Geographic Disparities in Saudi Mortality: Toward a Policy Relevant Analysis

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This DELTA Doctoral Project, Geographic Disparities in Saudi Mortality: Toward A Policy Relevant Analysis, presented by Nurah Maziad S Alamro, and Submitted to the Faculty of The Harvard T.H. Chan School of Public Health in Partial Fulfillment of the Requirements for the Degree of Doctor of Public Health, has been read and approved by:

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Date: March 21st, 2017
GEOGRAPHIC DISPARITIES IN SAUDI MORTALITY: TOWARD A POLICY RELEVANT ANALYSIS

NURAH MAZIAD S. ALAMRO

A DELTA Doctoral Thesis Submitted to the Faculty of
The Harvard T. H. Chan School of Public Health
in Partial Fulfillment of the Requirements
for the Degree of Doctor of Public Health

Harvard University
Boston, Massachusetts.

May 2017
Dissertation Advisor: Dr. Howard Koh

Nurah Maziad S. Alamro

Geographic Disparities in Saudi Mortality: Toward A Policy Relevant Analysis

Abstract

Health disparities rank as a leading public health challenge for much of the world. While many countries have launched national efforts to address health disparities, led by the United Kingdom, such themes have received little formal attention in Saudi Arabia. Despite the growing heterogeneity of the country by region, population and other dimensions, no formal efforts to date have attempted to document health disparities and address them from a policy perspective. Specifically, there has been:

a) No published quantitative evidence of health disparities within Saudi Arabia.

b) No national plan or policy to address such disparities, if they were shown to exist, and

c) No clear understanding of how the Saudi Arabian government would address health disparities, if asked to do so.

In 2015, King Salman Bin Abdulaziz, King of Saudi Arabia and the Custodian of the Two Holy Mosques, announced his Vision 2030 (Saudi Vision 2030), which promises to address national socioeconomic gaps and to improve the country’s health indicators in line with that of other, developed countries. As part of Saudi Vision 2030, for the first time, a major national theme has been to explore, for example, health disparities by region and begin a national process for addressing them. In this context, a royal decree established a High Level Committee (HLC) consisting of 20 high-ranking officials from a broad array of ministries, including health, to address regional health disparities for the first time.

In this historic context, I have implemented a Harvard TH Chan School of Public Health dissertation effort as part of the Doctoral Engagement in Leadership and Translation for Action
(DELTA) project. As part of the DELTA, this project generates new translational knowledge that will hopefully prove valuable to the effort for public health change for Saudi Arabia. This dissertation presents:

a) The first quantitative mortality disparities report in Saudi Arabia, which employed a direct calculation methodology (viewed by the WHO as the “gold standard”) using civil registration and vital statistics mortality data to map regional mortality. This direct calculation methodology is superior to census mortality estimation currently used by the Saudi government. This quantitative work demonstrated that significant geographical mortality disparities, including infant mortality disparities, exist across the 13 administrative regions of Saudi Arabia.

b) The first effort to document the process by which high-ranking government officials in Saudi Arabia would create policy to address health disparities. This qualitative analysis involved interviewing members of the Saudi Arabian HLC noted above and documenting major themes for addressing health disparities as part of future policy efforts. The analysis included comparing these themes with those previously established by the United Kingdom.

c) The first effort to set specific goals and targets to address health disparities using an adopted Regional Infant Mortality Disparities Action Framework for Saudi Arabia.

The outcomes from the DELTA project provide new learning tools for implementing public health change in the field of health disparities for Saudi Arabia. The findings and recommendations should be valuable to national and international practitioners, policymakers, and scholars interested in improving the practice of addressing health disparities.
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**Acronyms**

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
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<tr>
<td>(DELTA)</td>
<td>Doctoral Engagement in Leadership and Translation for Action</td>
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<tr>
<td>(GaStat)</td>
<td>General Authority of Statistics</td>
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<tr>
<td>(GCC)</td>
<td>Cooperation Council for the Arab States of the Gulf</td>
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<td>(GDP)</td>
<td>Gross Domestic Production</td>
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<td>(HE)</td>
<td>His Excellency</td>
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<td>(HLC)</td>
<td>High Level Committee on Regional Development</td>
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<td>(HRH)</td>
<td>His Royal Highness</td>
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<td>(IHME)</td>
<td>Institute of Health Metrics and Evaluation</td>
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<td>(MBS)</td>
<td>Mohammed Bin Salman</td>
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<td>(MCS)</td>
<td>Ministry of Civil Service</td>
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<td>(MDGs)</td>
<td>Millennium Development Goals</td>
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<td>(MEd)</td>
<td>Ministry of Education</td>
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<td>(MENA)</td>
<td>Middle East and North Africa</td>
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<td>(MEP)</td>
<td>Ministry of Economy and Planning</td>
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<td>(MLSD)</td>
<td>Ministry of Labor and Social Development</td>
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<td>Ministry of Municipalities and Rural Affairs</td>
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<td>(NHS)</td>
<td>National Health Services</td>
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<tr>
<td>(OECD)</td>
<td>Organization for Economic Co-operation and Development</td>
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<td>(OPEC)</td>
<td>Organization of the Petroleum Exporting Countries</td>
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<td>(SDGs)</td>
<td>Sustainable Development Goals</td>
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<td>(UK)</td>
<td>United Kingdom</td>
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<td>(UN-IGME)</td>
<td>United Nations - The Inter-agency Group for Child Mortality Estimation</td>
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<td>(UN)</td>
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<td>(WHO)</td>
<td>World Health Organization</td>
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Acknowledgment

To my life-coach, my late mother Salma Aldawas: I owe it all to you, thank you.

I am grateful to my father and siblings Maziad, Sulaiman, Arwa, and May for always providing me with moral and emotional support and to my other family members and friends who have supported me along the way.

I would like to take the opportunity to pay homage to my mentor, late Prof. James Ware for his initial motivation, guidance, support and encouragement. His profound knowledge and understanding inspired me to pursue my DELTA project for Saudi Arabia. I cherish his dedication in guiding me in my initial work on my DELTA project despite of his ill health. I wish his soul rest in peace and solace in the heaven.

I would like to express my sincere gratitude to my advisor Dr. Howard Koh for the continuous support, patience, motivation, and sharing his wealth of knowledge. His guidance helped me in so many times, both in and outside of Harvard. I could not have imagined a better advisor and mentor for my DrPH journey and beyond.

I would also like to thank the rest of my DELTA project committee: Prof. Ichiro Kawachi, Dr. John McDonough, and Dr. Nils Daulaire, for their insightful comments and encouragement, but also for asking the hard questions which incentivized me to widen my perspectives and enhance my leadership competencies.

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A special thank you goes to my enthusiastic friend Dr. Adel Almarshad for encouraging me to embark on this DELTA project and supporting me along the way.
My sincere thanks also goes to His Excellency Eng. Adel Fakeih, Minister of Economy and Planning in Saudi Arabia, who provided me an opportunity to join their team. Without his precious support, it would not be possible to conduct this DELTA project.

Last, but not the least, I thank my Centennial Fellows for the stimulating discussions, endless support, and all the fun we had in our DrPH journey.
I. Introduction

This section addresses: 1) the challenges of addressing health disparities in Saudi Arabia, 2) the opportunities for action with an emphasis on Saudi Vision 2030 as a policy window, and 3) a literature review of the most significant scholarly work related to the global and regional health disparities that could guide research and policy in Saudi Arabia. Summarizing these challenges, opportunities and lessons from the literature builds the rationale for the disparities analyses that follow in Section II and beyond (Table 1).

Table 1: Health Disparities in Saudi Arabia: Challenges and Opportunities.

<table>
<thead>
<tr>
<th>Challenges</th>
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<tr>
<td>• Health disparities probably exist within Saudi Arabia</td>
<td>In the context of Saudi Vision 2030:</td>
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<td>• A major national theme has been to explore health disparities by region and begin a national process for addressing them</td>
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<td>• No published quantitative evidence of health disparities within Saudi Arabia</td>
<td>The first quantitative mortality disparities report in Saudi Arabia</td>
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<td>• No national plan or policy to address such disparities</td>
<td>The first effort to document the process of creating policy to address health disparities</td>
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<tr>
<td>• No clear understanding of how the Saudi Arabian government would address specific disparities with goals and targets</td>
<td>The first effort to set goals and targets using an adopted Regional Infant Mortality Disparities Action Framework</td>
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I.1. Health Disparities in Saudi Arabia: Challenges

While limited to no information are available on health disparities in Saudi Arabia, they most likely exist for the following reasons:

- There is increasing global evidence of widening health gaps between and within countries (World Health Organization, 2011). There is no reason to believe that Saudi Arabia is exempt from this trend.
- Socioeconomic disparities exist, including higher rates of financial stress for Saudi Arabians in paying for medical costs compared to that reported for Organization for Economic Co-operation and Development (OECD) high-income countries similar to Saudi Arabia. (Alshamsan, Leslie, Majeed, & Kruk, 2017).
- An aging population. The proportion of population in Saudi Arabia aged 60 or more is predicted to be 25% of the total population of 40 million by the end of 2050 in comparison to 5% in 2010 (Abusaaq, 2015).
- Rural vs. urban variations in health outcomes among different regions of Saudi Arabia (Al-Nuaim et al., 2012; Hijazi, Abalkhail, & Seaton, 2000).
- The wide variation in consanguinity, an important socioeconomic factor, in the 13 administrative regions of Saudi Arabia (El-Mouzan, Al-Salloum, Al-Herbish, Qurachi, & Al-Omar, 2007).
- The fourth largest number of international migrants (10 million) in the world, constituting 32% of the total Saudi population (United Nations, 2015).

Assuming disparities exist, there has been little to no attempt to document them in the scientific literature. Such research focuses most on Europe and North America and less so on the Middle East including Saudi Arabia (Evans, 2001). Also reliable data systems needed to
ascertain disparities have been suboptimal; much current data comes from estimates, not direct measurement. Regional health services statistics are incomplete; for example, of the reported abnormal deliveries by the Saudi Arabia Ministry of Health, some regions do not even report neonatal mortality or maternal mortality (Saudi Arabia Ministry of Health, 2009).

In short, there is limited evidence on health disparities within Saudi Arabia and no clear understanding of how the Saudi Arabian government would address them if it were asked to do so.


Despite the challenges noted above, there are new opportunities to address health disparities in Saudi Arabia:

• King Salman bin Abdulaziz has recently announced a sweeping national planning initiative for the future of the Kingdom, entitled Saudi Vision 2030. More information on Saudi Vision 2030 is found in Section I.2.a below.

• As part of Saudi Vision 2030, the King announced a royal decree that establishes a Saudi Arabian HLC to address regional development including regional health disparities.

• As part of the DELTA project, I have produced the first quantitative mortality disparities report using a civil registry and direct mortality calculation methodology that is superior to the current census estimation methodology used in Saudi Arabia.

• I have been able to leverage a position as Senior Advisor to the Minister of MEP to engage qualitatively with high-ranking government officials to document and study the initial policy process of addressing health disparities. Of note, working with the HLC provides an opportunity to develop a broad, cross-sector interdisciplinary approach to health disparities, not just an approach involving health officials alone. A major
deliverable can be providing a broad societal framework for action with a set of goals and
targets.

I.2.a. Saudi Vision 2030: Policy Window

The origins of Saudi Vision 2030 date back to July 2015 when the government of Saudi
Arabia initiated plans to overhaul its economy, significantly improve the health of the population
and transition the world’s economy from an oil-based economy to one that does not rely on
hydrocarbons for revenue (Vision 2030, 2015). Saudi Arabia has a GDP per capita of $25,000,
making it one of the largest economies in the Middle East and an influential geopolitical world
player (UK Foreign and Commonwealth Office, 2016). Containing a quarter of the globe’s
proven oil reserves, Saudi Arabia is the foremost oil producer in the Organization of the
Petroleum Exporting Countries (OPEC) cartel and therefore well placed to provide world-class
health provisions for all of its population.

Booming oil prices from 2003 to 2013 contributed to increasing prosperity in Saudi
Arabia. Accordingly, the government invested heavily in education, health, and infrastructure
and increased its reserves amounting to almost 100 percent of GDP in 2014 (Al-Kibsi et al.,
2015).

However, in viewing the future, Saudi Arabia concluded that they could no longer rely on
oil revenue and public spending for development with the changing global energy market. For
example, the fall of oil prices from more than $100 a barrel in 2014 to about half that level in
2017 adds to the pressure to diversify Saudi Arabia’s revenue and become less dependent on oil
(Al-Kibsi et al., 2015). In addition, the country’s demographic trends of high birth rates and low
death rates will significantly increase the age and number of the working population significantly
by 2030, (Al-Kibsi et al., 2015).
In this context, while Saudi Arabia has improved health outcomes over the years, they do not reach the level the country has long sought. For example, while the United Nations Millennium Development Goals monitoring of progress reports a reduction in maternal mortality ratio (maternal deaths per 100,000 live births) and infant mortality rate (infant deaths per 1000 Live Births) (United Nations Statistics Division, 2015), the country has had lower provision of access to reproductive health services by 25% from 1996 (United Nations Statistics Division, 2015). Reproductive health services, including family planning, reduce infant mortality (World Health Organization, 2016). However, there is limited evidence on the impact of the low provision of reproductive health services in Saudi Arabia on national and regional infant mortality within the country.

Hence, one of the strategic mandates of the Vision 2030 policy is improvement in the provision of health care: “Our health care system has benefited from substantive investment in recent decades. As a result, we now have 2.2 hospital beds for every 1,000 people, world-class medical specialists with average life expectancy rising from 66 years to 74 years in the past three decades. We are determined to optimize and better utilize the capacity of our hospitals and health care centers, and enhance the quality of our preventive and therapeutic health care services” (Vision 2030, 2015, p. 29).

Saudi Vision 2030 also has an objective of increasing the average life expectancy from 74 years to 80 years (Government of Saudi Arabia, 2015, p. 31). In order for the government to achieve this objective, health disparities must be identified and addressed or this major initiative will benefit only the wealthiest and most educated people in society.

The King announced the Vision 2030 strategy in April 2016. Vision 2030 critically provides both the funds and the political will to “develop and retain national manpower and
expertise in media and health science research, develop infrastructure for sustainable, cutting-edge and competitive research in the medical and health sciences, facilitate...high-quality research in the medical and social sciences, and maintain effective communication of research findings...to policymakers and the public” (Diwan, 2016, n. p.).

Saudi Arabia intends to sell up to 5% of Aramco in 2018, which could raise $100 billion (Dipaola & Mahdi, 2017). Aramco is a national petroleum and natural gas company owned by the Saudi government that has both the world's largest proven crude oil reserves and largest daily oil production (Saudi Aramco, n.d.). Proceeds from the Aramco sale would increase the sovereign Public Investment Fund that is the cornerstone for economic diversification (Dipaola & Mahdi, 2017). Deputy Crown Prince Mohammed bin Salman envisions this Aramco initial public offering (IPO) as the centerpiece for sustaining national development, including health (Dipaola & Mahdi, 2017).

I.3. Health Disparities in Saudi Arabia: The Importance of Documenting and Addressing the Need

There are many reasons why examining health disparities and activating the policies needed to reduce them are critical for all Saudis. First, disadvantaged groups, such as rural residents, have worse survival rates than urban dwellers in many countries (Whitehead, 1991). Second, disadvantaged groups tend to experience the onset of chronic disease and disability at a younger age. Third, disadvantaged groups have worse rates of accessing preventive and curative health care services (Whitehead, 1991). Fourth, the poor health of disadvantaged groups can pose a threat to the public health of the whole population (Ibrahim, Thomas, & Fine, 2003).

In addition to the health and economic impact of health disparities, there are moral and ethical challenges in health disparities (Ibrahim et al., 2003). In Saudi Arabia, a government
mandate exists to provide health care for the entire population of Saudi Arabia. Specifically, a Royal decree in March 1992 established the Basic Law of Governance of the Kingdom of Saudi Arabia. Article 31 states that the state takes care of health issues and provides health care for each citizen (Bureau of Experts, 1992). While the exact means of implementation of this mandate remains a matter of ongoing debate, it is viewed as a social contract that should be respected.

From a humanitarian perspective, the Saudi Arabian government cannot claim that it is providing health care for all if the burden of diseases, disproportionately carried by the disadvantaged groups, is not addressed (Whitehead, 1991).

To put my DELTA proposals for health disparities in Saudi Arabia in context, I now present a succinct literature review of related global efforts.

I.4. Literature Review

I begin by presenting a working definition of key terms to provide the reader with the theoretical context for the section. Second, I discuss health disparities in more detail and ways in which they manifest globally. Third, I focus on the state of health disparities in the Middle East and North Africa (MENA) region, which includes Saudi Arabia. Fourth, I review the sparse literature related to Saudi Arabian health disparities documented to date. Finally, I discuss lessons from experience in the United Kingdom, a global leader in addressing health disparities, which can help guide action in Saudi Arabia.

I.4.a. Defining the Parameters of Equality and Equity

A review of the literature shows that researchers and policymakers vary greatly in using the terms equity, inequity, equality, and disparities (Crombie et al., 2005). In relation to health, the terms disparity and equality refer to measurable indicators. Disparity is observable
difference in health between subgroups of a population that might have otherwise remained hidden behind the overall average. Subgroups can be defined by demographic, geographic or socioeconomic factors such as age, economic status, education, place of residence and gender (World Health Organization, 2015, n. p.). Inequity is a normative concept, defined as the avoidable and/or unjust differences in health between population subgroups (World Health Organization, 2015, n. p.). Health equity involves a judgment about what is deemed to be right, fair or acceptable in a society. Measuring and monitoring health disparities is a starting point from which health equity can be evaluated (World Health Organization, 2015, n. p.).

Of note, not all health disparities are inequitable. For example, males disproportionately suffer from prostate problems. However, differences in gender access to health care would be considered a health disparity (Braveman, 2006; WHO-CSDH, 2008). “Disparities” is commonly used in the United States while “inequalities” is commonly used in the United Kingdom and European countries. For this DELTA project, I will use disparities going forward.

I.4.b. The Importance of Global Health Disparities

I.4.b.i. Ramifications

Global health indices have revealed great disparities in citizens’ access to healthcare systems worldwide. While access to healthcare is assumed to be better in developed countries, the latest data reveal considerable disparities and inequities in health and healthcare access among and within developed countries worldwide (World Health Organization, 2011). In particular, my review reveals that health disparities exist among socioeconomic fault lines (Adler & Newman 2002). Understanding the intersections between economic activity and social life can provide one with a clearer understanding of global health disparities (Siegel, et al. 2011). For example, an individual’s level of education (Winkleby, et al. 1992), status in the workplace
(Marmot et al., 1991), and personal and societal lifestyle choices (Bauer, 2014) all play key roles in either exacerbating or reducing key health indices.

Since the early 1990s, conceptualizations of global health have expanded beyond traditional health indicators to include measurement of poverty levels, educational levels, and household income levels as indicators of the health of the general population (Marmot, 2005; Gwatkin, 2000). Taken together, the research suggests that focusing on the reduction of global health disparities can lead to improved health and, by extension, economic growth and global social cohesion (Sen, 1976). Scholars such as King and Murray have therefore argued that inequities and disparities in public health should be reclassified as human security threats (King & Murray, 2001). Defined as the capacity to identify threats, to avoid them when possible, and to mitigate their effects when they do occur, human security involves the provision of adequate access to education, health care, food, and information (King & Murray, 2001).

The links between socioeconomic status and health disparities are becoming clearer through the accumulation of appropriate data, and this review also highlighted the importance of considering health disparities as issues of national and human security (Fourie & Schönteich, 2001). If global health disparities widen, they could have pronounced effects on the global economy, society, and the general health of future generations.

1.4.b.ii. Causes

The causes of global health disparities are numerous. They can emerge from socioeconomic factors that have an impact on nation states, including poor education, gender disparity, and poor lifestyle choices, which decrease the overall health of nations worldwide (Adler & Newman, 2002; Kawachi & Kennedy, 2006). As such, effectively addressing
disparities in global health presents a challenge to policymakers and health professionals (Marmot, 2005).

Seven dimensions of health can lead to disparities in health indicators: (1) biologic variations; (2) health-damaging behavior that is freely chosen, such as participation in certain sports and pastimes; (3) the change in the health advantages of one group over another when the former group adopts a health-promoting behavior before the latter; (4) health-damaging behaviors caused by severe restrictions in the degree of lifestyle choices; (5) exposure to unhealthy or stressful living and working conditions; (6) inadequate access to essential health and other public services; and (7) natural selection or health-related social mobility, which involves the tendency for sick people to move down on the social ladder (Crombie et al., 2005). Thus, while there are numerous natural biological variations among human beings that account for disparities in health, there are also specific, personal behaviors such as smoking that influence the quality of their health. Disparities in health also can occur when a specific group successfully adopts a specific behavior that influences their health as part of a decree or policy (such as the prohibition of smoking in public spaces). In addition, exposure to stressful workplaces can influence variations in health markers within a specific cohort (Marmot et al., 1991), while people without ready access to health care may suffer disparities in care (Adler & Newman, 2002).

I.4.b.iii. Measurement

Two distinct approaches are used by public health institutions and organizations around the world in the measurement of health disparities (Kawachi, Kennedy, Lochner, & Prothrow-Stith, 1997; Whitehead et al., 2004): examination of health indicators or outcomes (1) within social groups such as race, gender, and social class and/or (2) across a geographic population. In
this DELTA project, I focused on the geographic approach to measure health disparities for the following reasons:

- The available regional civil registry data with existing public mortality data for Saudi Arabia.
- The opportunity to use the geographic approach to propose a health disparities geocoding to determine which regional-based socioeconomic measure would be most appropriate for Saudi Arabian health surveillance system and research (Krieger et al., 2002).

I.4.c. Regional Health Disparities in the Middle East and North Africa and Their Relevance to Saudi Arabia

The Middle East and North Africa (MENA) region is divided into two principal regions: 1) The Middle East includes countries such as Saudi Arabia, Kuwait, Qatar, and the United Arab Emirates, and 2) North African countries such as Egypt, Algeria, and Libya.

Although key health indicators such as infant mortality rate and life expectancy have substantially decreased and increased respectively across the MENA region from 1990 to 2007 (Marmot, 2005), these overall figures can mask the true extent to which such health benefits are reaching all sectors of society (Iqbal, 2006).

Health disparities have been documented in the MENA region (Iqbal, 2006). On average, the poorest 20% of the population in MENA region have a much greater mortality rate than do the richest 80%. Another example, children in the richest 80% of the population are less likely to suffer from malnutrition than those in the poorest 20% (WHO-CSDH, 2008). In addition, there are notable disparities in health care access among different MENA countries as well as in their governmental expenditure on health care as a share of the gross domestic product (Osmani & Sen, 2003). Specifically, the data have shown that MENA countries allocate, on average, 5.9%
of their GDP to health; however, this does not account for the variation from 2.5% to 8.5% that exists amongst various MENA countries in relation to their specific expenditures on health (Iqbal, 2006).

The documented health disparities in the MENA region further my hypothesis that they also exist within Saudi Arabia as well.

### 1.4.d. Health Disparities in Saudi Arabia

The sparse literature specifically related to health disparities in Saudi Arabia stems from data collected by supranational organizations, such as the WHO (World Health Organization, 2015). According to WHO, male and female Saudi Arabian citizens have a life expectancy of 73 and 76 years, respectively. The total per capita expenditure on health is $2,466 USD and the total expenditure as a percentage of GDP is 4.7%, which is 50% lower than that seen in OECD countries similar to Saudi Arabia (World Health Organization, 2015; World Bank, 2016). The most common causes of death in the country are heart disease, stroke, respiratory infections, and road traffic accidents. Such WHO data suggests that Saudi Arabia, although a high-income developed country, has rates of non-communicable diseases similar to that reported in developing countries (Osmani & Sen, 2003).

To identify available studies of geographic disparities in Saudi Arabian mortality, I crossed Medical Subject Headings (MeSH) and non-MeSH terms representative of mortality and Saudi Arabia with those signifying disparities in Medline from 1966 through March 2017. While two articles regarding healthcare disparities in acute coronary syndrome address how outcomes differ by gender and nationality (AlFaleh, et al., 2015; Hersi, et al., 2013), neither had broad regional data on disparities needed to begin a policy discussion for Saudi Arabia.
I.4.e. Other Countries’ Policy Responses to Health Disparities, especially the United Kingdom

While other countries have tackled health disparities through policy actions that focus on social determinants of health at the national and regional level (Beeston, 2013; Lorenc T, Petticrew M, Welch V, and Tugwell P., 2012), only a few such as Sweden and Netherlands have addressed them in a concerted and substantial fashion. (Swedish National Committee for Public Health, 2000; Mackenbach & Stronks, 2002). The United Kingdom is one country that has pioneered the health disparities policy arena in a way that could be helpful to Saudi Arabia (Nutbeam, 2004). Saudi Arabia can learn from the United Kingdom’s experience to create their own policies (Black & Donald, 2001).

The United Kingdom (UK)’s long history of contributing to tackling health disparities on many fronts (Popejoy, 2016) encompasses three major areas: measurement and research, conceptualization of causes, and public policies (Popejoy, 2016).

Measurement and Research Contribution: UK has promoted research in the following key specific social determinant research areas:

- Income (Wilkinson, 1996)
- Employment and occupational health (Bambra 2011; Bartley and Plewis, 2002)
- Ethnicity and race (Riste et al., 2001; Templeton, Velleman, Persaud, & Milner, 2003)
- Gender (Doyal, 1995; Pollard & Hyatt, 1999)
- Geography and disparities mapping (Boyle et al., 2004; Mitchell, Dorling, & Shaw, 2000; Scott-Samuel, Birley, & Ardern, 2001; Shaw, Dorling, & Mitchell, 2002)
Conceptualization contribution: Key conceptual areas and their corresponding reports and publications include:

- Materialist explanation of health: Black Report found that poverty exposes people to health hazards such as living in areas with air pollution (Britain & Black, 1980). The Health Divide report, which aimed to update the Black report, showed that socioeconomic disparities persisted despite the improvements in health indices among all UK classes (Whitehead, 1987). The independent inquiry into disparities in health showed health disparities and their relationship to social class (Acheson, 1998).
- Life-course approach to understanding health disparities (Ben-Shlomo & Kuh, 2002; Smith, 2003; Kuh & Ben-Shlomo, 2004)
- Poverty and its impact on health (Gordon & Townsend, 2000; Lister, 2004; Pantazis, Gordon, & Levitas, 2006)
- Social exclusion (Levitas, 2005)
- The difference between social determinants of health and the gradient of social determinants of health (Graham, 2004, Graham, 2004, Graham, 2007)
- Lived experience and health disparities (Popay & Williams, 1997)
Public Policies: Key policy contributions include:

- Concepts for responding to health disparities (Graham, 2004; Smith, 2007; Smith & Bambra, 2012)
- Evaluation of governmental efforts to address health disparities (Hills, Sefton, & Stewart, 2009; Hills and Stewart 2005)
- Public policy for addressing health disparities (Asthana & Halliday, 2006; Whitehead & Dahlgren, 2006)
- Impact assessment for health disparities (Scott-Samuel et al., 2001)
- Translation of research into policy for health disparities (Petticrew, Whitehead, Macintyre, Graham, & Egan, 2004)
- Public health interventions for health disparities (Benzeval, Whitehead, & Judge, 1995; Marmot et al., 2010)
- Addressing social exclusion (Levitas, 2005)
- Welfare analysis for health disparities (Bambra & Eikemo, 2008).
- Health Inequalities Action Framework (Craig, 2013)

The extensive United Kingdom experience informs efforts for Saudi Arabia specifically by offering: 1) a theory of change in tackling health disparities, 2) understanding on what types of evidence could influence policymakers to address health disparities, and 3) a Health Disparities Action Framework.

I.4.e.i. Theory of Change

Whitehead’s logic illustrates the typology of actions required to tackle health disparities, although it lacks the implementation step which is important for policymakers (Whitehead,
In my DELTA, I can address the first 3 dimensions of the typology for the first time in Saudi Arabia. A modified typology is presented in Figure 1.

**Figure 1: A Modified Typology of Actions to Address Health Disparities.**

* Adopted from Whitehead, Margaret. "A typology of actions to tackle social disparities in health." Journal of Epidemiology and Community Health 61.6 (2007): 473-478

In addition, Whitehead has outlined several evaluation indicators for diffusion of health disparities’ ideas and evidence into policy arenas, leading to greater willingness to tackle these disparities (Whitehead, 1998). Diffusion in the context of health disparities is defined as the process by which research evidence and general awareness of the seriousness of health disparities come to the attention of national policymakers (Whitehead, 1998; Rogers, 2010).

### I.4.e.ii. Understanding How Evidence Can Influence Health Disparities Policymaking

In 2004, Petticrew et al explored the influence of health disparities evidence on policymaking by interviewing senior policy makers across a range of sectors (Petticrew et al, 2014). Their engagement process took place in a focused workshop employing three standard questions (Petticrew et al, 2014):
What sort of evidence do you/ministers/senior colleagues find convincing?

How can existing evidence be improved?

How can researchers help users of evidence?

Such questions prompted useful qualitative evidence on how policymakers could engage in addressing the gap between health disparities research and policy (Petticrew et al, 2014).

**1.4.e.ii. Health Disparities Action Framework: Background and Application**

The NHS Health Scotland created a Health Disparities Action Framework that recommends actions at three levels (Craig, 2013):

- Mitigating the health consequences of social disparities
- Preventing social disparities that impact health outcomes
- Undoing the policies and social processes that result in social disparities such as fiscal, cultural, and legislative policies.

This framework draws from the following theory base for health disparities:

- Unequal distribution of income, power, and resources is the main cause of health disparities resulting from social disparities that is lined to differences in health outcomes (Whitehead & Dahlgren, 2006)
- Addressing health disparities should aim at addressing determinants of health disparities rather than determinants of health (Graham & Kelly, 2004)
- Understanding the impact of social determinants of health and policy design requires the inclusion of the lived experience of those most affected (Whitehead & Dahlgren, 2006)
- There is a difference between targeting the most affected and reducing disparities across the whole population (Graham & Kelly, 2004; Marmot, 2010)
• Addressing health disparities requires collaboration between the public sector and the affected individuals and communities for an informed decision-making (Christie, 2011).
• Addressing fiscal, legislation, and cultural policies that contribute to health disparities are likely to be the most effective (Macintyre, 2007; Allen, Allen, Hogarth, & Marmot, 2013).
• Progress in addressing health disparities requires setting clear and realistic goals and objectives with indicators that are specific to reducing health disparities rather than improving the population health (Graham & Kelly, 2004; Marmot, 2010).

The Health Disparities Action Framework can help translate the research evidence and policy theory for health disparities into practice (Craig, 2013). The Framework supports collaborations among many entities to identify and agree on the scope of actions they can take to reduce the impact of social disparities on health. The framework uses a series of questions to take the planner through the steps needed to address health disparities while considering the theoretical base in relation to their own strategy or program (Appendix 1).

The framework has four components, each of which underpins the theoretical base discussed earlier (Whitehead & Dahlgren, 2006). The components, categorized into What, Why, How, and Progress sections, are not meant to be used in a step-wise process (Craig, 2013). The framework meets the teams and organizations at the stage they are at, highlights the importance of agreeing on a starting point by all team members, and guides them forward (Craig, 2013). Using this framework assumes (Craig, 2013):

• There is political will and commitment to address health disparities
• Addressing health disparities will include actions to improve individual health as well as social disparities that lead to health disparities
From conducting this literature review, I have learned the following:

1. There is considerable health disparities among and within developed as well as developing countries around the world.
2. In-depth study of the health disparities within Saudi Arabia has not yet been addressed.
3. United Kingdom is leading the research and policy response for health disparities.

Therefore, and based on the above learning, I decided to apply the following:

1. The global experience and guidelines in measuring health disparities to investigate geographic disparities in Saudi mortality by region, including regional infant mortality disparities.
2. The typology of actions to address health disparities as the theory of change for addressing health disparities in Saudi Arabia.
3. The health disparities policy engagement process in United Kingdom to engage senior policy makers in Saudi Arabia for addressing regional health disparities.
4. The United Kingdom’s “Health Disparities Action Framework” to produce an adopted Health Disparities Framework for Saudi Arabia with a focus on infant mortality, including setting targets and objectives.

I demonstrate this application in the Analytical Platform section below.

II. Analytical Platform

I present the opportunity for change, the project strategy with aims and objectives, overview of the project’s host organization, Saudi Arabian MEP, and the employed approach and methods.
II.1. Opportunity for Change

To deliver on Saudi Vision 2030, the Saudi government agencies have been conducting numerous workshops to examine their role for implementation (Government of Saudi Arabia, 2015). One priority for the MEP is the Regional Development Initiative, which examines regional development disparities, specifically for health and education, and then develops overall and sector-specific policy recommendations for future action (Government of Saudi Arabia, 2015; Ministry of Economy and Planning, 2016). The MEP is described more fully below in Section II.2.b.

Kingdon has written that successful change comes from the convergence of a policy stream, political stream and the problem stream (Kingdon, 1984). In the case of Saudi Arabia, the MEP represents the venue for the policy stream, which has the opportunity to document regional development disparities including health disparities (Kingdon, 1984). This policy stream converges with the political stream of Vision 2030 to open a policy window for interventions, including this research project (Figure 2) (Kingdon, 1984).

Figure 2: Saudi Arabia Opportunity for Addressing Health Disparities

II.2. Project Strategy

II.2.a. Aims and Objectives

In this project, I create both quantitative and qualitative deliverables. In the quantitative project, I examine geographic disparities in age-adjusted, all-cause mortality rates across all 13 regions of the Kingdom of Saudi Arabia between 2000 and 2010. Then I use the findings in the qualitative project to engage stakeholders in the study of the initial process of addressing health disparities, including the understanding of facilitators and barriers. Finally, I translate the findings into a proposed action framework to tackle a specific health disparities topic, infant mortality, in Saudi Arabia (Table 2).

Table 2: DELTA Project Aims, Objectives, Methods, and Outcomes.

<table>
<thead>
<tr>
<th>Aims</th>
<th>Objectives</th>
<th>Methods</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Specific aim 1: To investigate the geographical location’s contribution to the differences in age-adjusted, all-cause mortality rates in Saudi Arabia.</td>
<td>• Objective 1: Link mortality and population data sets to obtain regional age-adjusted mortality rates.</td>
<td>Ten-year descriptive ecological study</td>
<td>1. National Crude Death Rate and National Infant Mortality Rate</td>
</tr>
<tr>
<td></td>
<td>• Objective 2: Present the 10-year trend of mortality rate changes across all 13 regions, including infant mortality rates</td>
<td></td>
<td>2. Regional age-adjusted, all-cause mortality rate per 100,000 population (2000–2010).</td>
</tr>
<tr>
<td></td>
<td>• Objective 3: Use the findings to engage stakeholders to reach objectives of Specific Aim 2.</td>
<td></td>
<td>3. Regional all-cause Infant Mortality Rate per 1,000 Live Births (2000–2010).</td>
</tr>
</tbody>
</table>

(Continued)
Table 2: DELTA Project Aims, Objectives, Methods, and Outcomes.

<table>
<thead>
<tr>
<th>Aims</th>
<th>Objectives</th>
<th>Methods</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specific aim 2:</td>
<td>Use a qualitative electronic facilitated semi-structured interviewing process to discuss the research into policy for health disparities and regional development.</td>
<td>Qualitative semi-structured interviewing of 20 high-ranking officials</td>
<td>1. Thematic Analysis</td>
</tr>
<tr>
<td>To conduct and study the initial process of addressing health disparities, including the understanding of facilitators and barriers affecting the process to translate relevant findings into themes for government action to reduce health disparities.</td>
<td>Objective 2: Translate relevant findings from Objective 1 into policy themes for government action to reduce health disparities.</td>
<td>2. A Proposed Call for Action: Infant Mortality Disparities Action Framework for Saudi Arabia</td>
<td></td>
</tr>
</tbody>
</table>

**Specific Aim 1 (Quantitative Project).** To investigate the role of geography (regions) to the differences in age-adjusted, all-cause mortality rates in Saudi Arabia, I propose:

- **Objective 1:** Link mortality and population data sets to obtain regional age-adjusted mortality rates.
- **Objective 2:** Present the 10-year trend of mortality rate changes across all 13 regions.
- **Objective 3:** Use the findings to engage stakeholders to reach objectives of Specific Aim 2.

**Specific aim 2 (Qualitative Project).** To conduct and study the initial process of addressing health disparities, including the understanding of facilitators and barriers affecting the process to
translate relevant findings into themes for government action to reduce health disparities, I propose:

- **Objective 1**: Use of a qualitative electronic facilitated semi-structured interviewing process to assess the initial process of creating policy to address health disparities as part of regional development.

- **Objective 2**: Translate relevant findings from Objective 1 to propose policy approaches for government action for a specific topic, i.e., regional infant mortality disparity.

II.2.b. Host Organization

Since 1970, the Kingdom of Saudi Arabia has had a planning process to make prudent decisions in the allocation and utilization of its resources for development (Ministry of Economy and Planning, 2016). Under the ninth national development plan from 2010 - 2014, the Kingdom underwent tremendous transformation as evidenced by the rapid growth of income and living standards of the people, accompanied by dramatic improvements in social and physical infrastructure (Ministry of Economy and Planning, 2016). While the MEP does not provide direct services to citizens, it ensures that all government agencies work in a coordinated manner to achieve the priorities of the nation’s policymakers within the available national resources. Toward this end, MEP (Ministry of Economy and Planning, 2016):

- Prepares the Kingdom’s development plans.

- Prepares a periodic economic report about the Kingdom that includes an analysis of its economy and explains the progress made.

- Estimates the resources needed for the implementation of the development plans approved by the Council of Ministers. These estimates are the basis for preparing the Kingdom’s general budget. To this end, both the MEP and the Ministry of Finance
formally consult and exchange information to attain full coordination between the general requirements of the development plans and the available resources.

- Conducts the necessary economic studies in the field of relevant topics and submission of concluded recommendations.
- Assists the ministries and other government agencies in issues related to planning.
- Provides technical advice as directed by the custodian of the two holy mosques.

The MEP was chosen to host this DELTA Doctoral Project for the following reasons:

- The MEP has been tasked by the King to examine the remedies for the regional development disparities, including health disparities (Figure 3). I worked at the Minister’s office and reported to the Minister of MEP as well as worked with the Deputy Minister of MEP for Planning Affairs.

- The high level coordination responsibilities of MEP, including linking planning to budget resources, heightens the possibility for the diffusion of the policy recommendations that would result from this project. The proposal could have high sustainability given the mandate and funds allocated to address health disparities over the coming years.

- The proposal will align with the existing mandate for Regional Development.

- As the lead advisor at MEP on health disparities, I was based in Riyadh and had a unique high-level platform to explore how the HLC on Regional Development could employ a national strategy. MEP provided support staff, office space, and transportation (Figure 4).
Leveraging the perspective of the MEP has strategic advantages, since the HLC policymaking process is provided through a team composed of different stakeholders from different sectors and governmental agencies (Table 3). This would allow ready convening and dialogue among the information-rich subjects needed to achieve the study aim. Second, many of
the members of the high-level committee in the MEP are assigned to different regional disparities projects; hence, their experience and perceptions about the barriers and facilitators for addressing regional health disparities in both settings would be utilized.

**Table 3: Participants’ Organizations and Positions**

<table>
<thead>
<tr>
<th>Member’s Institution</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Ministry of Health</td>
<td>Deputy Minister for Planning</td>
</tr>
<tr>
<td>2 Ministry of Health</td>
<td>Assistant Deputy Minister for Vision Realization</td>
</tr>
<tr>
<td>3 Ministry of Health</td>
<td>Advisor for Vision Realization Office</td>
</tr>
<tr>
<td>4 Ministry of Education</td>
<td>Deputy Minister for Buildings</td>
</tr>
<tr>
<td>5 Ministry of Labor and Social Affairs</td>
<td>Deputy General Director of the Human Resources Development Fund of the National Labor Observatory</td>
</tr>
<tr>
<td>6 Ministry of Labor and Social Affairs</td>
<td>Advisor to Minister</td>
</tr>
<tr>
<td>7 Ministry of Labor and Social Affairs</td>
<td>Deputy Minister for Social Security</td>
</tr>
<tr>
<td>8 Ministry of Municipalities and Rural Affairs</td>
<td>Chief Technical Advisor for National Spatial strategy</td>
</tr>
<tr>
<td>9 Ministry of Municipalities and Rural Affairs</td>
<td>Director General for Studies and Research</td>
</tr>
<tr>
<td>10 Ministry of Finance</td>
<td>Director General of Budget Department</td>
</tr>
<tr>
<td>11 Ministry of Economy &amp; Planning</td>
<td>Deputy Minister for Planning</td>
</tr>
</tbody>
</table>
Table 3: Participants’ Organizations and Positions

<table>
<thead>
<tr>
<th>Member’s Institution</th>
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</thead>
<tbody>
<tr>
<td>Ministry of Economy &amp; Planning</td>
<td>Assistant Deputy Minister for Development &amp; Planning</td>
</tr>
<tr>
<td>Ministry of Economy &amp; Planning</td>
<td>Assistant Deputy Minister for Regional Development</td>
</tr>
<tr>
<td>Ministry of Interior</td>
<td>Deputy Minister for Regional Affairs</td>
</tr>
<tr>
<td>General Authority for Statistics</td>
<td>Census Specialist</td>
</tr>
<tr>
<td>Ministry of Justice</td>
<td>Deputy Minister for Development and Planning</td>
</tr>
<tr>
<td>Ministry of Justice</td>
<td>Assistant Deputy Minister for Development and Planning</td>
</tr>
<tr>
<td>Ministry of Civil Service</td>
<td>Deputy Minister for Studies &amp; Research</td>
</tr>
<tr>
<td>Ministry of Civil Service</td>
<td>Deputy Minister for Planning and Human Resources Development</td>
</tr>
<tr>
<td>National Center for Social Studies and Research</td>
<td>Director General of the National Center for Social Studies and Research</td>
</tr>
</tbody>
</table>

II.2.c. Approach and Methods

II.2.c.i. Quantitative Method

Investigating the contribution of geography to the differences in age-adjusted, all-cause mortality rates in Saudi Arabia involves: (1) linking mortality and population data sets to obtain regional age-adjusted mortality rates, (2) presenting the 10-year trend of mortality rate changes across all 13 regions, and (3) using the findings to engage stakeholders for the qualitative component of the DELTA project. I employed a direct calculation methodology using civil
registration and vital statistics mortality data to map regional mortality, viewed by the WHO as the “gold standard” methodology, and superior to the currently used census mortality estimation. (World Health Organization, 2014).

II.2.c.ii. Definitions of Key Terms

The following are definitions of key terms used in the quantitative methods:

**Vital Statistics:** The collection of statistics on vital events in a life-time of a person as well as relevant characteristics of the events themselves. Statistics were available on births, death, marriage, and divorce and other key indicators (United Nations, 2014).

**Civil Registration:** The continuous, permanent, compulsory and universal recording of the occurrence and characteristics of vital events pertaining to the population provided the source for vital statistics (United Nations, 2014).

**Population Census:** The total process of collecting, compiling, evaluating, analyzing and publishing or otherwise disseminating demographic, economic and social data pertaining, at a specified time, to all persons in a country or in a well-delimited part of a country (United Nations, 2008, para. 1.4). It is considered a complementary source for vital statistics to civil registration (United Nations, 2014).

**Burial Permit:** The official document, usually issued only for a legally registered death, authorizing the removal of the dead body (corpse) to the cemetery or for other final disposal (United Nations, 2014).

**Crude death rate:** The vital statistics summary rate based on the number of deaths occurring in a population during a given period of time, usually a calendar year, i.e., the number of deaths occurring among the population of a given geographical area during a given year, per 1,000 mid-year total population of that area during the same year (United Nations, 2014).
**Infant mortality rate:** The vital statistics summary rate based on the number of infant deaths occurring during the same period of time, usually a calendar year, i.e., the number of deaths of live-born children under 1 year of age occurring in a given geographical area during a given year, per 1,000 live births occurring among the population of that area during the same year (United Nations, 2014).

**Age-adjusted mortality rate:** The weighted average of the age-specific mortality rates per 100,000 persons, where the weights are the proportions of persons in the corresponding age groups of the country’s standard population (Ahmad, O. B., Boschi-Pinto, C., Lopez, A. D., Murray, C. J., Lozano, R., & Inoue, M., 2001).

**Regional Infant mortality rate disparity:** The ratio of the regional infant mortality rate compared to the national infant mortality rate. In an example, a value of 2.0 means that the babies in a certain region are dying at twice the rate of babies nationally (Gray, Hollowell, Brocklehurst, Graham, & Kurinczuk, 2009).

**II.2.c.iii. Data Sources**

To calculate mortality rates in each region, I utilized all-cause mortality for all age groups as the numerator, and the publically accessible population census provided by the General Authority for Statistic as the denominator. Doing so involved using census population data and burial permit data.

**Census Population Data:**

The Saudi Arabian General Population and Housing Census collects and analyzes demographic, economic and social data on population and their distribution to various geographic areas in a given time (General Authority for Statistics, 2017). Each of the 13 administrative regions of the Kingdom of Saudi Arabia is administered by a government agency.
that reports to the Ministry of Interior. Census results by region guide local service planning for projects related to roads, schools, hospitals and other public facilities (General Authority for Statistics, 2017).

**Burial Permits Data:**

Since 1980, Ministry of Health’s doctors working in hospitals and primary care centers and forensic specialists issue death certificates that include demographics, including place of death (Saudi Arabia Central Board for Accreditation of Healthcare Institutions, n. d.). These death certificates are required for issuing burial permits by the Ministry of Municipalities and Rural Affairs. Burial permits include the deceased name, age, gender, nationality, region, and date of death. Burial of the dead is the duty of each regional municipality and within their prescribed boundaries (Saudi Arabia Central Board for Accreditation of Healthcare Institutions, n. d.).

**II.2.c.iii.1. National Crude Death Rate and National Infant Mortality**


**II.2.c.iii.2. Regional Mortality Analysis Including Regional Infant Mortality**

For each region, I analyzed patterns of change in mortality rates from 2000–2010 for all 13 administrative regions, then compiled region data from two sources: the burial permit data

I also present patterns of regional infant mortality since:

- Infant mortality rates are sentinel public health indicators that reflect how well a country organizes and allocates its public and private resources (Wennemo, 1993).
- Addressing Saudi Arabia infant mortality rates is a way to address the fundamental need for all babies to be born healthy with equal opportunity to celebrate their first birthday and beyond (Reidpath & Allotey, 2003).
- Such rates are an example of a winnable and attainable goal for addressing regional disparities.

Regarding the specifics of the regional quantitative analysis process, I:

- Calculated age-group mortality rates by dividing the number of deaths in each respective age group by the region population number for that age group. Crude standardized rates were assessed for all age groups per region.
- Performed overall age-adjustment, including the region-level percentage change in the all-cause, age-adjusted mortality rate per 100,000 population.
- Applied a direct age-adjustment method, utilizing the age distributions from the year 2000 as the standard population, which allowed a comparison of the rates over time and eliminated the potential for confounding by age. A few Saudi regions have relatively small population sizes and, therefore, relatively few deaths over the 10-year study period. For these regions, the observed variations in mortality rates may be inaccurate because of
the small population sizes. For comprehensiveness, these regions have been included in the accompanying tables recognizing the limitations in the data.

- Compared age-adjusted mortality rates in regions over the 10-year period to account for the age differences between regions.
- Used a geographic information system to construct the entire country map with region-level data, including the composite 2010 age-adjusted mortality rate, the change in rate between 2000 and 2010, and the population distribution across the country.
- Used the Pearson’s chi-squared test to calculate for significance in rate change over time for the composite overall age-adjusted mortality rate between regions, for the less than 1-year-old age group (infants), and by age group. The Bonferroni–Holm method was also used to counteract the problem of multiple comparisons for accurate $P$-value assessment.
- Examined inter-region differences in the age-adjusted mortality rate using a Pearson’s chi-squared test for the 2010 composite rates.

For the analyses, I relied on R Core Team 2013 software (RCore, T. E. A. M., 2013). All of the tests were two-sided, and $P<0.05$ was considered to be statistically significant. The region map was geocoded using ArcGIS version 9.2 (ArcGIS, n. d.).

**II.2.c.iv. Qualitative Method**

To conduct and study the initial process of addressing health disparities, including the understanding of facilitators and barriers affecting the process to translate relevant findings into themes for government action to reduce health disparities, I (1) used a qualitative electronic facilitated semi-structured interviewing process to understand how these policymakers would address disparities, and (2) translated relevant findings from this interviewing into a proposed action framework for a specific application to infant mortality disparity.
I discuss the qualitative project in 6 subsections: rationale for using qualitative approach, setting and sample recruitment, ethical approval, interview questions, interview recording, and thematic analysis method.

II.2.c.iv.1. Rationale for Qualitative Approach

Denzin and Lincoln describe qualitative research as “a multi-method in focus, involving an interpretive, naturalistic approach to its subject matter. This means the qualitative researchers study things in their natural settings, attempting to make sense of, or interpret, phenomena in terms of the meaning people bring to them” (Denzin & Lincoln, 1994). The main aim is to improve understanding of social phenomena in their natural settings, giving special consideration to the meanings, experiences, and views of all the participants.

The qualitative research has several potential strengths with respect to policymaking. In this case, strengths related to this initial research (Britten, Jones, Murphy, & Stacy, 1995; Green & Britten, 1998; Morse, 2007) are as follows:

- Engage different stakeholders in the policymaking process;
- Understand the barriers against addressing regional health disparities and identifying obstacles to change;
- Identify facilitators for addressing regional health disparities;
- Enable access to areas not amenable to quantitative research such as attitudes, perceptions, and beliefs of members of the high-level committee.

For the qualitative analysis, I used purposive or theoretical sampling, a specific type of nonprobability sampling, allows selection of the most productive sample, called information rich, to be included in the study and answer the research question (Yardley, 2008).
II.2.c.iv.2. Ethics Approval

The Office of Human Research Office at Harvard T. H. Chan School of Public Health granted the ethical approval for the study (Appendix 2). I had official permission to conduct the semi-structured interview with the members of the high-level committee along with the minister’s permission.

II.2.c.iv.3. Interview Questions

I created a brief survey instrument that featured three questions adapted from Petticrew et al. (Petticrew et al., 2004) previously noted in the Literature Review (Section I.4.e.ii) above:

1. What sort of evidence on regional disparities, including regional health disparities, do you, ministers and senior colleagues, find convincing?
2. How can the availability of the convincing types of evidence for regional disparities, including regional health disparities, be improved in the Kingdom of Saudi Arabia?
3. How can national and international researchers help you as a policymaker and a user of evidence on regional disparities, including regional health disparities?

Several steps were included to minimize interviewer bias:

(1) I attended qualitative research courses and was trained by experts in social research to grasp the needed skills for carrying out semi-structured interviews and effectively communicating with participants.
(2) I reviewed the interview questions with the DELTA project committee to ensure that it was clear why each question is being asked, what each question meant, and to clarify ambiguities.
(3) I followed the Patton strategies to keep or maintain control of the interview, which included knowing the purpose of the interview, asking the right question to get the needed information, and giving appropriate feedback (Patton, 1987).
II.2.c.iv.4. Setting and Sample Recruitment

The study was carried out in the MEP located in Riyadh, Saudi Arabia. A list of members of the high-level committee was obtained from the Minister of MEP’s office along with their official governmental email addresses, cell phone numbers, and official titles. Members were contacted by email from the Minister of Economy and Planning (see Appendix 3).

The recruitment email contained a link to an electronic survey. The survey was created using Qualtrics (Qualtrics, Provo, UT). The participants took the survey in their choice of language: Arabic or English (Appendix 4 & 5). They were contacted once by the initial recruitment email from the Minister of Economy and Planning. A text message was sent during the recruitment week to remind members to answer the questions. The survey took between two and three hours to complete. There were around 400 words minimum limit for each question to ensure rich responses and examples from participants’ experiences. From the 20 members who were contacted, 17 agreed to be interviewed; therefore, the response rate was 85%.

II.2.c.iv.5. Recording Interviews

I collected the following identifiable information: name, email, phone number, title, and position to contact each member individually, if needed, in order to clarify the qualitative responses for the above questions. The governmental protocol in Saudi Arabia requires addressing senior policy members with their title and position. Also, the same senior members are often busy and can go days without checking their emails; thus, having their phone numbers allowed reminders if no response was given by midweek, in addition to clarifying responses as needed.

The identifiable data were deleted from the Harvard Qualtrics system one month after responses were submitted. This was set automatically in the configuration of the survey. The
responses in Qualtrics were subjected to the Harvard key two-step verification log in. The identifiers were collected only for follow-up if needed to clarify the qualitative responses as instructed by the doctoral committee. The email communications among the minister, committee members, and me took place in governmental servers, and all had password protection that was updated monthly.

II.2.c.iv.6. Thematic Analysis

I used thematic analysis to analyze the data from the interviews. Further explanation on thematic analysis is provided below.

Definition and rationale

Thematic analysis analyzes data and categorizes the recurrent or common themes (Braun & Clarke, 2006). This method was developed to meet the needs of investigating the experiences, meanings, and the reality of the participants, which help to achieve the study target (Braun & Clarke, 2006). I studied transcripts of semi-structured interviews with members of the HLC on Regional Development at the MEP and followed several standard processes for categorization and coding (Braun & Clarke, 2006; Campbell & Stanley, 1963). Specific stages of the categorization and coding process are noted below.

Stages of analysis

As seen in Figure 5, I followed five principal stages in the analysis of the data including: (1) familiarization; (2) generating initial codes; (3) searching for themes; (4) reviewing themes, defining, and naming themes; and (5) producing the report (Braun & Clarke, 2006; Campbell & Stanley, 1963). Each stage is described here.
All documents were systematically searched and coded based on the identified potential barriers or facilitators affecting the process to translate relevant findings into themes for government action to reduce health disparities. During the analysis process, the codes were regularly reviewed and regrouped or reclassified.

(1) **Familiarization**

Familiarization started with the collection of data from the members of the HLC on Regional Development and then rechecking the transcripts to ensure accuracy.

(2) **Generating initial codes**

Excel coding was used which offers the advantage of coding abstract themes in a simple way; coding could be done without software.
(3) Reviewing themes

Subthemes and codes were refined by reading and reviewing extracts. Input from the DELTA project committee was used in order to create and refine these subthemes and ensure the codes sounded coherent. The unfitted codes were then re-examined for further refinement.

(4) Defining and naming themes

In this stage, I examined the meaning behind the themes and elaborated upon them to define and refine them. Under each main theme, subthemes were generated.

(5) Producing the report

I wrote the results based on the data analysis and then compared the findings with the study carried out in UK. Then, the report was submitted to the Minister of MEP and the HLC on Regional Development.

Confidentiality and anonymity

Issues of confidentiality and anonymity are significant in the field of qualitative research. In this report, publication, all sources of quotes are given as “a member of HLC” to protect confidentiality and anonymity of the participants.

Language issues

In Saudi Arabia, while Arabic is the primary language, most senior government officials speak English as well. Hence, most interviews were carried out and transcribed in English. The ones that were conducted in Arabic were translated into English then transcribed.

Validity issues

I followed several steps to ensure the quality and rigor of the qualitative research (Yardley, 2008; Braun & Clarke, 2006; Campbell & Stanley, 1963):
(1) Clear exposition of the actual followed data collection and analysis method, including a short description on the method of coding development, to ensure transparency and maximize reliability.

(2) Included sufficient data in the qualitative results to allow the reader to judge whether the interpretation offered is adequately supported by the data.

(3) Compared findings from this work with the findings from other work in the same field to ensure the work is comparative.

(4) Followed steps to maximize reflexivity, including awareness of the social setting of the study itself, awareness of the wider social context, minimizing personal and intellectual biases at the outset to enhance the credibility of the findings, and methodological openness.

(5) Used respondent validation by orally presenting a summary of the findings to the participants.

II.2.c.v. Translating Evidence to Action For A Specific Health Disparity Example: Policy Recommendations for Infant Mortality Disparities

To demonstrate how the DELTA could apply to specific health disparities, I applied the Health Disparities Action Framework for Saudi Arabia (Craig, 2013) to address the specific topic of regional infant mortality disparities in Saudi Arabia.

III. Results Statement

III.1. Quantitative Results

III.1.a. National Crude Death Rates and National Infant Mortality

Although some discrepancy was found between my calculated national mortality rates and the reported rates by MOH and international agencies, my results showed consistency and stability over the 10 years period. As noted earlier, previous results from Saudi MOH, UN,
World Bank and IHME are based on estimates (General Authority for Statistics, Kingdom of Saudi Arabia, 2017; United Nations, 2015; World Bank, 2017; Institute of Health Metrics and Evaluation, 2016). The consistency found over the available four year data points gives confidence in using the data and methodology to compute regional mortality rates as shown in Table 4 and Table 5 below.

**Table 4: Crude Death Rate Per 1000 population**

<table>
<thead>
<tr>
<th>Year</th>
<th>Direct Calculation</th>
<th>Saudi MOH*</th>
<th>UN**</th>
<th>World Bank</th>
<th>IHME</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>1.87</td>
<td>3</td>
<td>3.9</td>
<td>3.69</td>
<td>2.72</td>
</tr>
<tr>
<td>2004</td>
<td>2.05</td>
<td>3.8</td>
<td>3.6</td>
<td>3.5</td>
<td>2.52</td>
</tr>
<tr>
<td>2007</td>
<td>2.15</td>
<td>3.9</td>
<td>3.5</td>
<td>3.45</td>
<td>2.4</td>
</tr>
<tr>
<td>2010</td>
<td>1.95</td>
<td>3.9</td>
<td>3.4</td>
<td>3.41</td>
<td>2.34</td>
</tr>
</tbody>
</table>

* MOH uses Saudi Arabian General Authority Statistics reported crude death rate
** UN - Population Division

**Table 5: Infant Mortality Rate Per 1000 Live Births**

<table>
<thead>
<tr>
<th>Year</th>
<th>Direct Calculation</th>
<th>Saudi MOH*</th>
<th>UN**</th>
<th>World Bank, WHO, &amp; UN-IGME</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>23.49</td>
<td>19.1</td>
<td>23</td>
<td>19.4</td>
</tr>
<tr>
<td>2004</td>
<td>24.66</td>
<td>18.1</td>
<td>19</td>
<td>17.2</td>
</tr>
<tr>
<td>2007</td>
<td>27.94</td>
<td>17.4</td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td>2010</td>
<td>23.98</td>
<td>16.9</td>
<td>15</td>
<td>14.7</td>
</tr>
</tbody>
</table>

* MOH uses Saudi Arabian General Authority Statistics reported crude death rate
** UN - Population Division
III.1.b. Regional Mortality

Figure 6 shows a map of Saudi Arabia with: 1) the age-adjusted, all-cause mortality rate per 100,000 populations for 2010 for all 13 regions, and 2) the change in mortality rate across the 10-year study period. The population density gradient for each region is shown for comparison with the most populous regions (i.e., Riyadh, Eastern and Makkah).

Figure 6: Geographic mortality disparities map across all 13 regions of Saudi Arabia; per-region composite age-adjusted, all-cause mortality rate per 100,000 population (2000–2010).

Note: One outlier region, Al-Jouf, exhibited an extremely high mortality rate change (2000–2010) likely due to underreporting of the death permits for the census year 2000. Excluding this one-year outlier did not change the statistical significance of the trend.
I observed significant differences among all regions in terms of mortality rate for the year 2010 (P<0.01). The Hail region had the highest 2010 age-adjusted mortality rate at 357 per 100,000 population with a 38% increase over the study period. The Al-Baha region had the lowest 2010 age-adjusted mortality rate at 27 per 100,000 population with a 200% increase over the study period. While the majority of regions exhibited increasing mortality rates between 2000 and 2010, four regions (Northern Borders, Tabouk, Riyadh and Madinah) exhibited statistically significant reductions in mortality. The Madinah region’s 2010 age-adjusted mortality rate (141 per 100,000 population) had the largest reduction in mortality rate (57%) over the 10-year period while the Al-Jouf region had the largest increase in age-adjusted mortality rates over the period with a 756% increase. The Al-Madinah region had the largest decrease in mortality rates over the period with a 57% decrease (Table 6).

The reasons for these disparities and changes in adjusted mortality rates by region over time are beyond the scope of the current DELTA project. The trends for Al-Jouf are of special note and possible socioeconomic determinants for them include:

- Its proximity to unstable countries such as Iraq and Syria.
- It has the highest unemployment rate in Saudi Arabia at 23% (Al-Mujaish and Alzahrani, 2015)
- It ranks 33 out of 35 on the Middle Eastern competitiveness index of regions, (Huggins, R., Izushi, H., Prokop, D., & Thompson, P., 2014).
- It has the least number of governorates in Saudi Arabia, which are the administrative unit responsible for local development needs (Khraif, R., Salam, A. A., Potty, R. S., Aldosari, A., Elsegaey, I., & AlMutairi, A., 2016).
• It has the highest sex ratio among the regions in Saudi Arabia with highest sex ratio among its non-Saudi residents (Khraif, R., Salam, A. A., Potty, R. S., Aldosari, A., Elsegaey, I., & AlMutairi, A., 2016). High population sex ratio increases the tendency of males to engage in risky behaviors and violence, thus increasing their risk of premature mortality (Waldron, I., 1993)

Table 6: Regional % Change in All-cause Mortality Rate from 2000 - 2010

<table>
<thead>
<tr>
<th>Administrative Region</th>
<th>Population 2010</th>
<th>Ranking</th>
<th>% Rate Change for Age adjusted all-cause mortality from 2000 - 2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Al-Madinah Al-Monawarah</td>
<td>1,777,933</td>
<td>1</td>
<td>- 57</td>
</tr>
<tr>
<td>Northern Borders</td>
<td>320,524</td>
<td>2</td>
<td>- 19</td>
</tr>
<tr>
<td>Riyadh</td>
<td>6,777,146</td>
<td>3</td>
<td>- 15</td>
</tr>
<tr>
<td>Tabouk</td>
<td>791535</td>
<td>4</td>
<td>+ 3</td>
</tr>
<tr>
<td>Makkah Al-Mokarramah</td>
<td>6,915,006</td>
<td>5</td>
<td>+ 6</td>
</tr>
<tr>
<td>Najran</td>
<td>505,652</td>
<td>6</td>
<td>+ 15</td>
</tr>
<tr>
<td>Aseer</td>
<td>1,913,392</td>
<td>7</td>
<td>+ 29</td>
</tr>
<tr>
<td>Eastern Region</td>
<td>4,105,780</td>
<td>8</td>
<td>+ 38</td>
</tr>
<tr>
<td>Hail</td>
<td>597,144</td>
<td>9</td>
<td>+ 38</td>
</tr>
<tr>
<td>Al-Qaseem</td>
<td>1,215,858</td>
<td>10</td>
<td>+ 68</td>
</tr>
<tr>
<td>Jazan</td>
<td>1,365,110</td>
<td>11</td>
<td>+ 126</td>
</tr>
<tr>
<td>Al-Baha</td>
<td>411,888</td>
<td>12</td>
<td>+ 200</td>
</tr>
<tr>
<td>Al-Jouf</td>
<td>440,009</td>
<td>13</td>
<td>+ 756</td>
</tr>
</tbody>
</table>

Ranking: 1 is best performing, 13 worst performing
The following are the related appendices for regional mortality disparities:

- Appendix 6 lists the regional age-adjusted, all-cause mortality rate per 100,000 population for each census year: 2000, 2004, 2007 and 2010. Hail region had the highest 2010 Regional mortality rate; Al-Baha region had the lowest mortality rate. The results of the Pearson’s chi-square tests indicate that there were significant positive and negative trends per region across the study period (P<0.01).

- Appendix 7 lists the all regional, all-cause mortality rates per 100,000 population over the 10-year period by age group including all cause infant mortality rate per 1000 live births. The results of the Pearson’s chi-square tests indicated significant changes in mortality rates for each age group by region except for Tabouk, Najran, and Al-Baha regions.

### III.1.c. Regional Infant Mortality Rates

Figure 7 shows a map of Saudi Arabia with: 1) the all-cause infant mortality rate per 1000 live births for the 2010 census year for all 13 regions, and 2) the change in infant mortality rate across the 10-year study period. The population density gradient for each region is shown for comparison with the most populous regions (i.e., Riyadh, Eastern and Makkah). I observed significant differences between almost all regions in terms of infant mortality rate for the year 2010 (P<0.01). Appendix 8 lists the all-cause infant mortality rate per 1000 live by region; there were significant trends per region across the study period (P<0.01) for all regions except Jizan region. Hail region had the highest 2010 regional infant mortality rate of at 57.5 per 1000 live births; Aseer region had the lowest statistically significant regional 2010 infant mortality rate of 5 per 1000 live births.
Figure 7: Geographic infant mortality disparities map across all 13 regions of Saudi Arabia; per-region composite all-cause infant mortality rate per 1000 live births (2000–2010).

*Note: One outlier region, Al-Jouf, exhibited an extremely high mortality rate change (2000–2010) likely due to underreporting of the death permits for the census year 2000. Excluding this one-year outlier did not change the statistical significance of the trend.
This analysis indicated that initial levels of infant mortality are high for southern regions and Hail region (Figure 8). In addition, the region that exhibited the largest percentage increase in infant mortality rates over the time period studied was consistently Al-Jouf. Conversely, the region that exhibited the largest percentage decrease in mortality rates over the time period was Al-Madinah and Tabouk. Figure 9 compares the 2010 regional infant mortality rates to national infant mortality and shows that infants in Hail are 2.5 times likely to die before their first birthday than infants nationally. A regional ranking for percent change in all cause infant mortality rate from 2000 – 2010 is presented in Table 7 below.

**Figure 8: Infant mortality rate per region for years 2000 and 2010.**
Figure 9: Comparison of Regional Infant Mortality Rate to the National Rate for Year 2010.

Table 7: Regional % Change in All-cause Infant Mortality Rate from 2000 - 2010

<table>
<thead>
<tr>
<th>Administrative Region</th>
<th>Live Births 2010</th>
<th>Ranking</th>
<th>% Rate Change for all-cause infant mortality from 2000 - 2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Al-Madinah Al-Monawarah</td>
<td>38,341</td>
<td>1</td>
<td>- 55</td>
</tr>
<tr>
<td>Tabouk</td>
<td>17,071</td>
<td>2</td>
<td>- 12</td>
</tr>
<tr>
<td>Riyadh</td>
<td>145,176</td>
<td>3</td>
<td>- 8</td>
</tr>
<tr>
<td>Northern Borders</td>
<td>6,927</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Makkah Al-Mokarramah</td>
<td>148,775</td>
<td>5</td>
<td>+ 3</td>
</tr>
<tr>
<td>Al-Qaseem</td>
<td>26,135</td>
<td>6</td>
<td>+ 13</td>
</tr>
<tr>
<td>Aseer</td>
<td>41,359</td>
<td>7</td>
<td>+ 21</td>
</tr>
<tr>
<td>Eastern Region</td>
<td>87,907</td>
<td>8</td>
<td>+ 26</td>
</tr>
<tr>
<td>Najran</td>
<td>10,913</td>
<td>9</td>
<td>+ 34</td>
</tr>
<tr>
<td>Hail</td>
<td>12,897</td>
<td>10</td>
<td>+ 63</td>
</tr>
<tr>
<td>Jazan</td>
<td>29,524</td>
<td>11</td>
<td>+ 94</td>
</tr>
<tr>
<td>Al-Baha</td>
<td>8,926</td>
<td>12</td>
<td>+ 310</td>
</tr>
<tr>
<td>Al-Jouf</td>
<td>9,469</td>
<td>13</td>
<td>+ 1059</td>
</tr>
</tbody>
</table>

Ranking: 1 is best performing, 13 worst performing
III.2. Qualitative Results of Thematic Analysis

The thematic analysis enhances understanding of both facilitators and barriers affecting the initial process of addressing health disparities.

The responses to the three qualitative questions varied by several ministries. The findings, unsurprisingly, shows that upstream ministries, i.e. ministries that do not provide direct services to citizens but work mainly on planning, fiscal, and legal policies, tend to address socioeconomics determinants while downstream ministries, i.e. ministries that provide direct services to citizens such as Ministry of Health and Ministry of Labor and Social Development, are more concerned with services provided.

Of the 132 descriptive codes identified from the electronic semi-structured interviews, I organized them into three principal themes corresponding to each question. Quotations from respondents have been selected to represent the themes most commonly cited. Table 8 summarizes themes and subthemes for each question.

Three principal themes emerged from the data, namely: (1) poor evidential foundation, (2) the need for systems thinking, and (3) the need for translational and policy research for action were identified from the thematic analysis and discussed in this section respectively.
Table 8: Qualitative Question, Corresponding Principal Themes, and Subthemes.

<table>
<thead>
<tr>
<th>Question</th>
<th>Principal Theme</th>
<th>Subthemes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. What sort of evidence on regional disparities, including regional health disparities, do you, ministers and senior colleagues, find convincing?</td>
<td>Theme One: Poor Evidential Foundation</td>
<td>a) Barrier: Lack of Evidence for Disparities</td>
</tr>
<tr>
<td></td>
<td></td>
<td>b) Barrier: Lack of Evidence for Root Causes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>c) Barrier: Lack of Evidence for Existing Programs &amp; Policies</td>
</tr>
<tr>
<td></td>
<td></td>
<td>d) Barrier: Lack of Evidence for Governance Impact</td>
</tr>
<tr>
<td>2. How can the availability of the convincing types of evidence for regional disparities, including regional health disparities, be improved in Saudi Arabia?</td>
<td>Theme Two: Need for Systems Thinking</td>
<td>a) Facilitator: Recognizing Interconnections</td>
</tr>
<tr>
<td></td>
<td></td>
<td>b) Facilitator: Monitoring and Feedback</td>
</tr>
<tr>
<td></td>
<td></td>
<td>c) Facilitator: Enablers</td>
</tr>
<tr>
<td></td>
<td></td>
<td>d) Facilitator: Need for Conceptual Frameworks and Models</td>
</tr>
<tr>
<td>3. How can national and international researchers help you as a policymaker and a user of evidence on regional disparities, including regional health disparities?</td>
<td>Theme Three: Need for Translational and Policy Research for Action</td>
<td>a) Barrier: The Evidence Gap</td>
</tr>
<tr>
<td></td>
<td></td>
<td>b) Barrier: Lack of Policy-Relevant Research Funding and Incentives Misalignment</td>
</tr>
<tr>
<td></td>
<td></td>
<td>c) Facilitator: Producing Culturally Appropriate Evidence</td>
</tr>
<tr>
<td></td>
<td></td>
<td>d) Facilitator: Need for Conceptual Frameworks and Models</td>
</tr>
<tr>
<td></td>
<td></td>
<td>e) Facilitator: Transparency</td>
</tr>
</tbody>
</table>
Below I show only the highlights of each principal theme. See Appendix 9 for the full thematic analysis results including a host of subthemes.

**Theme One: Poor Evidential Foundation**

Poor Evidential Foundation, a collective term covering multiple issues, encompasses subthemes such as suboptimal data and evidence concerning: the problem of health disparities, the root causes, potential policies, and governance issues related to who and how such policies should be pursued. The members of HLC described the poor evidence in different ways; however, it was chiefly expressed as lack of visibility.

“The key to avoid such unnecessary disparities is to have high visibility of the problems, their causes and alternative solutions in the form of policies and direct public and private interventions. The goal is not only to eliminate such disparities within and across regions, but also to elevate the entire country to an acceptable performance patterns that guarantee, first and foremost, the well-being of the people living on this land.”

**Theme Two: Need for Systems Thinking**

The need for systems thinking and approach to improving evidence on disparities was highly advocated by the members of HLC (Senge, 1997). Although the participants did not explicitly mention “systems thinking” as a phrase or concept, they repeatedly pointed to different components of systems thinking such as monitoring and feedback and enablers. Participants believe that these components are essential to addressing the complex issue of regional development, including reducing regional health disparities

“Areas such as health, education, human productive and innovative capacities, cultural worldviews, social cohesion, as well as quality of physical and natural settings that
impact performance, need to be analyzed within a ‘complexity’ framework, where each
area or system impacts on the other within the totality of the whole system”

Theme Three: Need For Translational and Policy Research for Action

Recognizing the poor foundational evidence on disparities that exists for Saudi Arabia illustrated in the first principal theme, members of the HLC called on researchers, national and international, to help improving the poor foundational evidence by producing translational policy research that can help them as senior policy makers. The HLC members talked about some barriers and facilitators to the translational policy research for disparities including health disparities.

“I think the Saudi researchers in universities and other research centers have not yet contributed to policies. Most academics do their research for the research sake and to submit for their promotions in their academic centers. It's extremely important that researchers should seek applicable policies, research leading to policies…”

III.3. Discussion

This DELTA project has created new knowledge in three areas. First the quantitative analysis has revealed statistically significant all-cause, age-adjusted mortality disparities in Saudi Arabia by region, providing concrete evidence for the existence of such disparities for the first time. Of note, large disparities have worsened over the study period (2000-2010).

The findings highlight the magnitude of the excessive mortality burden afflicting northern rural regions, results that are consistent with the observation that rural and less-dense regions such as Hail, Northern Borders, and Al-Jouf have poorer mortality outcomes than denser urban and suburban regions (National Center for Health Statistics, 2001). Hence, differences in rural versus urban communities in Saudi Arabia may be contributing to the health disparities
noted. Of note, the Saudi Arabian rural landscape is comprised of over 2000 villages with a population of 500–5,000 with an additional 150 small towns with a population of 5,000–25,000 (General Authority for Statistics, 2017).

The results of the Hail region offer some potential insights into the causes of health disparities. Hail incurred the highest mortality rates across most age groups compared with the other regions, consistent with Hail region’s poor regional health statistics such as the highest percentage of abnormal deliveries, the highest percentage of cesarean sections, and being among the most stagnantly deprived regions in terms of hospitals, health services, and healthcare providers (Saudi Arabia Ministry of Health, 2009). Possible explanations for the strong association between mortality and geographic regions are the combined effect of a number of factors, such as disparities in the quality of healthcare across regions, patterns in healthcare use and treatments, and government healthcare spending (Kinding & Cheng, 2013). Saudi Arabia’s financing structure may have contributed, since there is a documented mismatch between the allocated health budget and the demand for healthcare services. Moreover, spending on healthcare is likely to be inequitable given the current fragmentation of the healthcare budget among different governmental health sectors across different regions (Alkhamis, Hassan, & Cosgrove, 2013; Alshamsan, Leslie, Majeed, & Kruk, 2017).

The results do not indicate why mortality increased in more regions for several age groups than others. A recent WHO report, the Country Cooperation Strategy for Saudi Arabia, highlighted the sharp increase in non-communicable diseases such as cardiovascular disease and diabetes with traffic accidents as the largest cause of mortality among adult males aged 16–36 years (World Health Organization, 2013). My research clearly demonstrates the need for cause-specific regional mortality rates and an examination of the factors that might be helping to
decrease the mortality rates in some regions while other regions are exhibiting increasing mortality rates.

The DELTA quantitative analysis also focused on the specific issue of infant mortality disparities. Over the past two decades, Saudi Arabia has offered natal and post-natal services throughout the country to improve maternal health and reduce infant mortality (United Nation Development Program, n.d). The integrated child healthcare program involves activities that include control of diarrhea and malnutrition, and a comprehensive program of vaccination against communicable diseases. It was set as a national effort to monitor and achieve goal 4 of the MDGs (United Nation Development Program, n.d).

Yet, despite the efforts of Saudi Arabia to reduce infant mortality, the finding that many regions experienced no mortality reductions among the most vulnerable age group (less than one year old) should be of great concern to Saudi health policy makers, legislators, and the country’s leadership. Not only do these poor outcomes reduce the length and quality of life of these infants, they also contribute to growing healthcare expenditures for many more decades. In addition, poor mortality outcomes among other young age groups lower the productivity of a much-needed national workforce and reduce the economic competitiveness of future generations. The shown disparities in mortality raise questions about equitable distribution of regional health spending. The large number of regions with no improvements in mortality rates demands that policy makers create a broad investment strategy across health determinants coupled with an extensive future research agenda to explore geographic patterns in health disparities.
In short, the quantitative analysis now provides the government for the first time with:

2. Mapping of a health outcome disparity at regional level (i.e. mortality disparities), which can be used as a baseline for the regional development dashboard for Vision 2030. See section III.1.b and III.1.c.
3. A means to engage stakeholders in a national and regional policy dialogue.

The DELTA project also featured a qualitative analysis. As noted below, the results showed many similarities in the themes between senior policy makers in UK and Saudi Arabia with the major one being the ongoing evidence gap of translational and policy research for tackling health disparities (Table 9). However, a few differences were noted between the two countries, probably due to:

- Maturity of UK health disparities policy making.
- Different political settings.
- Ample evidence of UK disparities in comparison to the limited to no evidence in Saudi Arabia.

Regarding the three principal themes uncovered by the qualitative analysis, I compare them with previous findings from the United Kingdom (Petticrew et al., 2004).

**Theme One: Poor Evidential Foundation**

I found that the Saudi Arabian high-ranking officials attached importance to the regional level evidence on disparities similar to their counterparts in UK (Petticrew et al., 2004). Members of HLC felt that regional level evidence can provide visibility to the problem of regional disparities including health disparities. In their opinion, this visibility by evidence is important to activate the policy process of addressing regional disparities.
Table 9: Comparison of Saudi Arabian and United Kingdom’s Responses to the Three Qualitative Questions*

<table>
<thead>
<tr>
<th>Responses</th>
<th>Saudi Arabia</th>
<th>United Kingdom</th>
</tr>
</thead>
</table>
| 1. What sort of evidence on regional disparities, including regional health disparities, do you, ministers and senior colleagues, find convincing? | • Attached importance to the availability of evidence on regional disparities to advance policy.  
• Availability of evidence by itself won’t move the policy agenda. The evidence for political and policy processes are important as well.  
• Some members expressed satisfaction with the available evidence, others stated that they are not but they have to act anyway. | • Required evidence at a local and a micro level in addition to the national ones.  
• Required evidence on the mechanisms and structures within which policymakers work.  
• Highlighted the political influences on the use of evidence. |
| 2. How can the availability of the convincing types of evidence for regional disparities, including regional health disparities, be improved? | • Highlighted the need for systems thinking to approach the complex issue of disparities.  
• Pointed to Saudi Vision 2030 and its momentum as a major political mechanism to improve the availability of disparities evidence.  
• Noted that despite this momentum, the government is still working in silos, which will hamper any effort to improve the evidence on disparities. | • Acknowledged the complexity of improving the disparities evidence for policy. However, they didn’t provide an approach to address this complexity.  
• Pointed to three important criteria for improving the evidence for disparities: clarity, relevance, and timeliness. |

(Continued)
Table 9: Comparison of Saudi Arabian and United Kingdom’s Responses to the Three Qualitative Questions*

<table>
<thead>
<tr>
<th>Responses</th>
<th>Saudi Arabia</th>
<th>United Kingdom</th>
</tr>
</thead>
</table>
| 3. How can national and international researchers help you as a policymaker and a user of evidence on regional disparities, including regional health disparities? | • Noted the evidence gap: researchers produce non-policy research that of low utility to policy makers.  
• Pointed to need for culturally appropriate research on disparities  
• Processes to structure incentives and funding for policy relevant research. | • Noted the evidence gap: researchers produce policy-free evidence  
• Researchers to understanding the game and study the political process. |

*(Petticrew et al., 2004)

However, in contrast to the UK senior policy makers, Saudi officials frequently mentioned the regional level and rarely the other micro levels such as cities. This might be explained by the fact that UK has much evidence at different geographic and administrative levels in contrary to the limited to lack of any disparities evidence in Saudi Arabia. Also, the Saudi Arabian officials highlighted the fact that even if they were to be presented with disparities evidence, there is no guarantee that it will be used for policy making. In their opinion, as also noted by UK leaders, political commitment towards evidence informed policy is critical. They noted the need for evidence on the mechanisms and processes of how evidence is used in the policy arena. This specificity might be due to the maturity of UK policy process in addressing disparities.

This theme raises an important issue around interconnection of power and health disparities evidence and research (Popejoy, 2016). Although this study examined the axes of
geography and health disparities, the other determinants needs further examination with special attention to governance power and its impact on producing the needed evidence to push the agenda forward. This is even more critical knowing that presenting the geographic disparities in mortality in this project has changed the narrative from skepticism about the extent of regional health disparities, or even their existence in some instances, to trying to explain them for policy making.

**Theme Two: Need for Systems Thinking**

Both Saudi Arabian and UK officials acknowledge the complexity of health disparities. Saudi Arabian officials specifically mentioned many subthemes that point to the need for systems thinking to address the complex issue of disparities.

However, the HLC did not mention ownership and accountability as important subthemes for promoting and adopting systems thinking. In other words, who will own the responsibility to improve evidence on the complex issue of regional disparities including regional health disparities. The members of the HLC are experienced, high-ranking officials who advise ministers who control the access to data in their respective ministries. To date, there has been little action by ministries to improve evidence for regional disparities in Saudi Arabia prior to Saudi Vision 2030. This inactivity might be due to:

- Limited capacity of national researchers to recognize this issue for research.
- Limited activity of civil society organizations working on this issue and advocating for it.
- Political sensitivity of the regional disparities as they are closely related to the performance of regional emirates under the leadership of Ministry of Interior.
- Advocacy fatigue by concerned policy advisors and journalists.
• Limited examination of the social contract, the value of citizens, their responsibilities, and their rights.

However, the HLC members have an unprecedented opportunity under Saudi Vision 2030. In matter of fact, the current activities of the HLC offer a foundation to activate the policy process to tackle regional disparities including health disparities toward a winnable low hanging goal such as regional infant mortality disparity.

**Theme Three: Need For Translational and Policy Research for Action**

This work found similarity between Saudi Arabian and UK teams in their need for translational and policy research on disparities. Saudi Arabian officials noted that national and international research on Saudi Arabia is often non-policy related and of low utility to them. They implied that if there are no clear calls for translational disparities research for policy in Saudi Arabia, then the research is more likely to be descriptive and non actionable. The UK senior policy advisors noted that the plethora of disparities evidence for UK is policy-free and they called for complex policy evidence for action on disparities.

The UK participants highlighted the need for research that takes into account the political process to maximize its utility and impact. The Saudi Arabian participants pointed to the importance of culture in producing translational disparities research. They felt that importing international definitions, models, and plans for regional disparities, including health disparities masks the uniqueness of Saudi Arabian culture, hamper meaningful inference, and limits its implementation. The Saudi Arabian members highlighted the importance of funding and financial incentives to push the agenda for policy relevant disparities evidence. They frequently mentioned that the existing national research funding mechanisms are not built for translational and policy research.
There are new opportunities for obtaining national data currently. The recent royal decree number 64283 and Cabinet resolution number 11 of activating the General Authority of Statistics (GaStat) as the hub for national and regional statistics and research is poised to heighten regional disparities research, including regional health disparities, for Saudi Arabia by opening up their datasets for local and international researchers, students, and policy analysts (General Authority for Statistics, 2017).

III.3.a.i. Key Success Indicators

Using the indicators for diffusion as noted by Whitehead (see section I.4.e.ii above), I view the DELTA deliverables has serving as an impetus for:

- Establishment of a national commission and/or research programs on regional health disparities.
- Official modifications of existing national information systems to facilitate measurements and monitoring.
- Publication of policy briefs on health disparities by MEP and other governmental agencies.
- Prioritization of the health disparities issues by regulatory bodies such as the Consultative Assembly Council.

III.3.a.ii. Strengths and Limitations of the DELTA Analyses

III.3.a.ii.1. Principal Strength

The main strength of this DELTA project is using both quantitative and qualitative approaches to examine geographic mortality disparities, and conduct and study the initial process of addressing it by the Saudi Arabian government. Additionally, as this study is the first to be
carried in Saudi Arabia, findings are more likely to be transferable to other GCC and Arab countries. Table 10 summarizes the key strengths and limitations of the DELTA project.

Table 10: DELTA Project’s Strengths and Limitations

<table>
<thead>
<tr>
<th></th>
<th>Strengths</th>
<th>Limitations</th>
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<tbody>
<tr>
<td><strong>Quantitative</strong></td>
<td>1&lt;sup&gt;st&lt;/sup&gt; analysis using civil registry</td>
<td>• Ecological design</td>
</tr>
<tr>
<td></td>
<td>• Direct calculation method as opposed to Census estimation</td>
<td>• Data limitation: Accuracy depends on sources</td>
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<tr>
<td></td>
<td></td>
<td>• Data limitation: Data from two different sources</td>
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<td></td>
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<td>• Lack of causes of deaths</td>
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<tr>
<td><strong>Qualitative</strong></td>
<td>1&lt;sup&gt;st&lt;/sup&gt; analysis to document policy process post announcement of Vision 2030</td>
<td>• Purposive small sample</td>
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<td></td>
<td>• Highly informative participants</td>
<td>• Findings limited to the HLC.</td>
</tr>
<tr>
<td></td>
<td>• Questions and analysis adopted from UK</td>
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III.3.a.ii.2. Strengths and Limitations of Quantitative Method

**Strengths**

- The first study for Saudi Arabia to examine geographic mortality disparities using governmental civil registry data from 2000 to 2010. The use of civil registry data is recommended by WHO as the gold standard for mortality statistics (World Health Organization, 2014).
The followed direct calculation methodology, which is superior to the census estimation methodology, used by the Saudi government (World Health Organization, 2014).

Limitations

The constraints imposed by this ecological design have been previously well described (Morgenstern, 1995). Nonetheless; this type of study design can provide valuable insight into the possible role of geography on mortality. Several data limitations and potential sources of bias are considered. First, this analysis depended substantially on the accuracy of the Saudi Ministry of Municipal and Rural Affairs death-record reporting. In settings with scant data, mortality rate changes across the study period can have an important influence on results. This analysis underscores the challenges of assessing changes in mortality in places with small populations and relatively few reported numbers of deaths, for example, Al-Jouf’s region deaths for the year 2000. Second, bias is inherent in the estimates of mortality inequality owing to the numerator and denominator data arising from different sources. Third, the present analysis is unable to determine how individual relationships affect the cause-specific mortality rate (Szklo & Neito, 2005). Fourth, assuming that geographical populations are static presents a limitation because Regional migration may occur. Lastly, artifacts must be considered in explaining the described trends. Possible under-counting or over-counting by the reporting ministries will affect the observed associations.

III.3.a.ii.3. Strengths and Limitations of Qualitative Method

Strengths

- The first study in Saudi Arabia to document the policy making process.
- The use of reflective approach in this study improved the validity of the results.
- The use of rich informative subjects representing multiple sectors.
The interview questions and thematic analysis were adapted from the work of Petticrew et al. and Whitehead et al in the UK. (Petticrew et al., 2004; Whitehead et al., 2004)

**Limitations**

A major limitation of the qualitative study is the small sample size; however, this did not seem to affect the findings as participants were selected to contribute rich information. Another limitation is that the study was conducted on one site, and the findings may not be generalizable to other ministerial and governmental HLCs in the Kingdom of Saudi Arabia. However, I believe that findings from this study could be especially informative and beneficial to other governmental committees that are tasked with addressing non-health regional disparities given the similarity in the policy-making process and developmental challenges.

**III.4. A Proposed Call for Action: Addressing Regional Infant Mortality Disparities in Saudi Arabia**

**III.4.a. Why Infant Mortality?**

Saudi Arabia does well in comparison to other MENA countries based on its national infant mortality rate. For 2010, this DELTA project showed an infant mortality rate of 24 deaths per 1000 live births, which is better than MENA’s infant mortality rate for the same year at 37 deaths per 1000 live births (Population Reference Bureau, 2010). The DELTA project’s civil registry data and direct methodology showed a national infant mortality of 24 per 1000 live births for the year 2010 but this hides stark disparities between the 13 administrative regions (Figure 7).

This project’s infant mortality disparities analysis provides evidence for action and an entry point for addressing health disparities in Saudi Arabia.
III.4.b. Where We Are Now and Where Do We Need to Go?

This DELTA project showed the following:

- In 2010, the national infant mortality is 24 deaths per 1000 live births.
- In 2010, infants in southern regions are two times more likely to die before their first birthday than babies born in the northern regions (except for the Al-Jouf, the outlier region) (Figure 9)

This suggests that not all regions in Saudi Arabia have equal access to resources and opportunities that optimize health and allow families, mothers, and infants to thrive and develop to their fullest potential.

As one part of realizing Saudi Vision 2030, I can use the results of my analysis and framework application to propose a vision, goals, and objectives with targets for the specific area of regional infant mortality disparities.

III.4.b.i. Proposed Vision, Goals and Objective for Saudi Arabian Infant Mortality

**Vision**

All babies in Saudi Arabia are born healthy with equal opportunities to survive to beyond age of one.

**Goals**

- Reduce national infant mortality.
- Reduce regional disparities in infant mortality rates.

**Objectives**

- Achieve an overall national infant mortality rate that is 12 infants deaths per 1,000 live births or below by 2030 using civil registry data and direct calculation methodology.
This target is set to achieve the target 3.2 (By 2030, end preventable deaths of newborns and children under 5 years of age, with all countries aiming to reduce neonatal mortality to at least as low as 12 per 1,000 live births and under-5 mortality to at least as low as 25 per 1,000 live births) for Sustainable Development Goal 3 (United Nations, 2015). Infant mortality rate has been replaced by neonatal mortality rate for monitoring SDGs after the shift from MDGs in 2015 (United Nations General Assembly, 2015). Although there are strong and valid clinical reasons for this shift, replacing infant mortality rate with neonatal mortality rate probably will not be feasible for Saudi Arabia (United Nations General Assembly, 2015). There are two reasons for this challenge: first, the challenge of collecting real neonatal mortality data rather than deriving it similar to infant mortality rate through census estimation; and second, the resistance in changing the existing consistent datasets and data collection methods for infant mortality. However, I am proposing adopting SDG 3.2 target for reducing national infant mortality by 2030 till neonatal data becomes available for monitoring.

- **Reduce the regional infant mortality rate ratio (region to national) to 2 or below by 2030.**

Figure 9 shows that the highest regional infant mortality disparity is 2.5 in the Hail region for 2010. This means that the babies in Hail are 2.5 times more likely to die before their first birthday in comparison to the national infant mortality rate. This target is to reduce by at least 25% the gap in mortality between regional and national infant mortality rate by 2030 (Gray, Hollowell, Brocklehurst, Graham, & Kurinczuk, 2009).
III.4.c. How Will We Get There?

III.4.c.i. Infant Mortality Disparities Action Framework for Saudi Arabia

The DELTA project initiates the process of applying this framework by providing evidence for the problem, stating the aim, and setting targets for monitoring (Figure 10). However, the project’s scope does not provide policy recommendations on interventions for two reasons:

- Burial permits do not state the cause of death. Therefore, it is not feasible to identify cause-specific interventions.
- Burial permits do not state socioeconomic information such as income, education, or employment. Therefore, it is not feasible to identify socioeconomic policy interventions.

Figure 10: Proposed Infant Mortality Disparities Action Framework for Saudi Arabia
The framework uses a series of questions to help the proposed Regional Infant Mortality Reduction Steering Committee in their efforts to reducing regional infant mortality disparities (Appendix 10). The questions are intended to be used in the planning stage in order to prioritize initiatives and actions that can contribute to reducing disparities before developing and agreeing to the specific outcomes (NHS Health Scotland, 2013).

**III.4.c.ii. Stakeholders Activation: Proposed Regional Infant Mortality Reduction Steering Committee**

Addressing regional infant mortality disparities requires input from multiple stakeholders to ensure alignment and successful implementation. The existing HLC for Regional Development provides the platform to convene a Regional Infant Mortality Reduction Steering Committee. This proposed steering committee should have three main tasks (Minnesota Department of Health, 2015):

- **Prioritize** existing programs and policies to reduce infant mortality within Saudi Arabia.
- Identify additional national and regional *strategies* to reduce infant mortality disparities.
- Identify topic-specific *workgroups* needed to develop regional action steps to improve infant mortality disparities.

The above tasks should be guided by applying the adopted Infant Mortality Disparities Action Framework for Saudi Arabia (Craig, 2013).

**IV. Contribution of the DELTA Project**

This DELTA project has contributed to my personal leadership development, the host organization, and the public health field. Below are the details for each.

**IV.1. Leadership Skills and Personal Growth**

This DELTA project informed my leadership development in three domains:
**Transformation**

- *Analytical Thinking*: by understanding the mortality disparities in Saudi Arabia by breaking them into smaller pieces and tracing their implications in a step-by-step way.
- *Information Seeking*: by scanning for opportunities to find additional information and data, as well as seek the host organization’s view on the best utilization of the information.
- *Strategic Orientation*: by considering the scientific, demographic, cultural, political, and regulatory implications of disparities policies and decisions.

**Execution**

- *Initiative*: by identifying the problem of mortality disparities as well as obstacles and opportunities to address it. Also by proposing a framework for action in light of this identification to address the problem of mortality disparities and potential policies.
- *Organizational Awareness*: by understanding and learning formal and informal decision-making structures and power relationships within MEP. This included understanding the chain of command, positional power, rules and regulations, policies, and procedures of the MEP structure; recognizing the norms and values as well as becoming familiar with the expectations, priorities, and values of stakeholders; and adopting the “language and feel” of the Ministry and its environment.
- *Public Policy*: by maximizing opportunities to educate policymakers about the impact of non-existing policies on mortality disparities and to advocate for strategies to bring desired policy change. This included framing the problem on mortality disparities based on key available data; identifying a wide range of stakeholders who influence changes in
disparities policies; understanding the roles and relationships of those involved in policy
development and implementation, including the members of HLC.

Relationships

• Relationship Building: by establishing, building, and sustaining contacts with
stakeholders for the purpose of building networks for future collaboration. This included
making and sustaining connections; identifying the key leaders during DELTA project
and potential ones in the future; establishing good working relationships with them;
building personal relationships with colleagues; and maintaining contacts with other
community stakeholders for mutual assistance.

IV.2. Host Organization

This DELTA project contributes to MEP in the following ways:

• Expands the vision and mission of MEP in tackling regional disparities.
• Contributes to a priority project that is strategically significant.
• Offers best practices and an action framework to addressing regional health disparities.
• Brings the network of the Harvard T.H. Chan School of Public Health and its community.

IV.3. Public Health

This DELTA project makes a significant contribution to public health change and
specifically policies for health disparities. This impact is achieved through direct action to
improve HLC work on regional development and the creation of significant translational policy
recommendations that have high potential to influence the formation of future national health
disparities strategy and action plans.
V. Future Research Needs

Following findings from this DELTA project, future research needs are classified into three areas (WHO-CSDH, 2008):

1. Research on determinants of health disparities in addition to the determinants of average population health:
   • To understand reasons for the relationship between social determinants and health outcomes.
   • To understand the interaction between social determinants such as gender, education, income, and health disparities.
   • To quantify the impact of national political, economic, and social systems on health and health disparities within Saudi Arabia.

2. Research on interventions, national and regional, to address the social determinants of health and health disparities:
   • To evaluate the impact of societal-level policies and programs on health disparities.
   • To research the social, economic, and health costs and benefits of reducing health disparities.

3. Policy analysis:
   • To analyze policy processes towards health disparities interventions.
   • To understand the contextual barriers and enablers to inter-sectoral action in national and regional governance and policymaking.
   • To identify current good practices and develop tools for inter-sectoral action.
VI. Conclusion

In the historic context of Saudi Vision 2030, this Doctoral Engagement in Leadership and Translation for Action (DELTA) project generated new translational knowledge and creates value for public health change for Saudi Arabia. Following the project’s theory of change, the project started by presenting evidence on the existence of health disparities in Saudi Arabia (Whitehead, 2007). This DELTA project presented the first quantitative mortality disparities report in Saudi Arabia, using civil registry and direct methodology. This analysis used existing publically available mortality data for Saudi Arabia and employed a direct calculation methodology to map regional mortality. This quantitative work demonstrated that significant geographical mortality disparities, including infant mortality disparities, exist across the 13 administrative regions of Saudi Arabia. This DELTA project has revealed statistically significant all-cause, age-adjusted mortality disparities in Saudi Arabia by region. In addition, it has examined changes in all-cause mortality rates across the 13 geographical regions between 2000 and 2010, and it has demonstrated that the majority of regions experienced an increase in mortality over the 10-year study period.

In addition, the finding that many regions experienced no mortality reductions among the most vulnerable age group, i.e. infants, should be of great concern to Saudi health policy makers, legislators, and the country’s leadership. Addressing regional infant mortality disparity fulfills Saudi Arabia’s commitment of adopting the 2030 Agenda for Sustainable Development, which includes a set of 17 SDGs to end poverty, fight disparities and injustice, and tackle climate change by 2030.

This DELTA project presented the first effort to document the process by which high-ranking government officials in Saudi Arabia would approach the policy process of addressing
health disparities. This qualitative analysis documented three principal themes that emerged from the qualitative engagement, namely: (1) poor evidential foundation, (2) the needs for systems thinking, and (3) translational and policy research for action. There were many similarities in responses between senior policy members in Saudi Arabia and UK. However, there were few differences that are believed to be due to maturity of UK health disparities policy making, the different political settings, and the plethora of UK’s disparities evidence in comparison to the limited to no evidence in Saudi Arabia.

Continuing on the journey of the DELTA project’s theory of change, this project’s specific attention to infant mortality disparities analysis along with the qualitative responses provide evidence for action and an entry point for addressing health disparities in Saudi Arabia. I proposed a call for action that presents the first effort to set goals and targets to address health disparities using an adopted Regional Infant Mortality Disparities Action Framework for Saudi Arabia.

Addressing regional infant mortality disparities requires input from multiple stakeholders to ensure alignment and successful implementation. The existing HLC provides the platform to convene a Regional Infant Mortality Reduction Steering Committee. This steering committee should have three main tasks:

- **Prioritize** existing programs and policies to reduce infant mortality within Saudi Arabia.
- Identify additional national and regional **strategies** to reduce infant mortality disparities.
- Identify topic-specific **workgroups** needed to develop regional action steps to improve infant mortality disparities.

The above tasks should be guided by applying the adopted Infant Mortality Disparities Action Framework for Saudi Arabia (Craig, 2013). Finally, the project initiated the process by
illustrating the application of this framework using series of questions to guide the future
government efforts to address infant mortality disparities in the short-term as a winnable goal.
This DELTA project envisions addressing infant mortality disparities to be the first step toward
building a national disparities action plan.

The DELTA project used Whitehead’s evaluation indicators for diffusion of health
disparities’ ideas and evidence into policy arenas, leading to greater willingness to tackle these
disparities (Whitehead, 1998). The quantitative findings of this DELTA project were
instrumental in bringing the issue of regional health disparities to the attention of the HLC in
Saudi Arabia. This initial diffusion within MEP is a success that the project advocates for its
sustainability by adopting the proposed goals, targets, and disparities action framework for Saudi
Arabia.

This project has important implications for health disparities in Saudi Arabia as well
other GCC countries, as many findings and the processes are likely to be transferable to these
countries. Several strategies have been followed to disseminate the results from this work
nationally and internationally. On the level of Saudi Arabia, a full report of the study will be
submitted to the Minister of Economy and Planning who chairs the HLC for consideration. In
addition, it is hoped that results from this work will be helpful to other GCC countries. With this
in mind, the results from this study will be presented at national and international conferences.
To publicize the findings from this study, a press release, a policy brief and a media infographic
will be developed for communication.

Following findings from this DELTA project, future translational and policy research
needs are classified into three main areas:
• Saudi government should expand its national funding to include health disparities research, including regional health disparities, with incentives to attract more local researchers into the field.

• Saudi government should revise its national research agenda to focus on social determinants of health disparities and interventions to address them, promoting the translation of research into evidence for policy.

• Saudi government should restructure the funding mechanisms of existing national universities and research agencies to be reconfigured to address the causes of, and intervention for health disparities.

Building on the facilitators identified by HLC members, future policy needs are classified into three main areas:

• Advance the existing inter-sectoral efforts at HLC to develop strategies and action plans to reduce regional health disparities.

• Bridge the traditional divisions of ownership between different ministries and governmental agencies to share the political responsibility for failures and successes in addressing regional health disparities.

• Activate the engagement of the affected region by health disparities to understand causes and construct solutions that will have higher chance of implementation.

In conclusion, documenting the findings of geographic disparities in Saudi mortality, including infant mortality disparities, Saudi Arabia has started the process of addressing regional health disparities under Saudi Vision 2030 and can do more. Even with the absence of perfect scientific evidence, immediate action should be taken to meet regional needs by helping policy makers in developing culturally appropriate strategies and interventions while fostering more
policy-relevant translational health disparities research. Addressing regional health disparities in Saudi Arabia is a starting point from which the status of health equity within the country can be explored and evaluated.
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Appendices

Appendix 1: Health Disparities Action Framework

The framework ideally should be used at the planning phase of any programmatic design or services, and then continue to guide the team through till evaluation (Craig, 2013). The following sections will explain each component of the framework.

Stating the aim (the What component)

The framework highlights the importance of stating clear, articulate, and agreed upon aim to address health disparities. The framework illustrates three aims to addressing health disparities that are closely related and interlinked but each sets a different course of action (Craig, 2013). Actions to address health disparities can aim at targeting the worst off group, reducing the disparities gap between the worst and best, and improving the health disparities universally, i.e. reducing the gradient of health disparities (Craig, 2013). For example, in the context of Saudi Arabian mortality disparities, if the aim is set to target the region with the worst mortality rate, this will improve the region’s health outcome. However, the decision makers would be challenged to claim that they’ve reduced health disparities as there is no comparator group (Craig, 2013). Another example would be universal access to reduce the health disparities, such as universal health services, across the whole population result in in poorer disparities outcomes as they don’t take into account the social factors of the disadvantaged (Marmot, 2010).

Needs Assessment and Baseline Data (the Why component)

This component illustrates the importance of health disparities evidence (Craig, 2013). This provides an understanding of the problem, its extent, and a baseline for action (Craig, 2013). This evidence can be at the population level such as demographics and health and social
outcomes, at the individual level of their lived experiences, and scientific research (Craig, 2013). For example, this project provided the differentiated impact of geography on infant mortality.

*Interventions (the How component)*

This component highlights the three different levels for action actions (Geronimus, 2001). The three levels are not mutually exclusive and they are interlinked in a continuum of actions (Craig, 2013):

- **Actions to mitigate health disparities:** These are downstream actions that reduce health disparities by action at the level of health and social services. Most of health disparities actions target mitigating the impact of social disparities on health outcomes but they are unlikely to address the social determinants of disparities. For example, trauma centers for speed related road traffic injuries would be more effective if there is better speed-limit enforcement.

- **Actions to prevent health disparities:** These are upstream actions that reduce health disparities by action at the level of social disparities that impact health and social outcomes. Examples are tackling homelessness, poverty, and unemployment among the worst off groups in comparison to the better off.

- **Action to undo fiscal, social, and legislative policies that contribute to increasing health disparities.** This level is very complex and challenging technically and politically. This explains the limited actions globally this level. An example of this is establishing a progressive taxation system (Whitehead & Dahlgren, 2006).
Measuring Progress (the Progress component)

This component outlines the three approaches to measure progress in addressing health disparities (Craig, 2013). Each approach depends on the stated aim for addressing health disparities and each will have a different set of indicators. Two main issues are important to highlight in this component. First, the importance of setting a comparator group, otherwise, the planners cannot judge whether their actions have increased or decreased health disparities (Craig, 2013). Second, universal actions to reduce health disparities across the population are challenging to evaluate as they require impact assessments that are complex and expensive (Craig, 2013).
Appendix 2: Ethical Approval Letter

Harvard T.H. Chan School of Public Health
Office of Human Research Administration
90 Smith Street, 3rd Floor
Boston, MA 02120
Federal wide Assurance
FWA00002642

Notification of Initial Study Exemption Determination

October 31, 2016

Howard Koh
hko@hsph.harvard.edu

Protocol Title: Geographic Disparities in Saudi Mortality: Toward a Policy-Relevant Analysis
Principal Investigator: Howard Koh
Protocol #: IRB16-1760
Funding Source: None
IRB Review Date: 10/31/2016
IRB Effective Date: 10/31/2016
IRB Review Action: Exempt

This Initial Study submission meets the criteria for exemption per the regulations found at 45 CFR 46.101(b)(2). As such, additional IRB review is not required. For international research,
the Principal Investigator is required to comply with any applicable local laws, legislation, regulations, and/or policies. Additionally, if local IRB/ethics review is required, it must be obtained before any human subjects research activities are conducted in the field. If assistance with applicable local requirements is needed, please contact the Harvard T.H. Chan School of Public Health IRB office.

The determination that your research is exempt does not expire, and you will not file annual renewals. If changes to the research are proposed that would alter the IRB’s original exemption determination, they should be submitted in ESTR by selecting the Create Modification activity. If unsure, contact the Harvard T.H. Chan School of Public Health IRB office.

The IRB made the following determinations:

• Research Information Security Level: The research is classified, using Harvard’s Data Security Policy, as Level 2 Data.

Please contact me at 617-432-3071 or gbullock@hsph.harvard.edu with any questions.

Sincerely,
Grace Bullock
IRB Review Specialist

University Area IRB
http://cuhs.harvard.edu

Longwood Medical Area IRB
http://www.hsph.harvard.edu/ohra/
Appendix 3: Recruitment Email Sent by HE Minister of Economy & Planning to Members of the HLC

Dear XXXX

Ministry of Economy and Planning (MEP) has been mandated per the Royal Decree number 21648, dated 19-05-1436 Higri to lead the joint committee on Regional Development to conduct regional diagnostics and to review the fundamentals and standards of development distribution between cities, governorates and sub-governorates of the Kingdom of Saudi Arabia.

As a senior policy member of this process, I am requesting you to provide your comments and input on the regional development policy process with specific reference to regional disparities.

We at MEP find it critical at this early stage to take into account the needs of policymakers and the reality of regional development policy process in the Kingdom.

Please follow the link to provide your comments and views
https://harvard.az1.qualtrics.com/SE/?SID=SV_bkAMa9DBcpzqV3n

Please note that the commentary period closes by 5 PM, Monday, November 07, 2016. Once your input and others are received and compiled, we will share with you a memo summarizing the findings. You will have the opportunity by then as well for further commentary, if any.

If you have any problems with the link or any questions that you would like addressed, please contact my advisor, Dr. Nurah Alamro at nalamro@mep.gov.sa or +9665XXXXXX.

Thank you.

 Regards,
Appendix 4: Interview Instrument – English

Default Question Block

Introduction and Welcome

Regional development is the effort to reduce regional disparities by supporting employment and wealth-generating economic activities in regions. In the past, regional development policy tended to try to achieve these objectives by means of large-scale infrastructure development and by attracting inward investment.

Past policies have fallen short to reduce regional disparities significantly and have not been able to help individual lagging regions to catch up, despite the allocation of significant public funding. The result is under-used economic potential and weakened social cohesion.

Regional disparities are the regional differences in development that are unnecessary and avoidable. For example, regional disparities in mortality are the regional differences in death rates that are unnecessary and avoidable.

Ministry of Economy and Planning work on regional development recognizes that a new approach to regional development is emerging; one that promises more effective use of public resources and significantly better policy outcomes. This involves a shift away from redistribution and subsidies for lagging regions in favor of measures to increase the competitiveness of all regions.
Some key features of this new approach to regional development include:

- A development strategy that covers a wide range of direct and indirect factors that affect the performance of regions
- A focus on regional specific assets, and less on top-down investments and transfers
- An emphasis on opportunity rather than on disadvantage or need for support
- A collective/negotiated governance approach involving national, regional and local government plus other stakeholders, with the central government taking a less dominant role

Royal Decree number 21648, dated 19-05-1436 Higri, stipulated the formulation of a senior committee at the Ministry of Economy & Planning in conjunction with the Ministries of Interior, Justice, Finance, Labor, Health, Education and the Ministry of Municipal & Rural Affairs. The joint committee will review the fundamentals and standards of development distribution between cities, governorates and sub-governorates of the Kingdom of Saudi Arabia.

Regional Disparities in Mortality: Reality According to Policymakers

Preliminary results of analyzing one of the key indicators for regional development, regional differences in death rates, showed significant differences between the 13 administrative regions of the Kingdom of Saudi Arabia. While the research team is still refining the finding from technical perspective, we at MEP find it critical at this early stage to take into account the needs of policymakers and the reality of regional development policy process.

Below is an example of the preliminary findings:
Strengthening the **bridge between research and policy** is an urgent priority for the **mandate of regional development**. Although improving the accessibility of primary and secondary evidence will help achieve this, we also require a clearer understanding of **how the available regional disparities evidence, such as regional disparities in mortality, is viewed by policymakers**.

Also, we need a clearer understanding of how the production of relevant evidence on regional disparities and their reduction may be fostered, if the well reported gaps in this evidence for policy for the Kingdom of Saudi Arabia are to be filled.

We seek to advance this understanding by soliciting views and advice from YOU as
a senior member of the Kingdom of Saudi Arabia’s policy community. To participate in this senior policy commentary, please click on the next button below. Commentary period closes at 5 PM on Monday, November 7th, 2016.

First Name

Last Name

Email

Phone number

Title and Position

Duration of Serving in This Position

Organization

- Ministry of Interior
- Ministry of Economy and Planning
The next three questions are to explore with YOU as a senior policymaker and/or policy adviser how research evidence on regional development for the Kingdom of Saudi Arabia influences regional development policy making, and how its relevance and utility could be improved, with specific reference to the evidence on the production and reduction of regional health disparities.

Please elaborate on your answers with examples and lessons learned from YOUR policy-making experience.

What sort of evidence on regional disparities, including regional health disparities, do you, ministers and senior colleagues, find convincing?

Please elaborate on your answer with examples from your policy-making and policy advising experience.
How can the availability of the convincing types of evidence for regional disparities including regional health disparities, be improved in the Kingdom of Saudi Arabia?

Please elaborate on your answer with examples from your policy-making policy advising experience.

How can national and international researchers help you as a policymaker and a user of evidence on regional disparities, including regional health disparities?

Please elaborate on your answer with examples from your policy-making policy advising experience.
Thank you for taking the time to share your views and experience.

We have reached the end of our questions.

Before we finish, are there other important aspects of policy-making for regional development and disparities, including regional health disparities, that we should know about?

Is there anything else on your mind that you think we should include from policy perspective on this issue?

Is there a person that you think his/her input is important and of a high added value? Please share their name, email, and phone number and will make sure to send it to them as well.

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Appendix 5: Interview Instrument – Arabic

Default Question Block

مقدمة وتحبيب

تُعرّف التنمية المتواضعة بأنها محاولة الحد من التناقضات المتواضعة من خلال دعم فرص العمل وتوجه الأنشطة الاقتصادية في المناطق. ولتحقيق هذه الأهداف، فإن اتجاهات سياسة التنمية المتواضعة لطالما ركزت على تطوير البنية التحتية على نطاق واسع لمحاولة جذب الاستثمارات المحلية.

ومع ذلك فإن هذه السياسات المتواضعة للمناطق لم تستطع تقليل التباينات المتواضعة بشكل فعال ولم تكن قادرة على مساعدة المناطق المتاخرة على أن تركز على النمو الاقتصادي على الرغم من التمويل الحكومي الضخم.

التباينات المتواضعة هي الفوارق المتواضعة في التنمية التي لا تزول عنها ويمكن تدفقها. على سبيل المثال، التباينات المتواضعة في معدلات الوفيات في الفوارق المتواضعة في معدلات الوفيات التي لا تزول عنها ويمكن تدفقها.

لقد أضحى لوزاراة الاقتصاد والتخطيط من خلال عملها الحالي على التنمية المتواضعة أهمية اعتماد توجه جديد يهدف إلى فعالية تخصيص واستخدام الموارد العامة لتفعيل السياسات المتواضعة المستقبلية. ينطوي هذا التوجه على التقليل من الإعاقات المتواضعة وإعادة توزيعها بما يزيد من القدرة التنافسية للمناطق المتواضعة.

أداه بعض الملامح الرئيسية لهذا التوجه الجديد في التنمية المتواضعة:

- وضع استراتيجيات تنمية تعطي مجموعة واسعة من العوامل المباشرة وغير المباشرة التي تؤثر على آداء المناطق

التركيز على أصول مناطقية محددة، وتشريد الاستثمارات الحكومية المركزية

التشديد على الفرص بدلاً من التركيز على التحديات أو الحاجة إلى الدعم الحكومي

التوصل إلى نموذج جوكر مناطقية تفاوضية تشارك فيها الحكومة المركزية والمناطقية والمحلية بالإضافة إلى أصحاب المصلحة الآخرين

نص المرسوم الملكي رقم ٢١٦٤٨ بتاريخ ١٩ - ٥ - ١٤٣٤ هـ على أن تقوم اللجنة العليا برئاسة وزارة الاقتصاد والتخطيط وبتعاون مع وزارة الداخلية ووزارة العمل ووزارة المالية ووزارة الصحة ووزارة التعليم ووزارة الشؤون البلدية والقروية بمراجعة أسس ومعايير توزيع التنمية بين المناطق والمحافظات والمدن في المملكة العربية السعودية.

التباينات المنطقية في معدلات الوفيات: تشخيص الواقع وفقاً لتصنيف القرار

أظهرت النتائج الأولية تحليل أحد المؤشرات الرئيسية لسياسات التنمية المنطقية، وهو التباين المنطقي في معدلات الوفيات. أن هناك فوارق كبيرة بين المناطق الإدارية الـ ١٣ للملكة العربية السعودية. في حين أن فريق البحث في وزارة الاقتصاد والتخطيط لا يزال في مرحلة صقل النتائج من منظور تقني، إلا أنه نجح أنهم اتضح في هذه المرحلة المبكرة أن ناخذ في الاعتبار احتياجات صناعة السياسات وواقع عملية صنع السياسات التنموية للمناطق.

وفيما يلي توضيح النتائج الأولية للمؤشر أعلاه:
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والسياسات
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إلى
ذلك،
تحقيق
على
يساعد
سوف
والثانوية
الأولية
والبيانات
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رفيف
تنتمي الساعة الخامسة مساء من يوم الأربعاء 19 أكتوبر 2016.

الإسم الأول

العائلة

البريد الإلكتروني

رقم الهاتف/الجوال

المسمى الوظيفي

مدة عملك في هذه الوظيفة

جهة العمل

- وزارة الداخلية
- وزارة الاقتصاد والتخطيط
- وزارة الصحة

جهات عمل أخرى

في الأسئلة الثلاثة المقبلة، سنقوم معاك كصناع سياسات أو مستشار سياسات باستكشاف دور البراءين البحثية للتنمية المناطبية في المملكة العربية السعودية وتأثيرها على صناعة سياسات التنمية المناطبية، وكيف يمكن تحسين استخدامها، مع إشارة خاصة إلى البراءين الخاصة بتشخيص التباينات الصحية المناطبية والحد منها.

يرجى توضيح إجاباتك بامثلة ودروس مستفادة من تجربتك الشخصية كصناع ومستشار سياسات في مجال تخصصك.

برأيك، ما هي البراءين على التباينات المناطبية، بما في ذلك التباينات الصحية المناطبية، التي تجدها مفيدة لك وللوزراء وصناع القرار؟

يرجى توضيح إجاباتك بامثلة من خبرتك الشخصية في صنع السياسات وتقديم المشورة في التنمية المناطبية.
يرجى توضيح إجاباتك باستفادة من تجاربك الشخصية كصانع ومستخدم سياسات في مجال تخصصك.

يركز، كيف يمكن تحسين وتطوير البراهين المقنعة على التنبؤات المنطقة. بما في ذلك التنبؤات الصحية المنطقة. في المملكة العربية السعودية؟

يرجى توضيح إجاباتك باستفادة من تجاربك الشخصية كصانع ومستخدم سياسات في مجال تخصصك.
نُشكرك على أخذ الوقت لمشاركتنا وجهات نظرك وخبراتك.

لقد وصلنا إلى نهاية الأسئلة. ومع ذلك، هل هناك جوائز هامة أخرى تؤد مشاركتها تتعلق بعملية صنع السياسات التنمية المناطية، بما في ذلك تكاليف التبادلات المناطية الصحية؟ من وجهة نظرك، هل تعتقد أن هناك أي شيء آخر يجب أن نأخذه بعين الاعتبار من ناحية صنع السياسات في مسألة التنمية المناطية وتبادلاتهما؟ هل هناك شخص آخر تعتقد أن مشاركته بهذا الحوار مهمة وذات قيمة مضافة عالية؟ يرجى فضلاً تزويدنا بالإسم والبريد الإلكتروني والرقم الهاتفي وسنقوم بإرسال الرابط له.

### Appendix 6: Regional age-adjusted, all-cause mortality rate per 100,000 population (2000–2010).

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Appendix 6: Regional age-adjusted, all-cause mortality rate per 100,000 population (2000–2010).

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P value < 0.01; chi-squared test trends 2000–2010

(continued)
Appendix 6: Regional age-adjusted, all-cause mortality rate per 100,000 population (2000–2010).

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P value < 0.01; chi-squared test trends 2000–2010
Appendix 7: All regional age-group, all-cause mortality rate per 100,000 population (infant mortality per 1000 population; 2000–2010).

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(continued)
Appendix 7: All regional age-group, all-cause mortality rate per 100,000 population (infant mortality per 1000 population; 2000–2010).

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Appendix 7: All regional age-group, all-cause mortality rate per 100,000 population (infant mortality per 1000 population; 2000–2010).

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Appendix 7: All regional age-group, all-cause mortality rate per 100,000 population (infant mortality per 1000 population; 2000–2010).

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Appendix 7: All regional age-group, all-cause mortality rate per 100,000 population (infant mortality per 1000 population; 2000–2010).

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Appendix 7: All regional age-group, all-cause mortality rate per 100,000 population (infant mortality per 1000 population; 2000–2010).

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Appendix 7: All regional age-group, all-cause mortality rate per 100,000 population (infant mortality per 1000 population; 2000–2010).

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# Appendix 8: Regional all-cause infant mortality rate per 1000 Live Births (2000–2010)

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P value < 0.01; chi-squared test trends 2000–2010
Appendix 9: Full Thematic Analysis Results

1. *What sort of evidence on regional disparities, including regional health disparities, do you, ministers and senior colleagues, find convincing?*

Theme One: Poor Evidential Foundation

Poor Evidential Foundation is a collective term covering multiple issues such as the poor evidence of the problem, the root causes, the existing solution and policies, and governance. The members of HLC described the poor evidence in different ways; however, it was chiefly expressed as lack of visibility.

“The key to avoid such unnecessary disparities is to have high visibility of the problems, their causes and alternative solutions in the form of policies and direct public and private interventions. The goal is not only to eliminate such disparities within and across regions, but also to elevate the entire country to an acceptable performance patterns that guarantee, first and foremost, the well-being of the people living on this land.”

a) Barrier: Lack of Evidence for Disparities

Participants attached importance to the role of evidence of regional disparities in improving the evidential foundation for policy. It was felt if availability of evidence of regional disparities was improved, including the mortality disparities, coupled with political commitment then the policy process can be accelerated and enhanced. Some members of HLC expressed satisfaction with the available evidence for their ongoing efforts to push the development agenda including efforts to tackle regional disparities. Other respondents felt that their efforts were not informed by evidence but that they have to act anyway.

“Even though such activities require intensive research based on historical data and trends, a luxury we don’t have in such pressured times, we can agree on the convincing
evidence that we believe are key for directing comprehensive and sustainable regional
development policies.”

When members of HLC were asked about the types of evidence that they find convincing
for policy, they identified several evidence characteristics including source, validity, and utility.
For instance, few participants mentioned that the observed regional disparities including health
disparities are not supported by population data.

“The presence of disparities in development leads to such poor health outcome. No
population data can support these assumptions. All of these assumptions are personal
experience of practicing health workers”

Some participants noted that evidence stemming from public finance and fiscal structure
is a major source for disparities evidence.

“An important source of evidence on regional disparities is the current structure of
expenditure in the national budget. This structure is mainly classified according to
functions of government and economic activities. That is, the classification of public
expenditure does not clearly indicate the public resources that are allocated to each
region”

Participants pointed out that the regional capacity is one of the challenges that contribute
to the poor evidence for regional disparities.

“Local capacity of regional government departments is weak, this was clear through the
field visits while preparing for the five year plans. The quality of reports lacks the basics
of planning and data collection methodologies”
b) *Barrier: Lack of Evidence for Root Causes*

HLC members said that lack of evidence for root causes of health disparities represented a major barrier for policy formulation. Members of HLC also revealed that root causes such socioeconomic conditions enable better understanding of regional disparities and improve the design of policy interventions. In most of the cases, participants shared the feeling of being more assured, more interested, and willing to push the disparities agenda when they were able to access and incorporate evidence of root causes in the process of translating evidence into policy.

“One of the most prominent indicators of the presence of developmental variance among areas is the immigration to the main cities... immigration also affects the demographic, economic and social characteristics of the population... immigration plays a vital role in the distribution of the population in the Saudi regions which has resulted in a clear variance between the 13 administrative regions”

Participants pointed out that the observed poor regional health outcomes are the result of poor socioeconomic factors such as employment but there is no population level data to support their observations or their personal experiences.

“Health outcome is a result of the social development within cities and regions. Ability for people to have jobs and build future is important. The presence of development disparities leads to such poor health outcome. No population data can support these assumptions. All of these assumptions are personal experience of practicing health workers”

Some participants noted that the increasing immigration to major cities due to poor employment, education, and public services in their regions led to imbalance in regional development and resulted in increasing regional disparities.
“if there was a real implementation of a balanced developmental process, it would have resulted in creating projects and governmental and/or private investments in each region which would thus create equal job opportunities with the same level of salaries in all of the regions without exception; in addition to providing municipal, educational, health and social services, this would discourage people from immigrating and uprooting to receive these services or to find employment with decent wages that could provide them with basic levels of living”

When members of HLC were presented with the map of regional disparity in mortality, many suspected that socioeconomic factors probably are the drivers for such disparity in mortality, even with the absence of scientific evidence. Their suspicion is drawn from their respective experiences, personal observations, and their current work within the committee.

“As the presented mortality map shows, mortality patterns of disparity between regions provide such evidence based on strong correlation between factors shaping mortality rate and socioeconomic conditions. This has already been demonstrated by the result so far where Al-Jouf high mortality rate of 274 per 100,000 population (2010), jumping to a significant 784% rate of change from year 2000, is linked to the low ranking of socioeconomic conditions of the region’s governorates on the General Development Index, as demonstrated in the HLC project output so far”

Other participants highlighted the impact of educational disparity on health outcomes such as mortality in Al-Jouf region.

“Other findings by Public Education Evaluation Commission (PEEC), indicate that the general education output in Al-Jouf shows lowest students’ scores in the Kingdom, way
below average. This evidence also corresponds to Al-Jouf’s highest unemployment rate in the Kingdom, as stated by Job Creation and Employment Commission (JCEC)”

c) **Barrier: Lack of Evidence for Existing Programs & Policies**

Members of the HLC pointed that poor integration between national, regional, and local policies at the planning and implementation phases have a major impact on regional disparities including health disparities. However, the lack of evidence of integration contributes to low visibility of regional disparities.

“Segregation of sectorial and spatial policies is a MAJOR concern... Policies of Previous national five year development plans DID not integrated the spatial dimension. A gap was apparent in the National Spatial Strategy and the national development plans. The gap is further enhanced by poor integration of sectoral budgeting system into regional level”

Participants noted that the lack of evidence on utilization of existing healthcare services contributes to regional health disparities

“There are numerous primary care centers commissioned in rural areas with populations around 500 people. These have been extremely difficult to run, especially with a commitment to open imaging, lab, dentistry and pharmacy in many of them, resulting in suboptimal service (it could be said that there may even be serious harm), and stretching of our already very limited resources.”

Participants pointed out that although there are many hospitals that are built in rural areas they may be underutilized.

“There is a glaring example of this in the so called 50-bed hospitals in rural areas. These have been very difficult to recruit into, and utilization has not exceeded 30% in best
cases. At the same time, they struggle to get biomedical engineering contractors to fix medical equipment which is often times down for many months as contractors include the limited penalties in their fee schedule.”

**d) Barrier: Lack of Evidence for Governance Impact**

Members of HLC commented that their governance structure concerns often using the words “centrality”, “decentralization”, and “restricted decision-making”. They expressed concerns that the existing regional governance model increases inefficient services, including healthcare services, and reduces the quality of healthcare and human development. Participants pointed out that there have been calls to reform governance; however, the lack of evidence of the effect of existing regional and local governance structure contributed to limited visibility of the issue of regional disparities.

“One of the reasons for the lag in regional development especially from an economic standpoint is the centrality of the decision-making and the restricted power of the decision-makers at the regional level”

Participants noted the role of civil society organization in providing visibility to the problem through empowering them and their regional outreach programs.

“Early mortality, including infant mortality are also due to the inefficiency of civil society institutions in playing their role in raising awareness levels”

**Theme Two: Need for Systems Thinking**

The need for systems thinking and approach to improving evidence on disparities was highly advocated by the members of HLC (Senge, 1997). Although the participants did not explicitly mention systems’ thinking, they pointed to different components of systems thinking such as monitoring and feedback and enablers. Participants believe that these components are
essential to addressing the complex issue of regional development, including reducing regional health disparities; therefore, improving the quality of disparities evidence for the Kingdom of Saudi Arabia.

a) Facilitator: Recognizing Interconnections

Participants mentioned that poor recognitions of the interconnectivity of different programs and initiatives for regional health development including addressing disparities are worrisome. Many of the participants noted that ministry-specific teams are not interested in a systems approach; therefore, their lack of interest would reduce their efforts. As a consequence, participants commented that regional development, including regional health disparities, should be led by an independent entity that coordinates all entities involved before building a strategy or an action plan for regional development for Saudi Arabia.

“To narrow disparities between regions, there is a need to create entity which will be responsible for coordinating work between different government bodies in regions to ensure a balance in development projects, government spending and in infrastructure projects”

Some participants noted the importance of interconnections from a fiscal perspective. They claim that given the context of Saudi Arabia, the success of any attempt towards regional fiscal reform for development needs a systems thinking approach.

“The current budgetary accounts focuses only on inputs without any indication for outputs or measures of the efficiency of government activities. Government agencies generally do not determine the targets or outputs they have to achieve with their budgetary allocations. There is a need for some sort of “value for money” approach”
b) **Facilitator: Monitoring and Feedback**

Participants pointed out that monitoring and feedback is not yet activated for meaningful regional development policy. They mentioned that current governmental feedback processes are not up to the government’s vision 2030 as it is not integrative or inclusive.

“Activate the monitoring and follow up process for the Vision 2030 programs and initiatives submitted by the entities (technically, financially, strategically, and according to the agreed upon tasks) repeatedly with inclusion and integration”

c) **Facilitator: Enablers**

The participants cited several enablers to systems thinking for improving regional disparities such as utilizing technology and telecommunication, setting values and principles, and empathizing with available evidence.

“Utilizing technology to bridge the gap by capitalizing on the fact that the penetration of smart phone devices is over 70% in Saudi Arabia, and using the now increasingly available applications to gather evidence as well as provide healthcare services”

Participants pointed out to transparency and clarity as major enablers to systems’ thinking to improve the availability of evidence for regional disparities.

“Convincing proofs based on regional disparities can be improved and developed through the following: transparency, clarity, ease of application and usage, participation planning, and monitoring and following up”

Some participants noted that the expectation for improving the availability of evidence on disparities requires a balance between the need for accurate data and the reality of existing information systems.
“Here in lies the importance of developing a strategy for regional development, while taking into account the convincing proofs based on regional variations in an accurate and realistic way”

d) **Facilitator: Need for Conceptual Frameworks and Models**

Members of the HLC talked about the importance of frameworks for improving the evidence for regional disparities including health disparities. Participants cited a few frameworks such as complexity and theoretical frameworks to providing or improving available and future collected evidence related to regional disparities.

“We need to develop a theoretical framework to understand the possible determinants of these patterns through understanding the most significant evidence we can gather.”

Participants pointed out that the need for complexity framework to address regional disparities including regional health disparities stems from the complexity of the issue of disparities where many upstream factors impact health outcomes.

“Areas such as health, education, human productive and innovative capacities, cultural worldviews, social cohesion, as well as quality of physical and natural settings that impact performance, need to be analyzed within a ‘complexity’ framework, where each area or system impacts on the other within the totality of the whole system”

**Theme Three: Need For Translational and Policy Research for Action**

Recognizing the poor foundational evidence on disparities that exists for Saudi Arabia illustrated in the first principal theme, members of the HLC called on researchers, national and international, to help improving the poor foundational evidence by producing translational policy research that can help them as senior policy makers. The HLC members talked about few
barriers and facilitators to the translational policy research for disparities including health disparities.

_a) Barrier: The Evidence Gap_

Given the fact that members of the HLC come from different sectors, members expressed their concerns about the evidence gaps that exist for regional development in Saudi Arabia. They felt that using urban development evidence or healthcare evidence only to frame regional disparities cannot solve this issue as it could act as an obstacle for the information needed by diverse policy makers; therefore, the policy formulation could be affected. They highlighted different research areas for disparities policies, including fiscal processes, programs’ efficiency, and implementation research.

“Research in the following areas could help in understanding regional disparities....

Allocation of budgetary resources should be complemented by studies of welfare analysis, which goes beyond understanding how prices and quantities are determined; to the calculation of how much value the markets create for society”

Members of the HLC talked about the historical time of Vision 2030 and its impact on policy-relevant research and their hope that researchers will help them in addressing the many pressing policy issues such as efficiency of regional services.

“Since Saudi is going through a new historical juncture represented in 2030 vision of the Kingdom and the National Program of transition in 2020, I hope that researchers would focus on the concept of increasing efficiency as a basis to provide services to citizens, and we have to focus on spreading awareness of the need to move from quantum to quality culture”
Participants pointed out the need for teaming up with national and international researchers to produce actionable evidence for regional development policy.

“Regional Development Planning depends mainly on international and local researchers to support the optimal planning process and implementation of economic development programs”

Participants noted the importance of lived experience and qualitative research in understanding the context and extend of regional disparities. They highlighted the need to reach out to regional emirates and regional public servants to better understand regional disparities.

“Departments in charge of regional planning have many things to say on the topic of disparities through their experience in the implementation of their plans and the regional challenges that face them... In my view, it is easy to learn from these experiences”

Some members of the HLC saw the opportunities in mapping regional disparities, including regional health disparities. They pointed out the opportunity of conducting regional case studies to gain more insights into the causes of the observed disparities.

“The disparities among different regions can be good material for policy research and analysis, making comparisons and understanding the causes and results”

“While the development of a plan is an important first step, evaluation of the plan’s proposed interventions and policies should be a priority.

b) Barrier: Lack of Policy-Relevant Research Funding and Incentives Misalignment

Members expressed their worries about the existing incentive system for local researchers, and identified it as a key barrier to driving policy-relevant research; therefore, reducing my motivation to produce evidence for action.

“I think the Saudi researchers in universities and other research centers have not yet
contributed to policies. Most academics do their research for the research sake and to submit for their promotions in their academic centers. It's extremely important that researchers should seek applicable policies, research leading to policies”

Participants noted the importance of revisiting the existing research funding and incentives criteria and modifying them towards policy-relevant research.

“The national allocations for research is little and can't really give enough incentives to national researchers to really spend the time and effort to conduct proper policy research. The criteria of distribution of research funds have to be revised focusing on funding applied research and policy driven”

c) Facilitator: Producing Culturally Appropriate Evidence

Members of the HLC stressed the significant influence of the Saudi culture on researching disparities for policy and action. They frequently mentioned that the design and conduct of regional disparities research for policy, including health disparities, should take into account the Saudi culture to provide culturally appropriate recommendations.

“But unfortunately, recently economic and social development studies are assigned to foreign research centers, which lacks the cultural, religious and social composition of population and they would just want to apply those models and development programs that have already applied in communities which are different in nature from the Saudi society”

Members of the HLC talked about the critical need to integrate Saudi culture in the process of policy research and analysis for regional disparities. Participants noted that this is of high importance to understanding the context and it increases the chances of success in tackling disparities.
“If the term ‘sustainable development’ is interpreted locally, other traditional dimensions may become apparent and begin to inform policy statements. Rethinking these traditions in the current framework of sustainable development may bring about a new formulation of localized policy-making content that is more integrated with the local culture and has higher chance of succeeding”

Participants pointed out the importance of culturally appropriate benchmarking for analysis or policy solutions recalling their experiences with international agencies.

“International researchers are also important to bring the international benchmarks but these benchmarks should be accommodated to local culture. I did have experience with many UN and World Bank research agencies, their findings have to be really dealt with carefully”

d) Facilitator: Capacity Building for Disparities Policy Research

Members mentioned that the limited national capacity to produce policy-relevant evidence for regional disparities is one of the barriers to tackling regional disparities. Therefore, they highlighted the need for knowledge transfer, teaming with national and international researchers, and institutionalization of research into policy.

“Signing on the UN Sustainable Development Goals (SDGs) means commitment to a measurable state of affairs. To merge with the rest of the world and improve our position on the index, we need to be open to new ideas and concepts. This necessitates seeking knowledge transfer and learning from international experts in many parts of the world, where cases of social determinants of regional disparities and policy objectives provide insights into our conditions at home”

Participants pointed out the linkage between poverty and health disparity and the need for
research informed planning to address this dimension. They highlighted the need for training and capacity building.

“Researchers can help in developing an effective plan to reduce poverty and health disparity in Saudi Arabia that includes a multi-year disparities plan that includes training current and future local researchers and build their capacity and capabilities”

Some participants recalled their visits to other countries and international centers as an example of existing models that Saudi Arabia can learn from.

“I will mention the South Korean experience in this. They have research centers for every ministry; their policies are based on solid research based on evidence. Policies are tested before final application”

Some members disagreed with the others in regards to policy research capacity. They motioned that the capacity exists but the lack of policy relevant research is related to the process of institutionalizing research into policy.

“In Saudi Arabia, I believe we do have capacities to contribute more to policy issues. But this needs to be institutionalized”

Participants pointed out the need for specialized disparities research centers, as the issue of disparities is complex.

“It may be worth considering specialized research centers, especially a decision support center regarding the priorities of issues related to regional disparities to be studied by researchers and specialized research centers locally and around the world”

Some members noted that the lack of political will in building capacity for policy-relevant research is an issue that they’ve faced previously and it might hamper the regional disparities efforts as well.
“I did propose to establish a policy center equipped with actual solid researchers dealing with proposing and assessing regional policies, but this did not find much acceptance”

e) Facilitator: Transparency

Members attached importance to transparency in improving disparities evidence for action. They mentioned annual reporting of results of regional policies, open data, and public reporting of regional monitoring and evaluation.

“The disparities plan should consist of interventions that have been shown to be effective in the field of health disparities, include an evaluative component that continues to conduct research directed at the development of new interventions, include concrete short and long-term targets, publically publishes data, and policy results should be reported publicly on an annual basis”

Participants noted the importance of transparency in evaluating national and regional plans. They believe that including evaluation from the design phase is a sign of commitment to transparency and it will improve the outcomes of regional and national plans.

“In order to determine if interventions are effective, evaluation strategies need to be developed in conjunction with the plan. A common problem that emerges in the national and regional reports on, for instance, reducing poverty is the lack of evaluation”
Appendix 4: Applying Health Disparities Action Framework Using Series of Questions for Planners

The framework uses a series of questions, as shown below, to help the planners in applying the framework to tackle health disparities.

**Defining the problem**

- **Do we know the population we are working with?**

  This project describes the Saudi Arabian regional infant mortality rate trends from 2000 to 2010. It shows the percentage change in infant mortality rate for each region using whole population data from the census, together with regional civil registry data (Figure 7). Infants in north regions are three times more likely to die before their first birthday than babies born in the south regions (Table 7). However, this analysis doesn’t capture small groups data such as gender, the cause of death, and other health and social outcomes.

- **What are the living and working conditions experienced by the population?**

  This project captures the geographic dimension by regions. However, regional profiles should include social and economic data; environmental factors; housing; education; healthcare provision; and available employment. A recent proposed geodatabase for the General Authority of Statistics (GaStata) in Saudi Arabia that is similar to United States Census Bureau can be instrumental for capturing the needed information (Alghamdi, 2016). However, this information does exist, and needs analysis for policy until the proposed geodatabase is fully adopted.

- **What do we know about the social causes of the problem we are seeking to address?**

  The data used for this project does not capture causes of infant mortality. The steering committee needs to capture this information by requesting it from all healthcare providers in Saudi Arabia. The Saudi Health Council is the executive coordinator for the Saudi Arabian health sector (Saudi Arabia Health Council, 2017). This council should activate its platform and
provide the steering committee with the causes for infant mortality, its regional distribution, and the accompanying reported socioeconomic determinants. The steering committee should later draw on academic studies on the links between social factors and infant mortality, such as how and why might poverty, parents’ education or housing impact infant mortality disparities.

- **What is it like to experience the problem?**

  It is important to learn from the journey of regional infant mortality and its different touch points. It is crucial to capture the voice of the voiceless to help understand the extent of the problem of infant mortality disparities as well as to help develop relevant solutions. Lived experience might be gathered through, for example, interviewing representative from regional councils, academic qualitative research, regional case studies and community or public involvement in participatory process activating the newly passed civil society organizations law in Saudi Arabia (Ministry of Labor and Social Development, 2016).

*Agreeing on the aim*

- **Is the aim to address health disparities?**

  The scope of the proposed steering committee is to address the needed systemic and structural changes to reduce infant mortality disparities. Their proposed actions should, first, be able to demonstrate impact on infant mortality disparities. Second, to demonstrate impact on infant mortality improvement for individual regions.

- **Is the aim to target a particular group?**

  This project showed that the worst performing region in infant mortality is Hail (Table 7, Appendix 8). Hail should be targeted and should be sought in order to understand its high infant mortality rate and to contribute to finding solutions. This targeted aim and its actions would clearly benefit infants born in Hail, but they could not claim to reduce the infant mortality gap
without action or comparison at the other end of the scale, such as national infant mortality rate. It is important to note that his approach is unlikely to address the complexity of infant mortality disparities that exist in Hail or other regions. Targeting geographical areas with or without consideration of comparator such as national infant mortality rate, have not always demonstrated reductions in mortality levels with the gap in health experienced by rich and poor continuing to widen rather than close, and the health gradient from poor to rich remaining in place (Leyland, Dundas, McLoone, & Boddy, 2007)

- **Is the aim to reduce a gap between one group and another?**

  This project advocates for prioritizing the aim of reducing at least 25% the gap in mortality between regional and national infant mortality rate by 2030 (Gray et al., 2009). The steering committee needs to consider carefully not just the targeted regions but also the national infant mortality intended to compare progress with. The national infant mortality rate, i.e. comparator, is unlikely to remain static, and attributing an intervention’s impact in the targeted region using this method needs to be examined carefully.

- **Is the aim to reduce health disparities across the whole population?**

  Although universal health services and programs can reduce infant mortality disparities in a non-stigmatized approach, they often result in widening disparities or remaining the same. This is because universal services are designed with the assumption of equitable distribution and utilization and the evidence is contrary to this assumption. This project provides an evidence for increasing disparities in regional infant mortality despite the Saudi Arabian universal health coverage provided by Ministry of Health (Almalki, Fitzgerald, & Clark, 2011).
The three approaches to stating the aim of addressing regional infant mortality disparities, although different, are intertwined. The framework is based on the argument is that each approach can represent the goal for specific policies, with targeting and closing the gap contributing to reducing the gradient and each adding a further layer to policy impact (Graham & Kelly, 2004). All three approaches to reducing infant mortality disparities taken together within a regional development goal to reduce regional disparities would enable partnerships and teams to identify specific actions within their respective ministries and to identify actions that would need to be taken elsewhere (Graham & Kelly, 2004).

**Measuring the impact**

Infant mortality disparities are complex and there are no straightforward solutions. No single intervention will lead to reducing disparities but they might improve infant mortality in targets regions. Therefore, and considering the complexity of infant disparities, we need to avoid assuming that an improvement in regional infant mortality will lead to a reduction in regional infant mortality disparities.

- **Is the aim of the action to target a particular group?**

  For targeted regional actions, such as targeting Hail infant mortality, the impact needs to measure towards a planned regional target. This project’s scope does not set regional infant mortality targets as they are closely related to region-specific actions that need to be agreed on by the proposed steering committee. However, it is important to note that improvement in regional infant mortality rates will not be able to claim a reduction in infant mortality disparities unless they are compared to national infant mortality rate.
• **Is the aim to reduce health disparities between a targeted group and a comparator group?**

This project sets a target for reducing regional infant mortality disparities. The target is to *reduce the regional infant mortality rate ratio (region to national) to 2 or below by 2030.* This translates to reduction of at least 25% the gap in mortality between regional and national infant mortality rate by 2030 (Gray et al., 2009). The baseline is the project’s 2010 regional infant mortality rates calculated using civil registry data and employing direct calculation methodology (Appendix 8). It is important to note that this target does not take into account non-regional dimensions of disparities in infant mortality, for example, gender disparities.

• **Is the aim to reduce inequalities across the population?**

This project sets a target for reducing national infant mortality across the whole population. The target is to achieve an overall *national infant mortality rate that is 12 infants deaths per 1,000 live births or below by 2030,* using civil registry data and direct calculation methodology. This target is set to achieve the target 3.2 (By 2030, end preventable deaths of newborns and children under 5 years of age, with all countries aiming to reduce neonatal mortality to at least as low as 12 per 1,000 live births and under-5 mortality to at least as low as 25 per 1,000 live births) for Sustainable Development Goal 3 (United Nations, 2015). Infant mortality rate has been replaced by neonatal mortality rate for monitoring SDGs after the shift from MDGs in 2015 (United Nations General Assembly, 2015). Although there are strong and valid clinical reasons for this shift, replacing infant mortality rate with neonatal mortality rate probably will not be feasible for Saudi Arabia (United Nations General Assembly, 2015). The are two reasons for this challenge: first, the challenge of collecting real neonatal mortality data rather than deriving it similar to infant mortality rate through census estimation; and second, the
resistance in changing the existing consistent datasets and data collection methods for infant mortality. However, I am proposing adopting SDG 3.2 target for reducing national infant mortality by 2030 till neonatal data becomes available for monitoring.

**Seeking solutions: mitigating, preventing or undoing health disparities?**

As mentioned earlier, the scope of this project does not include recommending interventions to reducing regional infant mortality. This project initiates the process of applying the framework with the intention that the proposed steering committee to continue this process.

The three levels of intervention of addressing regional infant mortality disparities, although different, are intertwined. The framework is based on the argument is that each level of intervention can represent specific policies, with targeting and closing the gap contributing to reducing infant disparities across the whole population and each adding a further layer to policy interventions (Graham & Kelly, 2004).

- **Mitigating:** What actions contribute to mitigating the impact of social disparities on health?

  Most of the services provided by Ministry of Health and Ministry of Labor and Social Development act at this level, where mothers and infants are seeking help. Services could increase their sensitivity to social disparities to better understand the high region-specific infant mortality rate and the regional infant mortality disparities. This also helps in seeking multi-agency interventions. An example for this might be revising regional prenatal visitation program to include strategies for following-up missed appointments, including routine enquiry about social circumstances and providing social support for mothers in need.
• **Preventing:** How can we prevent social disparities leading to health disparities?

Ministry of Health and other healthcare providers are not solely responsible for housing and working conditions that can prevent social disparities leading to infant mortality disparities. However, they could help in partnering with other ministries in doing so. Infant mortality disparities reduction is the best winnable goal for prevention. The focus on early years of life where equality in health and social outcomes is predicted by the better start of living condition such as housing, income, education and healthy environment. An example for this is to advocate for female transportation policy, as women still can not drive with poor public transportation system, to maximize the programmatic efforts to reduce missed prenatal appointment.

• **Undoing:** Can we act to reverse health disparities gaps or gradients?

Although this level of action constitutes the most powerful level, it is the most complex and politically challenging to pursue. Actions at this level include advocating for and influencing change in, fiscal, legislation, and cultural policies and norms. An example for this is providing local and international researchers with access to data to run epidemiological and policy analyses to influence economic policy change, or reviewing the impact of existing and future policies on infant mortality disparities.