for weighting the need factors (Carr-Hill et al., 1994). However, there are criticisms with this method as the use of health services can be affected by different factors, as described previously. Empirical analysis may not be appropriate to weight need indicators where the resource allocation model is created by accumulating the sum of the population size adjusted for demographic, ill-health, and socioeconomic factors separately. In this case the expert experiences on how the factors are related to the need as well as the political issues are the main criteria for weighting the need variables (McIntyre and Anselmi 2012).

Age-sex composition was considered as an important direct indicator of need for health care because of the close relationship between the use of health services and some specific age-sex groups, in particular younger children, women of childbearing age, and the elderly (Okojie 1994; Mendoza-Sass and Béria 2001; McIntyre et al., 2007; Layte et al., 2009). Mortality indicators have been shown to be appropriate indicators of need; however, mortality measures are considered as indirect proxies of need as the relationship between mortality and need is not straightforward. Therefore, death rates cannot be mechanistically included in the resource allocation formula as this may lead to nonsensical and unrealistic resource allocation patterns (Cengiz et al., 2008). Therefore, weights of less than 1 are applied to these indicators. Socioeconomic factors were also considered as indirect proxies of need, meaning that the magnitude of the need cannot be mechanistically equal to the level of adverse socioeconomic status (Blackwell et al., 2009). Therefore, weights of less than 1 are given to the socioeconomic factors where a needs-based formula is to be developed. Thus, demographic composition can take a higher weight in the model and the mortality and deprivation factors would take lower weights compared to the age-sex structure.

7.4. Other possible elements of needs-based formula

Cross-border utilization and differing costs of health services are other elements that may need to be considered when a needs-based formula is to be developed (Ensor et al., 2001; Bertinato et al., 2005; Manthalu et al., 2010). Cross-boundary flow is where patients may cross health care boundaries to seek care from neighboring health services (Bertinato et al., 2005). Cross-border use of health services is often by people who are temporary visitors, those who use facilities serving border regions, who seek treatment in other cities or abroad, and people who were referred to other cities or abroad by their own health funder because the treatment is unavailable at home or there is undue delay in obtaining the care (Bertinato et al., 2005; Rich and Merrick 2006).

Where there is additional workload due to cross-boundary flows, it is necessary for the health authorities to be recompensed through appropriate mechanisms. Without compensation, patients may be encouraged to seek health care from outside their catchment areas. Cross-boundary flows have been considered as an element in many resource allocation formulae (Ensor et al., 2001; Sutton et al., 2002; Northern Ireland FRG 2004). However, in many cases, there is a lack of information on cross-boundary flows, particularly in developing countries; this creates limitations to including the cross-border use of health services where needs-based resource allocation formulae are to be developed (Green et al., 2000).

The costs involved in delivering similar services may vary widely in different locations (Green et al., 2000). The differing costs can, for example, be far higher in remote rural areas where transport costs are higher and staff may need to be paid remote area allowances to get them to work there (Manthalu et al., 2010). The cost may be also inflated due to sparse population in an area or country with a very low population density (Rockefeller Foundation and SIDA 2005). Costs can also vary as a result of variations in input costs across purchasers (Scanlon 2006). These imply that a needs-based formula may have to be adjusted for the costs of service provision resulting from geographical factors. However, to include the differing costs in the formula, appropriate data need to be provided; in addition, deciding on adjustment for the differing costs of services is usually a political issue (Diderichsen 2004).

In Iran, the primary care services as well as the majority of medical care services are obtained from providers located in each province. However, there are also some parts of the population, usually from deprived provinces, who will require treatment in provinces with more specialists and advanced health facilities in both public and private sectors. In addition, Iran’s provinces are varied in terms of population density and geographical location, with some having more remote and rural areas (Statistical Center of Iran 2007); this can affect the costs of providing health services across the provinces and may need to be considered in the health resource allocation model. However, there is a lack of information to represent the differing costs and cross-border use of health services across the provinces.

7.5. Phasing the timeframe for re-allocation

Once a formula has been agreed, it is necessary to set up a manageable timeframe for moving from current budget allocations to the equity target allocations calculated through the formula (Pearson 2002; Smith 2008a; McIntyre and Anselmi 2012). The timeframe should be essentially outlined in relation to the degree of health inequity in a country (McIntyre et al., 2007). However, some other factors such as political influences, technical issues, and ability of health services in the areas to absorb budgetary changes are other factors that can affect the decision on a timeframe for implementation of a needs-based formula (Smith 2008a; Magnussen 2010).

A reasonable pace and clear annual targets need to be adopted for the relative redistribution of health care budgets; this will facilitate appropriate planning and avoid unnecessary disruption to services (McIntyre et al., 2007). There is relative consensus that a needs-based formula should be implemented in a medium to long term period (Smith 2008a). In technical terms, for example, where a large percentage of the budget is fixed, it may be infeasible to reduce the spending in a short time as it can significantly affect the performance of the current facilities (Pearson 2002). RAWP, introduced in England in 1978, gradually made significant shifts in the budget from the over-financed areas to the under-financed parts in the North in a 10-year period without any absolute cut (Mays 1995); in order to avoid unmanageable annual changes of the budgets, it set a maximum increase of 5% in the previous year's allocated budget and a maximum of 2.5% reduction in real budgets. On the other hand, the case in South Africa after apartheid that aimed to shift the resources from the richer areas to the poorer ones in a short time was not fully successful (McIntyre et al., 2004); as the prosperous provinces received less resources in a short time while the poorer provinces were not able to absorb additional resources effectively. There is also concern around keeping the commitment where a long-term timeframe is outlined for redistribution and moving funds across geographical area (Smith 2008a). In general, a medium-term timeframe of three to five years may not be sufficient for implementation of a needs-based formula; a longer term timeframe is necessary to be planned in this regard (Pearson 2002).

7.6. Other issues

There are other issues that need to be considered when developing a needs-based resource allocation formula, including policy commitment, timely data, exclusion of certain services from the formula, reviewing and updating the formula (Pearson 2002). A clear policy commitment to equity is a key factor that contributes to the implementation of equitable resource allocation strategies as resource allocation is a highly politicized process (McIntyre et al., 2007). It is necessary to engage the key stakeholders in the process of developing and implementing an equitable resource allocation strategy, including related politicians and those who provide funding for public sector health services such as the Ministry of Finance and managers at the provincial / regional, district and facility level as well as frontline health workers (Pearson 2002; McIntyre et al., 2007; McIntosh et al., 2010). There would be considerable opposition to the process if this support is not secured.

Access to reliable and timely data is a challenge for creating an effective resource allocation formula (Ardal et al., 2006; PBRA Team 2009). There is usually a lack of reliable data on demographic, socioeconomic and mortality indicators which are considered as appropriate proxies of need to health care (Zere et al., 2007; Kephart and Asada 2009). In many cases information on small area levels, such as district or lower geographical areas which include more homogenous populations, is not available, and where there is, the information may be unreliable or out of date (McIntyre et al., 2002). Therefore, lack of the correct data can divert the direction of the resources away from the need. However, Pearson (2002) believes that with the available data it is still possible to create a needs-based formula through which resources can be distributed beyond a simple per capita allocation. He also states that highly sophisticated needs-based formulae need more and detailed data and may not be appropriate for low-income countries. A simple funding model considering the population size, sex and age groups with higher need for health care, and also some local socioeconomic characteristics may be sufficient for developing needs-based models in developing countries (Pearson 2002).

Whether to exclude certain services from the formula (carve out) is an important factor that may arise when decisions need to be made on how to deliver essential services and where to allocate resources (Smith 2008a). For example, expenditure on mental health services may need to be separated from the local budget and distributed using another mechanism as the criteria of need for these services may be different from other health services (NHS Information Centre 2011). Some specific services such as respiratory problems and HIV/AIDS may have high costs and require carving out to be funded at national level with other methods (Maguire et al., 1998). This carving out may protect patients, physicians and the managed care organizations; however, they make implications for the process of formula funding (Smith 2008a).

Due to changes in the factors involved in the funding formula, updating is necessary after a period of time; the resource allocation formula in the UK was reviewed several times from its establishment in 1978 (Sutton et al., 2002; Department of Health 2008; PBRA Team 2009). There may be changes in the size of the population as a result of general population growth, migration, or population transition (Sutton et al., 2002) that should be considered for updating. Socioeconomic factors and the pattern of mortality and morbidity may change in the related areas or populations over time (Department of Health 2008). Urbanization, in particular in developing countries, can affect some socioeconomic factors involved in the formula (Cohen 2006). In addition, technical problems in the construction of the resource allocation models may arise in the subsequent studies that need to be resolved (PBRA Team 2009).

Implementation of a need-based funding formula may also be indirectly affected by an inadequate financial management system, inadequate monitoring and supervision, and potential uncertainties and risks in the health systems (Pearson 2002; Smith 2008a). An effective financial management system is necessary to regulate financial flows to improve access to health services (Smith 2008a). Lack of an adequate relationship between the releases and budgets is a considerable concern where releases of funds tend to be unpredictable, in particular in developing countries; the funds released to the regions at the end of fiscal year may be used in an inefficient and inequitable way (Witter 2009). An effective monitoring and supervision system can help in the appropriate implementation of need-based formula and reaching the equity objectives. For example, it can support shifting resources from advantaged areas to the poorer people (not affluent) in the less advantaged areas; or it can prevent direction of funds from essential services such as maternal care to non-essential ones like cosmetic surgery. There are usually uncertainties about future rates of morbidity and about inflation of care costs that need to be managed as estimated resources may not suffice for the actual need (Pearson 2002). Risk pooling is limited in smaller areas making them more vulnerable to higher costs and devolution of resource allocation to lower levels and smaller populations (Rice and Smith 2001).

7.7. Summary

In this chapter I reviewed the literature on needs-based resource allocation in health care including the rationales, concept of need, indicators of need, what a needs-based resource allocation looks like, and the timeframe for implementation of a needs-based formula. The main proxies of need considered in a formula are the size of population, age/sex structure, ill-health (mainly mortality), and socioeconomic status or deprivation. Age and gender structure has been shown to have a strong relationship with the use of health care and is considered as the direct proxy of need for health care. The relationship between socioeconomic status and ill-health is not straight; thus socioeconomic factors are considered as an indirect proxy of need. Socioeconomic factors have been used for the measurement of need particularly in the form of deprivation indexes. In general, a needs-based resource allocation formula is developed using a combination of age/sex groups adjusted for national utilization of health services plus population adjusted for mortality plus population adjusted for deprivation. After developing a needs-based formula, because of political and technical considerations a medium to long term timeframe needs to be developed for implementation of the formula.

8. The methodological issues in developing needs-based resource allocation models

8.1. Introduction

Having reviewed the literature on needs-based resource allocation in chapter 7, in this chapter examines the key methods and issues related to developing a need-based formula for allocation of government expenditure on health care across the provinces of Iran are described. I provide a conceptual framework for the approach and describe each adjustment in turn. To achieve this, I first describe the main methods for the adjustment for the different elements of the needs-based resource allocation formula, including the population size, demographic composition (age/sex groups), mortality measures, and deprivation indicators,) with the related sources of data. Methods for developing a deprivation index for adjustment in the formula are presented. In the next part, I describe how a resource allocation formula would be used to allocate health budgets across the provinces of Iran. A sensitivity analysis is provided and an alternative formula is developed to explore the sensitivity of the main formula. Finally, the method of phasing the implementation of the needs-based formula for moving the budget from provinces with lower need for health care to those with higher need is described.

8.2. The population size

Size of population was considered as the main factor for developing a geographic needs-based resource allocation formula. In this study the total numbers of people who live in the provinces are considered to be adjusted for the estimation of the share of budget for the provinces. Estimates of past populations (mainly from census) and projected populations are two forms of official resident population which were considered to use for estimating the need for health care and developing resource allocation models. Population projections were considered more appropriate to use for resource allocation purposes (Oliveira and Bevan 2003); however, because of the implication of changing population size due to new births and migration (Buxton and Klein 1978) as well as unavailability of information of population projection in Iran, data from the census was considered more appropriate to use in this study.

Therefore, census data were considered an appropriate source to obtain the number of people in the geographical areas to use for health resource allocation (Michel et al., 2008). The use of census data prevents the manipulation of the population size by the stakeholders (Smith 2008a). RAWP used the latest available mid–year population estimates for revenue targets and a five-year forward projection of population was recommended for capital targets (Department of Health 1976). If the size of population is the only indicator for resource allocation, it implies that an area with some proportion of total population (say 18%) would need the same share (18%) of total health care resources (McIntyre and Anselmi 2012).

The information on the provinces population size was abstracted from Iran's 2006 Census conducted in the month of Abban (October), the time in which there is usually the lowest population movement across the country (Statistical Centre of Iran 2006) http://www.amar.org.ir/Default.aspx?tabid=786, available 5th August 2012). As mentioned in the previous chapter, census data are appropriate to use as the counting of the population in the Census is checked through different methods; further, the risk of manipulation or exaggeration of the population numbers by stakeholders in the provinces is very low since the population counted in the Census is the real number of residents in the provinces and not a population reported by the regional bodies that may be a potential to be manipulated.

8.3. The demographic composition

Age and sex structure adjusted by the national utilization of health services was considered in the literature as an appropriate measure of need for health care to include in a health resource allocation formula. In this study the age/sex groups are identified and weighted by the national utilization rates of health services using the following five steps: (1) the age/sex groups appropriate to be adjusted given the country context are determined; (2) the age/sex groups for each area in the current population of the area are obtained; (3) the rates of the national average utilisation of outpatient services for each group are identified (this is usually derived from a household survey; however, information from a comparable country within the same region and similar national income can be used in this regard); (4) the utilisation rates are normalized by identifying the age/sex group that has the lowest utilisation rate, then all the utilisation rates in the groups are divided by the lowest utilisation rate; and (5) finally, the weighted population for each age/sex group is calculated by multiplying the population in that group in that area by the normalised utilisation rate for that group.

The age/sex groups in this study (Table 8.1 below) were chosen based on the level of need for health services in the age/sex groups evidenced in the literature as well as the context and availability of information on the national utilisation of health services in Iran. Thus, the six age/sex groups of population aged under-5, men and women aged 15-49 years, population aged 50-64 years and the elderly age 65 and over were selected to be adjusted for the resource allocation formula. The data on the demographic composition of the population in the provinces was abstracted from the results of the Iran's 2006 Census which is provided in five-year interval age and gender groups.

Table 8-1. Age/sex group populations (%)

	0-4 Yr	5-14 Yr	male 15-49 Yr	Female 15-49 Yr	50-65 Yr	65<	Total
Ardebil	1.70	1.87	1.69	1.74	1.63	1.88	**1.74**
Bushehr	1.41	1.24	1.37	1.21	1.10	0.98	**1.26**
Charmahal	1.31	1.33	1.18	1.22	1.07	1.18	**1.22**
East Azarbayjan	4.74	4.68	5.14	5.08	5.61	6.23	**5.11**
Esfahan	5.74	5.68	6.69	6.57	7.11	7.21	**6.47**
Fars	5.76	5.90	6.28	6.29	6.05	6.17	**6.15**
Gilan	2.57	3.03	3.28	3.45	4.42	4.80	**3.41**
Golestan	2.47	2.49	2.20	2.34	2.17	1.89	**2.29**
Hamedan	2.16	2.39	2.37	2.43	2.50	2.94	**2.42**
Hormozgan	2.56	2.41	1.96	1.87	1.43	1.56	**1.99**
Ilam	0.76	0.80	0.79	0.79	0.68	0.67	**0.77**
Kerman	4.30	4.23	3.69	3.65	3.23	3.41	**3.76**
Kermanshah	2.41	2.67	2.68	2.68	2.72	2.76	**2.67**
Khorasan	11.06	10.91	9.44	9.83	9.52	10.28	**9.99**
Khuzestan	6.83	6.94	6.03	5.97	5.05	4.42	**6.06**
Kohgyloyeh	1.03	1.04	0.87	0.90	0.68	0.74	**0.90**
Kurdestan	2.02	2.19	1.98	2.02	2.03	2.09	**2.04**
Lorestan	2.40	2.63	2.44	2.44	2.10	2.35	**2.43**
Markazi	1.72	1.79	1.91	1.93	1.94	2.53	**1.92**
Mazanderan	3.42	3.57	4.17	4.31	4.89	4.79	**4.15**
Qazvin	1.59	1.57	1.67	1.64	1.54	1.59	**1.62**
Qom	1.62	1.54	1.51	1.48	1.32	1.30	**1.48**
Semnan	0.78	0.74	0.86	0.83	0.90	0.97	**0.84**
Sistan & Baluch.	5.79	5.06	2.90	2.98	2.21	1.94	**3.41**
Tehran	16.65	16.09	20.14	19.65	21.55	18.15	**19.04**
West Azarbayjan	4.38	4.50	3.95	3.96	3.85	4.01	**4.08**
Yazd	1.49	1.31	1.47	1.35	1.36	1.57	**1.41**
Annan	1.32	1.40	1.32	1.38	1.34	1.57	**1.37**

Table 8.1 indicates the figures of population size in the different age/sex groups in the provinces. Implications of the age/sex weighting on the provincial share of population is clearly illustrated in Chapter 9.

To estimate what an area's utilization should be, the population (numbers of people) within each age/sex group in the area is usually adjusted for the national average utilization rate for that group. In fact, it is the use of health services by the age/gender groups at national level that is considered for distribution of resources, not the actual utilization rate in the area. The data on the national utilisation in the age/sex groups in this study are from a survey called "Utilisation of Health Services in Iran" conducted by Iran's Ministry of Health (Naghavi and Jamshidi 2005). The survey has evaluated the health services utilisation in terms of hospital admissions in the country. Inpatient use of services is estimated in terms of the percentage of population in each age group admitted to hospital for the first time during the previous year. The information on the use of inpatient services is used for the adjustment of the population size in each of the age groups in this study.

Table 8-2. Proportion of hospital admissions in different age groups in Iran

	Admitted first time during the previous year%	**Normalized by the minimum**
Under 1	13	6.5
1-4 years	6	3
Pop 0 – 4 years	7.4*	3.7
Pop 5-14 years	2	1
Pop 15-49 years	5	2.5
Male 15-49 years	2.9**	1.5
Female 15-49 years	7.2**	3.6
Pop 50-64 years	8	8
65<	13	6.5

* estimated using weighted average; ** estimated using information from other countries

The utilisation data on the under-5 age group was estimated on two groups of the children, those aged under-1 and those aged 1-4 years. These two groups were combined in one age group (0-4 years) using a weighting average given the population in each age group. The survey has not evaluated the utilisation by the gender groups; hence, the use of health services by males and females aged 14-49 years were estimated based on the utilisation services in the age/sex groups in South Africa (McIntyre and Ansell, 2012). South Africa has similar gross national income to Iran; based on the United Nations Development Plan (UNDP) report in 2011 the GNI per capita based on the purchasing parity power (PPP) in South Africa was $9469 and the figure for Iran was $10164. In this regard, the rates of the health services utilisation in males and females aged 14-49 years were estimated using the results by McIntyre and Ansell (2012) conducted in South Africa and gave an overall rate of health care utilisation in the 14-49 age group (5%) in Iran (Table 8.2 above). The national utilization rates were normalized by the minimum rate related to the age group of 5-14 years taking a rate equal to 2% among the age groups (Table 8.2 above). Then, the population size of the age/sex groups was weighted by the national utilization rates as shown in Table 8.3 (below).

Table 8-3. Age/sex groups population size adjusted for the national utilization rates

	Pop 0-4 %	Pop 5-14 %	Male 15-49%	Female 15-49%	Pop 50-64%	Pop > 65 %	Total adjusted %	[a]Dif. adj. of total Pop%
Ardebil	1.70	1.87	1.69	1.74	1.63	1.88	**1.74**	**0.00**
Bushehr	1.41	1.24	1.37	1.21	1.10	0.98	**1.22**	**-0.04**
Charmahal	1.31	1.33	1.18	1.22	1.07	1.18	**1.20**	**-0.02**
East Azerbaijan	4.74	4.68	5.14	5.08	5.61	6.23	**5.24**	**+0.13**
Esfahan	5.74	5.68	6.69	6.57	7.11	7.21	**6.59**	**+0.12**
Fars	5.76	5.90	6.28	6.29	6.05	6.17	**6.16**	**+0.01**
Gilan	2.57	3.03	3.28	3.45	4.42	4.80	**3.60**	**+0.19**
Golestan	2.47	2.49	2.20	2.34	2.17	1.89	**2.26**	**-0.03**
Hamedan	2.16	2.39	2.37	2.43	2.50	2.94	**2.46**	**+0.04**
Hormozgan	2.56	2.41	1.96	1.87	1.43	1.56	**1.90**	**-0.09**
Ilam	0.76	0.80	0.79	0.79	0.68	0.67	**0.76**	**-0.01**
Kerman	4.30	4.23	3.69	3.65	3.23	3.41	**3.68**	**-0.08**
Kermanshah	2.41	2.67	2.68	2.68	2.72	2.76	**2.67**	**0.00**
Khorasan	11.06	10.91	9.44	9.83	9.52	10.28	**9.98**	**-0.01**
Khuzestan	6.83	6.94	6.03	5.97	5.05	4.42	**5.82**	**-0.24**
Kohgyloyeh	1.03	1.04	0.87	0.90	0.68	0.74	**0.87**	**-0.03**
Kurdestan	2.02	2.19	1.98	2.02	2.03	2.09	**2.04**	**0.00**
Lorestan	2.40	2.63	2.44	2.44	2.10	2.35	**2.39**	**-0.04**
Markazi	1.72	1.79	1.91	1.93	1.94	2.53	**1.97**	**+0.05**
Mazanderan	3.42	3.57	4.17	4.31	4.89	4.79	**4.28**	**+0.13**
Qazvin	1.59	1.57	1.67	1.64	1.54	1.59	**1.62**	**0.00**
Qom	1.62	1.54	1.51	1.48	1.32	1.30	**1.46**	**-0.02**
Semnan	0.78	0.74	0.86	0.83	0.90	0.97	**0.85**	**+0.01**
Sistan& Baluchistan	5.79	5.06	2.90	2.98	2.21	1.94	**3.17**	**-0.24**
Tehran	16.65	16.09	20.14	19.65	21.55	18.15	**19.24**	**+0.20**
West Azarbyjan	4.38	4.50	3.95	3.96	3.85	4.01	**4.03**	**-0.05**
Yazd	1.49	1.31	1.47	1.35	1.36	1.57	**1.41**	**0.00**
Annan	1.32	1.40	1.32	1.38	1.34	1.57	**1.39**	**+0.02**

[a]Difference of the adjusted population (%) from the non-adjusted population (%) in the provinces.

Table 8.3 indicates the proportion of population in different age/sex groups adjusted for the use of health services at national level. The last column, on the right, shows the difference between the total population size (as indicated in Table 8.2) and population adjusted for the utilization of health services at national level. The figures may be difficult to interpret and compare in their ‘raw’ form as presented, however, the implication of the age/sex weighting on the provincial share of the population is clearly illustrated in Chapter 9.

8.4. Mortality indicators

Mortality was considered as the next variable to measure the relative need for health care and to develop the formula for the allocation of the health care budget. In this study three premature death measures of mortality under-5 and mortality in men and women aged 15-60 years as mortality proxies are explored for adjustment in developing the needs-based resource allocation models. Age-specific mortality indicators were shown to be appropriate indirect proxies of need for health care. They have been used as need indicators in other countries (Rice and Smith 2001). In addition, the finding of the first part of this study showed significant variation of these indicators, in particular the mortality under-5 and mortality in adult men across the provinces.

Table 8-4. Mortality rates in the provinces of Iran

	Under-5 mortality rates (deaths/1000 live birth)	Normalized under-5 mortality rates	[a]Adult male mortality (deaths/100000 pop)	Normalized Adult male mortality	[b]Adult female mortality (deaths/100000 MAW	Normalized adult female mortality
Ardebil	35	1.4	185	1.24	129	1.1
Bushehr	33	1.32	186	1.25	124	1.06
Charmahal	34	1.36	181	1.21	127	1.09
East Azarbyjan	33	1.32	177	1.19	126	1.08
Esfahan	26	1.04	162	1.09	121	1.03
Fars	30	1.2	188	1.26	122	1.04
Gilan	25	1	191	1.28	123	1.05
Golestan	36	1.44	192	1.29	126	1.08
Hamedan	35	1.4	179	1.2	126	1.08
Hormozgan	34	1.36	196	1.32	127	1.09
Ilam	40	1.6	203	1.36	126	1.08
Kerman	36	1.44	218	1.46	132	1.13
Kermanshah	37	1.48	196	1.32	130	1.11
Khorasan	39	1.56	190	1.28	124	1.06
Khuzestan	32	1.28	176	1.18	125	1.07
Kohgiloyeh	42	1.68	183	1.23	127	1.09
Kurdestan	46	1.84	193	1.3	130	1.11
Lorestan	38	1.52	201	1.35	126	1.08
Markazi	32	1.28	175	1.17	125	1.07
Mazanderan	32	1.28	170	1.14	123	1.05
Qazvin	29	1.16	167	1.12	123	1.05
Qom	29	1.16	164	1.1	123	1.05
Semnan	29	1.16	175	1.17	120	1.03
Sistan	47	1.88	211	1.42	131	1.12
Tehran	25	1	149	1	117	1.0
West Azarbyjan	38	1.52	186	1.25	129	1.1
Yazd	27	1.08	164	1.1	122	1.04
Annan	36	1.44	184	1.23	127	1.09

Source: Khosravi et al., 2007; [a]men and [b]women aged 15-60 years

As described in chapter 3, the information on the mortality measures was originally from the death registration system gathered in 2004 and then a completeness study was done on the data to consider any under-reporting on the number of deaths in each province by Khosravi et al., (2007). The adjustment is done for the mortality measures separately to see how each of the measures may affect the resource allocation model; then the appropriate measure is adopted to use in the final formula. Before adjustment, the indicators are normalized by dividing the scores in each variable by the minimum score to provide an appropriate scaling of the indicators. As mortality indicators cannot be applied mechanically in the resource allocation formula, for the main formula a weight equal to 0.1 is given to the mortality measure and a weight equal to 0.25 is given to the measure in the alternative formula which is developed for the sensitivity analysis.

8.5. Socioeconomic status

8.5.1. Socioeconomic indicators

Socioeconomic status or deprivation was considered as an indirect measure of need for health care because of its strong relationship with ill-health. However, the main concern is which of the socioeconomic factors can be used to capture real deprivation and therefore real need. Deprivation both in terms of economic status (Zere et al., 2007) and in broader terms of social deprivation (including both economic and other social factors) has been used to estimate the need for health (McIntyre et al., 2002; Asante et al., 2006 a). The economic status approach has considered mainly income and wealth indicators; the social deprivation approach has included demographic factors (e.g. age groups such as population under-5), place of residence (e.g. living in rural areas), and social factors (e.g. education) as well as the income indicators.

I consider deprivation as the broader term of social deprivation in this study. Given that, a combination of indicators including illiteracy rate, inversed GDP per capita, overcrowding (number of people per room in household), proportion of rural population, unemployment rate, household size, and proportion of population aged under-5, were selected as final variables for creation of the deprivation index. These indicators were chosen based on the literature and availability of data as well as the significant relationship between the socioeconomic indicators and mortality measures across the provinces presented in chapter 5. As described in chapter 3, the source of data for the deprivation indicators was Iran's 2006 Census in Iran except for the general income indicator. Data on GDP per capita was abstracted from the study called "Annual Domestic Growth in Iran" conducted by the Statistical Centre of Iran in 2006.

To include the deprivation factor in the formula in this study a deprivation index is developed using the six socioeconomic indicators. As described in the literature in chapter 7, deprivation indexes have been developed and used to measure the relative need for health care and to guide allocation of health care funds in many countries (Bajekal et al., 1996; McIntyre et al., 2002; Carr-Hill et al., 2005; Asante et al., 2006 b; Zere et al., 2007; Manthalu et al., 2010). The international experiences provide useful information on how to embark on constructing a country-specific or/and study-specific index.

8.5.2. Methods of developing the deprivation index

To develop a deprivation index first the interested socioeconomic indicators should be determined. The indicators need to be aggregated; however, the indicators may have different units which do not allow summing up the indicators directly and therefore the indicators need to be standardized using statistical methods (EQUINET 2003; Asante et al., 2006 a; Zere et al., 2007). An index is created by summing up the standardized socioeconomic indicators. The created index needs to be normalized before it is included in the formula. A deprivation index as a measure of need should also meet two main criteria, namely that component variables should be additive (i.e. someone with two of the characteristics reflected in the variables should be more likely to experience deprivation than a person with only one of the characteristics) and that differential weightings should be assigned to variables to reflect their relative contribution to the overall need (Gordon 1995; McIntyre et al., 2002).

The principle component analysis (PCA) technique is used for selecting and weighting the final variables to use in the composite index. PCA is a statistical technique usually used for the reduction of the number of variables to more manageable sets of variables called factors or components (Asante et al., 2006 a; Pallant 2007). There are assumptions underlying the PCA technique that need to be considered including number of cases and variables entered into the analysis, normality of variables, linearity of relationship between variables, factorability of the correlation matrix (Field 2005; Pallant 2007).

There is a lack of consensus on the sample size and number of variables that need to be considered for factor analysis, however, a general statement is that a larger number of cases is better for factor analysis as in a small sample size there may be less reliability of the correlation coefficients (Field 2005). Tabacknick and Fidell (2007) stated that at least 300 cases is a comfortable level for factor analysis; it is also suggested to have five cases per variable entering the analysis (Pallant 2007). However, Zhao (2011) evaluated the minimum sample size used in factor analysis in a large number of studies; he concluded that the general rule of thumb of the minimum sample size is not valid and useful, but he recommended undertaking the Kaiser-Meyer-Olkin (KMO) test (>0.6), mean values of all communalities to be above 0.7, dropping factors with an eigenvalue less than 1.0, setting the loading size cut-off values as 0.6, and dropping the factors including less than 3 variables (Zhao 2011). In our study, the number of cases is 28 provinces of Iran, and the number of variables entered in the different analysis is 6 need variables; indicating around 5 cases per variable entering the analysis that meet the criterion by Pallant (2007); however, we consider the criteria by Zhao (2007) in this study. The other assumptions were considered carefully, and are described below.

To meet the linearity assumption, there needs to be a minimum correlation ($r > 0.3$) between the variables, and the variables with lower correlation should be omitted from further analysis (Field 2005; Pallant 2007). Compared to regression methods, some degree of collinearity is acceptable in factor analysis; multicollinearity occurs when variables are highly correlated with each other, making it difficult to produce reliable estimates of the variables' individual regression coefficients (Tabachnick and Fidell 2007). In addition, when two variables are highly correlated, they are basically measuring the same phenomenon or construct, and convey essentially the same information. Therefore, very high correlation between the variables ($r > 0.9$) is not considered appropriate in factor analysis because of the collinearity problems it makes in the model (Field 2005).

The normality of variables was identified and resolved in chapter 5. The factorability assumption implies that in the correlation matrix variables should have at least some correlations of $r = 0.3$ or greater with the central related factors (Field 2005). The factorability can be tested using KMO method and Bartlett's Test of Sphericity available in SPSS; there is appropriate factorability when the KMO takes a score equal to 0.6 and above, and where the Bartlett's test is statistically significant at $P < 0.05$ (Pallant 2007; Zhao 2011). The factorability of variables in this study was examined through these two tests and is described in the results section.

For creation of the composite deprivation index the most appropriate factor is chosen for further analysis (Asante et al., 2006 a; Pallant 2007). The factor extraction is often undertaken using the two statistical techniques of Kaiser's criterion and Scree test. The Kaiser's criterion called the "eigenvalue rule" implies that only components with an eigenvalue of 1.0 or above are adequate for further analysis (Reinhardt et al., 2010). An eigenvalue of a factor represents "*the amount of total variance explained by that factor*" (Pallant 2007, P 182). In addition to the above statistical assumptions, there is another assumption to consider in the development of the needs-based models called the "additivity" principle (McIntyre et al., 2002; PBRA Team 2009). The "additivity" implies that someone with two of the characteristics reflected in the variables should be more likely to experience deprivation than a person with only one of the characteristics (Gordon 1995; EQUINET 2003; Manthalu et al., 2010).

The variables are weighted using the regression method in the PCA. In this method, the "component matrix coefficients" or loadings of the individual variables in each factor are considered as weights of variables (Field 2005). The factor loadings are, in fact, the regression coefficients between the variables with the related factor or the relative contribution that individual variables make to the related central factors (Pallant 2007). However, the loadings have been considered to be weak weights for the variables and instead the “standard score coefficients” have been stated to be stronger and more sophisticated weights to the variables (Field 2005). In this case, to produce stronger weights, the factor loadings are adjusted to take account of the initial correlations between the variables (Field 2005; Asante et al., 2006 a). The multiple regression method is considered as an appropriate method to create the score coefficients (Field 2005). In our case, the final selected variables were weighted in a final running of the PCA using SPSS, presented in the results section.

Before the creation of the index the various indicators must be combined; how the indicators are combined will influence the validity of the index. A simple aggregation of the raw variables may lead to bias as there are differences in the units of measurement, statistical range and relative importance to the outcome measures of interest (Field 2000). Therefore, some form of standardization is necessary before aggregating the socioeconomic indicators. Standardization using z-scores has been used in many studies in the literature (Dolan et al., 1995; McIntyre et al., 2002; Asante et al., 2006 a; Zere et al., 2007). A z-score is a standardized score meaning that it is the score in standard deviations away from the mean. It is calculated by Z = (score – mean)/standard deviation (Field 2005).

For the purpose of deriving outcomes in this study, z-scores of the indicators are calculated through the SPSS. Then, the resulted z-scores in each indicator are multiplied by the related weight. A final index is created by additive combination of the standardized weighted indicators. In this approach some of the index values will be negative for some provinces (those that are least deprived) and positive for other provinces (those that are most deprived). To resolve this the index is normalised so that the least deprived province takes a value of 1 and all other provinces are expressed in relation to the value of the least deprived province; in fact, the axis is shifted so that the minimum score is 1 (EQUINET 2003).

8.6. Developing the resource allocation formula

Having the indicators in the three different domains representing the need for health care in the provinces, a formula is created by giving a weight less than 1 to each of the demographic composition, mortality, and deprivation indicators; the measures are adjusted with the weights and the resulted values are summed up. Because of a lack of information on the other potential elements of the formula such as cross-border use and differing cost of health services, they are not considered in the final formula.

In the age/sex factors, first the rates of health services utilization of the different age and sex groups are normalized by dividing them by the group with the minimum score. Then, the population in each age group is multiplied by the normalized score to obtain the adjusted population for the age/sex group in each province. The adjusted populations in the age groups are summed up to determine the age/sex adjusted population in the provinces. The percentage share of population in the provinces is estimated by dividing the population of each province by the total population and multiplying by 100 (McIntyre and Anselmi 2012). A similar process is done for the mortality indicators; the mortality measures are normalized by the province with the minimum rate of mortality. Then, the current population in each province is multiplied by the normalized mortality measures to determine the adjusted population for ill-health in each of the three indicators in the provinces. The share of adjusted population is estimated by dividing the adjusted population in each province by the total adjusted population multiplied by 100. The deprivation index, as described previously, is normalized by transferring and adding the scores to the same value so that all the provinces take a score starting from +1 for the province with the most negative score. Then, the province populations are multiplied by the normalized scores to determine the adjusted population for deprivation in the provinces.

The need indicators cannot be applied mechanistically in the model as they may inappropriately change or influence resource allocation across the provinces; as a result, weights less than 1 (as a percentage share) are given to each of the demographic, mortality and deprivation indicators (McIntyre and Anselmi 2012). In this regard, the age/sex structure is given a weight equal to 80% (0.8), and the mortality and deprivation factors are given the same weights equal to 10% (0.1). There is no ‘golden rule’ on what these weights should be, however, the higher weight given to the demographic factor is because of higher use of health services by some particular age/sex group and consequently a more direct relationship between the age/sex and need for health care (Staines et al., 2010; Rice and Smith 2001). The adjusted share of the population in each of the three factors is multiplied by the given weight to the factors and the results are summed up to determine the adjusted population and consequently the percentage share of budget based on the need for each province.

8.7. Sensitivity analysis

Alternative resource allocation formulae are explored for sensitivity analysis of the main formula. We explore the adjustment for three different measures of mortality under-5 and mortality in adult males and females to represent how the different indicators may affect the final resource allocation formula. An alternative model is also developed by giving alternative weights to the age/sex (0.5 vs 0.8), mortality (0.25 vs 0.1), and deprivation (0.25 vs 0.1) factors to show how the share of budget which is given to the provinces is changed when the weights are changed.

8.8. The time frame for redistribution of the health budget

Setting up a time-frame for moving and targeting the budget is considered important when a resource allocation formula is to be implemented. In this study a five-year time-frame is suggested for moving from the current budget to the needs-based budget across the provinces. To do this, first the difference between the current budget and the need-based expenditure is calculated. The resultant figures are divided by 5 to determine the percentage share of budget that needs to be increased or decreased in the provinces in each year. Then, the budget for the year is estimated by increasing or reducing the current budget to the percentage needing to be changed in the first year in each province. For the following years, the budget for the previous year is increased or reduced according to the amount of changed that has been planned for each province.

8.9. Summary

In this chapter I described the key methodological issues related to the development of needs-based resource allocation formulae and investigated their implications for creation of the needs-based models for the health care system of Iran. In this study needs-based models are developed using the three different need factors of age/sex structure, mortality, and deprivation across the provinces. To include the socioeconomic status in the formula a deprivation index is created using six socioeconomic indicators given the broader terms of deprivation as social deprivation. Before entering the analysis, the age/sex structure, mortality, and deprivation indicators are normalised by dividing the all values by the lowest value in each of the indicators. The different need factors are given a percentage share of weights to be applied when the formula is being developed. The normalised indicators are multiplied by the weights and the percentage share of budget for the provinces is estimated by summing up the resulted values. To explore the sensitivity of the model an alternative model is developed by giving alternative weights to the age/sex, mortality, and deprivation factors. Given the impossibility of moving resources across the provinces in a short time, a timeframe as a medium term plan is developed for phasing the movement of health budget between the provinces towards the equity target in a five year period.

9. Results of alternative needs-based models

9.1. Introduction

In chapter 8 I described different methodological issues related to the development of needs-based resource allocation models and identified the methods which are appropriate and applicable for the creation of need-based models at provincial level in the context of Iran. In this chapter, the results from the adjustment for the different age/sex, mortality, and socioeconomic elements in the needs-based resource allocation formula are presented. Then the results on the exploration of the formula sensitivity are described. This is followed by a suggested timeframe for moving the health budget between the provinces given the equity share target determined based on the cumulative resource allocation model. Finally, the discussion and conclusion on the results are presented.

9.2. Overview of percentage share of health budget based on different indicators

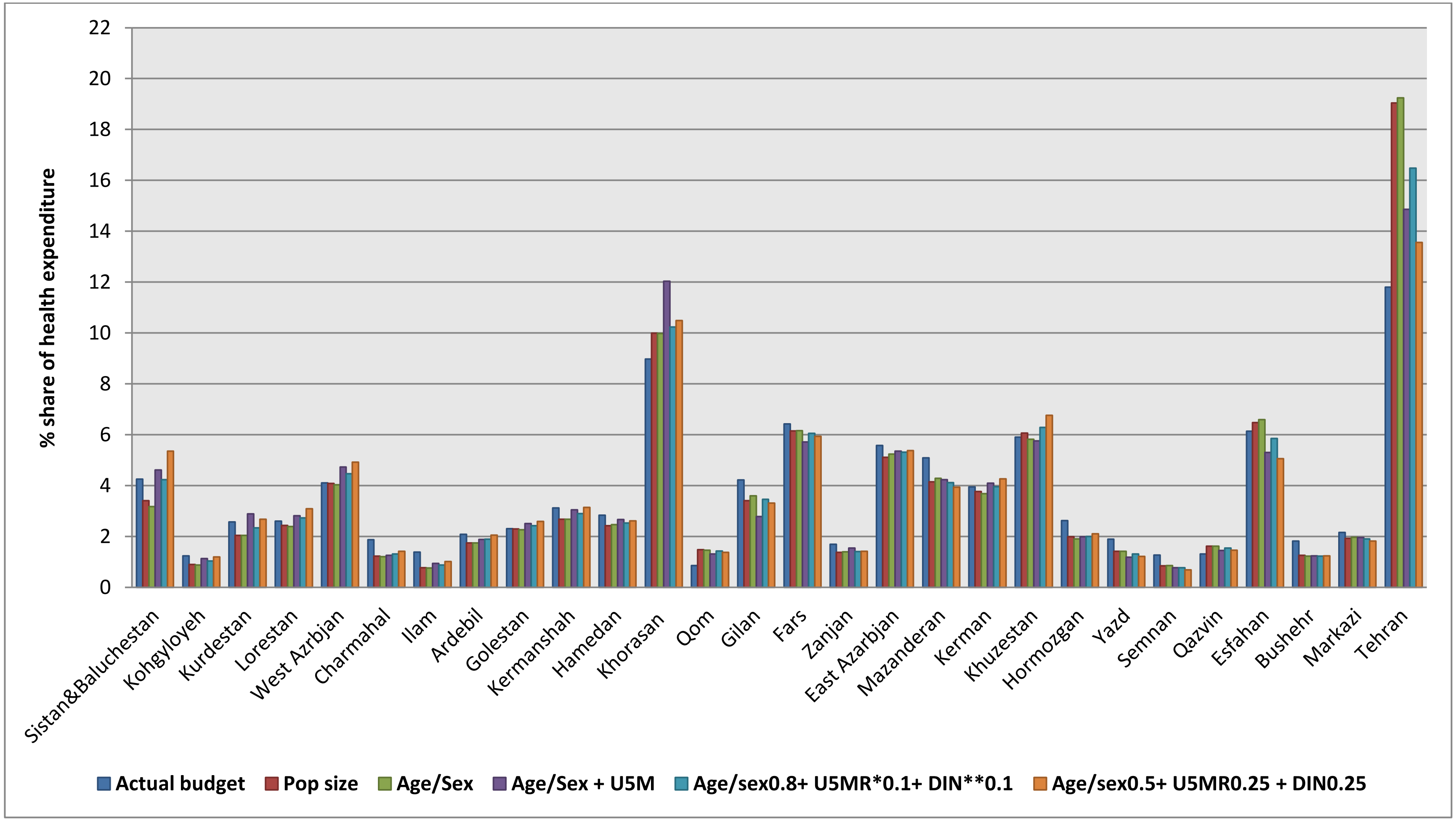
Alternative models were explored for allocation of public health expenditure between the provinces. Table 9-1 (next page) shows the percentage share of health budget in the provinces estimated based on the indicators of population size, age/sex structure, mortality measures, and based on a combination of the demographic composition, mortality, and socioeconomic (deprivation) factors in two models (cumulative and alternative cumulative) using different weights. The share of budget changed marginally as additional indicators were entered into the model; in general, adjustment for age/sex changed the share in favour of more affluent provinces; while the mortality and deprivation indicators increased the share in less affluent provinces. Tehran (the most affluent province), and Sistan & Baluchestan (the least affluent province) experienced the largest changes amongst the provinces (Figure 9.1 below).

Table 9-1. Percentage share of health budget based on different need indicators

	Actual budget %	Pop size%	Age/Sex %	Age/Sex + [a]U5M%	Age/Sex +[b]MAM %	Age/Sex +[d]WAM%	Age/sex0.8+ U5MR0.1+ [e]DIN0.1%	Age/sex0.5+ U5MR0.25 + DIN0.25%
Ardebil	2.08	1.74	1.74	1.88	1.81	1.81	1.89	2.05
Bushehr	1.82	1.26	1.22	1.24	1.27	1.22	1.22	1.23
Charmahal	1.87	1.22	1.20	1.26	1.22	1.23	1.31	1.41
East Azarbyjan	5.57	5.11	5.24	5.35	5.22	5.34	5.31	5.37
Esfahan	6.14	6.47	6.59	5.30	6.00	6.45	5.85	5.06
Fars	6.42	6.15	6.16	5.71	6.51	6.07	6.05	5.93
Gilan	4.22	3.41	3.60	2.78	3.86	3.57	3.46	3.31
Golestan	2.30	2.29	2.26	2.51	2.44	2.30	2.42	2.59
Hamedan	2.83	2.42	2.46	2.66	2.48	2.51	2.53	2.61
Hormozgan	2.62	1.99	1.90	1.99	2.09	1.95	2.00	2.10
Ilam	1.38	0.77	0.76	0.94	0.87	0.77	0.88	1.01
Kerman	3.94	3.76	3.68	4.09	4.51	3.92	3.96	4.26
Kermanshah	3.12	2.67	2.67	3.05	2.94	2.80	2.90	3.14
Khorasan	8.97	9.99	9.98	12.03	10.66	10.00	10.23	10.49
Khuzestan	5.90	6.06	5.82	5.75	5.76	5.88	6.28	6.76
Kohgyloyeh	1.24	0.90	0.87	1.13	0.90	0.89	1.03	1.19
Kurdestan	2.57	2.04	2.04	2.89	2.21	2.14	2.34	2.67
Lorestan	2.60	2.43	2.39	2.81	2.70	2.44	2.73	3.09
Markazi	2.16	1.92	1.97	1.95	1.94	1.99	1.90	1.82
Mazanderan	5.09	4.15	4.28	4.23	4.09	4.25	4.11	3.93
Qazvin	1.31	1.62	1.62	1.45	1.52	1.61	1.54	1.46
Qom	0.85	1.48	1.46	1.31	1.34	1.45	1.42	1.37
Semnan	1.27	0.84	0.85	0.77	0.84	0.83	0.77	0.68
Sistan	4.25	3.41	3.17	4.61	3.76	3.36	4.23	5.35
Tehran	11.80	19.04	19.24	14.86	16.11	18.19	16.48	13.56
West Azarbjan	4.10	4.08	4.03	4.73	4.21	4.20	4.46	4.92
Yazd	1.89	1.41	1.41	1.18	1.30	1.39	1.31	1.21
Zanjan	1.69	1.37	1.39	1.54	1.43	1.42	1.40	1.41

[a]U5M: under-5 mortality; [b]MAM: men adult mortality; [d]WAM: women adult mortality; [e]DIN: deprivation index of need.

Figure 9-1: Alternative health resource allocation models

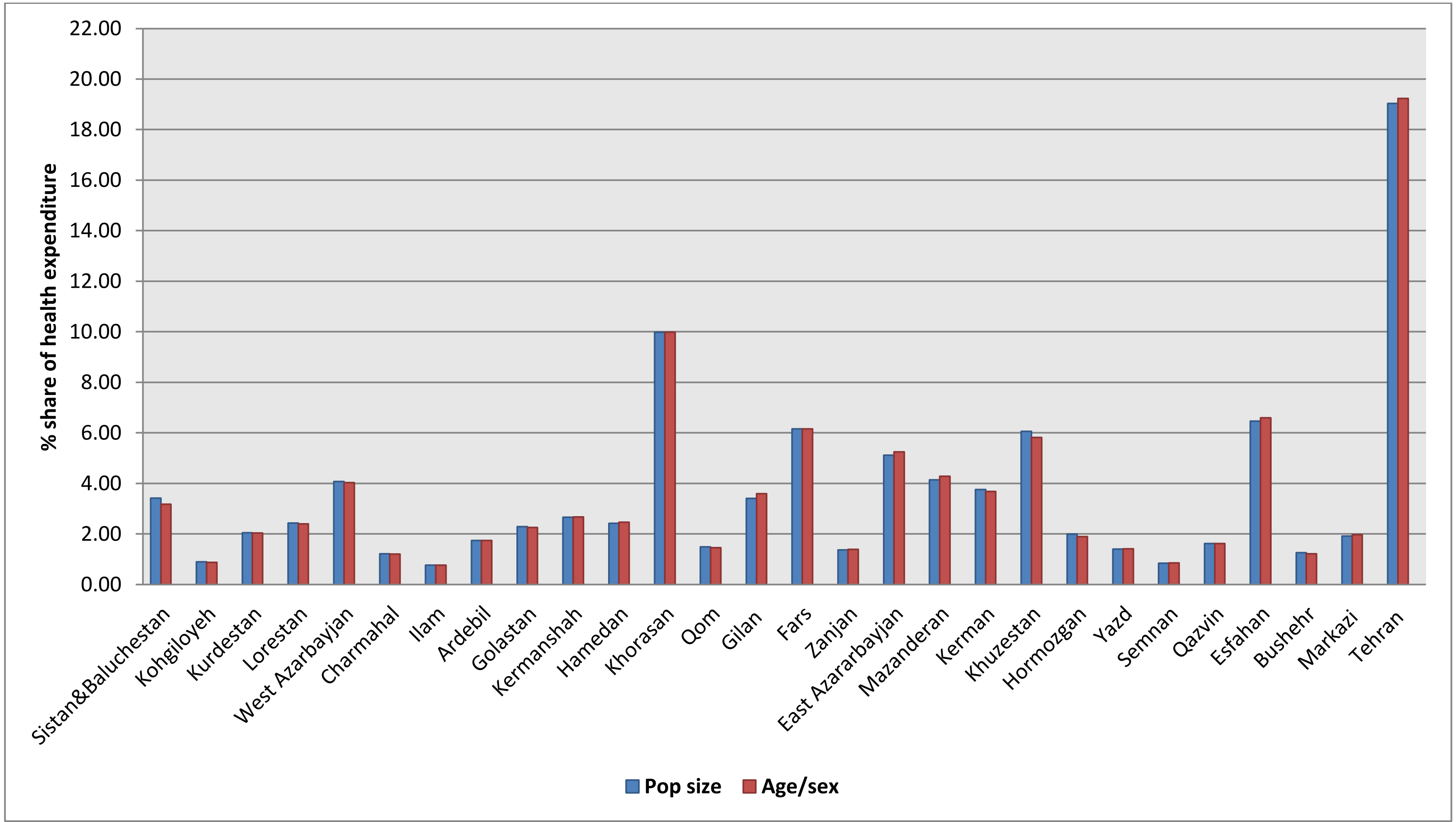


9.3. The impact of the need indicators on the model

9.3.1. Population size

Figure 9.1 illustrates the share of health budget based on the population size in the provinces which is ranked based on the economic status (GDP per capita): with the less advantaged provinces located on the left; the more advantaged on the right, and medium advantaged in the middle. Based on the population size, the largest share was related to Tehran (19.04%), Khorasan (9.99%), Esfahan (6.47%), Fars (6.15%) and Khuzestan (6.06%); and the lowest share was related to Ilam (1.38%), Semnan (1.27%), Kohgyloyeh (1.24%), Charmahal (1.22%), and Bushehr (1.26%) (Table 9.1 above; Figure 9.2 below). This indicates that the majority of the population in Iran was located in the middle and most affluent provinces; thus, allocation based on the number of people would direct the resources mainly to the more affluent provinces with the largest share to Tehran.

Figure 9-2: Health expenditure based on population size and age/sex structure



9.3.2. Demographic composition

There were changes in the share of health expenditure in the provinces when the population size was adjusted for age/sex utilisation of health services (Figure 9.2 above). Compared to the population size, the expenditure based on age/sex increased mainly in Tehran (0.20%), Gilan (0.19%), East Azarbayejan (0.13%), Mazanderan (0.13%), Esfahan (0.12%), Markazi (0.05%), and Hamedan (0.04%) (Table 9.1 above; Figure 9.2 below); these provinces are considered to be among the medium and most advantaged provinces. On the other hand, the share decreased in Sistan & Baluchestan (0.24%), Khuzestan (0.24%), Hormozgan (0.09%), Kerman (0.08%),West Azarbayejan (0.05%), Bushehr (0.04%) and Lorestan (0.04%); majority of the provinces are those with lower economic status. There was no change in Ardebil, Kermanshah, Kurdestan, Qazvin, and Yazd (Table 9.1 above; Figure 9.2 below). These results indicate that, overall, the adjustment for the demographic composition changed the share of budget marginally in favour of the provinces with medium and high economic status.

9.3.3. Mortality

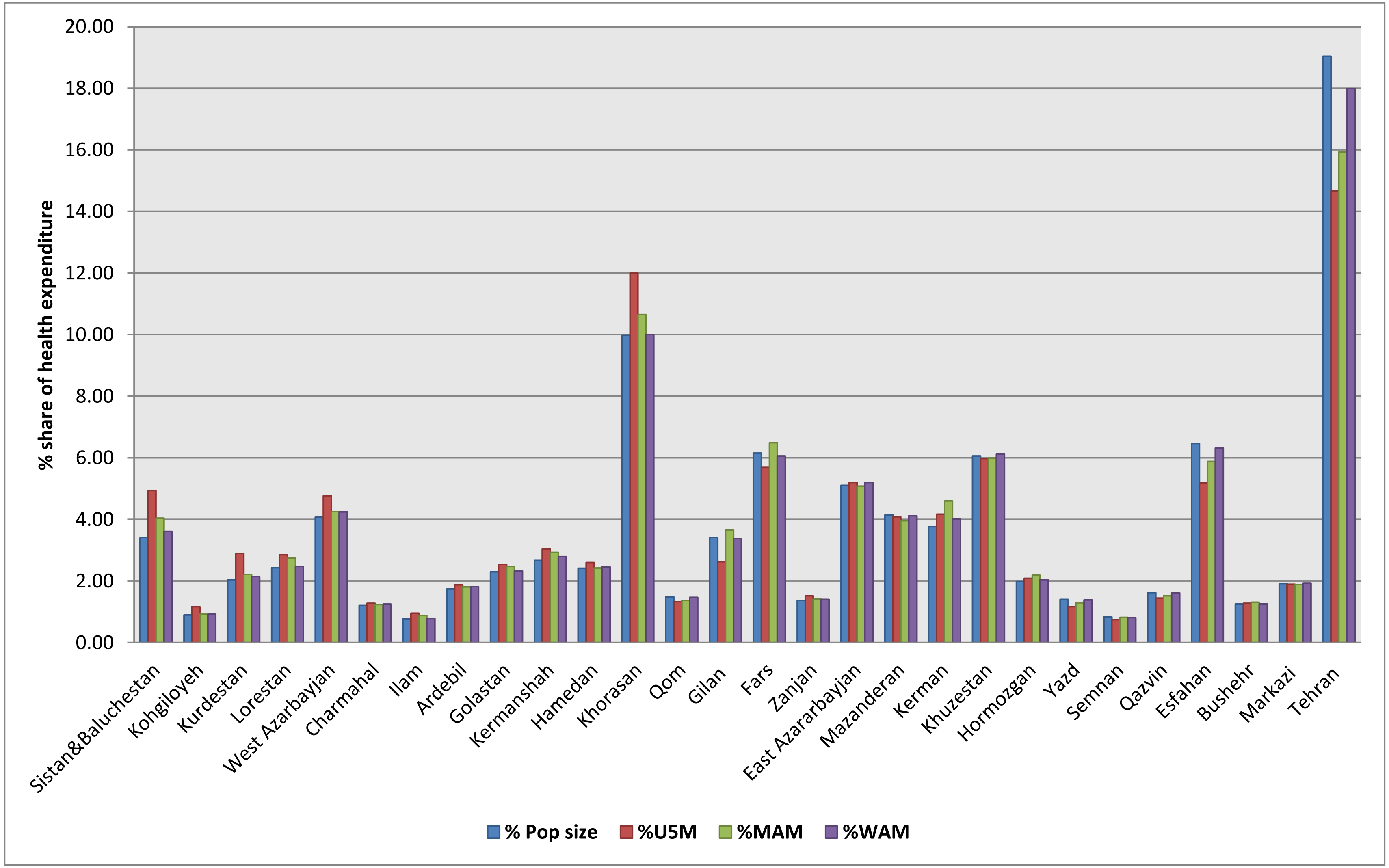
The results from the adjustment for the three mortality measures of the under-5 mortality and adult male (MAM) and female (WAM) mortality showed that compared to the population size, the budget share increased mainly in the less affluent; but decreased in the more affluent provinces. The change was larger in the U5M than the MAM and WAM; and in MAM than WAM (Figure 9.3 below).

The share based on the U5M increased in seventeen provinces with largest in Khorasan (2.02%), Sistan & Baluchestan (1.53%), Kurdestan (0.85%), West Azarbayejan (0.70%), and Lorestan (0.42%); mainly among the less affluent provinces (Figure 9.3 below). The share decreased in other provinces, mainly in Tehran (4.37%), Esfahan (1.29%), Gilan (0.78%), Fars (0.46%), Yazd (0.24%), which are among the more affluent provinces. This implies that the mortality under-5 changed the share of health expenditure in the provinces of lower economic status.

Compared to the population size, the share based on the MAM increased in around half of the provinces with the largest in Kerman (0.84%), Khorasan (0.67%), Sistan & Baluchestan (0.63%), Fars (0.34%), and Lorestan (031%); the majority of them are among the provinces with lower economic status; but the share decreased mainly in the more affluent provinces of Tehran (0.3.11%), Esfahan (0.59%), Mazanderan (0.19%), Qom (0.12%), and Yazd (0.11%).

The share based on the WAM increased in seventeen provinces with the largest in Kerman (0.25%), Sistan & Baluchestan (0.20%),West Azarbayjan (0.17%), Kermanshah (0.13%), and Kurdestan (0.10%); the provinces with lower economic status. The share decreased in ten provinces with the largest in Tehran (1.05%), Esfahan (0.15%), Fars (0.09%), Mazanderan (0.03%), and Semnan (0.03%) which are among the more affluent provinces.

Figure 9-3. Health expenditure based on population adjusted for mortality indicators



9.3.4. Socio-economic status/deprivation

9.3.4.1. Results from developing the deprivation index

It was noted in the methodology chapter (chapter 8) that a quite high relationship (R > 0.3) is necessary between the socioeconomic indicators when PCA is used to create the deprivation index. Table 9-2 (below) shows the correlation coefficient between the socioeconomic indicators of illiteracy rate, inversed GDP, unemployment rate, proportion of rural population, people per room (overcrowding), household size and children aged under-5 measured using Pearson's correlation technique. As can be seen from the table, in all the cases the correlation coefficients are larger than 0.3 and less than 0.9; this implies that all the indicators meet the relationship criterion to enter the PCA for further analysis.

Table 9-2. Correlation between the selected need factors

	Pop Under-5	Invrtd GDP	illiteracy	Unempl	Member/ room	Rural Pop	Household size
Pop Under-5	1.00	.379*	.398*	0.314	.454*	0.311	.645**
Inverted GDP	.379*	1.00	.840**	.695**	.651**	.548**	.632**
Illiteracy	.398*	.840**	1.00	.595**	.626**	.683**	.586**
Unemployment	0.314	.695**	.595**	1.00	.682**	.431*	.681**
Member/room	.454*	.651**	.626**	.682**	1.00	0.212	.719**
Rural Pop	0.311	.548**	.683**	.431*	0.212	1.00	.467*
Household size	.645**	.632**	.586**	.681**	.719**	.467*	1.00

*. Correlation is significant at the %5 level (2-tailed). **. Correlation is significant at the %1 level (2-tailed).

To identify the appropriate factors for creation of the deprivation index, the socioeconomic indicators were entered into the PCA. In the first running of the PCA, the suitability of data for factor analysis was assessed. The KMO test showed a score of 0.758, exceeding the recommended value of 0.6 and Bartlett’s Test of Sphericity reached statistical significance (P <0.000), supporting the factorability of correlation matrix. The PCA was run for the second time to identify the appropriate factors for further analysis. The results revealed (Table, 9.3 below) the presence of only the first component with an eigenvalues larger than 1.0, meeting the Kaiser criterion, to make it appropriate for further analysis (Pallant 2007).

Table 9-3. Total variance explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Component	**Total**	**% of Variance**	**Cumulative %**	**Total**	**% of Variance**	**Cumulative %**
1	4.361	62.301	62.301	4.361	62.301	62.301
2	.936	13.378	75.679	.936	13.378	75.679
3	.772	11.029	86.708	.772	11.029	86.708
4	.410	5.856	92.564			
5	.240	3.428	95.993			
6	.184	2.622	98.614			
7	.097	1.386	100.000			

Extraction Method: Principal Component Analysis

In the third running of the PCA, the component matrix of the selected factor indicating loadings of the related indicators were identified (Table 9.4 below). The loadings are, in fact, the correlation or regression coefficients between each variable and the related central factor in the component matrix (Field, 2005). The loadings can be considered as the weights of the indicators to apply for creation of the deprivation index.

Table 9-4. Component matrix

	Matrix (loadings)	Score coefficient
Inverted GDP	.877	.201
Illiteracy over 6	.867	.199
Unemployment	.812	.186
People per room	.804	.184
Rural population	.650	.149
Household size	.860	.197
Population under-5	.611	.140

Extraction Method: Principal Component Analysis; 1 components extracted.

However, only the indicators taking a loading of 50% or greater are often considered appropriate for further analysis (Asante et al., 2006 a). The results showed that all the loadings have taken scores larger than 0.5 making them appropriate to use for further analysis (Table 9.4 above). As described in chapter 8, the loadings are considered as poor weights for the variables (Field, 2005); therefore, the score coefficients of the loadings were identified in an additional running of the PCA to use as the weights or gravity of variables to apply in the index (Table 9. 3 above).

Looking at the given weights to the variables in the first component (Table 9.3 above), the variables are given a range of weights between 0.140 - 0.201. The largest weights are given to the inverted GDP (CS= 0.201), then illiteracy rate (CS= 0.199). The significant relationship between all the socioeconomic variables and health care access and outcomes in the literature was described previously. Looking specifically at these two variables, the findings of the first part of this thesis showed a strong relationship between these two socioeconomic variables and premature mortality across the provinces of Iran. This together with the evidence in the literature can imply that the highest weight given to these variables is reasonable. The population under-5 (CS= 0.140) and rural population have taken the lowest weight among the variables (CS= 0.149). Despite the significant relationship between the two variables and premature mortality, compared to the others, these two variables reflect the need in a limited number of populations in the provinces. For example, the average number of children under-5 in the provinces is around 8% and the average proportion of the rural population across the provinces is 40%; therefore, the given weights seem to be appropriate considering the related sizes of population under-5 and rural population.

The indicators of unemployment and household size are given the same quite large weight with a value of CS= 0.206. The results from the first part of this study showed a strong positive relationship of unemployment rates and household size with premature mortality measures across the provinces. The unemployment rate was shown to be the strongest predictor of mortality in adult men and household size had the largest correlation with mortality measures after the illiteracy rate and unemployment.

Compared to other variables, the overcrowding variable (number of people/room in household) was given a moderate weight (CS= 0.198). There was strong relationship between overcrowding and health outcomes across the provinces; however, it was not as large as that for illiteracy and GDP per capita; on the other hand, compared to the rural population indicator, the overcrowding variable covers all the populations in the provinces. These together can justify the moderate weight given to the overcrowding indicator. Having the final variables with the given weights, the deprivation index for each province was created using the following formula:

$$DIN = \sum WiZi$$

In this index, Wi is the estimated weight of the related variable and Z is the standardized value of cases in the variables. The provinces were ranked based on the magnitude of the created DIN from the largest, which indicates the highest need, to the smallest, indicating the lowest need for health care (Table 9.5 below).

The index values for some provinces are negative (those that are least deprived) and for some other are positive (those that are most deprived). This makes it problematic to use the indexes with opposite signs for further analysis. To resolve this, the approach used by EQUINET (2003) and Zere et al. (2007) was applied to normalize the scores; the negative scores were transferred to take values more than zero by adding all the scores to a constant value of 1.339. By this, the least deprived province (Tehran) takes a value of 1 and all other provinces were expressed in relation to the value of the least deprived province; in fact, the axis was shifted so that the minimum score is 1.

Table 9-5. Deprivation based Index of Need (DIN)

	DIN	Normalized DIN
Sistan	2.952	5.703
Kohgiloyeh	1.319	4.07
Ilam	1.226	3.977
Lorestan	1.056	3.807
Kurdestan	0.843	3.594
West Azarbayejan	0.662	3.413
Khuzestan	0.561	3.312
Charmahal	0.556	3.307
Ardebil	0.545	3.296
Kermanshah	0.448	3.199
Kerman	0.387	3.138
Golestan	0.316	3.067
Hormozgan	0.182	2.933
Hamedan	-0.131	2.62
East Azarbayejan	-0.256	2.495
Bushehr	-0.339	2.412
Khorasan	-0.345	2.406
Zanjan	-0.425	2.326
Fars	-0.484	2.267
Gilan	-0.523	2.228
Qom	-0.571	2.18
Markazi	-0.784	1.967
Qazvin	-0.791	1.96
Mazanderan	-0.818	1.933
Yazd	-0.979	1.772
Semnan	-1.42	1.331
Esfahan	-1.438	1.313
Tehran	-1.751	1.000

Looking at the estimated index (Table 9.5 above), the provinces of Sistan & Baluchestan, Kohgiloyeh & Boyer-Ahmad, Ilam, Lorestan, Kurdestan, West Azarbayejan, and Khuzestan, located in the lowest quintile, have taken the largest scores showing the highest level of deprivation among the provinces. Except for Kohgiloyeh & Boyerahmad and Lorestan which are located in central parts, the other five provinces are located in the South and West part of Iran with long borders with neighboring countries and related problems of drug and arms struggling, illegal migration and refugee flows (MOHME 2008).These provinces also experience two extremes of weather: dry and hot in the south (e.g. Sistan & Baluchestan and Khuzestan), and mountainous and cold (e.g. Kohgiloyeh & Boyer-Ahmad, Ilam, Lorestan, Kurdestan, West Azarbayejan) (Kheirabadi 2003).

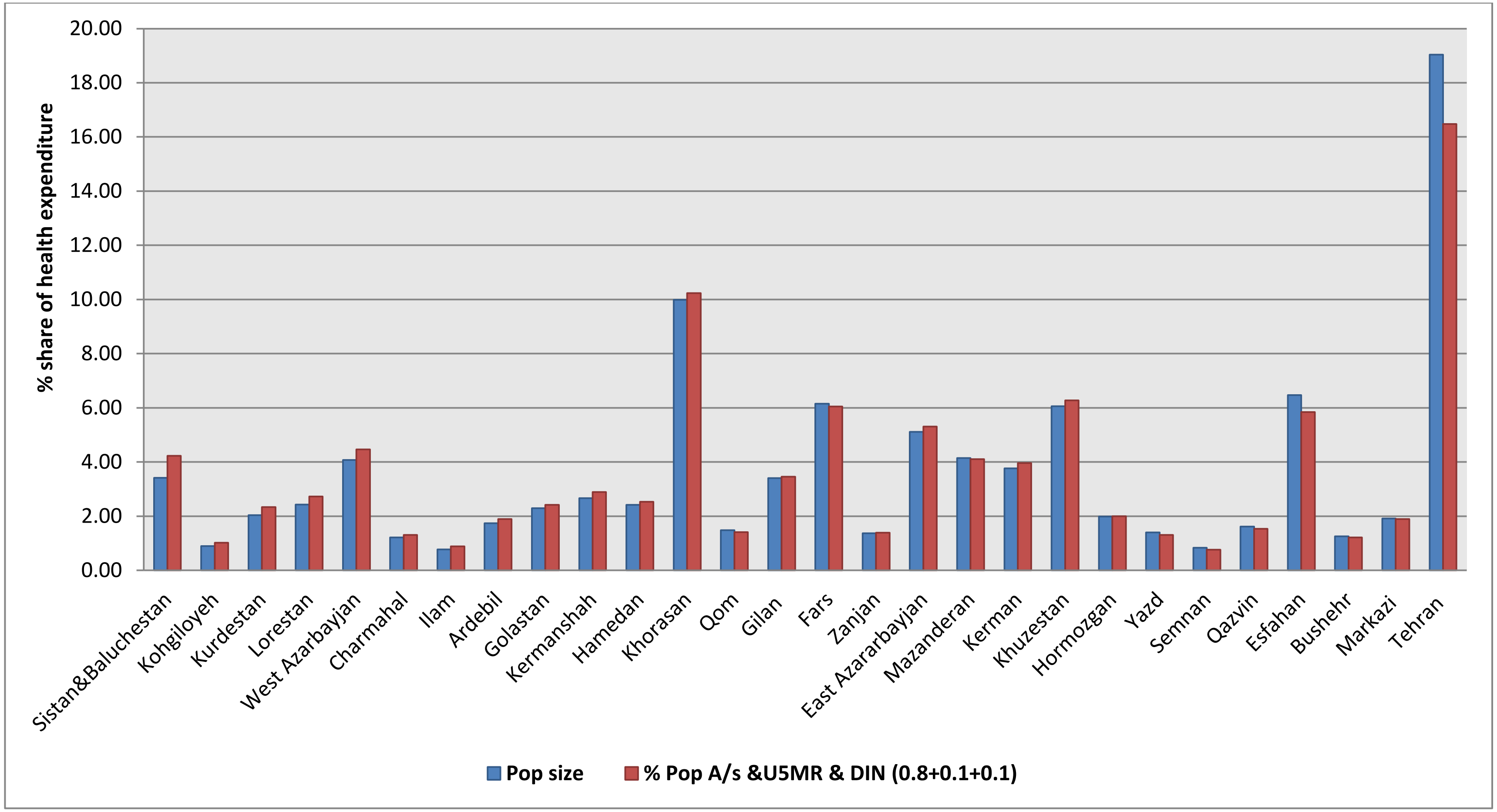
On the other hand, seven provinces of Tehran, Esfahan, Semnan, Yazd, Mazanderan, Qazvin, and Markazi, which are located in the highest quintile in the index, had the smallest scores, showing the lowest level of deprivation among the provinces. All the provinces, except Mazanderan which borders the Caspian Sea, are located in the central areas of the country with a semi-dry climate (Kheirabadi 2003).

According to the deprivation index, around 19.7% of the total population in Iran is living in provinces located in the lowest quintile in the index with the highest deprivation. On the other hand, the provinces located in highest quintile in the index comprise 35.4% of the population. However, the rural population size in the lowest quintile was 25.1% which is around 1.3 times that in the highest quintile (19.9%) (Statistical Center of Iran 2007). The deprivation index also showed significant negative relationships with the giving birth in hospital ($r = -0.800$) and vaccination services ($r = -0.634$) across the provinces, indicating an appropriate direction of the index in association with the inequities in access to primary care across the provinces. The deprivation index also had moderate to weak association with public health expenditure ($r = 0.352$, $P<0.060$) in the provinces. These results support the appropriateness of the deprivation index for inclusion in the final formula.

9.3.4.2. Results on the cumulative adjustment for the age/sex, mortality, and deprivation

The equity share of the health expenditure was estimated using the age/sex structure, mortality (U5M), and deprivation index in cumulative terms (Figure 9.4 below). Compared to the population size, the expenditure share based on the cumulative model increased in eighteen provinces with the largest in Sistan & Baluchestan (0.82%), West Azarbayejan (0.39%), Lorestan (0.30), Kurdestan (0.30%); the less advantaged provinces. The equity share decreased in Tehran (2.56%), Esfahan (0.62%), Fars (0.10%), Yazd (0.09%), Qazvin (0.08%), which are among the most affluent provinces (Figure 9.4). Overall, the adjustment for the cumulative formula increased the share of budget in favour of the provinces with lower economic status.

Figure 9-4: Expenditure based on population size, age/sex structure, mortality and deprivation

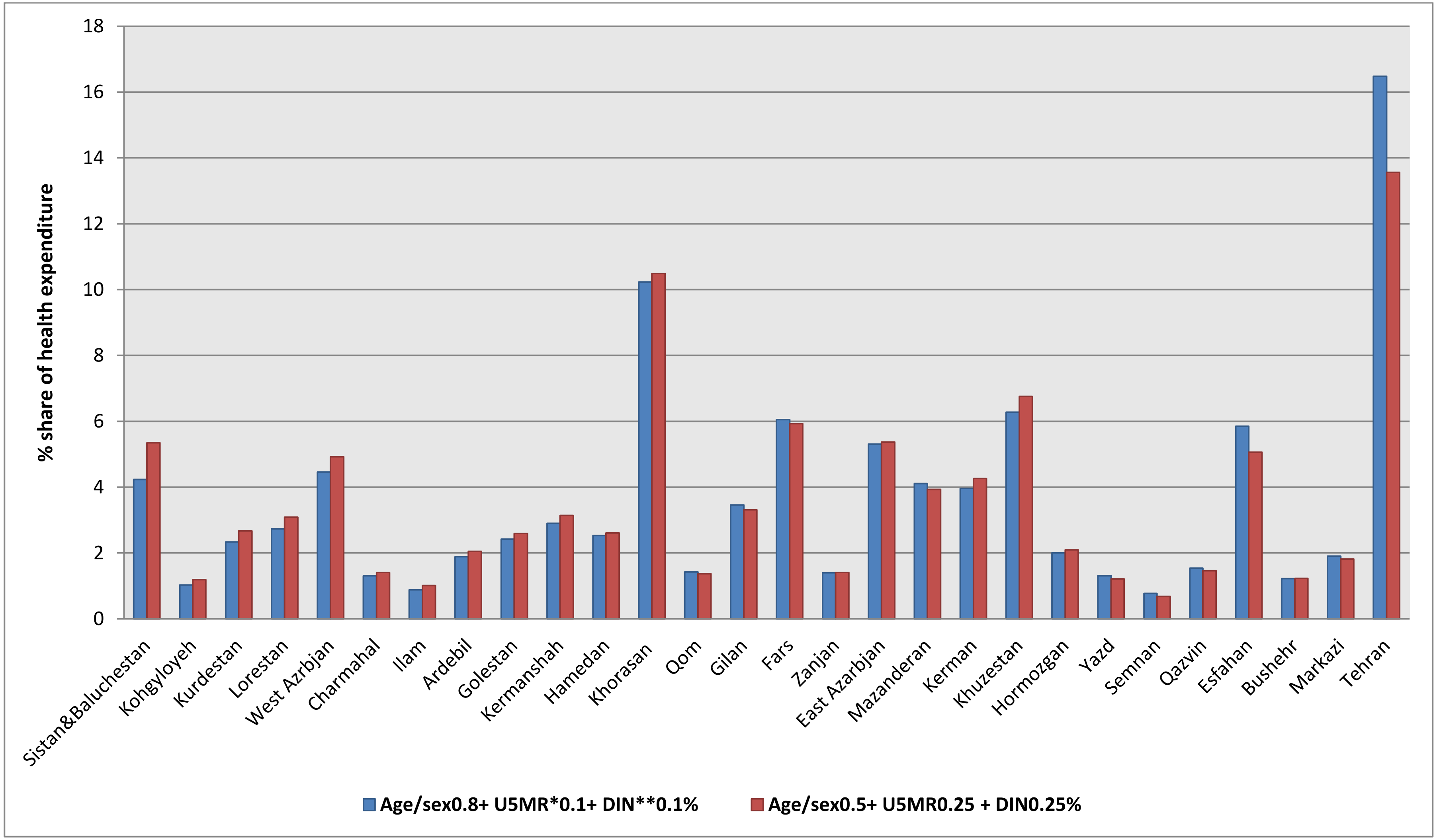


9.3.4.3. The sensitivity analysis (alternative cumulative model)

To explore the sensitivity of the formula an alternative model was created by giving alternative weights to the three elements of demographic (0.5 vs 0.8), mortality (0.25 vs 0.1), and socioeconomic (0.25 vs 0.1) factors. In fact, larger weight was given to the mortality and deprivation factors versus the smaller weight given to the age-sex structure. Figure 9.5 illustrates the share of health budget in the provinces based on the alternative weights given to the need indicators in the model.

The larger weights given to the mortality and socioeconomic indicators led to increasing the share mainly in the provinces of lower economic status and decreasing the share in the more affluent provinces (Figure 9.5 below). The share of budget increased in eighteen provinces with the largest increase in Sistan & Baluchestan (1.12%), Khuzestan (0.48%), West Azarbayejan (0.46%), Lorestan (0.36%), and Kurdestan (0.33%), which are among the less affluent provinces. On the other hand, there was a decrease in the share in 10 provinces with the largest in Tehran (2.92%), Esfahan (0.79%), Mazanderan (0.18%), Gilan (0.15%), and Fars (0.12%); these are among the more affluent provinces. Overall, the alternative cumulative model changed the share of health budget in favour of the provinces with higher economic status.

Figure 9-5: Alternative resource allocation models based on age/sex, mortality, and deprivation

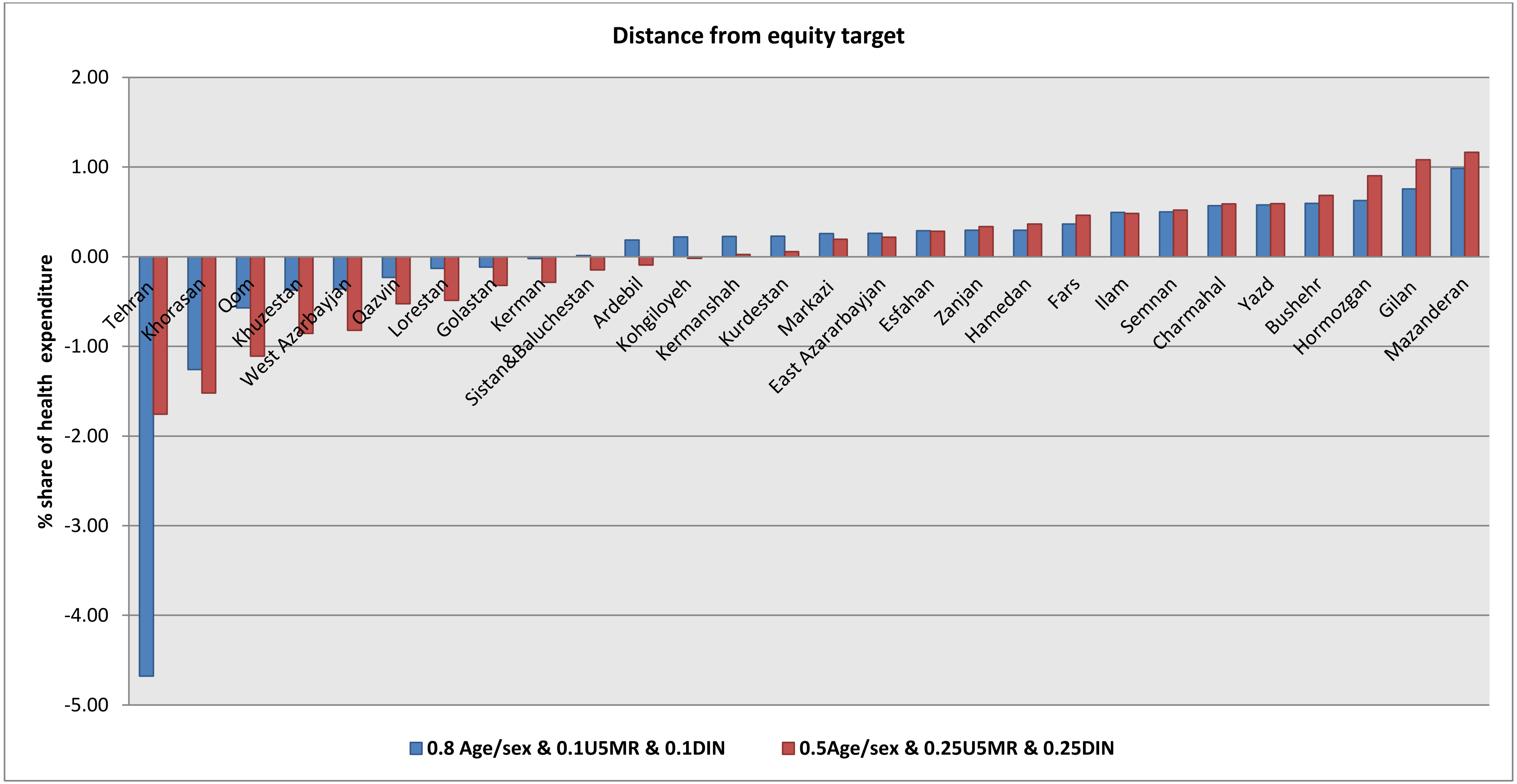


9.4. Equity/inequity in the health actual expenditure

Having the equity target share based on the cumulative model (0.8 age/sex + 0.1 mortality under-5 + 0.1 deprivation) , the actual expenditure was shown to be larger than the equity target in 19 provinces with a larger gap in Mazanderan (0.98%), Gilan (0.76%), Hormozgan (0.62%), Bushehr (0.59%) and Yazd (0.58%). In other 9 provinces the actual share was lower than the equity target with the largest distance in Tehran (4.68%), Khorasan (1.26%), Qom (0.57%), Khuzestan (0.37), and West Azarbayejan (0.36). Kerman (-0.02%) and Sistan & Baluchestan (0.01%) were the closest to the equity target (Figure 9.6 below).

Giving larger weights to the mortality and deprivation indicators, the results showed a larger distance of the actual expenditure from the equity target in the provinces with lower economic status; and a smaller distance from the equity target in the more affluent provinces (Figure 9.6 below). Based on the alternative cumulative model, the actual budget was higher than the equity target in 18 provinces; the largest gap was in Mazanderan (1.16%), Esfahan (1.08%), Gilan (0.91%), Yazd (0.68%), Semnan (0.59%). The actual expenditure was lower than the equity share in ten provinces mainly in Tehran (1.76%), Khorasan (1.52%), Sistan & Baluchestan (1.1%), Khuzestan (0.86%), and West Azarbayejan (0.82%). The provinces of Kurdestan (-0.1%) Kermanshah (-0.02%), and Ardebil (0.03%) are closest to the equity target.

Figure 9-6: The equity/inequity in health expenditure based on the cumulative and alternative models



9.5. Phasing the movement of health budget across provinces

The pace of implementation of a needs-based formula was considered to affect its ability to successfully reach the equity target determined in the formula. It was suggested that a medium to long-term plan be developed to redirect budget shares as determined between the provinces. Given the differences identified between the actual spending and needs-based shares of budget across the provinces, a five-year timeframe was developed to reallocate resources across the provinces. To reach the equity target determined, based on the cumulative model, the difference between the current budget and the equity target was calculated. The resulted figures were divided by the number of years (5) in the period to determine the average percentage share of budget that needs to be increased or decreased in the provinces in each year. Then the budget for the year was estimated by increasing or reducing the current budget to the percentage needing to be changed in the first year in each province. For the following years, the budget for the previous year was increased or reduced according to the amount of change that has been planned for each province.

Figure 9.7 (below) shows the annual equity targets determined based on the cumulative model over a five-year plan. As indicated in Table 9.6 (below) the largest reductions will be in the provinces of Mazanderan (.93%), Gilan (0.76%), Hormozgan (0.65%), Charmahal (0.62), Bushehr (0.59%), Ilam (0.55) and Yazd (0.54%). The provinces of Tehran (5.85%), Khorasan (1.22%), and Qom (0.59%) will respectively receive the largest shares of budget redirected from other provinces.

Figure 9-7: Timeframe for redistribution of health expenditure across the provinces

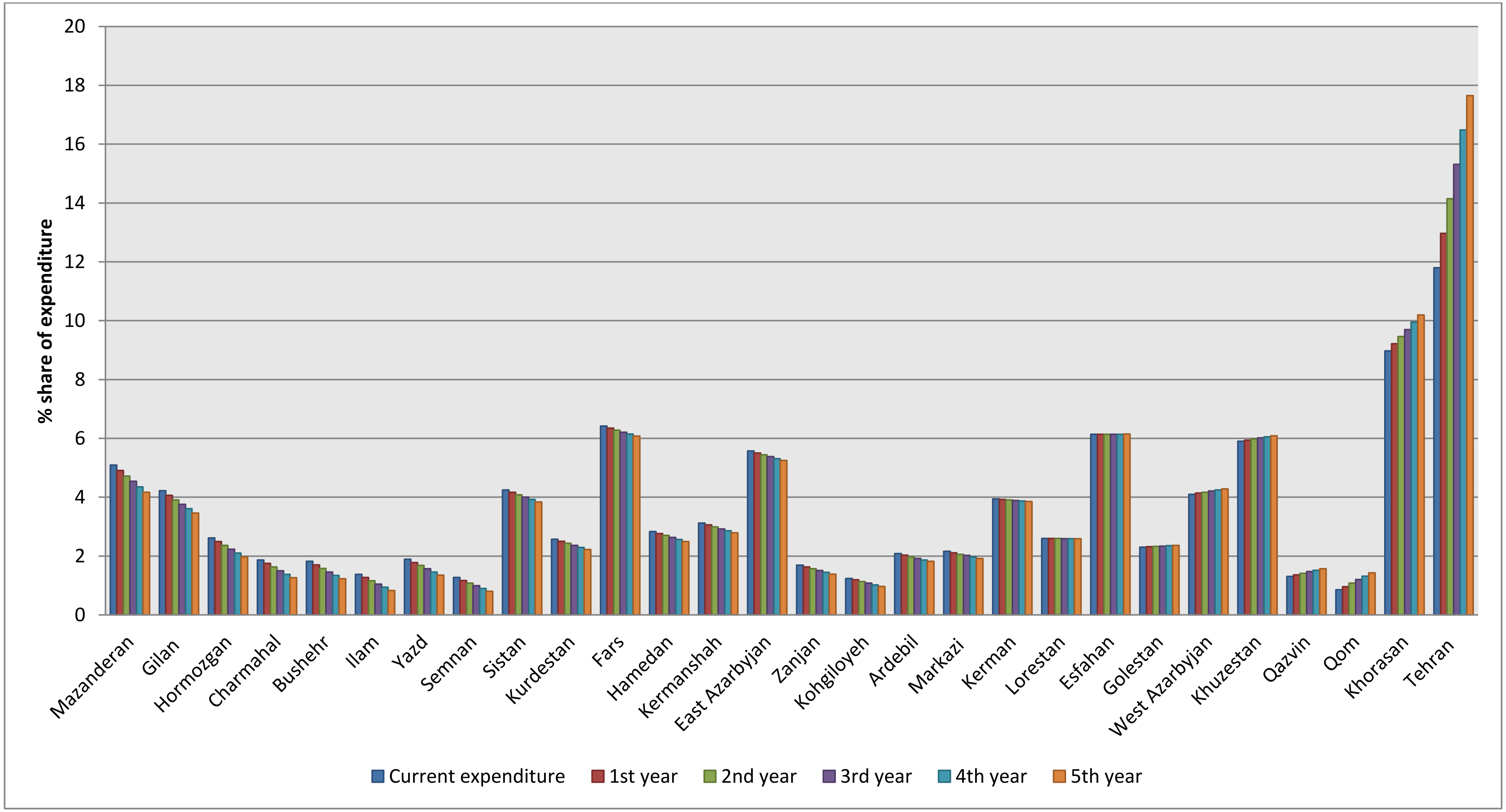


Table 9-6. Phasing the redistribution of health expenditure between provinces in 5-year plan

	Current budget%	Diff%	1st year%	2nd year%	3rd year%	4th year%	5th year % (equity target)
Mazanderan	5.09	-0.93	4.91	4.72	4.54	4.35	4.17
Gilan	4.22	-0.76	4.06	3.91	3.76	3.61	3.46
Hormozgan	2.62	-0.65	2.49	2.36	2.23	2.10	1.97
Charmahal	1.87	-0.62	1.75	1.63	1.50	1.38	1.26
Bushehr	1.82	-0.59	1.70	1.58	1.46	1.34	1.23
Ilam	1.38	-0.55	1.27	1.16	1.05	0.94	0.83
Yazd	1.89	-0.54	1.78	1.68	1.57	1.46	1.35
Semnan	1.27	-0.46	1.17	1.08	0.99	0.90	0.80
Sistan	4.25	-0.40	4.17	4.08	4.00	3.92	3.84
Kurdestan	2.57	-0.35	2.50	2.43	2.36	2.29	2.22
Fars	6.42	-0.34	6.35	6.28	6.21	6.15	6.08
Hamedan	2.83	-0.34	2.76	2.70	2.63	2.56	2.49
Kermanshah	3.12	-0.33	3.06	2.99	2.92	2.86	2.79
East Azarbyjan	5.57	-0.32	5.50	5.44	5.38	5.31	5.25
Zanjan	1.69	-0.30	1.63	1.57	1.51	1.45	1.39
Kohgiloyeh	1.24	-0.28	1.19	1.13	1.08	1.02	0.97
Ardebil	2.08	-0.26	2.03	1.97	1.92	1.87	1.82
Markazi	2.16	-0.23	2.11	2.06	2.02	1.97	1.92
Kerman	3.94	-0.09	3.92	3.91	3.89	3.87	3.85
Lorestan	2.60	-0.02	2.60	2.60	2.59	2.59	2.59
Esfahan	6.14	0.01	6.14	6.14	6.14	6.14	6.15
Golestan	2.30	0.05	2.32	2.33	2.34	2.35	2.36
West Azarbyjan	4.10	0.18	4.14	4.17	4.21	4.25	4.28
Khuzestan	5.90	0.19	5.94	5.98	6.02	6.05	6.09
Qazvin	1.31	0.26	1.36	1.41	1.47	1.52	1.57
Qom	0.85	0.59	0.96	1.08	1.20	1.32	1.43
Khorasan	8.97	1.22	9.22	9.46	9.70	9.95	10.19
Tehran	11.80	5.85	12.97	14.14	15.31	16.48	17.65

9.6. Discussion and conclusion on developing the needs-based formula

This study has attempted to shed light on issues of geographical health resource allocation in Iran, with the aim of generating the evidence required to move away from historical incremental budgeting towards a needs-based allocation; and to contribute towards the reduction of health inequities in the country. To assess the consistency of estimates of percentage share of relative need for health services based on different need indicators, this study estimated differences in the need for health care and share of budget between Iranian provinces using the current expenditure and four approaches. Based on data mainly from the Iran's census of 2006 and death registration system for 2004, the different need indicators of population size, age/sex utilisation of health services at national level, mortality, and socioeconomic status were used to develop and explore alternative needs-based models for allocation of public health expenditure between the provinces. Our primary conclusion is that the different approaches led to different and inconsistent results; this was consistent with the results of other studies (Kephart and Asada 2009; McIntyre and Anselmi 2012).

9.6.1. Impact of different indicators of need on equity target budget

It was indicated that around 33% of the Iranian population are living in the provinces located in the best-off quintile and 15% are living in the provinces of worst-off quintile. Thus, the adjustment for the size of population would direct the health resources in favour of the provinces with higher economic status. This indicates that population size is not appropriate to use as the only indicator of need to inform the resource allocation for health care across the provinces. The adjustment for population would not take all the need; thus, other need factors should be added to provide a more accurate need for health care in the provinces. This confirm the other studies that have used a combination of need indictors including the population size to inform the health resource allocation across geographical areas (EQUINET 2003; Oliveira and Bevan 2003; McIntyre et al., 2007; PBRA Team 2009).

The need indicator of age/sex utilisation of health services (at national level), when entered into the model, changed the share of the overall budget in favour of the provinces with higher economic status. Among the age/sex groups, the three groups of children under-5, women of childbearing age, and the elderly had the highest need for health care. However, the proportion of the age/sex groups was different in the provinces with low and high economic status. As described in chapter 4, the number of children was higher in the less affluent provinces; thus adjustment for this group would change the share in favour of the worst-off provinces. On the other hand, the proportion of women of childbearing age and older people were larger in the provinces with higher economic status. Therefore, this indicator reflects a balance of the need for health care in both the more and less affluent provinces. The share of health expenditure that moves to the less affluent provinces, due to the adjustment for the number of children undr-5, can help in the reduction of the inequalities in access to health care and in morbidities (e.g. low weight in children) across the provinces which were reported in the first part of this study. On the other hand, the adjustment for the women of childbearing age and the older population move the budget in favour of the well-off groups; this can help to provide more services for larger number of these age/sex groups in the provinces with higher economic status; in addition, this can help to bridge the gap in the prevalence of the coronary risk diseases (diabetes, high blood cholesterol, and hypertension) across the provinces which was indicated in the first part of this study.

The adjustment for the three measures of under-5 mortality, adult male and female mortality separately indicated changing the share of health budget mainly in favour of the less affluent provinces. However, the changes were different in the three mortality measures with the largest related to the mortality under-5 and the lowest related to the female mortality. In fact, compared to the male and female mortality, the mortality under-5 moved more resources from the well-off provinces to the worst-off provinces; thus, only this indicator was entered in the model. The change in the share of expenditure due to the adjustment for mortality under-5 can contribute to reduction of the inequities in access to health services (hospital delivery, vaccination, and antenatal care) and inequities in the premature mortality across the provinces.

The cumulative model (age/sex structure, mortality, and deprivation) would take the effect of a combination of the need indicators on the share of health expenditure in the provinces; the adjustment for the children under-5 increased the share of expenditure in favour of the worst-off provinces; and the women in childbearing age and older population changed the share towards the more affluent provinces. The mortality under-5 and deprivation index would change the share of budget mainly in favour of the less affluent provinces. The larger weights given to mortality (0.25 vs. 0.1) and deprivation (0.25 vs. 0.1) indicators and smaller weights given to the demographic factors (0.5 vs. 0.8) in terms of the alternative cumulative model also changed the share of health budget in favour of the less affluent provinces. Overall, the adjustment for the number of women of childbearing age and population age 50 years and over can lead to provision of health care in the well-off provinces in proportion to the number of the population in these two age/sex groups. In addition, this can contribute to the reduction of inequalities in the coronary risk factors (diabetes, high blood cholesterol, and hypertension) which was shown to be higher in the more affluent provinces. On the other hand, the adjustment for population aged under-5, mortality under-5, and deprivation would change the share of health budget in favour of the worst-off provinces; this can help to reduce the inequities in access to health services (hospital delivery, vaccination, and antenatal care) as well as inequities in the low weight in children under-5 which were reported in the first part of this study.

In all the adjustments the largest changes were in Tehran, and Sistan & Baluchestan; the actual share of budget in Tehran was 11.8%, increased to 19.04% by adjustment by population size, increased mildly to 19.24% by age/sex adjustment; the share decreased to 16.8% by mortality adjustment; then decreased to 16.4% by accumulative model. In addition to the largest population in the province of Tehran, there is a heterogeneous population in the province in particular in the city of Tehran as the capital. There are rich people mainly living in the north part of the city and the poor living in the south and other districts in the province. The province of Tehran showed to have the largest net immigration (616) among the provinces. A large number of immigrants are from the poorer provinces, looking for job, and advanced medical services in Tehran. There is also a large number of Afghan and Iraqi refugees living in the provinces, looking for job and other basic needs. In addition, the city of Tehran is suffering from traffic jams and air pollution that affect the health of the citizens. All these have made a specific situation in the province of Tehran in terms of health and resource allocation.

9.6.2. Equity/inequity in the health actual expenditure

The findings showed that in the majority of the provinces the actual expenditure was far from the equity target determined based on the cumulative model (Figure 9.6). The largest difference was related to Tehran; the share of actual budget in Tehran (11.8%) was 4.68% lower than the equity target set based on the cumulative model (16.48%). This implies that the size of population in Tehran is not appropriately considered in the current health expenditure. In addition, Tehran is the most affluent province in the country, and political forces may caused more resources directed to the provinces with lower economic status. On the other hand, Mazanderan, Gilan, Hormozgan, and Bushehr which are among the more affluent provinces had the largest share higher than the equity target. This implies that the budget has mainly moved from Tehran to these provinces, not to the less affluent provinces; as in the majority of the provinces of lower economic status such as Lorestan, Golestan, Kerman, Sistan & Baluchestan, Ardebil, and Kohgyloyeh the health expenditure is close to the equity share (Figure 9.6).

The alternative cumulative model where larger weights were given to the mortality and deprivation changed the distance from the equity target (set based on the cumulative model) in favour of the worst-off provinces (Figure 9.6). Having this, Tehran, Mazanderan, Gilan, Hormozgan, and Bushehr which are among the more affluent provinces would receive a small share; while some less affluent provinces such as Kohgiloyeh, Ardebil, Sistan & Baluchestan, Kerman, Golestan, and Lorestan would receive a larger share of budget. This indicates that, given the current context in Iran, the alternative cumulative model may provide a more appropriate equity target in the provinces. However, more research is needed to inform the weights given to the need indicators. In addition, it needs to be remembered that the pattern of inequalities between the provinces may differ if the population dependent on the public expenditure (McIntyre et al, 2000) is used for the adjustment instead of the total population.

The current health expenditure was generally in favour of the provinces of lower socioeconomic status, indicating that socioeconomic status has been politically considered as the main factor in allocation of the resources between the provinces. In all the approaches, Tehran was the province with the largest changes (increase) in the equity target share of health budget; this implies that Tehran has been considerably under-resourced given the different need-based models. Tehran has a heterogeneous population including areas with very high socioeconomic status (e.g. in the northern of the city of Tehran) and deprived areas (e.g. in the southern part of the city of Tehran and some other districts in the province). On the other hand, in Tehran (mainly in the city of Tehran as the capital) there is quite a big private sector and there are more affluent people who receive their services from the private sector, paying directly for the services; and thus, not dependent on the public services. This may be the reason why politically a share smaller than the equity targets has being given to Tehran and why resources have been moved to the more deprived provinces (due to the political pressures), and not based on an estimated need for health care.

9.6.3. What are the limitations of the current analysis? Or what can be refined in future?

There are limitations on the developed formula, implying space for the refinement of the formula in the future.

Population size in the provinces used in this study was abstracted from the 2006 census, and was shown to be affected by the fertility rates and migration across the provinces. The fertility rate was larger in the less affluent provinces while net immigration was higher in the more affluent provinces. It is likely that the number of new births and net migration in the provinces will change over time. It is suggested the resource allocation model needs to be refined when updated data on population size in the provinces is available. The data from Iran's 2011 census would be accessible from late 2012 onward is an appropriate source in this regard. Given the role of population size as a basic and important indicator in the model, the updated and accurate data on the size of population can provide a more equitable formula for the resource allocation.

As mentioned previously, the province of Khorasan was split into three new provinces in 2003-2004 which led to changing the number of provinces from 28 to 30; however, as the available data, in particular data on mortality, was on the original province of Khorasan, the data on 28 provinces was used for the analysis. Khorasan is currently divided into three provinces of Khorasan Razavi, North Khorasan, and South Khorasan, the earlier is among the most advantaged and the two latter are among the less advantaged provinces. This has implications for measuring the need for health care in the current provinces and estimating the share of health budget in particular for the new provinces if the developed formula is to be used for the distribution of health resources among the provinces. By providing updated data in particular on mortality, it is suggested the formula to be redeveloped and updated based on the latest administrative divisions in the country. Given the different socioeconomic status in the three new provinces, the updated formula will help to a more equitable allocation of health resources and the reduction of health outcome inequities across the provinces.

There were insufficiencies in the data on the national utilization of health services by the age and sex groups. For example, the national use of health services was not distinct for men and women aged 14-49 years to inform the higher need for health care in women of childbearing age in the survey used for this study (Naghavi and Jamshidi 2005). The information in the first part of the study indicated inequalities in the proportion of children under-5, women of childbearing age, and population aged 50 years and over across the provinces; the number of children under-5 was higher in the provinces with lower economic status and the population of women in childbearing age and old population (aged 50 years and over) were larger in the more affluent provinces. There was also higher prevalence of low weight in children under-5 in the less affluent provinces and chronic diseases (diabetes, high cholesterol, and hypertension) in the more affluent provinces. In this respect, adjustment for the use of health services in the different age/sex groups based on accurate data can appropriately take the need for health care in the provinces and provide budgets consistent with the ill-health inequalities across the provinces. Therefore, it is useful for more research to be conducted to provide appropriate data on the age/sex groups' utilisation of health services; and the resource allocation model to be refined based on the new information. This can appropriately help to reduction of the inequities in access to the health care and in morbidities in respect of coronary risk factors (diabetes, high blood cholesterol, and hypertension) which were more prevalent in the more affluent provinces.

For weighting the need indicators larger weight (0.8) was given to the demographic composition as age and sex, which are considered the direct measures of need, and a strong relationship between the demographic factors and the use of health services is evidenced in many studies (Okojie 1994; Mendoza-Sass and Béria 2001; McIntyre et al., 2007; Layte et al., 2009). The mortality measure (0.1) and socioeconomic status (0.1) were given smaller weights as the association between these factors and the need for health care was not clear (Diderichsen 2004). Mortality is an outcome of illnesses that lead to death; not reflecting the effect of illnesses for which the result is not death (Gugushvili 2007). The relationship between the socioeconomic status and need for health care is not also mechanistically straightforward and socioeconomic factors are considered as an indirect measure of need (Blackwell et al., 2009). Giving smaller weight to the demographic factor (0.5 vs 0.8) and larger weights to mortality (0.25 vs 0.1) and deprivation (0.25 vs 0.1) changed, overall, the share of budget in favour of the well-off provinces. The weights were given based on the expert experiences (McIntyre and Anselmi 2012); not based on an empirical analysis (Carr-Hill et al., 1994) as the need indicators were from different domains that make it impossible to use empirical method in this regard. Having said this, it is suggested that more research is conducted to provide information for giving appropriate weights to the need indicators, so as contribute further to the reduction of the inequities across the provinces reported in the first part of this study.

The focus of this study was on public spending on health care, but there was a lack of information on the share of population that mainly uses the public health services in the provinces. Providing appropriate information through household surveys in this regard can assist in a better adjustment for the populations who are dependent on public expenditure in the provinces. In the less affluent provinces, such as Sistan & Baluchestan and Kurdestan, it is more likely that a larger proportion of population will be dependent on public resources than in the more affluent provinces such as Tehran and Esfahan. The findings of the first part of this study indicated that access to health services (hospital delivery, vaccination, and antenatal care) was lower in the provinces with lower socioeconomic status. Using the populations that are mainly relying on the public health budget for the adjustment can shift more resources to the less affluent provinces and help to reduce inequities in access to the health services. In this regard, it is helpful accurate data to be provided on the relevant population size and the allocation model to be updated based on the number of people who have higher needs for public expenditure.

The resource allocation models in this study were developed at provincial level; however, in many cases the provinces are too large with diverse population size and social groups. For example, the province of Tehran has the highest economic status as well as the largest but heterogeneous population from the most affluent in the north of the city of Tehran to the least affluent in the south and other districts in the province. There is to some extent the same situation in other big provinces such as Khorasan, Esfahan, and Fars. This may inappropriately affect the need for health care and distribution of health services between the provinces. Resource allocation at smaller areas, such as districts, has been shown to be more useful in reduction of health inequalities (Sutton et al, 2002, McIntyre et al, 2002). Given that, it is suggested when appropriate data is available, the resource allocation model should be redeveloped on district level; and resources to allocated to the districts instead of provinces. This approach can more effectively contribute to the reduction of health care and health outcomes inequities across the country.

In addition to the health care need factors, differing cost of health services was another factor that can affect the share of budget in the geographic areas (Green et al., 2000) . However, this factor was not considered in the health resource allocation model developed in this study, because of the lack of information on this factor in the country. Provinces with larger remote and rural areas may have higher costs in providing health services; the information in the first part of this study indicated variation in the rural areas and populations across the provinces. Population density can be also a factor that can represent the remoteness in the provinces. The rural population indicator which was used in the model may to some extent compensate for the higher cost of providing services in the provinces with more remote areas (Sutton et al., 2006). However, there are other reasons for differing costs of health services, such as input price in large cities in some of the provinces such as Tehran and Esfahan, which can be considered in the formula. Entering the differing costs of health services in the formula is a political decision (Diderichsen 2004); however, it is useful for appropriate information to be provided on the above indicators and applied in the final allocation model to shift more resources to provide more equitable access to health services across the provinces.

Another factor that was considered to affect the amount of health budget in the areas was the cross-border use of services (Ensor et al., 2001; Bertinato et al., 2005; Manthalu et al., 2010); however, it was not also considered in the formula because of the lack data on this factor. Cross-border use of health care across the provinces is mainly due to seeking specific specialist services in the more advantaged provinces, in particular in Tehran the capital (Abolhallaj 2004). Tehran is currently providing a large number of advanced medical services to the people in other provinces mainly the neighboring and the less advantaged provinces while there is no clear method to compensate for the health services given to the referral patients. It is suggested, when appropriate data is available, the indicator of cross-border use of health services to be entered to the formula to provide a more equitable health expenditure for the provinces.

In most health systems there are health services that are considered national services, e.g. transplant services, pediatric oncology, and neurosurgical services, which are both individually very costly and relatively rarely needed (Vega et al., 2010). This is true for the health system of Iran; for example, services such as heart, kidney and bone marrow transplantation are delivered mainly in provinces such as Tehran, Esfahan, and Fars; but these services are also used by patients from other provinces. For this reason, it is suggested that the budget for these services is removed from the formula and distributed through other appropriate equitable mechanisms. This can help to more equitable access to health services in the country.

Despite the efforts to follow appropriate processes to take all the needs for health care into account in the formula, because of technical implications and also insufficiencies in content and availability of information (Pearson 2002; Dixon et al., 2011), all needs for health care may not be included in the formula, leading to unmet need in some provinces. Therefore, it is recommended that not all the health budget is distributed through the formula; some part (say 30%) is kept to be allocated to compensate the insufficiencies (unmet need) in the provinces where it arises.

It may be difficult to cut the budget currently given to the over-funded provinces identified based on the formula to transfer to the under-funded provinces (McIntyre and Anselmi 2012). This may lead to discontinuing or reduction in the levels of the services provided in the existing health centers and perpetuate the inequities in access to the health care in the provinces. In addition, it may lead to resistance by the stakeholders, in particular politicians in the affected provinces. Therefore, it is suggested that provinces that are currently under-funded are given priority when there are increases in overall budget.

A reform is being conducted in the health system of Iran regarding family physicians (Iran Daily 2012). Based on the family physician plan, all Iranian citizens who register with a General Practitioner will receive free primary services and pay a small part of the cost of secondary services. This can reduce financial barriers and increase access to health services in particular in the provinces that have lower access to health services. It is suggested that the budget determined for the family physician plan is distributed across the provinces based on this equitable resource allocation formula when it is updated based on the above recommendations.

In general, allocation of health budget across the provinces is a political process and can often be controversial, therefore, appropriate management of the process is necessary (Smith et al., 2001). It is also useful to engage the key stakeholders, particularly senior managers at provincial and district level, in the process of development and implementation (McIntyre et al., 2007; Kirigia 2009). An important first step is to achieve consensus on the principle that resources should be equitably allocated, i.e. that resources should be allocated to geographic areas on the basis of each area's relative need for health services. The next step is to discuss with these stakeholders potential indicators of need that could be included in the formula and the relative weights to be given to different indicators. Thereafter, data can be compiled and different versions of a needs-based formula calculated so that their implications can be scrutinised.

Despite the timeframe suggested in this study, it needs to be kept in mind that the pace of change in redistribution of budgets based on the resource allocation formula is a political decision. Therefore, the formula is not a decision-making machine but it shows the overall direction the funds need to be moved across the provinces. It is also difficult to actually cut the current budgets to the provinces with the lower level of need. Based on the cumulative formula, funds should be moved from the provinces of Mazanderan, Gilan, Hormozgan, Bushehr, Yazd, and Charmahal. Tehran, Khorasan, Qom, Khuzestan, and West Azarbayejan are the priority provinces for increased budgets. It will be more feasible to re-allocate resources if when the overall budget increases, all of the increase is given to those provinces that are below their target allocation and the relatively over-resourced provinces receive no real increase.

10. Overall conclusion and recommendations

10.1. Overview

This thesis has attempted to generate evidence on health inequities between the provinces of Iran and to explore equitable health care resource allocation models to contribute to reduction of the interprovincial inequities and promotion of health equity in the country. Access to health care has been shown to influence health and health inequities (Diderichsen 2004; Marmot et al., 2008), and the impact of health expenditure on health outcomes has been evidenced in many studies in both developed (Martin et al., 2008) and developing countries (Bhalotra 2007; Bokhari et al., 2007; Anyanwu and Erhijakpor 2009; Gani 2009). Therefore, equitable distribution of health financial resources may help to reduce inequities in health care and health outcomes.

Despite the considerable actions taken by the Iranian government in the past three decades to promote health and reduce health inequities in the country, there is evidence of inequities in health care and health outcomes across the provinces (Ministry Health 2010). The current method of public health care resource allocation in Iran is also on the basis of historical incrementalism and political bargaining rather than the need for health care (Abolhallaj 2006; EMRO 2006) which may perpetuate the inequities in health care access and health outcomes.

This thesis began by evaluating the principles underlying health equity to identify the main ethical principles to underlie the health equity assessment and equitable health resource allocation in Iran. This was followed by an investigation of Iran's political context and the perspective underlying the government in order to reveal how it may be supportive for equity promotion activities. I evaluated the concept of health equity to identify a practical definition to guide the measurement of health inequities. I also evaluated horizontal and vertical principles of equity to see which would be more effective to consider in the inequity assessment and in developing resource allocation models in this research. The thesis then looked at the literature on the main frameworks and methodological issues on the assessment of health inequities to identify a framework and appropriate methods for the measurement and establishment of the health inequities as per the aim of this study. I evaluated the main elements in regard to the health inequities including the related social groups, health status, and health care to identify the appropriate indicators in the domains for the inequity measurement. I described the sources of data used in this study: Iran's census 2006, death registration system 2004, and the HDS. The main domains in regard to inequity and related indicators were evaluated in the context of Iran and across the provinces to provide information (chapter 4) for better understanding of the health inequities which I aimed to measure in this research (chapter 5).

Action across all sectors of government was considered to be required to tackle health inequities and the health system was suggested as a good place to start (Riley et al., 2007; Marmot et al., 2008). Therefore, the second part of this thesis looked at equitable allocation of public health resources as an effective means for the reduction of health care and health outcome inequities between the provinces. I evaluated the health system structure and administration to indicate how these are supportive for the promotion of health equity in general and equitable resource allocation in particular. This was followed by an evaluation of the main sources of funding of the health system to see how the health system is funded in general and to provide appropriate information on government expenditure in health which was the focus for the equitable allocation in this study. Then, I looked at the current approaches of health care public resource allocation and actual public expenditure on health in the provinces to indicate how the existing methods of allocation are inequitable. The thesis looked at the literature on geographical resource allocation to identify the main methods of needs-based resource allocation and the factors which indicate the need for health care (chapter 7). I evaluated the appropriate methods and need factors in the context of Iran that can be used for the development of needs-based models for allocation of public resources across the provinces (chapter 8). Finally, this thesis explored alternative models for the allocation of the health budget across the provinces.

10.2. Brief of the main findings

This study provides an overview of the health inequities and the methods used to promote an equitable distribution of health care resources across geographic areas. In part one, the evaluation of the ethical principles underlying equity showed that a combination of the main principles, including utilitarian, egalitarian, and need principles, can cover all aspects of equity in health and health care. However, the need principle will play the main role in the assessment of health inequities and equitable allocation of health care funds in health systems. Considering the role of government perspectives on promotion of equity, it was indicated that the Iranian government perspective takes a place between the collectivist and liberal views which was thought to be supportive for the assessment and for taking action for promotion of health equity in the country.

Evaluation of the concept of health equity led to adoption of its definition as the absence of systematic disparities in health (or in the major social determinants of health) between social groups who have different levels of underlying social advantage/disadvantage—that is, different positions in a social hierarchy (Braveman and Gruskin 2003) as a practical concept for the measurement of health inequities. The main idea that underlies this concept is a significant structural pattern of relationship between the health outcomes and health care with the social conditions affecting health. Evaluation of the equity principles showed that despite the too frequent use of horizontal equity because of its ease of application, the vertical principle was considered to be more effective to underlie the provision of health care and reduction of health inequities (Mooney 1996; Mooney and Jan 1997; Mooney 2000; Sutton 2002).

The findings from the measurement of health inequities showed considerable inequalities of mortality in relation to the socioeconomic factors across the provinces. Mortality in children under-5 had the largest relationship with the socioeconomic factors in the provinces compared to the adult male and female mortality. The association between the socioeconomic factors and mortality in men was stronger than the relationships with mortality in women. Illiteracy rate was shown to be the strongest predictor of mortality in children under-5 and adult women; and unemployment was the strongest predictor of mortality in adult men across the provinces. These findings confirmed the results from previous studies showing significant relationship between education and unemployment with mortality.

The findings indicated significant inversed association between the low socioeconomic status and the lifestyle related morbidities (diabetes, high serum cholesterol, and high blood pressure) across the provinces. This was consistent with the findings of another study in Iran (Ministry Health 2010) and in other developing countries (Yang et al., 2010) but was inconsistent with the findings of studies in developed countries that indicated an adverse relationship between socioeconomic status and lifestyle-related morbidities (Bays et al., 2007). This is due to the effect of the demographic and epidemiological transition happening in the developing countries. Low socioeconomic status had significant direct association with child malnutrition across the provinces which is consistent with the findings in the literature. The findings indicated no significant association between the socioeconomic factors and mental disorders across the provinces, contradicting findings of other studies in the literature. There was also significant direct association between health care utilization and high socioeconomic status across the provinces. Household size was shown to be the strongest predictor of hospital delivery and illiteracy was the strongest predictor of children’s immunization across the provinces.

In the part two of this thesis, the health system structure in Iran was shown to be based on the principles of the Alma Ata Declaration, focusing on primary care and the administration system was centralized with the main health policies made at national level; both were considered to be supportive for the promotion of health equity in the country. Evaluation of the sources of funding showed a mixed health financing system in Iran with a higher share of out-of-pocket payment (58%) and lower share of public expenditure (42%), which was considered to be unfair as the latter was smaller than the average global figure and the larger the share of public spending on health, the more progressive and equitable the funding system. The public health resource allocation was shown to be mainly based on an historical incremental mechanism and political bargaining rather than the need for health care which were considered to be inequitable. The actual government expenditure on health care was shown to be inconsistent with the level of ill-health in the provinces.

Evaluation of the factors influencing the need for health care showed that population size, demographic composition, mortality and socioeconomic status (deprivation) were the most appropriate indicators of need to use for the development of geographic needs-based resource allocation models. Population size was shown to have considerable effect on the share of health budget in the provinces; this confirmed the results in the literature of the importance of the size of population in catching the need for health care in a population or geographic area (EQUINET 2003; Oliveira and Bevan 2003; McIntyre et al., 2007; PBRA Team 2009). The demographic composition had a strong relationship with utilization of health services and was considered to be a direct indicator of need for health care. However, the adjustment for the age/sex structure changed the shares of health budget in favour of the more affluent provinces. Adjustment for under-5 mortality changed the health budget towards the provinces with lower socioeconomic status; while male and female mortality changed the shares in favour of the less affluent provinces. The adjustment for socioeconomic status changed the shares in favour of the more deprived provinces. Compared to the individual need indicators, the cumulative adjustment using the age/sex structure, mortality and socioeconomic status changed the health budget towards the provinces with lower socioeconomic status; however, compared to the actual budget the effect was inversed.

Looking at the inequities in access to health services, there was lower access in the provinces with lower socioeconomic status. The adjustment by the mortality and deprivation indicators changed the share of health budget in favour of the more deprived provinces; this can lead to provision of more health services in the deprived provinces, reducing the health care inequities between the provinces. Similarly, the movement of the health budget towards the more deprived provinces due to the adjustment for the mortality and deprivation factors can contribute to the reduction of inequities in mortality between the provinces.

There was a strong direct relationship between high socioeconomic status and the lifestyle-related diseases of diabetes, high blood cholesterol and hypertension. These inequities in lifestyle-related illnesses were considered to be due to the demographic and epidemiological transition happening in the country. Looking at the needs-based resource allocation models developed, the adjustment for demographic composition has in fact taken into account the need for health care due to the increase in chronic diseases in more advantaged areas. This changed the share of health budget in favour of provinces with higher socioeconomic status, which consequently can contribute to the reduction of inequity in the lifestyle-related diseases between the provinces.

In general, in the final developed model, the adjustment for the combination of demographic composition, mortality, and low socioeconomic status created a balance between the two types of need for health care in the provinces. While the age/sex structure adjustment took into account the need for health care due to chronic diseases and changed the budget shares in favour of the provinces of higher socioeconomic status, the mortality and deprivation indicators balanced this in favour of the more deprived provinces and the need for health care due to deprivation and ill-health. However, the weights given to the need factors can affect the balance between need and budget shares created by the combination of need factors. A larger weight was given to the demographic factor, compared to the deprivation and mortality measures, as the age/sex structure was considered a direct indicator of need for health care and the other two factors as indirect indicators of need. However, it needs to be kept in mind that weights are usually given to need factors based on expert opinion and political issues.

Compared to the actual expenditure, the developed model changed the share of health budget towards the more advantaged areas, which implies that low socioeconomic status has been the predominant factor politically affecting the allocation of public expenditure on health to the provinces in Iran. Therefore, research is needed to provide information to guide the magnitude of the weights given to need factors in light of the current socioeconomic and political pressures in the country.

The findings of part two provide an overview of the methods used to promote an equitable distribution of health care resources across geographic areas. They highlight that a needs-based resource allocation formula is, to a very high degree, valuable in breaking the inertia to change the historical incremental budgeting that is so frequently used to determine health budgets across areas. They also highlight that, because of challenges such as lack of specialist staff and inability of geographic areas to absorb additional funds allocated to them, all too frequently developing and trying to move towards equity targets generated by a needs-based resource allocation formula is not sufficient; appropriate phasing to moving the funds, an effective health system structure, and supportive administration system are necessary for successful implementation of a needs-based resource allocation model and consequently reduction of health inequities.

10.3. The limitations of this thesis

There were several limitations in conducting this study:

In 2003, the number of provinces in Iran increased to 30 provinces from the previous 28 by splitting the province of Khorasan into three new provinces. However, some data was only available on the previous 28 provinces, and therefore the measurement of health inequities and development of needs-based resource allocation models were based on the 28 provinces. This could raise problems in health resource allocation in particular for the three new provinces. In this regard the formulas need to be updated when data on the full 30 provinces is available.

Due to lack of data on smaller geographic areas, e.g. health districts, the study focused on assessment of health inequities and developing criteria to allocate resources among the provinces. The analysis at provincial level has its limitations in that the population is unlikely to be homogeneous in its characteristics across a whole province, implying that there will be deprived areas within relatively well-off provinces. This may raise the problem of ecological fallacy causing mis-measurement of the health inequities, the real magnitude of the need for health care, and consequently health budget allocated to the provinces. Therefore, it is recommended the study be updated at district level for both the inequity assessment and equitable allocation of health budget across the country.

The models were developed by relying mainly on quantitative data on deprivation derived from the census and household survey. As need for health care is multi-faceted, having different parts (Minujin and Delamonica 2005), relying only on the quantitative data may not take into account all the need for health care in the provinces. Measuring the need for health care using a combination of quantitative data and qualitative information (that can be obtained through knowledge and experiences of the local experts) could be a more appropriate approach to follow (McIntyre et al., 2000; Kirigia 2009). However, it was not possible to do this in this study because of the time limit and inaccessibility of the experts.

10.4. Speculations on the limitations of implications

This study clearly indicates that there are inequities in health outcomes and health care access across the provinces of Iran. These findings have major policy implications, requiring adoption of a well-designed and transparent equity-oriented strategy, and policies for monitoring and reduction of the health inequities in the country. This in turn requires the provision of appropriate data on socioeconomic and health indicators, in particular at district level, so that the health inequities can be measured and evidence provided to enable policy makers to develop appropriate plans for equity promotion.

This research has mainly focused on equitable allocation of resources at national level; this can have significant implications. Equitable allocation of resources from national to provincial level is essential; however, this is not enough to reach an equitable health care resource allocation system in the country. Correction of imbalances at lower levels within the provinces is also required. It is at the sub-provincial level (e.g. districts) that the resources are translated into programs and services to meet the health needs of the population. Thus, focusing on national level at the expense of lower levels constrains the promotion of equity. It is, therefore, important that concrete measures are developed and implemented to promote equitable resource allocation within the provinces in collaboration with the provincial authorities. The starting point for this could be assisting provinces to develop appropriate mechanisms to guide intra-provincial (at district-level) resource allocation, including tools for assessing health needs, setting priorities and service targets.

When developing any funding formula, it is important that relevant health officials at the national, provincial, and district levels are involved in the development process to ensure the formula is methodologically practical with sufficient ease of implementation and that it reflects the actual population health needs. The development of a funding mechanism at the provincial and district levels should involve extensive consultations with the health officials at the frontline of service provision as they have superior knowledge about the health needs of their populations and are, therefore, better positioned to allocate resources more equitably to areas where there are higher needs for health care.

Developing needs-based resource allocation models is not sufficient for an equitable resource allocation. Successful implementation of resource redistribution can be greatly facilitated by conducting a detailed gap analysis that provides a basis for developing detailed infrastructure and service development plans. It is also necessary to strengthen local capacity for planning, budgeting and implementing plans to ensure effective use of limited health care resources and phasing of implementation. Monitoring and evaluation of all these processes will enable learning that can enhance effective redistribution of resources to promote health service equity across geographic areas and contribute to reduction of health inequities.

10.5. Significance and contributions to the knowledge

This study is a multidisciplinary research, endeavoring to contribute to health equity promotion by measuring and establishing the health inequities. For this, the study combined philosophy and quantitative methodologies and used diverse areas of sciences including bioethics, politics, epidemiology, public health, health economics, and statistics to provide evidence on geographic health inequities. This is one of the first efforts in this regard in Iran, aiming to measure and establish the health inequities across the provinces.

This study supports the use of the principle of vertical equity, implying treating unequal individuals unequally, as an important principle for assessing health inequities and guiding resource allocation. As described in the literature, the emphasis has been more on horizontal equity ideology to guide the monitoring of equity and allocation of resources in most health systems. Recently, there has been an emerging literature in support of placing more emphasis on vertical equity goals to drive the assessment of inequities and resource allocation. This study contributes to this literature and the different perspectives on social justice to support the argument that society has a moral duty to improve the lives of its most disadvantaged and vulnerable groups. This study has highlighted the view that it is through discrimination in favour of the worse-off in inequity assessment and resource allocation that disadvantaged groups will be made better-off or benefit from resource allocation. The conceptualisation of equity undertaken in this research supports the choice of a vertical equity principle which focuses on the notion of unequal but equitable treatment of the unequal, rather than promoting horizontal equity which mainly considers equal treatment for equal need.

There is a view that measuring health inequities based on different perspectives of equity and different inequality indicators may lead to different presentations of inequities in a community (Asada 2005; Schneider et al., 2005a). This study measured and compared the health inequities using two different equity perspectives and consequently two different inequality indicators. It confirmed that differences in the magnitude of inequities can arise when inequities in health are measured based on different equity perspectives and using different methods.

The second part of this study is an effort to promote the equitable distribution of health care resources among geographic areas in Iran. It is the first effort in the context of Iran that has tried to explore alternative needs-based resource allocation models for equitable distribution of health care resources across the provinces. This can promote the use of needs-based formulae for health resource allocation and confirm that a needs-based resource allocation formula as a vertical approach is valuable in breaking the current and common method of public health budgeting, in particular in developing countries, whereby resource allocation is mainly based on historical incrementalism and political bargaining.

10.6. Suggestions for Future Research

This study suggests three directions for future research: 1) research on the basic principles and policy on health equity, 2) research on to time and data constraints, and 3) research on the perspectives of policy makers and health executives involved in health care and resource allocation.

- Given the insufficiencies in the equity-oriented strategy in Iran's health system, I suggest developing an "overall framework for tackling health inequities" in the country. This framework can provide overall practical guidelines to consider the main factors affecting the health inequities and to inform the reduction of health equities across the country.

- Because of the lack of information on the district level in Iran, this study focused on the provincial level for measurement of health inequities and developing the needs-based resource allocation models. However, as the provincial level seems to be too large in this regard, it is suggested health inequities are measured and established at district level when data is available.

- In this study, I measured and compared the health inequities based on two different equity perspectives, of "equity as systematic, pervasive or structured inequality" and "equity as the average health of the worst-off group". However, there are other equity perspectives underlying health and health care such as the "capability function" perspective introduced by Amartya Sen. Further research is necessary to confirm the findings of this study as well as to examine the measurement of health inequities based on other equity perspectives.

- In this study the resource allocation models were explored at provincial level. However, the populations in the provinces are large and heterogeneous in social terms, which can lead to incorrect measurement of the need for health care; leading to inappropriate allocation of resources across the provinces. It is recommended, when data is available, that the needs-based resource allocation models be re-developed at the district level.

- I measured the need for health care and developed the needs-based formula using quantitative data. Experience shows that in order to take into account the real need for health care in the formula, it is useful if the views of stakeholders such as health managers and health professionals are considered in the formula. Therefore, it is suggested further qualitative study be conducted to take the views of different stakeholders into account in determining the need for health and development of health needs-based resource allocation models. This can contribute significantly to informing and supporting health policy reforms that aim to promote equity in resource allocation in the health system of Iran.

10.7. Questions Addressed by this Study

This thesis set out to answer, and has answered, the following research questions:

- What is the ethical and political background for the promotion of equity in health in Iran?
- What is the appropriate concept and principle of health equity for the measuring health inequities?
- What is the appropriate framework and strategy for the assessment and measuring health inequities in Iran?
- What are the main socioeconomic factors influencing health inequities in Iran?
- What are the main aspects of health in respect of inequity (health care and health outcomes) in the context of Iran?
- What are the main health inequities (inequities in mortality, morbidity, and health care access) across the provinces of Iran?
- How the current methods of health resource allocation and health expenditure in Iran are inequitable?
- What are the appropriate need indicators to use in the context of Iran
- What are the alternative needs-based models for allocation of public health expenditure in Iran? And which one is more appropriate to apply?

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