

A Capability Approach to Understanding the Efficient Conversion of Health Resources into Health Outcomes: Piloting a Mixed-Methods Methodology in Northern Vietnam

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ABSTRACT

Achieving efficiency, or maximizing the outputs achieved per unit of resource invested, is of great interest to governments, donors and other stakeholders in the health sector. Many studies consider efficiency in public health using Cost Effectiveness Analyses which estimate the health outcomes achieved per unit of cost. Others employ Technical Efficiency Analysis to understand which health system units, usually hospitals, provide the most health services per unit of resource. However, very little is known about demand-side efficiency or how efficiently individuals convert available health resources into health outcomes.

To address this gap, I developed and piloted a two-stage methodology using Amartya Sen's Capability Approach as a theoretical framework mapping the process by which individuals convert resources into outcomes. The first stage estimates conversion efficiency using Order-m Efficiency Analysis then identifies the social groups most likely to be efficient using regression analysis. The second stage undertakes focus group discussions and semi-structured interviews to investigate how and why the social groups identified in the quantitative stage were more likely to be efficient.

I conducted my analysis in Ba Vi district, northern Vietnam looking specifically at how efficiently pregnant women converted maternal health resources—including health facilities and human resources for health—into both appropriate care and healthy pregnancy and delivery. I found that ethnic minorities and women in non-mountainous areas were more likely to be efficient at achieving appropriate care while ethnic minorities and less educated women are more likely to be efficient at achieving healthy pregnancy and delivery outcomes. Through qualitative feedback, women who were ethnic majorities, better educated and generally more affluent expressed stronger technology preference, greater use of the private sector, less continuity of care, tendencies towards overnutrition, less focus on mental and emotional health and more varied sources of health information including advertising and the internet. Evidence links each of these themes to adverse care and/or health outcomes. Consequently, the more affluent populations, who also have a greater endowment of public health resources, may be less likely to achieve good outcomes—explaining at least in part why they are found to be less efficient. My findings highlight that the development process and attendant epidemiological and nutrition transitions give rise to a new set of challenges not solely for public health, but also for the efficiency with which it is achieved using existing health system resources.

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LIST OF ABBREVIATIONS

AIDS	Acquired Immune Deficiency Syndrome
ANC	Antenatal Care
BHPS	British Household Panel Survey
BMI	Body Mass Index
CDC	Center for Disease Control
CHC	Commune Health Center
CSDH	Commission on Social Determinants of Health
C-Section	Cesarean Section
CUREC	Central University Research Ethics Committee
CVD	Cardio Vascular Disease
DALY	Disability Adjusted Life Year
DEA	Data Envelopment Analysis
DHS	Demographic and Health Survey
FAO	Food and Agriculture Organization
FDH	Free Disposal Hull
FGD	Focus Group Discussion
FILABAVI	Fields Laboratory Ba Vi
GDP	Gross Domestic Product
GNI	Gross National Income
GP	General Practitioner
HDSS	Health and Demographic Surveillance Site
HIC	High Income Country
HIV	Human Immunodeficiency Virus
ICECAP	ICEpop Capability Measure
ICECAP-O	ICEpop Capability Measure for Older People
LIC	Low Income Country
LMIC	Lower Middle Income Country
MDG	Millennium Development Goals
MNCH	Maternal Neonatal and Child Health

NHS	National Health Service
NICE	National Institute of Care and Health Excellence
OLS	Ordinary Least Squares
PPM	Public Private Mix
PPP	Purchasing Power Parity
QALY	Quality Adjusted Life Year
RCT	Randomized Control Trial
TB	Tuberculosis
UK	United Kingdom
UN	United Nations
UNDP	United Nations Development Program
UNICEF	United Nations Children's Fund
US	United States of America
USD	United States Dollars
VHLSS	Vietnam Household Living Standards Survey
VLSS	Vietnam Living Standards Survey
WHO	World Health Organization
WOMAC	Western Ontario and McMaster Universities Arthritis Index

CHAPTER 1: INTRODUCTION & BACKGROUND

1.1 Introduction

In *Poverty and Famines*, Amartya Sen argued that famines are not necessarily caused by a shortage of food, but rather by social factors that constrain people's ability to access it (Sen, 1982). My research investigates a similar dynamic in the field of global health. While international donors and national governments have invested billions of dollars in improving the supply of essential health resources – including medicines, vaccines, clinics, health workers and health information -- these resources too often fail to achieve the desired health outcomes. In one example, a systematic review of randomized controlled trials of HIV prevention programs that provide health information and education found that none of these interventions had a significant effect on disease incidence (Padian et al., 2010). Likewise, heavy subsidies and social marketing to promote gold standard Malaria treatment in Cambodia has thus far resulted in only slow uptake of recommended Artemisinin Combination Therapy and Rapid Diagnostic Tests (Yeung et al., 2011). Similarly, a study in India found that making childhood immunizations free, reliably accessible, and heavily promoted, raised complete vaccinations rates only as high as 18% (Banerjee et al., 2010). Thus, as in Sen's analysis of the 1943 Bengal Famine, availability of key resources has proven necessary but not sufficient if demand side constraints-- such as poverty, social marginalization, gender dynamics or education levels-- are ignored.

A broad literature addresses demand side constraints to health service access and utilization. Systematic reviews map how access to care and service utilization are influenced by factors such as geography, income, gender, cultural beliefs, migration, language differences, knowledge/education and social networks (Colvin et al., 2013, Agudelo-Suárez et al., 2012, Adaui et al., 2013, Boerleider et al., 2013).

However, comprehensively understanding demand side dynamics requires more than looking at access to services or patterns of healthcare utilization. For example, in order to achieve the outcome of effectively treated Malaria, a patient must not only seek care but must also effectively engage with health staff, undergo diagnosis, obtain the medicine prescribed, take the medicine as recommended and seek further care for side effects, complications or unresolved cases. Thus a more complete understanding of the demand side involves investigating not just care-seeking but the entire process by which people convert available resources into health outcomes.

Thus the question becomes one of efficiency—or achieving the optimal output, in this case health outcomes, from available input, in this case health resources. Identifying and addressing the factors that prevent people not just from accessing resources but from taking optimal advantage of them has the potential to improve the return on investments in global health.

In this chapter, I review the existing literature on efficiency in public health in order to identify the gaps related to demand-side efficiency as well as methodologies and findings that may be relevant to further exploration of this issue. In the second chapter, I discuss the geographic and health context in which I examine this issue of demand side efficiency; I explain why Vietnam, as a country context, and healthy pregnancy and delivery, as a health issue, offer an interesting and appropriate context in which to consider the optimal conversion of health resources into health outcomes. In the third chapter, I present the mixed-methods approach I applied in order to examine, quantitatively, which groups of people are most likely to be efficient at converting health resources into health outcomes and, qualitatively, the perceptions, choices and behaviors that contribute to efficiency. In

the fourth chapter, I present my quantitative analysis and findings using data on maternal care and healthy pregnancy and delivery from Ba Vi district in Northern Vietnam. In the fifth chapter, I present the findings of my qualitative investigation, highlighting themes which may help explain how and why the groups identified in the quantitative stage were more likely to achieve efficiency. In the final chapter, I discuss these findings referring back to the conceptual framework of the Capability Approach. I also suggest some policy approaches to targeting the less efficient converters and the specific challenges they face in achieving the optimal health outcomes with available resources.

1.2 Background

Achieving efficiency, which is defined as maximizing the outputs achieved per unit of resource inputs invested (Palmer and Torgerson, 1999), is naturally of great interest to national governments, international donors and other stakeholders in the health sector. As a result, it has been studied extensively. I review the existing literature on efficiency in public health in order to identify the gaps related to demand-side efficiency as well as methodologies and findings that may be relevant to further exploration of this issue.

1.2.1 Existing Approaches to Efficiency in Public Health

1.2.1.1 Cost-Effectiveness Analyses

One approach to understanding efficiency in the health sector is Cost-Effectiveness Analysis which estimates the ratio of the cost of an intervention to the health gains it achieves. The most straightforward cost-effectiveness analyses measure cost per health outcome (Drummond et al., 2005), such as the cost per patient treated for tuberculosis (Ferroussier et al., 2007) or per life year saved by vaccination (Rose et al., 2009). This type of analysis has the benefit of being methodologically straightforward and producing results that are easy to interpret. It is criticized, however, for being difficult to compare across interventions

(Grosse et al., 2007, Denil et al.). For example, it is difficult to argue whether spending \$100 per patient treated for TB is more or less efficient than spending \$100 per life year saved by a vaccine. Cost Effectiveness Analyses which use health outcomes, such as morbidities treated or avoided, are also criticized for failing to account for the actual impact of the health outcome on people's lives and well-being (Grosse et al., 2007, Denil et al.) and to account for trade-offs in morbidity and mortality such as extending life but only with increased morbidity or disability (Drummond et al., 2005).

1.2.1.2 Cost Utility Analysis

In response, Cost-Utility Analysis, uses a combined measure of health outcome and the resulting impact on quality of life as its denominator (Drummond et al., 2005). The most common measures combining health outcomes and their utility are Quality Adjusted Life Years or Disability Adjusted Life Years which multiply the life years produced by an intervention by a measure of the quality of life during those extra years (Galárraga et al., 2009, Mäklin et al., 2012, Grosse et al., 2007). Cost-Utility measures are straightforward to compare across interventions (Grosse et al., 2007, Denil et al.) and account for both the health outcomes and their impact on welfare—or both length and quality of life (Drummond et al., 2005). They are most commonly criticized however for being more complex and resource intensive to generate and less intuitively meaningful than Cost-Effectiveness measures that look at cost per outcome (Denil et al., Grosse et al., 2007).

1.2.1.3 Cost-Benefit Analysis

A third approach is Cost-Benefit Analysis which compares the cost of an intervention to a monetized measure of social benefit (Drummond et al., 2005). Cost-Benefit Analysis is intuitive to interpret and to compare across interventions. Furthermore, while Cost-Effectiveness Analysis and Cost-Utility Analysis inform allocative efficiency—or how best to

direct a limited budget—Cost Benefit Analysis facilitates the consideration of the potential monetary benefits of expanding the budget (Drummond et al., 2005). However, despite its unique informational advantages, assigning a social cost to health benefits requires methodological decisions and assumptions to identify and aggregate the likely value of health and human life that can be difficult to justify (Grosse et al., 2007). Moreover, some have argued that even trying to monetize health and human life is fundamentally unethical (Coast, 2004, Grosse et al., 2007).

1.2.1.4 Applications and Trade-Offs of CEA, CBA and CUA

Maximizing efficiency in public health and health systems has been investigated from a variety of angles using Cost-Effectiveness, Cost-Utility and Cost-Benefit Analyses. Many types of interventions have been evaluated from a cost-effectiveness perspective including new technologies (De Steur et al., 2012, Abbott et al., 2012), treatment protocols (Fitzpatrick and Floyd, 2012), public health approaches (Duintjer Tebbens et al., 2010) and changes to health system structures (Ferroussier et al., 2007). Cost-Utility analyses have also been applied across the spectrum of diseases and public health concerns ranging from high profile infectious diseases such as HIV (Galárraga et al., 2009, Dandona et al., 2010), to neglected tropical diseases such as schistosomiasis (King et al., 2011) as well as non-communicable diseases (Ha and Chisholm, 2011) and associated behaviors (Higashi et al., 2011), from Maternal and Child Health (Black et al., 2008), to mental health (Lewis et al., 2012). A wide range of research methodologies have been used to estimate the outcome measures used in Cost-Effectiveness and Cost-Utility analyses ranging from mathematical modeling (Barton et al., 2011) to observational (Jit et al., 2011), quasi experimental (Sijbesma and Christoffers, 2009, Johansson et al., 2008) and experimental studies (Wiseman et al., 2012, Banerjee et al., 2010).

While Cost-Effectiveness and Cost-Utility Analyses are very common in the academic literature evaluating the efficiency of health programs, some have argued that they have been less influential in informing policy and decision-making (Birch and Gafni, 2006, Grosse et al., 2007). Perhaps in response, policy makers and national institutions such as the UK's National Institute for Health and Care Excellence (NICE) have increasingly tried to integrate cost-effectiveness analyses into decision making generally by comparing the cost-effectiveness of a current program with the cost-effectiveness of a new program (Kelly et al., 2010, NICE, 2006). However, in addition to the trade-offs inherent in the choice of cost-effectiveness, cost-utility or cost-benefit approaches, there are also overarching criticisms of these methods.

Some of the criticism of cost-effectiveness analysis and cost-utility analysis comes from a social justice perspective which largely rejects the welfarist, or utility maximizing, construct (Harris, 1987, Harris, 1988, Singer et al., 1995). They argue that Cost Effectiveness Analysis, and more specifically the decision-making paradigm which maximizes cost-utility inherently discriminates against people who are older or who have harder to treat conditions (Harris, 1987, Harris, 1988) as well as people who are disabled (Singer et al., 1995) though these people have equal moral claim to duration and quality of life. Furthermore, identifying and prioritizing the most cost-effective interventions does not consider their effect on the overall distribution of health outcomes nor the arguable moral imperative of assuring a minimum standard for the worst-off (Coast et al., 2008d). In fact it may very likely have adverse effects in both cases. This point raises a critical issue to which I will return: that efficiency, however it is measured, is a complement not a substitute for measuring health outcomes and the distribution of health outcomes. While maximizing efficiency allows the greatest impact to be had with scarce resources, it would be unacceptable to do so to the detriment of overall health outcomes as well as health equity.

Both Coast et al. (2008) and Anand (2005) further criticize cost-utility on the grounds that it depends on a person's own evaluation of their welfare and thus is susceptible to adaptive preferences wherein very badly off individuals adapt to their circumstances and no longer attribute disutility to them (Anand, 2005, Coast et al., 2008c). As a partial remedy to these shortcomings both Coast and Anand recommend a Capability Approach that evaluates interventions based on their impact on the capabilities people value and have reason to value (Grewal et al., 2006, Coast et al., 2008a, Coast et al., 2008c, Anand, 2005).

While joining the proponents of the Capability Approach in their concerns regarding equity, Birch and Gafni (2006) criticize cost effectiveness-based decision making from a methodological and strategic perspective. They argue that decision-making based on comparative Cost Effectiveness Analysis erroneously assumes both divisibility and constant returns to scale of the intervention inputs and outputs. To illustrate this issue they give the example of a kidney dialysis machine which produces 50 QALYs per year. In this case neither divisibility, that one can purchase a fraction of a dialysis machine, nor constant returns to scale, that 10 dialysis machines would produce 500 QALYs, are reasonable assumptions (Birch and Gafni, 2006). They also raise the strategic issue that choosing interventions based on comparative cost effectiveness does not take into account the overall budget constraints nor does it necessarily align with broad policy objectives. It is easy to imagine a scenario where the top ten most cost effective interventions are neither affordable within the budget nor do they accomplish an overall health objective such as increasing life expectancy or reducing morbidity from chronic disease (Gafni and Birch, 2006).

Yet there is another key limitation of cost-effectiveness analysis which is not addressed by any of these critiques. While cost-effectiveness analyses estimate the impacts of a given

health resource (e.g. vaccine, medicine, technology, or care) per dollar or pound spent on them, they do not address whether impacts have been optimized per unit of health resource. In one example used above, a vaccine program reaches only 18% of children in rural India (Banerjee et al., 2010). It is easy to imagine a second program which, for the same cost, reaches 25% of children. Using cost-effectiveness analysis the latter program would be preferred as having better outcomes per cost. But the question of how close or far those outcomes are from the *optimal* achievable outcomes remains. Perhaps an optimal vaccine program could reach 80% or 90% or even 100% of children. Cost-effectiveness analysis does not shed light on this issue.

The issue of optimizing the relationship between health resources and health outcomes is more directly addressed by a smaller but growing literature which utilizes Technical Efficiency Analysis. Originally developed within the field of production economics, this approach was designed to maximize a firm's production of outputs for a given set of inputs (Fare et al., 1994, Rao et al., 2005).

1.2.1.5 Technical Efficiency Analysis

The Technical Efficiency Analysis literature in health studies the level of output, in this case health outcomes, achieved per level of input, in this case health-related resources. Unlike Cost Effective Analysis which generates a ratio of costs to outcomes, Technical Efficiency Analysis generates an efficiency frontier representing the highest possible level of outcome for each level of resource. To take a simple example, assume that for every doctor on staff, a hospital can potentially treat ten patients. Thus the efficiency frontier is given by the function.

$$\text{\# of patients treated} = \text{\# of doctors} \times 10$$

A graph of the efficiency frontier, representing the maximum output per level of input is shown in Figure 1.1.

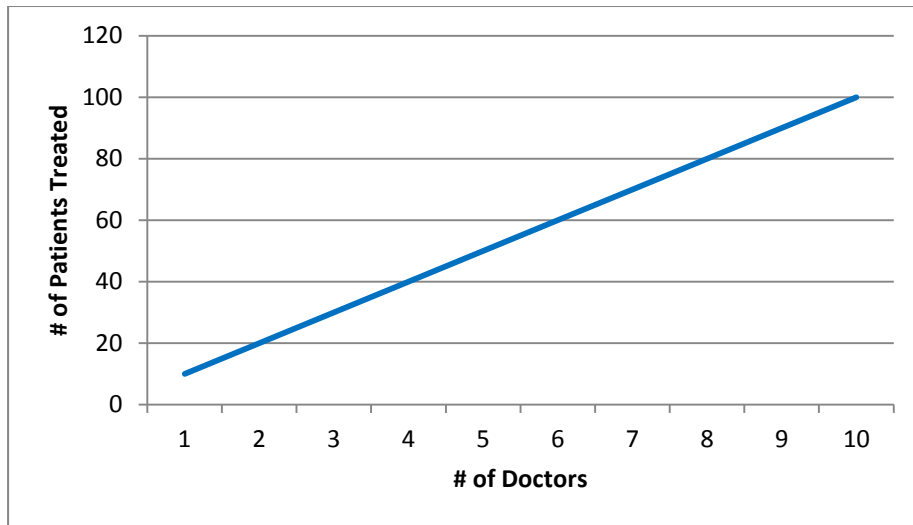


Figure 1.1: Efficiency Frontier if # of patients treated = # of doctors x 10

Now, assume that there are two hospitals: Hospital A has 4 doctors and treats 40 patients per week and Hospital B has 6 doctors and treats 50 patients per week. They are represented below in Figure 1.2:

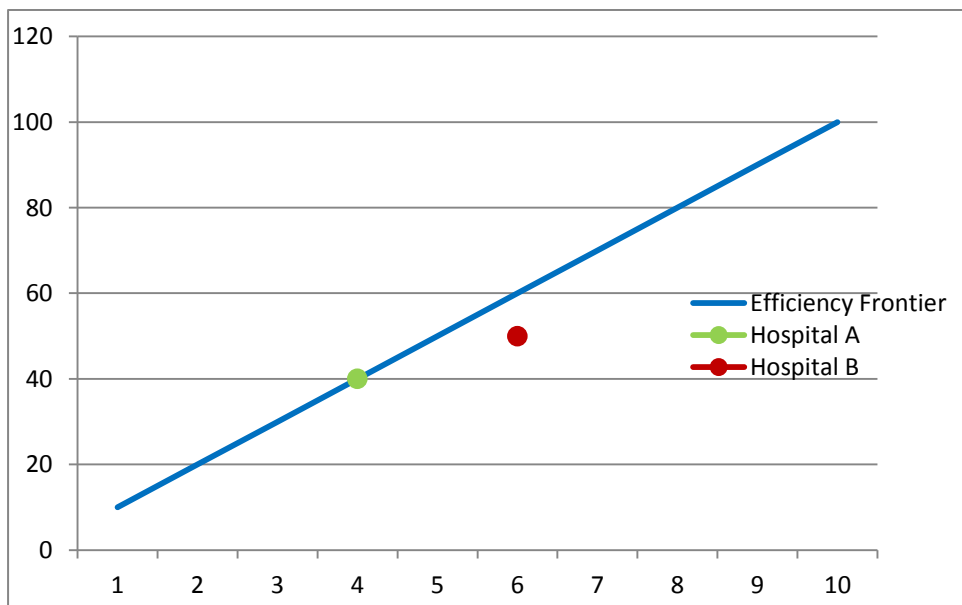


Figure 1.2: Efficiency Frontier Showing Hospitals A and B

As Figure 1.2 demonstrates, Hospital A lies on the efficiency frontier indicating that it has optimized efficiency, or maximized its output given its resource endowment. Hospital B however, lies below the efficiency frontier, indicating its efficiency is sub optimal. We can generate an efficiency score for each hospital by comparing its output to the optimal output achievable at the given level of resource. This means that for Hospital A:

$$\text{Efficiency Score} = \frac{\text{Optimal Output with 4 Doctors}}{\text{Achieved Output with 4 Doctors}} = \frac{40}{40} = 1$$

Whereas for hospital B:

$$\text{Efficiency Score} = \frac{\text{Optimal Output with 6 Doctors}}{\text{Achieved Output with 6 Doctors}} = \frac{60}{50} = 1.2$$

Hospital A's efficiency score of 1 indicates that it is efficient. Hospital B's efficiency score of greater than 1 indicates that it is inefficient. Specifically, the score of 1.2 indicates that Hospital B needs to increase its output by a factor of 1.2 or an additional 20% to become efficient.

$$1.2 \times 50 \text{ patient} = 60 \text{ patients} = \text{Optimal Output for Hospital w/ 6 Doctors}$$

The comparison between Hospital A and Hospital B also underscores how outcomes and efficiency differ. While Hospital B achieves the better health outcomes, in that it treats the larger number of patients, Hospital A is more efficient as it treats more patients *per unit of resource*, in this case, per doctor.¹

As discussed in greater detail below, some efficiency analyses go a step further by using the efficiency scores generated as the dependent variable in regression analysis in order to understand how institutional or social factors are associated with efficiency.

¹ This example also highlights how this type of technical efficiency differs from cost-effectiveness by considering the output *per unit of resource* as opposed to *per unit of cost*.

Clearly, the results derived from an efficiency analysis depend largely on how the efficiency frontier is constructed. In the example above, I define the efficiency frontier by assuming a multiplicative relationship between inputs (# of doctors) and outputs (# of patients treated). Because I specify, *a priori*, the functional form of the frontier this would be considered a parametric approach.

However, in practice, it is difficult to justify assumptions about the functional form of the efficiency frontier—or an equation describing a consistent relationship between inputs and outputs. Why should the relationship between doctors and patients treated be multiplicative by a factor of 10? Why not 5? Or why not assume that increasing the number of doctors leads to economies of scale wherein everyone is able to see more patients and thus there are increasing marginal returns or an exponential relationship between number of doctors and number of patients treated?

To avoid the problem of having to make assumptions about the functional relationship between inputs and outputs, it is possible to generate an efficiency frontier using a non-parametric approach, or an approach which simply draws a frontier around the data without specifying any relationship between input and output. One common non-parametric approach proposed by Charnes et al. (1978) is aptly named Data Envelopment Analysis (DEA) (Charnes et al., 1978). Figure 1.3 shows a hypothetical dataset while Figure 1.4 shows the efficiency frontier that Data Envelopment Analysis would derive from it.

Hospital	# of Doctors	# of Patients Treated
Hospital A	1	12
Hospital B	3	13
Hospital C	5	27
Hospital D	6	21
Hospital E	9	35

Figure 1.3: Hypothetical Dataset of # of Doctors and # of Patients Treated per Hospital

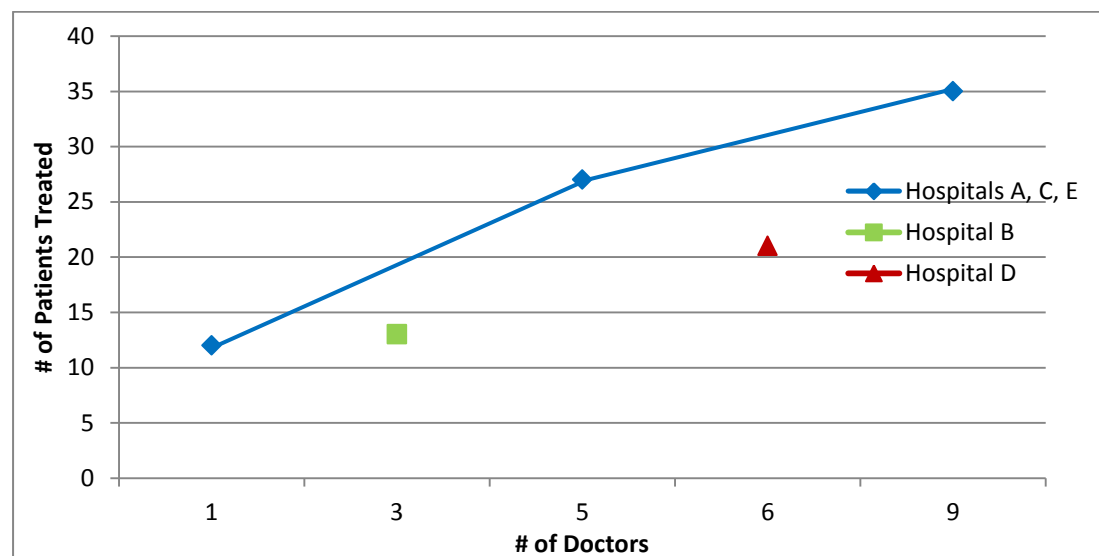


Figure 1.4: DEA Efficiency Frontier for Hospitals A-E

Data Envelopment Analysis wraps an efficiency frontier around the farthest outlying data points, or the units achieving the highest output per input, i.e. the units with greatest efficiency. While Data Envelopment Analysis does not assume any particular form of the efficiency frontier it does assume convexity – or a smooth frontier which is continuously increasing as resources increase. Again, the hospitals on the frontier, A, C and E, are efficient while those below the frontier, B and D, are inefficient.

A growing body of literature has applied, Technical Efficiency Analysis, and in particular Data Envelopment Analysis to understand efficiency – or the amount of health outcomes achieved per health resources — within the health sector. As the example above

demonstrates, this type of efficiency analysis is intuitively suited to assessing the relative efficiencies of health care facilities. Reflecting the complexity of the provision of healthcare in the real world, most of the analyses look at multiple input and multiple output variables at once in a multi-dimensional variation of the stylized example above. For example, several studies consider the number of beds and personnel (Mané, 2012a, Geitona et al., 2012) as well as operating expenses (Nayar et al., 2013) as inputs and the number of inpatients and inpatient days (Geitona et al., 2012) as well as births attended (Mané, 2012b) and training conducted (Nayar et al., 2013) as outputs. A more abstract example considers management and social factors such as governance, workforce development and economic conditions as inputs and access, coordination, continuity and comprehensiveness of care as well as quality indicators as outputs (Pelone et al., 2013).

These types of Data Envelopment Analysis have been used to assess and compare efficiencies across hospitals, health centers, clinical divisions and other health care institutions in an impressively diverse range of contexts. These include Greece (Pantouvakis and Mpogiatzidis, 2013, Polyzos, 2012) the United States (Nedelea and Fannin, 2013, Nayar et al., 2013) Denmark (Kristensen et al., 2010) Tunisia (Chaabouni and Abednnadher, 2013) China (Audibert et al., 2013, Hu et al., 2012) Canada (Asmild et al., 2013) Turkey (Sulku, 2012) Iran (Sabermahani et al., 2012, Farzianpour et al., 2012) South Korea and Vietnam (Nguyen et al., 2012d) Senegal (Mané, 2012b) and Sierra Leone (Kirigia et al., 2011) among others.

While some of these analyses simply estimate the efficiencies of a set of health centers (Nayar et al., 2013, Gautam et al., 2013, Geitona et al., 2012) others take a more dynamic approach looking at how efficiency has varied over time (Zhang and Pan, 2013, Chaabouni and Abednnadher, 2013) or across geographic locations such as different provinces (Asmild et al., 2013, Hu et al., 2012) . Some take the analysis a step further using regression analysis

to identify the characteristics associated with higher and lower levels of efficiency. For example, one study in the United States identified the financial monitoring metrics, including the number of full time employees per bed and the average daily occupancy of the hospital, were significantly predictive of hospital efficiency (Wilson et al., 2012). Another example from China found that the proportion of private sector and of high quality hospitals in an area was positively associated with efficiency whereas receiving a government subsidy was negatively associated with efficiency, at least in coastal areas (Hu et al., 2012). This latter example demonstrates how efficiency analysis can be used to evaluate the impacts of policy approaches, funding mechanisms and management strategies on health center efficiency.

While the majority of literature in this area focusses on the efficiency of health facilities, a few articles demonstrate the potential of this methodology to shed light on the relative efficiency of other types of entities such as programs or budgetary allocations. For example, one study conducts a cross country analysis of the efficiency of HIV/AIDS programs in converting funding into health services. It finds that countries with greater civil society participation in policy making were more efficient and that an increase in Gross National Income per capita improved efficiency though only among the lowest quartile (Zeng et al., 2012). Another study which applies Technical Efficiency Analysis to health outside the health facility context investigates the efficiency with which provincial governments in the Philippines convert social spending into education (school enrollment and literacy) and health (life expectancy) outcomes. It finds that provinces with high income inequality as well as those which receive a larger proportion of budget support in grants are less efficient at producing outcomes (Lavado and Cabanda, 2009). A final study in India estimates the efficiency of state level health systems aggregating the number of hospitals, beds, doctors and nurses per state as inputs and treating female life expectancy and under 5 survival rate as outputs. The study identified varying efficiencies among the states and then used

regression analysis to identify characteristics associated with more efficient states including higher female literacy, higher vaccination rates and lower income poverty rates (De et al., 2012).

Yet all of these studies, from the majority focused on the efficiency of health facilities to the smaller number focusing on the efficiency of programs or budgetary allocations, consider health production from a supply side perspective. That is they consider how efficiently various facets of the health system produce goods and services and, in turn, health outcomes. Very few studies touch on demand-side efficiency or how efficiently the *health system users* convert the available resources into health outcomes. For example, while a hospital may be efficient at diagnosing malaria and dispensing malaria treatment, in order for the key resources (Rapid Diagnostic Tests and Artemisinin Combination Therapies) to be converted into health outcomes (effectively treated malaria) the people with malaria have to seek care at the hospital, effectively engage with health staff, obtain the medicine prescribed, take the medicine as recommended and seek further care for side effects, complications or unresolved cases. Thus achieving health outcomes requires the efficient conversion of resources to outcomes on the demand side as well.

To some degree, the last two examples given above – the efficiency analysis of provinces in the Philippines and state health centers in India capture both supply and demand side effects without distinguishing between the two. In both cases the health outputs of life expectancy and under 5 survival had to have been produced both by care provided by the health system and the utilization of that care on the part of residents. That factors such as literacy and poverty rates of the population significantly predicted efficiency suggest that people of different backgrounds achieved health at different rates of efficiency. However, neither article actually strives to disaggregate supply and demand side factors, let alone

seeks to understand how and why populations which were wealthier, more equal or more literate were more efficient. In fact it would be impossible for these studies to address that issue as none considers the individual as the unit of observation. While health care facilities and administrative zones such as states or provinces undoubtedly convert health resources into health outcomes with varying degrees of efficiency, so too do individuals, yet the individual level remains unexplored.

The only study that I could identify which explicitly considered demand-side factors in the context of Technical Efficiency Analysis investigated how fluctuations in demand levels affect the efficiency of health facilities. This study found that increases in demand for health services driven by expansion of health insurance has incentivized health centers to add staff but health outputs including mortality rates, number of disabled beneficiaries and self-reported health status did not necessarily improve. As a result increased demand from health insurance expansion decreased the efficiency of health facilities (Cozad and Wichmann, 2013). However, studying the effect of demand on supply-side efficiency is not the same as studying demand side-efficiency; it sheds no light on the question of who is most efficient at converting available resources to health outcomes and why.

Thus while the use of Technical Efficiency Analysis to understand the optimal production of services from available health system resources has led to a diverse and growing literature, I could not identify any studies which use this approach to consider the constraints and opportunities influencing the individual people who access those services and the active role that these individuals play in converting available resources into outcomes. My research will focus on this under-explored area.

In order to systematically approach the issue of individual efficiency at converting available health resources into health outcomes, it is useful to draw on a conceptual framework which maps the conversion process.

1.2.2 A Conceptual Framework: The Capability Approach

Amartya Sen's Capability Approach, a theoretical model from the field of welfare economics frequently applied in international development and poverty reduction, provides a useful theoretical mapping of the process by which individuals convert resources into outcomes.

The Capability Approach describes individuals as having an endowment of resources which determine their capabilities-- what they are able to be and do (Sen, 1980, Sen, 1985a, Sen, 1985b, Sen, 1999, Robeyns, 2005). For example, with a loaf of bread as a resource, an individual may have the capability to be nourished. In the aggregate, the capability set comprises all of the things a person is able to be and do given their resource endowment.

The individual then has the choice to act on a subset of those capabilities to actually achieve certain states of beings and doings, or what Sen terms 'functionings' (Sen, 1985a, Robeyns, 2005). The individual with the bread may choose to eat it, and, as a result, achieve the functioning of being nourished. That individual may also choose not to eat the bread in which case he would not achieve the functioning of being nourished. The Capability

Approach also recognizes the mediating role of individual, social and environmental conversion factors that influence how individuals convert their resources into achievements (Sen, 1990, Robeyns, 2005). For example, if the individual with the bread is gluten intolerant, he may not choose to eat it. Or, if he does eat it, he may not achieve the functioning of being nourished. Likewise if the person holds religious beliefs mandating fasting, or if he lives in a community where observing a religious fast is the social norm, he also may not choose to eat the bread. In this case gluten intolerance, holding religious beliefs and community social norms are all conversion factors which influence the process

by which the individual converts a resource, bread, into an outcome, being nourished.

Figure 1.5 presents these relationships schematically.

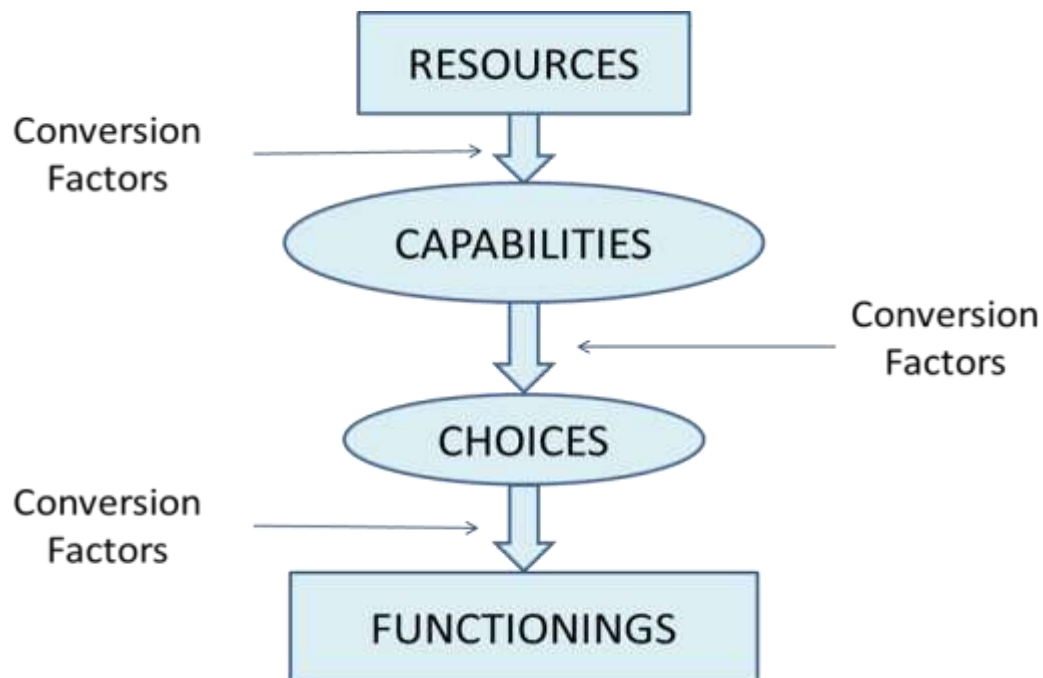


Figure 1.5: Diagram of the Capability Approach

Using the Capability Approach as a theoretical framework, the factors that constrain or enable people to convert available resources into health outcomes can be understood as conversion factors. In turn the efficiency with which people convert available resources into outcomes is defined as conversion efficiency (Binder and Broekel, 2011, Binder and Broekel, 2012).

The interpretation in Figure 1.5, which shows conversion factors acting at each level of the process by which resources are converted into achieved functioning, represents a somewhat novel interpretation. While it is compatible with the role of conversion factors described in both the theoretical and empirical capabilities literature, it makes somewhat more explicit

the influence of conversion factors on choice and achieved functioning as well as capabilities.

The theoretical literature on the Capability Approach defines conversion factors broadly as social, personal and environmental factors that influence the conversion of resources into functionings with particular focus on the conversion of resources to capabilities (Robeyns, 2005). In her theoretical survey of the Capability Approach, Robeyns (2005) offers an example in which the environmental factor of living in an unsafe neighborhood would constrain an individual's capability to leave the house and move about freely. She also presents a diagram wherein individual conversion factors specifically mediate between resources and capabilities. However, in the diagram she acknowledges that social and environmental factors act not just at the level of converting resources into capabilities, but also at the level of choice and achieved functioning. It would seem that these social and environmental factors could also be described as conversion factors. Furthermore, without specifically using the term 'conversion factor' Robeyns acknowledges that both Sen and Nussbaum have extensively addressed how social factors influence preferences and in turn choice, particularly for women (Sen, 1990, Nussbaum, 2000). Thus while the Capability Approach literature is generally understood to describe conversion factors as mediating the conversion of resources to capabilities, it also acknowledges that social, individual and environmental factors influence the choices made based on capabilities and the functionings achieved as a result.

The empirical literature dealing with conversion factors, both with respect to health and to economic and human development more broadly, tends to echo the least specific definition—that conversion factors are factors that influence the conversion of resources into functionings (Binder and Broekel, 2011, Binder and Coad, 2011, Chiappero-Martinetti

and Salardi, 2007). However one article, which examines the conversion of capability inputs into health functionings among women in Ethiopia, maps conversion factors as acting at multiple levels more similar to my formulation (Mabsout, 2011). Specifically, Mabsout formulates conversion factors as influencing both capabilities and functionings directly as well as influencing the conversion of capabilities into functionings.

The formulation above is thus compatible with the roles of social, individual and environmental factors acknowledged in the theoretical and empirical Capabilities literature, while at the same time offering a more specific illustration of the multiple levels where conversion factors may exert influence. Specifically these levels include: 1) the conversion of resources into capabilities 2) the choice to act on capabilities and 3) the conversion of choices into functionings. To illustrate the difference between these three levels I draw on the example given in Ferrer and Carrasco (2010) of an obese, hypertensive, diabetic patient's struggle to eat a healthier diet (Ferrer and Carrasco, 2010). The patient lives in a low-income neighborhood where produce is low-quality and prohibitively expensive. These conversion factors act at the first level of the diagram, limiting the degree to which a resource (produce) confers on her the ability to eat healthily. Furthermore, even when she is able to get her son to drive her to more distant markets where produce is available and affordable, she sometimes chooses not to prepare healthy meals because her husband dislikes them and refuses to eat them. In this case her husband's preferences, as well as the cultural and social norms requiring that she provide appealing meals for her husband, act at the second level of the diagram -- influencing her choice of whether or not to act on her capability to eat healthily. Lastly, while it is not stated in the case history, it is possible that this patient, or similar patients, do not know the best ways to prepare food to optimize the nutritional value such as avoiding frying or overcooking. In this case, the knowledge of food preparation, and the social and cultural factors that influence food preparation, are conversion factors

mediating how the choice to eat healthily is converted to the functioning of actually eating healthily. Thus understanding how individual, environmental and social factors influence the level of achievement an individual derives from a certain resource requires understanding which factors act at each of these three levels and how.

Thus the Capability Approach, and the concepts of conversion factors mapped above, provide a theoretical framework for understanding how individuals convert available health resources into health outcomes, which factors influence how those factors are converted and why. Yet in order to approach these issues empirically, it is useful to understand how the theoretical framework of the Capabilities Approach has been empirically applied to health.

1.2.3 Empirical Applications of the Capability Approach to Health

In 1998, Swedish researchers published the first empirical application of the Capability Approach to health that I could identify. Their work sought to evaluate the impacts of cataract surgery by quantifying whether, following the procedure, patients were more able to convert resources into the achievements they would value. Using a method similar to the Technical Efficiency Analyses described above, the authors indexed post-surgery functionings against the original functioning frontier. They find that 85% of patients experienced improved functioning in day to day activities, such as recognizing faces, walking on uneven ground and reading newspapers, following the operation. Roos and Lundstrom do not adhere to the terminology of The Capability Approach throughout their paper, referring to resources as inputs and achievements as outputs. However their initial definition of these terms with reference to Sen's seminal work *Commodities and Capabilities*, indicates a conscientious engagement of the Capability Approach as a theoretical framework. Perhaps as a result of the terminology used, this piece is rarely cited

in the capabilities literature. While their use of terminology may be inconsistent, their attempt to measure the benefits of a health intervention in terms of its impact on people's ability to convert resources to functioning foreshadows the work that follows in this field (Roos and Lundstrom, 1998). A similar approach was recently implemented by another group of Swedish researchers studying outcomes among diabetes patients and the relative impacts of various interventions. Interestingly the researchers found that, for some patients, improved knowledge of how to live with diabetes had a greater impact on overall well-being than improved biological indicators. As the authors explain, this finding suggests that patients placed greater value on their capabilities, in this case the ability to understand and manage their condition, than on achieved functioning, the physical impacts of diabetes (Palaszewski et al., 2011).

Drawing on the central tenet of the Capability Approach-- that capabilities are the critical unit of measure for justice and well-being-- Coast and colleagues have developed a capability-based approach to measuring the outcomes of health and social interventions for older people. In a series of articles, the team uses mixed methods including best-worst scaling, statistical analyses of correlations, and in-depth interviews to i) identify that the outcomes most valued by older people in the United Kingdom are capabilities to be and do the things they value ii) identify 5 attributes – attachment, security, role, enjoyment and control-- that represent the most valued functionings across the sample population and iii) develop and tests a methodology for analyzing the outcomes of health and social interventions using those attributes to measure impacts on valued capabilities (Coast et al., 2008b, Coast et al., 2008a, Grewal et al., 2006). This work has resulted in the ICECAP-O index for measuring capabilities in older people in the context of economic evaluations of the health interventions.

The ICECAP-O has subsequently been applied in a variety of contexts. In Australia, researchers found lower income and unemployment negatively influenced capabilities across all age groups while being married or cohabiting was positively associated with capabilities among younger people and being Australian-born was positively associated with capabilities among older people (Couzner et al., 2013). A second application tested whether the WOMAC osteoarthritis index could accurately predict results of the ICECAP-O index. The authors find that prediction of ICECAP-O results was possible for the majority of dimensions though the attachment attribute was the most difficult to predict (Mitchell et al., 2013). Lastly, another empirical study has tested a key question underlying the ICECAP-O index: is self-reported capability a valid and reliable indicator? Al-Janabi et al. (2013) find evidence that self-reported capability can be both valid and reliable, though providing some guidance to respondents may be helpful in obtaining consistent answers, again particularly in relation to the capability of attachment (Al-Janabi et al., 2013).

The high value placed on capabilities, as opposed to functioning or utility, is a theme that recurs throughout the empirical literature and substantiates the theoretical contention that capabilities should be the primary unit of analysis for questions of distributive justice and the measurement of well-being. A study in Taiwan examines the effects of irritable bowel syndrome (IBS) on patients' capabilities as well as functionings. Consistent with previous studies in the UK (Grewal et al., 2006) and Sweden (Palaszewski et al., 2011), the patients expressed that their overall well-being relied more on their condition's impact on their capabilities than on their functionings (Hsueh et al., 2011). Another study in the US conducts qualitative interviews of students working in fast food restaurants to tease out the capability constraints and other influences which affect subject's diets and specifically their consumption of fast food. The researchers identify factors such as time, cost, restaurant

policies, perceptions of food options and knowledge of food preparation as likely capability constraints (Mulvaney-Day et al., 2012).

Anand and colleagues have also studied the questions of how to measure capabilities, in particular which capabilities, including health, contribute to overall life satisfaction and welfare. Working from the list of ten core capabilities enumerated by Nussbaum, Anand and colleagues conduct ordinary least squares and logistic regression analysis on a combination of primary and British Household Panel Survey (BHPS) data to find that i) capabilities can be robustly measured using existing data and ii) certain key capabilities, including those related to health, are correlated with overall life satisfaction (Anand et al., 2009, Anand et al., 2005, Anand and van Hees, 2006).

Nikiema et al. (2012) also aim to measure capabilities using routine survey data by creating an index of questions from the Burkina Faso DHS to represent women's capability to access health care. The authors conclude that the index is both reliable on the basis of a high Cronbach's Alpha and valid on the basis of factorial analysis as well as a positive correlation between capability and living standard. While it seems theoretically defensible that capabilities would increase with household living standards, evidence empirically demonstrating such a relationship would strengthen the authors' claim that the correlation between the two indicates construct validity (Nikiema et al., 2012).

Although the majority of studies in this field focus on High Income Country (HIC) contexts, a small but growing literature empirically applies the Capability Approach in Low or Middle Income Countries (LMICs). Two studies test hypotheses regarding the impact of capabilities on macro level indicators. Boidin and Lardé (2010) conduct a principal component analysis to identify that there are certain minimum health thresholds below which countries cannot

develop due, in theory, to constrained capabilities at both the individual and population level (Boidin and Lardé, 2010). Wigley and Akkoyunlu-Wigley (2006) use a fixed effects regression analysis of development indicators from 35 low and middle income countries to demonstrate that education leads to improvement in health, as measured in life expectancy, not only by increasing incomes but also by increasing key capabilities. (Wigley and Akkoyunlu-Wigley, 2006).

On the micro-level, Mabsout (2011) analyzes Ethiopian household data to understand how household decision-making capabilities and other conversion factors are related to women's health achievement. Using a structural model to estimate the latent variable of decision making, he finds that decision making capabilities are associated with increased BMI, while reductions in anemia were more responsive to household wealth and bargaining indicators (Mabsout, 2011). Using a series of logistic regressions on data from India, Mohindra (2009) finds that participation in micro-finance self-help groups was associated with improved capability to access health and improved mental health (Mohindra, 2009). A final application in Vietnam investigates the impacts of health insurance by focusing on two potential outcomes that the authors argue are in keeping with the ethical constructs of the Capability Approach namely: the ability to access care and the freedom of financial protection from catastrophic healthcare spending. They find that while Vietnam's Health Insurance approach has been effective at reducing vulnerabilities, improvements are still required to reduce out of pocket costs and improve accessibility (Nguyen et al., 2012a).

In their 2011 review of the literature, Binder and Coad and Binder and Broekel aptly note two key gaps. The first was that there is no consensus and very little attention to what they term the "circularity problem" in the Capability Approach-- the fact that factors such as health, education or employment can be viewed as resources, capabilities, conversion

factors or achievements. Binder and Coad use panel vector autoregression- a model combining fixed-effects and time lags-- in order to “disentangle the circularity” of factors such as health, happiness, nutrition and income which play multiple roles as resources, conversion factors and functionings in order to begin establishing directions of influence. They find that some capabilities, such as being happy, do indeed serve as resources for other achievements while others, including being sheltered and having satisfying social relationships, do not (Binder and Coad, 2011). The second gap they identified was that there is very little empirical analysis focused on conversion factors and specifically on conversion efficiency. In the context of developing a structural equation model of functionings which treats capability as a latent variable, Kuklys (2005) estimates the role of conversion factors, such as gender, age, education, marital status and living in London on several outcomes including health. While she finds that being female, being older, being married, being unemployed and living in London are all negative conversion factors, she cautions the interpretation of these findings given the potential for endogeneity and reverse causality. She does not address this issue in depth as her focus is ultimately on the estimation and distribution of functionings, particularly in comparison to income based measures of well-being (Kuklys, 2005).

Responding to the lack of empirical literature on conversion factors and conversion efficiency, Binder and Broekel propose an efficiency analysis methodology which applies a robust variation on the Data Envelopment Analysis approach described above in order to quantify the relative efficiencies of individuals and identify the influence of conversion factors on efficiency. Looking at a cross-section as well as a panel of the British Household Panel Survey, they find that being older, being self-employed, being married, having no health problems and living in London all increased the efficiency with which people were able to convert available resources into health outcomes (Binder and Broekel, 2011, Binder

and Broekel, 2012). In other words, given the same level of resources, people with these characteristics achieved better outcomes than people without these characteristics.

Thus the identification of conversion factors and conversion efficiency of health resources into health outcomes remains relatively underexplored with only two closely related papers examining conversion efficiency and identified key contributing and constraining conversion factors (Binder and Broekel, 2011, Binder and Broekel, 2012). No study has examined conversion factors and conversion efficiency for health in the developing world. Likewise no study that I can identify has followed the quantitative estimation of the relative contribution of conversion factors with qualitative research to elucidate why and how those factors influence conversion efficiency by acting on both capabilities and choices. My research will therefore fill this gap by empirically examining conversion efficiency in a low income context and further investigate the factors that contribute to that efficiency.

Given that there are no studies in the literature of Technical Efficiency in health that focus on the individual level and only one study looking at conversion efficiency for health within the capabilities literature, it is useful to look further afield in order to understand how social factors interact with health and which social factors may be of interest as conversion factors. There is a large literature on social epidemiology and the social determinants of health which speak to these issues. While this literature focusses on how social determinants impact health outcomes, rather than the efficiency with which individuals produce health outcomes, they are nonetheless instructive in highlighting key social factors known to influence health which might be expected to act as conversion factors. Thus the social determinants literature helps inform my identification of conversion factors which affect the efficiency with which health resources are converted into health outcomes.

1.2.4 Social Determinants of Health: A Literature Informing the Choice of Conversion Factors

The influence of social factors on health outcomes has been extensively studied within the field of social epidemiology and, recently, through the work of the WHO's Commission on the Social Determinants of Health (CSDH). The literature on the social determinants of health looks broadly at the relationships between social factors and health outcomes.

The Social Determinants of Health and Social Epidemiology literatures clearly demonstrate that social factors including wealth, education, ethnicity, gender, geography, and employment have the potential to influence health outcomes. This literature also highlights the complexity of the relationships between social factors and health. For example, while factors such as ethnicity, economic status or gender may be associated with worse health outcomes in one context, they may have the opposite effect if the outcomes of interest or the context is changed. To further elaborate these complexities I explore each factor individually below.

1.2.4.1 Wealth

The positive relationship between wealth and health is seemingly unshakeable, with leading researchers in the field making such bold statements as "The relationship between income and health is well established: the higher an individual's income, the better his or her health." (Kawachi and Kennedy, 1999). Indeed, many studies substantiate that poverty is generally associated with poorer physical (Bourne, 2011, Zere et al., 2012) as well as mental health (Melchior et al., 2010). The field of social epidemiology has explored and elaborated on the relationship between income and health in part by identifying the role of mediating factors including inequality and social capital. Kawachi and Kennedy (1999) go on to nuance their statement above by demonstrating how distributional factors mediate the relationship

between poverty and income, exacerbating the negative effects where inequality is high (Kawachi and Kennedy, 1999). Furthermore they identify that for some adverse health outcomes such as teen pregnancy, inequality acts through the pathway of degraded social capital (Gold et al., 2002). The social determinants literature, which generally focusses less on pathways and causal models, still finds that the negative associations between income and health become stronger when poverty is compounded by weak social capital (Ahnquist et al., 2012) and social inequality (Reyes-García et al., 2009). However, while higher income is broadly associated with better health globally, significant exceptions exist. While poverty is associated with many health risks, higher wealth significantly predicts overweight and obesity among women in the low and middle income countries (Hruschka and Brewis, 2013, Zere et al., 2012) though this relationship is somewhat mediated by the region of the world from which the women hail (Hruschka and Brewis, 2013). Furthermore, across Sub-Saharan Africa, there is some evidence that both wealthier countries and wealthier individuals are at increased risk for HIV (Fox, 2010). Thus even the seemingly well-established relationship between low income and poor health is specific to both context and disease area.

1.2.4.2 Education

Lower levels of education are also typically associated with poorer health. Empirically, education has been shown to be inversely correlated with excess mortality (Jemal et al., 2008, Menvielle et al., 2010), tobacco use (Gupta, 2006), poor oral health (Moreira et al., 2010) and, through maternal education levels, increased infant (Karlsen et al., 2011) and child mortality (Agarwal and Srivastava, 2009). However, the effects are again context and condition specific. A study of childhood stunting in Central India found that mother's education was not significantly predictive of stunting while father's level of education was (Deshmukh et al., 2012). Moreover while level of education is negatively associated with the

risk of obesity (Cohen et al., 2013), cardiovascular disease and cancers in High Income Countries, it has been positively associated with the same risks in some developing countries. A large scale longitudinal analysis of overweight and obesity among women of reproductive age in 33 low and middle income countries identified that lower education was associated with higher risk of obesity in North, West and Central Africa as well as Latin America while higher education was associated with higher prevalence of overweight in South and Southeast Asia and Sub-Saharan Africa (Lopez-Arana et al., 2013). Likewise a study in Nairobi identified significantly higher rates of metabolic syndrome among men with University education as opposed to those with lower education attainment (Kaduka et al., 2012). A larger study of 41 low and middle income countries found that education was inversely correlated with the risk of angina, asthma and depression but positively correlated with the risk of diabetes though not as strongly as wealth (Hosseinpoor et al., 2012a). Thus while there is a larger overall body of evidence demonstrating a positive link between education and health outcomes there is also evidence clearly demonstrating the opposite effect particularly in developing countries likely to be undergoing nutrition and epidemiological transitions.

1.2.4.3 Gender & Ethnicity

For both children and adults, gender is associated with differential health outcomes though again the direction of influence is not consistent across contexts and disease areas. While being female is associated with poorer average health globally (Hosseinpoor et al., 2012b), being male has been linked to some increased health risks such as mortality from respiratory infection in the UK (Jordan et al., 2006) and heart failure in the southern US (Husaini et al., 2011).

Likewise, significant links between ethnicity and health outcomes are also demonstrated, though directions of influence are again complex. For example, in the US indigenous peoples were significantly more likely to suffer from TB (Bloss et al., 2011), while African Americans were more likely to experience heart failure (Husaini et al., 2011) than whites. However there is significant complexity within ethnic groups. For example, a 2005 study of Latinos in the United States found different health effects and social determinants of health among different ethnic sub-groups. While those of Mexican origin had a lower incidence of chronic disease than the White population, those of Puerto Rican origin had worse health outcomes in all categories. Cubans and Dominicans had lower self-rated health but outperformed the majority population on objective health outcomes such as number of chronic medical conditions. Further adding to the complexity, social determinants of health had different directional effects for different sub-groups: while higher socioeconomic status and acculturation was associated with worse health among Mexicans, the same factors were associated with improved health among Cubans, Dominicans and Puerto Ricans (Zsembik and Fennell, 2005). Another study tested the hypothesis that ethnic minorities would have better health in cities with large communities of that ethnicity. Previous studies had demonstrated positive associations between ethnic community size and density and the health of its residents speculating that social support networks were stronger in denser and larger communities and had a protective effect on both physical and mental health (Pickett and Wilkinson, 2008, Halpern and Nazroo, 2000, Veling et al., 2008). However when the authors compared the health of ethnic Chinese seniors living in various cities in Canada they found the opposite—that health was better among those living in cities with smaller Chinese communities possibly because the smaller communities were less segregated from the majority population and were thus more likely to have contact with the mainstream society and its social and health resources (Chau and Lai, 2011).

Challenging the tendency to attribute ethnic health disparities to genetic predisposition, a related branch of the literature looks at the impact of acculturation on health noting how ethnicity based health disparities change as ethnic minorities increasingly adopt and adapt to the majority culture. To identify these effects, this body of literature compares the health of recent immigrants by ethnic group to that of native born people by ethnic group, primarily in North America. Researchers in this field have identified that foreign born ethnic minority (Black, Hispanic, Asian) immigrants to the US have longer life expectancies and lower incidence of low birth weight infants and infant mortality than their US-born counterparts (Singh and Miller, 2004). Furthermore, immigrants as a group had lower risk of disability as well as morbidity from chronic disease than ethnic majority Americans, although these risks increased with the amount of time that the immigrants had been in the United States (Singh and Miller, 2004). However this broad trend, known as the Healthy Immigrant Effect, belies significant heterogeneity across different diseases, ethnic groups as well as men and women. For example, while immigrants had lower risk of mortality from lung, prostate, breast, kidney and colorectal cancers they had much higher risk of mortality from stomach and liver cancers (Singh and Hiatt, 2006). While black immigrants had lower mortality rates from cardiovascular disease than their US born counterparts, White and Asian immigrant women had higher mortality from cardiovascular disease than US-born women of the same ethnicity (Singh and Hiatt, 2006). The acculturation theory seems especially relevant in explaining the better outcomes of recent immigrants with respect to nutrition suggesting that nutritional outcomes deteriorate as immigrants increasingly adopt the dietary pitfalls of the high income receiving country including overeating and overconsumption of sugars, carbohydrates, fats and processed foods. However, a systematic review of the literature on acculturation and obesity identifies that while some positive associations have been identified, negative associations between acculturation and BMI have been documented as well. The latter are particularly prominent in the case of women,

possibly due to the greater acceptability of physical activity and exercise and the higher premium placed on thinness in the North American context (Delavari et al., 2013).

1.2.4.4 Employment

Employment status and type of employment are also shown to be significantly correlated with health outcomes though in varying directions depending on the context and health outcome. Unemployment has been associated with adverse mental health outcomes (Puig-Barrachina et al., 2011) while employment in manual labor, particularly if it is temporary or involves hazardous exposures, is associated with both increased and premature mortality (Niedhammer et al., 2011). Again however, the effects of employment on health vary within sub-populations, particularly gender. An analysis of WHO data from 57 countries indicated that while being in paid employment was positively associated with self rated health, the effect was larger for men than women in both Africa and Europe in turn widening gender inequalities (Hosseinpour et al., 2012c). Another study in Spain found that while increasingly precarious employment is associated with increasingly poor mental health, the negative gradient was steeper for men than for women (Vives et al., 2013). The social epidemiology literature also considers how the social configuration of a workplace influences health outcomes identifying that low-social capital work environments significantly increased the risk of hypertension in men though this effect was partly mediated by obesity and alcohol consumption (Oksanen et al., 2012).

1.2.4.5 Geography and Rural/Urban Context

Area of residence and geography are also associated with differential health outcomes (Drewnowski et al., 2007) as well as with different relative influences of other social determinants (Wanless et al., 2010). A large literature focuses on the differential effects of

rural and urban contexts in both high and low income countries. In the US and Canada, living in a rural area has been associated with adverse health outcomes including increased risk of CVD (Quarells et al., 2012). Effects of living in a rural area were compounded for ethnic minorities including African Americans in the United States (Scott and Wilson, 2011) and indigenous communities in Canada (Postl et al., 2010, Brown et al., 2011) . Rural disadvantage was also reflected in low income countries particularly with respect to reproductive maternal neonatal and child health (Fox and Heaton, 2012, Abera et al., 2013, Bhutta et al., 2013). However, urban contexts posed their own health challenges including rapid population growth, migration, informal housing, inadequate infrastructure and high-levels of inequality (Vearey et al., 2010, Friel et al., 2011). These factors pose a challenge in the context of infectious diseases such as HIV/AIDS (Vearey et al., 2010), syphilis and other sexually transmitted infections (Tucker and Cohen, 2011) as well as increased chronic diseases and accident and injury (Friel et al., 2011). However while broad relationships between types of geographies and health outcomes have been demonstrated, some argue that these obscure greater variation at the level of smaller geographies (Cooper et al., 2012). Indeed more nuanced geospatial approaches highlight that patterns of health advantage and disparity exist on a more micro level at the district (Tabuchi et al., 2012), county (Moonesinghe et al., 2012) sub-district (Sartorius et al., 2011) and even neighborhood (Drewnowski et al., 2007, Wilson et al., 2009, Cooper et al., 2012) level.

1.2.4.6 Beyond Associations, Identifying Pathways of Influence and Directions of Causality

Thus the associations between social factors such as wealth, ethnicity, education, employment and geography are clearly demonstrated, though the direction and the magnitude of influence vary greatly by context and health measure. While the social epidemiology literature has gone somewhat further in teasing out directions and pathways

of causality (Krieger and Smith, 2000), several reviews and commentaries have noted a gap in this area among the social determinants literature (Epstein et al., 2009, Kim and Saada, 2013, Marmot et al., 2010, Kelly et al., 2007). Some note the methodological challenges in identifying the complex pathways of distal social factors (Braveman et al., 2011) and others acknowledge that the exploration of causal links often requires focusing on a single health outcome rather than multidimensional or broader measures of health (Adler et al., 2012).

Yet efforts to identify pathways and establish causal inference of social determinants have grown in recent years with researchers using strategies such as structural models involving latent variables (Yang et al., 2012) or path analysis (James and Porter, 2012) as well as temporal approaches (Giordano et al., 2012), propensity score matching (Elstad and Pedersen, 2012) and directed graphs (Rettenmaier and Wang, 2012).

Yet while each of these methods offers a statistically valid approach to identifying directions of influence and causal pathways they all require either an *a priori* hypothesis about directions and pathways of influence or, at the very least, an *ex ante* determination of which factors of influence to consider. Like all quantitative methods, these are designed to use data on pre-determined variables to confirm or reject a predetermined hypothesis. Given both the complexity and context specificity of the pathways through which social determinants influence health outcomes, qualitative methods, which allow unforeseen factors and pathways to emerge, may be useful at least in informing the hypotheses that underlie a causal model in a specific context.

1.2.4.7 Qualitative and Mixed-Methods

Yet despite the recommendations of the Commission on Social Determinants of Health urging more qualitative and mixed methods research (Kelly et al., 2007), these approaches

remain relatively rare in the literature. Few studies report empirical findings from qualitative or mixed methods work examining the critical questions of *how* and *why* social factors influence health outcomes. Some of the few articles that touch on this area consider perceptions and drivers of risk behaviors for HIV among ethnic minorities in North America (Operario et al., 2008, Baidoo-Boonso et al., 2013), factors influencing adherence to HIV treatment among poor women in Colombia (Arrivillaga et al., 2011) and perceptions of diabetes risk and healthy eating behaviors among low-income Latinos in California (Chaufan et al., 2011). Other studies use qualitative methods to identify people's perceptions of which social factors determine health, such as race (Kumar et al., 2011) gender, or living conditions (García-Calvente et al., 2012). None of these studies however sample across a social determinant of interest in order to tease out how social determinants influence the health perceptions, choices and behaviors differentially across that spectrum. The first group of studies consider homogenous sub groups such that, while they can identify the barriers to treatment adherence or healthy eating faced by the poor women, they cannot begin to speculate whether these factors or perceptions are the same or different across the economic spectrum. The second group of studies only considers perception of social determinants but not the perceptions, choices and behaviors influenced by social determinants that lead to health outcomes.

Moreover, none of the literature on social determinants of health, or the pathways through which they act, looks at social determinants of efficiency. Rather they all focus on the social determinants of health outcomes but not the efficiency with which individual convert available resources to achieve those outcomes. No studies that I have been able to identify specifically investigate the role of social factors as conversion factors that contribute to or inhibit people from making the most of available resources to achieve good health. Yet

understanding how social factors enable people to take optimal advantage of available health resources is essential if we hope to maximize the impact of health inputs.

My research develops and implements a mixed methods methodology to answer three questions:

- 1) How efficient is a population in converting health resources into health outcomes?
- 2) Are some groups of people more likely than others to be efficient?
- 3) How and why do the social factors identified as significant influence conversion efficiency?

CHAPTER 2: **HEALTHY PREGNANCY IN VIETNAM**

I address my research questions specifically with respect to the issue of healthy pregnancy and delivery in the context in Vietnam. This chapter explains why I chose to look at the context of Vietnam and the issue of healthy pregnancy and delivery specifically.

2.1 Why Vietnam?

With respect to public health and development, Vietnam presents a dynamic if complex context ripe for efficiency analysis. Rapid economic development and significant focus and investment in social services on the part of government have resulted in overall poverty reduction and improvements in health indicators. Yet, by some measures, inequalities persist. At the same time rapid development and alleviation of some of the main poverty related health concerns has launched Vietnam into health transitions which necessitate new and different public health approaches and resources. These shifting patterns of health among the emerging middle class coupled with persistent poverty related morbidities among the poorest and most remote groups present a multi-faceted challenge to Vietnam's public health system creating an even greater need to maximize the impact of scarce resources on all fronts.

2.1.1 Development & Inequality

Vietnam exemplifies a dynamic development context. The transition from central planning to a market economy which began with the 1989 Doi Moi reforms has resulted in both rapid economic growth and poverty reduction. As seen in Figure 2.1, Vietnam's Gross Domestic Product per capita has risen from \$837 in 1988 to over \$3133 in 2010.

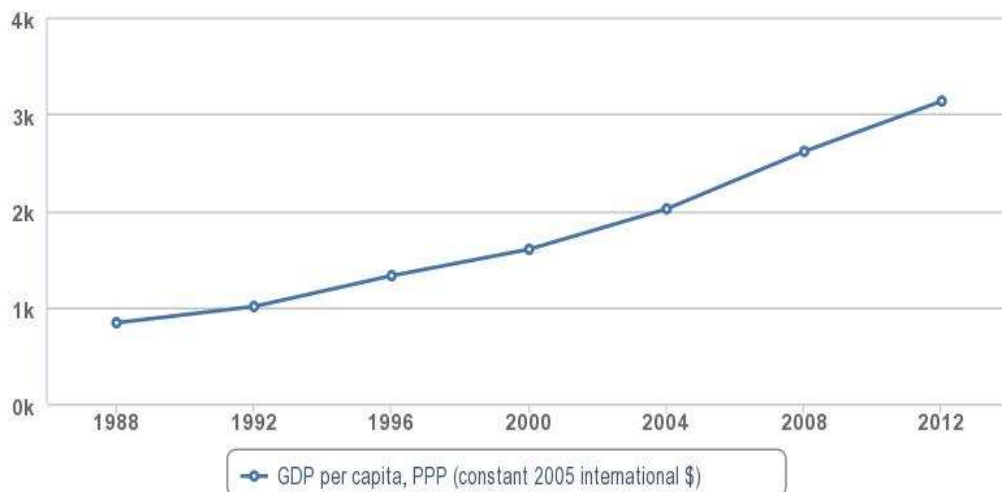


Figure 2.1: Per Capita GDP Growth in Vietnam (World Bank Group, 2012)

On the micro level, the percentage of Vietnamese living below the national income poverty line fell from 58.1% in 1993 to less than 14.5% in 2008. While it rose again to 20.7% in 2010, possibly as a result of the global financial crisis, it still represents a dramatic decrease in income poverty in the last two decades as seen in Figure 2.2.

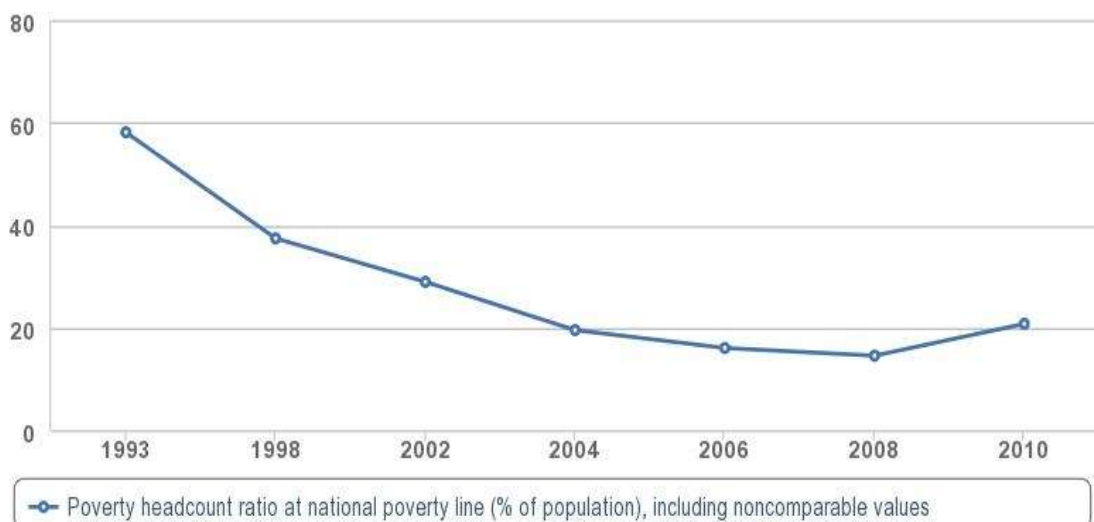


Figure 2.2: Poverty Reduction in Vietnam (World Bank Group, 2012)

In the last two decades Vietnam has achieved not just rapid income growth but also improvements in human development that have exceeded expectations (UNDP, 2013). As the 2013 Human Development Report notes, between 1990 and 2012, Vietnam had the third highest annual growth in GNI per capita while also ranking among the top 20 for improvement in Human Development Index ranking (UNDP, 2013). Specifically, with respect to education, while the gross enrolment ratios for primary school were already high, enrolment rates for secondary and tertiary education have risen markedly as seen in Figure 2.3. Secondary enrolment has increased 20 percentage points to 77%. While well less than half of students enroll in tertiary school, these rates have increased exponentially from 2.7% in 1990 to 24% in 2011. At the same time, pre-primary enrolment has more than doubled from 30% to 73% with nearly three quarters of children receiving education and enrichment during this critical period of early childhood development.

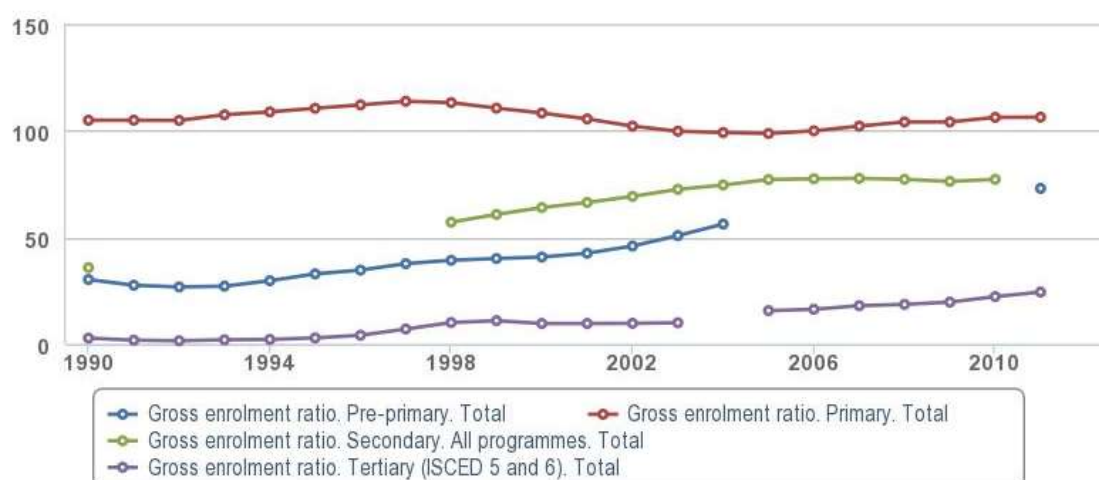


Figure 2.3: School Enrollment in Vietnam (World Bank Group, 2013b)

Vietnam has also achieved significant improvements in the health sector. Life expectancy has risen by 10 years from 65 to 75 over the last two decades. This increase was driven partly by the significant decline in maternal and particularly child mortality over that time period. As seen in Figure 2.4 and Figure 2.5 the maternal mortality ratio has decreased by

75% from 240 to 59 per 100,000 while under-5, infant and neonatal mortality have all decreased by at least half.

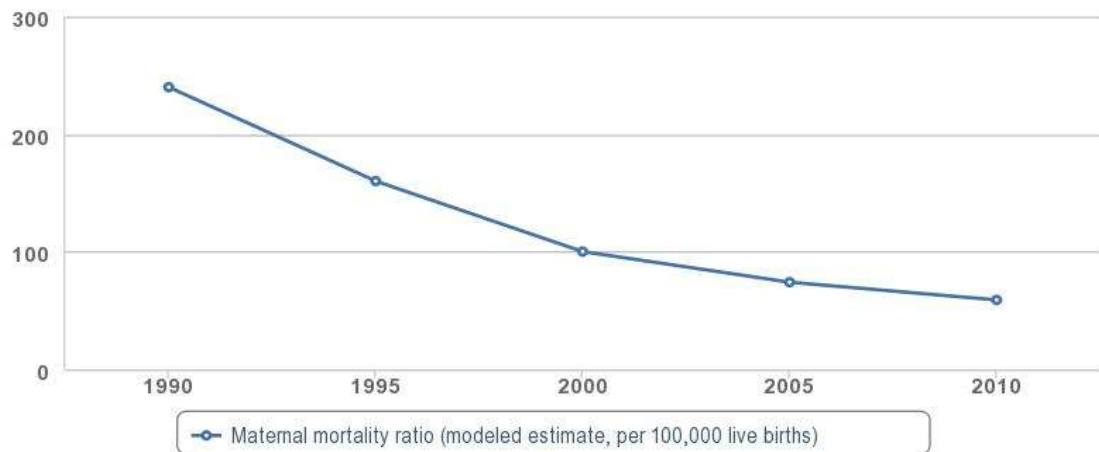


Figure 2.4: Decreasing Maternal Mortality Ratio in Vietnam (World Bank Group, 2012)

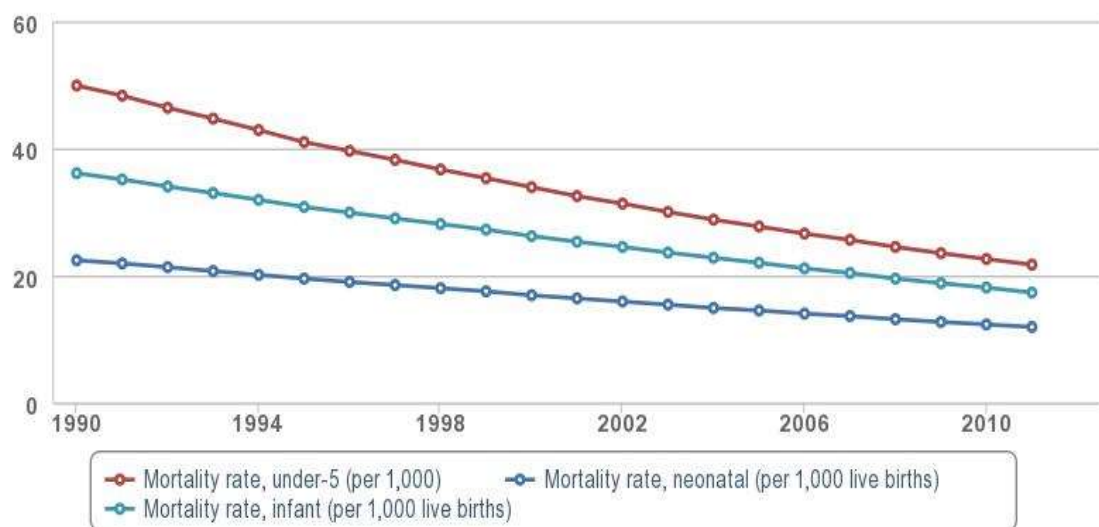


Figure 2.5: Decreasing Under-5, Infant and Neonatal Mortality Rates in Vietnam (World Bank Group, 2012)

Among the growing cohort of surviving children, nutrition has also improved. Malnutrition prevalence as measured by stunting decreased from 61% to 30% while malnutrition as measured by weight for age decreased from 37% to 20% (see Figure 2.6).

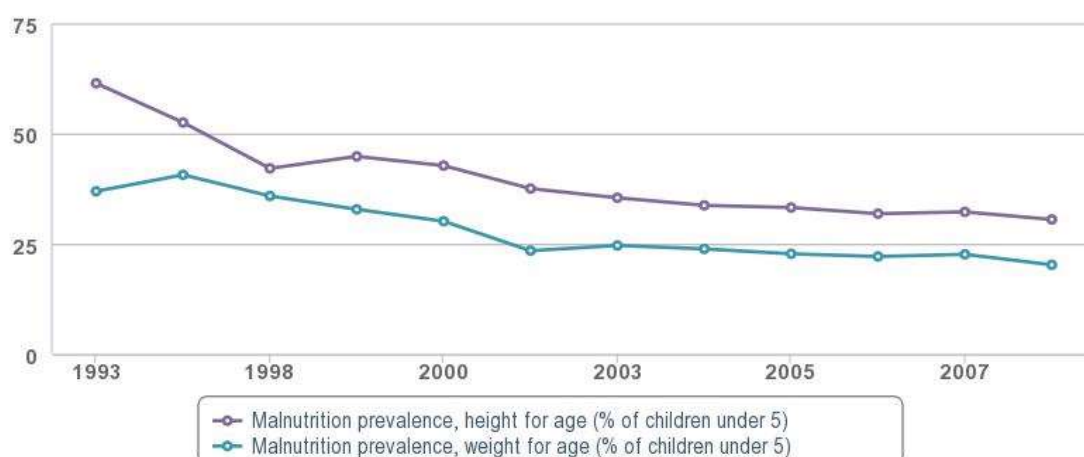


Figure 2.6: Decreasing Malnutrition Prevalence Among Children Under 5 in Vietnam (World Bank Group, 2012)

Yet while overall economic and human development has surged ahead in Vietnam, not everyone has benefitted equally. Despite significant reductions in income poverty and improvements in health and education, some inequalities persist, particularly across rural/urban and ethnic majority/minority lines (Baulch et al., 2012, Epprecht et al., 2011). While the literature broadly agrees on this point, evidence as to whether inequality is increasing or decreasing is mixed.

With respect to economic inequality, measures of income inequality such as the GINI Index² have remained essentially stable at 35.5/35.6 from 1993 to 2008. Vietnam has been reviewed favorably for achieving more inclusive, or equally distributed, growth, particularly as compared with its neighbor China which has seen its GINI index increase from 35.5 to 42.6 over the same time period (Malesky et al., 2011, World Bank Group, 2012). Yet, it is not clear that income is the best measure of economic status in Vietnam. While data is lacking on the informal sector, estimates of the percentage of people working in agriculture range

² The GINI index is a standard measure of inequality equaling zero in the case of perfectly equal income distribution and 100 in the case of perfect inequality. It is based on the area between a 45 degree line where % population = % of income and a line representing the actual distribution of wealth in a country.

from 60% (World Bank) to 70% (FAO) -- the large majority of the working population.

Agricultural work yields income that is hard to measure as it can vary widely year to year and is accrued irregularly throughout the year. As a result, asking households their income in a recent month or year is likely to provide either an overestimate or an underestimate of the resource endowment that they actually experience after smoothing effects (saving from a surplus period and spending in a deficit period). Additionally, measuring income fails to account for the fact that an agricultural household may require less income to maintain a comparable living standard to a non-farming household since they likely do not purchase food at market prices, especially in Vietnam where monoculture is discouraged and farming households generally do grow food for their own consumption.

To address this issue, much of the literature on poverty in Vietnam instead focusses on consumption, expenditure or asset data, information which more smoothly reflects how a household's economic endowment is manifested in their standard of living. Using these measures, the findings support the existence of an urban/rural and ethnic minority/ethnic majority gap but are less clear as to whether inequality is growing or shrinking. For example, the Young Lives longitudinal study of children in Vietnam found that, in 2009, children living in rural areas or belonging to minority ethnic groups were 4 times more likely to be poor based on consumption and expenditure data than children in urban areas or majority ethnic groups (Duc et al., 2011). Yet the same study found that over just three years, between 2006 and 2009, the percentage of rural children living in absolute poverty decreased over three times as quickly as the percentage of urban children living in absolute poverty. Moreover the percentage of ethnic minority children in poverty also decreased nearly four times as quickly as the percentage of ethnic majority children in poverty (see Figure 2.7).

		Absolute poverty			Relative poverty		
		2006	2009	% point change	2006	2009	% point change
Sectors							
	Urban	7.4	3.5	-4	2.2	2.2	0
	Rural	26.6	12.5	-14.1	11.9	12	0.1
Ethnicity							
	Ethnic majority (Kinh)	16.7	7.8	-9	5.8	6.7	0.9
	Ethnic minority	59.9	28.8	-31	35.7	30.3	-5.4

Figure 2.7: Changes in the Percentage of Children Living in Poverty in Vietnam (Duc et al., 2011)

While these poverty reduction rates would suggest that key poverty gaps are narrowing, a separate analysis of the same data suggest that while consumption is increasing among all wealth deciles, that increase was consistently several times greater among the wealthiest decile than among the poorest (Dornan, 2011). An examination of the 1993 to 2006 Vietnam Living Standards Survey corroborates the theory that inequality is growing, finding that the urban-rural expenditure gap increases along the spectrum from poorer to richer groups. (Huong and Booth, 2013). Examining the ethnic gap, Kang et al. (2012) corroborate the Young Lives finding that poverty among ethnic minorities has been reduced more quickly than among the ethnic majority. However, within group disparities in living standards have been rising with differential benefits of economic growth among different ethnic minority groups (Kang and Imai, 2012). Lastly, considering inequality across geographies, Cuong et al. (2010) find that while rural poverty has decreased in all provinces, provinces which had average poverty levels in 1999 reduced poverty rates more quickly than provinces with poverty rates well above the national average (Cuong et al., 2010). However, due at least in part to the lag time required to compile national surveys, analyze them and publish findings, none of these studies of inequalities looks at data post 2009 and only one looks past 2006. Thus it is possible that new shifts in the patterns and nature of inequality have emerged in the interceding years.

Persistent, and some would argue growing, inequalities are observed among human development indicators relating to education and health as well. While nearly 60% of ethnic majority children enrolled in high school as of 2006, only 30% of ethnic minorities enrolled (Baulch, 2010). Young Lives data suggests that rural and minority children were also three times more likely to be stunted at age 8 while children from the poorest quartile were more than 5 times more likely to be stunted than children from the wealthiest quartile (Duc et al., 2011). Analysis of the 1998 Vietnam Living Standards Survey (VLSS) and the 2002, 2004 and 2006 Vietnam Household Living Standards Survey (VLHSS) further suggests that this gap has widened for some indicators between 1998 and 2006. Among rural residents there was no statistically significant difference between under-2 stunting rates for majority and minority ethnicities in 1998. However by 2006, a 6 percentage point gap had appeared in favor of the former (Baulch, 2010).

Looking specifically at how inequalities in Reproductive Maternal Neonatal and Child Health have evolved across several social dimensions—including wealth, ethnicity, rural-urban, education and region-- Axelson et al. (2012) tell a more nuanced story. They find that across nearly all dimensions, inequalities in access to health services are decreasing. Coverage of exclusive breastfeeding, immunization and family planning interventions were the most equitably distributed while inequalities persisted with respect to receiving a minimum of 4 antenatal visits and skilled attendance at birth. In the case of early initiation of breastfeeding and exclusive breastfeeding, inequalities actually favored poorer, less educated and ethnic minority women as of 2006. With respect to health outcomes, most inequalities either grew or persisted. Inequalities in infant and under 5 mortality increased across the wealth, education and ethnicity spectrum from 1997-2006. However the greatest gains were shared by the poorest and the wealthiest quintile such that, by 2006, the second

poorest quintile had the highest rates of under-5 mortality rather than the poorest. At the same time, inequalities in low birth weight decreased across the economic spectrum over time and nearly disappeared across the spectrums of education and ethnicity (Axelson et al., 2012).

These findings raise questions regarding demand-side efficiency with respect to maternal and child health in Vietnam. On the one hand, the fact that inequalities in infant and under-5 mortality have grown suggest that, despite the increasing resources targeting the poor and marginalized groups (detailed later in this chapter), some of these resources are not being efficiently converted into two key health outcomes. At the same time, the fact that the least well off have caught up and even eclipsed their better off counterparts with respect to factors such as immunization, breastfeeding and low birth weight suggests that some less well-off people, still likely to have lesser total resources, are actually the most efficient at converting these resources into specific health outcomes.

While it is comprehensive and allows nuances in the evolution of health trends and maternal and child health equity to emerge, Axelson et al.'s approach has a few limitations. The first, as the authors themselves acknowledge, is that all of their analyses of health trends and inequality are bi-variate, for example looking at intervention coverage outcomes and wealth or nutrition outcomes and ethnicity. Yet all of the social dimensions they consider are correlated and thus are likely to confound each other. In the end, we know that people who are poorer, ethnic minorities, less educated and more rural are on the losing side of many health inequalities. However we don't know the relative contribution of each of these factors. A second limitation is common to all of the studies cited here and the health equity literature in Vietnam at large. Namely, these studies focus solely on health issues related to poverty such as infant mortality, access to basic services, undernutrition and infectious

childhood diseases. They do not consider health issues which are equally serious but more common among higher income individuals and contexts such as overweight and obesity, diabetes, hypertension and related maternal and child health complications. For example, Axelson considers only low birth weight (a condition often caused by undernutrition) but not high birth weight, a similarly serious antenatal complication often caused by gestational diabetes, overweight and obesity as well as excessive weight gain during pregnancy. While it is important to understand inequality in relation to poverty related health conditions in order to ensure that improvements in health and human development are not leaving the poor and marginalized behind, it is also important to consider the trends and distribution of conditions associated with middle income countries and the emerging middle class which increasingly affect public health in transitional countries like Vietnam.

2.1.2 Importance of Transitions

At the same time that Vietnam continues to grapple with some health inequalities anchored by entrenched poverty and poverty-related health crises among the poorest and most remote groups, the country is also undergoing epidemiological and nutrition transitions which raise new issues and challenges among the more urban and affluent groups.

2.1.2.1 Epidemiological Transition

The theory of epidemiological transition argues that as countries undergo economic development, rates of communicable disease, such as Tuberculosis and diarrheal disease, decline while rates of non-communicable diseases, such as cardiovascular disease become the key drivers of morbidity and mortality. During this transition, rates of maternal and child mortality also decline while the prevalence of injury increases (Omran, 1971, Harper and Armelagos, 2010).

As seen in Figure 2.8, Vietnam has undergone precisely such an epidemiological transition in the last 30 years with communicable disease accounting for a much smaller portion of morbidity and mortality while both non-communicable disease and injury have risen.

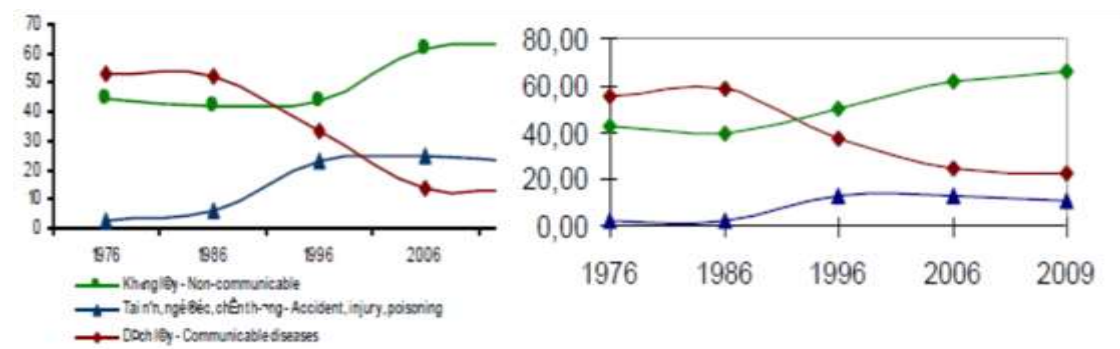


Figure 2.8: Evolution of the Causes of Mortality (left) and Morbidity (right) in Vietnam (Ministry of Health Government of Vietnam)

Specifically, as the burden of communicable disease has declined, non-communicable disease and accident and injury now account for 70% of life years lost (WHO, 2012). Cardiovascular Disease is now the leading cause of death in hospitals (Minh et al., 2003), and, based on a study of verbal autopsies, appears to be a leading cause of mortality at a community level as well (Huong et al., 2006a, Huong et al., 2003). At the same time, some infectious diseases remain prevalent in particular sub-regions including dengue in the Mekong delta and malaria in the northern mountains (Oanh et al., 2009). Vietnam also faces public health challenges from newly emerging diseases such as Avian Influenza as well as the emergence of drug resistant strains of historically endemic diseases such as Tuberculosis (Coker et al., 2011). While containing, treating and preventing these infectious diseases is critical to ensuring public health, they presently account for only a small portion of morbidity (~20%) and mortality (~10%) as estimated by the Ministry of Health (Ministry of Health Government of Vietnam).

2.1.2.2 Nutrition Transition

Vietnam's epidemiological transition is accompanied by, and in some respects closely linked to, a nutrition transition. Like the theory of epidemiological transition, the theory of nutrition transition proposes that economic and demographic changes associated with the development process drive a shift in nutritional patterns and attendant nutritional problems. Specifically, nutrition transition theory suggests that as developing economies shift from hunter-gatherer and agricultural economies to industrialized economies, rates of severe and chronic under-nutrition subside while both total and relative overconsumption of animal fats, sugars and processed foods rise. Consequently, nutrition deficiency, particularly among women and children, declines while new morbidities including overweight and obesity, diabetes and cardiovascular disease increase (Popkin, 1999).

As Vietnam's economic growth is driven by an increasingly industrial economy , and accompanied by rapid urbanization (World Bank Group, 2013a), evidence suggests it is undergoing a nutrition transition largely in keeping with the theory. Childhood under-nutrition has declined sharply in recent decades accompanied by rapid decreases in the prevalence of childhood stunting and an average adult height increase of as much as 9 centimeters among the 16-25 year old cohort. (Khan and Khoi, 2008, Khan et al., 2010). Deficiencies of micronutrients including iron and vitamin A have also decreased (Khan and Khoi, 2008).

Yet despite encouraging improvements these concerns have not disappeared. In 2008, the prevalence of under-5 stunting was still 30.5% (World Bank Group, 2013c). Likewise, Vietnam's 2009-2010 General Nutrition Survey found 28.8% of pregnant women and 29.2% of children suffered from anemia (Nguyen et al., 2012b). Furthermore, in 2010 20.6% of mothers of children under-5 suffered from chronic energy deficiency (National Institute of

Nutrition- Ministry of Health, 2012). Under-nutrition, micronutrient deficiency and food security tend to be concentrated among both the poor and those in disadvantaged areas (National Institute of Nutrition- Ministry of Health, 2012).

However, while under-nutrition related concerns persist at the national level, and at high levels among some sub-groups, Vietnam has also begun facing health issues due to overconsumption of fats, sugars and processed foods, particularly in urban areas. While the Government of Vietnam describes no reports of overweight and obesity prior to 1995, a 2005 Government survey indicated rates of overweight and obesity among adults aged 45-54 have reached 43% in urban areas and 17% in rural areas (Khan and Khoi, 2008). A 2007 study of pre-school children in Ho Chi Minh City found roughly 37% to be overweight or obese with similar rates in wealthy and less wealthy areas (Dieu et al., 2007). As expected, the shift in diet and anthropometry has been accompanied by a proliferation of over-nutrition related morbidities. Between 1960 and 2001 the rate of hypertension in Northern Vietnam increased from 1% to 23% and the incidence of stroke tripled between the mid-90s and mid-2000's (Khan and Khoi, 2008). As discussed above, the burden of cardio-vascular disease has also rapidly increased.

Thus Vietnam faces a double burden of nutrition challenges, continued undernutrition among the poorest and most remote, coupled with a rapid increase in overnutrition related concerns in more urban areas and among the emerging middle class.

2.1.3 Vietnam Health System

As with the trends in economic development, human development and epidemiology, Vietnam's health system has also undergone major transitions in the last three decades. The 1986 Doi Moi reforms which began Vietnam's transition from a centrally planned to a

market oriented economy also initiated a parallel transition in the health system. While Vietnam had previously offered an entirely free public health system fully funded by the government, the Doi Moi reforms introduced user fees for public health services. In 1989 the Doi Moi reforms also allowed private health care providers to enter the market for the first time. As discussed in greater detail below this has led to a rapid expansion in private sector health provision through over 100 private hospitals and 30,000 private clinics. (Tran, 2012, Ngo and Hill, 2011).

While the Doi Moi reforms provided much needed funding and flexibility to the health care system, the introduction of user fees initially resulted in a rise in catastrophic spending as well as inequity of health coverage (Somanathan et al., 2013). As a result, Vietnam has worked to implement a series of health insurance schemes to reduce financial barriers to health care, provide financial protection and ultimately achieve universal coverage. These include: mandating health insurance for formal sector workers and civil servants through a national scheme in 1998, the development of the Health Care Fund for the Poor which, in 2002, began providing free health insurance coverage for the poor, children under 6 and ethnic minorities in marginalized geographic locations as well as the ongoing promotion of voluntary health insurance for the non-poor employed in the informal sector (Somanathan et al., Tran, 2012).

At the same time Vietnam has also decentralized its health authority devolving more responsibility to provincial, district and commune level administrative health offices and health facilities (Oanh et al., 2009). The key features and lines of supervision of the Vietnamese health system are indicated in

Figure 2.9.

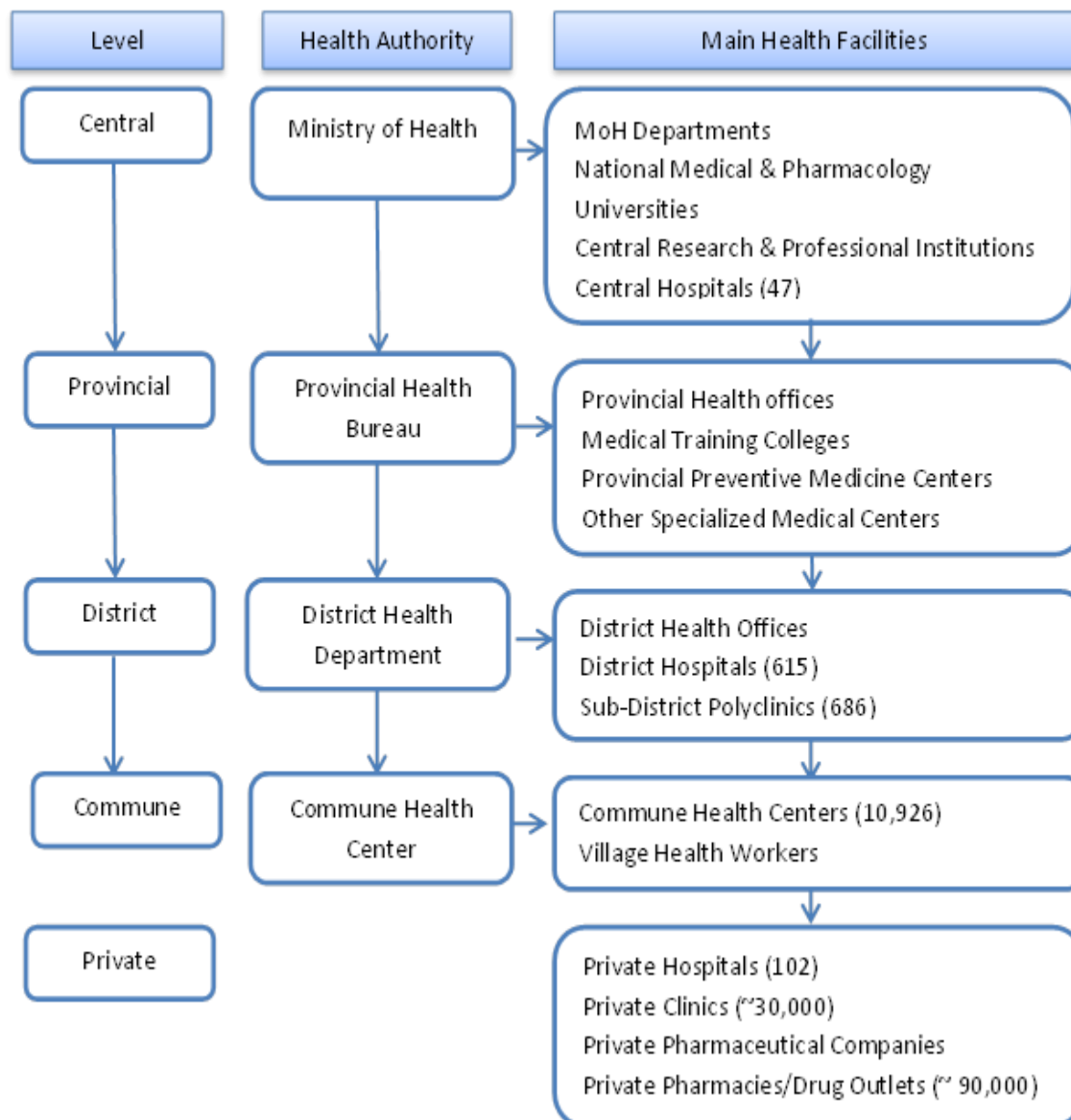


Figure 2.9: Vietnam's Health System (Tran, 2012, Ministry of Health Government of Vietnam, 2011)

The most important health facilities for this study include Commune Health Centers (CHC), the District Hospital and Private Clinics. Commune Health Centers are the primary public sector community level health facility. They are responsible for primary care as well as preventative care and public health promotion activities particularly for reproductive, maternal and child health (Tran, 2012). As of 2008, 99% of Vietnamese Communes had a Commune Health Center (Rheinlander et al., 2011) including all of the Communes in Ba Vi district where my research takes place.

The District Hospital is a much larger health care facility located in the district capital. While it provides basic services it is also used as a referral hospital providing secondary curative care and higher level services for complicated cases. For example, while Commune Health Centers are equipped to deliver babies, only the District Hospital can perform Caesarian Sections.

Concurrently with the transition from a centrally planned to a market economy in the late 1980's, Vietnam began to allow the operation of private sector health providers. Since the private health sector was legalized in 1989 the number of private clinics has mushroomed to over 30,000 nationwide. The private sector has reduced some of the patient load on the public sector (Tran, 2012) and has also provided patients with customer-service oriented healthcare that strives for a pleasant and satisfying patient experience. At the same time, private sector clinics are largely unregulated. While many private clinics are operated by public sector workers there are also a large number of unlicensed providers, particularly in rural districts like Ba Vi (Tran, 2012). Furthermore, even those licensed to practice medicine in the public sector have little oversight of their private sector activities. Driven by customer satisfaction and profit, the private sector has been known to overuse technology. Due to both the lack of oversight and the overuse of technology, the private sector has been shown to offer an inferior quality of care (Tuan et al., 2005) while exclusive use of the private sector has been specifically associated with a lesser likelihood of receiving appropriate antenatal care in Ba Vi and nearby districts (Tran et al., 2012a).

2.1.4 Summary: Four Dimensions of Interest in Vietnam

There are four key reasons why Vietnam is an interesting and important context in which to study the efficient demand side conversion of health resources into health outcomes. First,

rapid economic development and investment in the health system has led to improvements in health outcomes. However, no one has addressed whether these improvements are commensurate with the increasing investment in the health system or whether opportunities remain to optimize the level of outcomes achieved. Second, shifting distributions of health outcomes suggest varying levels of efficiency. Specifically, despite significant investment in health systems and resources for the poor and marginalized, some health inequalities appear to persist. This suggests that there are persistent demand side obstacles to the efficient conversion of these health resources into health outcomes. At the same time, other health inequalities are shrinking or reversing, suggesting that in some instances the least well-off are achieving higher outcomes with still comparatively less resources. In other words this dynamic raises the possibility that, in some cases, the less well-off may be more efficient though it is not clear how and why. Third, health transitions are raising new and additional challenges which existing resources must be stretched to meet without compromising the gains achieved in reducing poverty related health concerns such as infectious disease, poor maternal and child health and undernutrition. Specifically the epidemiological transition has resulted in a dramatic increase in the proportion of morbidity and mortality caused by non-communicable disease. As these diseases are often chronic in nature, they are particularly resource intensive to address. In addition, the nutrition transition has led to a double burden of malnutrition, persistent undernutrition in poor and marginalized groups with emerging concerns related to overconsumption of sugars, fats and processed foods in more affluent groups. The Government of Vietnam must now stretch its limited resources to maintain epidemiological gains, address resource intensive chronic diseases, reach the most marginalized populations with nutrition support and head-off the obesity crisis faced by many middle and high income countries. Achieving these goals will require increasing levels of efficiency or increasing impact per resource invested. Lastly, the evolution of the health system in Vietnam, including the introduction of

extensive programs to target the poor as well as the rapid emergence of private sector health care means that the very nature of health resources in Vietnam has shifted. As a result, it is critical to understand who is best navigating this new resource landscape, how and why in order to ultimately target inefficiencies and optimize the benefit that all groups derive from public health resources.

2.2 Why Healthy Pregnancy & Delivery?

2.2.1 A Global Priority

Further to the focus on Vietnam as a country, my study specifically analyzes conversion efficiency with respect to healthy pregnancy and delivery. Galvanized by the Millennium Development Goals, global health initiatives and development assistance schemes have invested increasing effort and funding to achieve Maternal Neonatal and Child Health outcomes. Health Economists from the London School of Hygiene and Tropical Medicine have tracked the flow of official development assistance for Maternal Neonatal and Child Health (MDGs 4 and 5) noting an increase from \$2.12 Billion in 2003 (Greco et al., 2008) to a high of \$6.51 Billion in 2009 decreasing only slightly to \$6.48 Billion in 2010 (Hsu et al., 2012). The stream of funding hails from a uniquely large and diverse pool of donors including the bilateral aid agencies of at least 25 countries, multilateral institutions such as The European Union, The Arab Fund, various UN agencies and The World Bank Group as well as Global Health Initiatives such as GAVI and the Global Fund (Hsu et al., 2012).

Yet despite both the magnitude and the diversity of funding, progress towards the Millennium Development Goals relating to Maternal Neonatal and Child Health (MNCH) continues to be mixed. While some remarkable gains have been achieved, concern that overall progress is insufficient remains (Horton, 2008, Singh, 2012). For example while most

countries in the South East Asia Region have either achieved or are on track to achieve the required reductions in maternal mortality, coverage of reproductive health services and antenatal care has only marginally improved (Singh, 2012) and reductions in neonatal death rates remain sluggish (Bhutta et al., 2010). Furthermore inequities in outcomes between countries and even within countries persist and in some cases have even grown (UN-ESCAP et al., 2012, Målqvist et al., 2013) . Systematic reviews identify growing inequities in MNCH outcomes in the world's most populous countries, India and China. These reviews begin to trace the social determinants of inequities including economic status, ethnicity, migrant status, social class/caste, geography, age and religion. Most of the articles they identify deal with service utilization rates and outcomes whereas few (though more in China than India) consider how and why social determinants affect demand side behaviors. The authors conclude that further qualitative work would be useful to better understand these dynamics (Sanneving et al., 2013, Yuan et al., 2013).

2.2.2 A National Priority for Vietnam

In keeping with the increasing global focus on MNCH, ensuring healthy pregnancy and delivery has also been a focus for the Government of Vietnam (Målqvist et al., 2013, Tran, 2012). This is evident from the inclusion of key MNCH targets in the Vietnam Development Goals, Vietnam's national adaptation and elaboration of the Millennium Development Goals. The Vietnam Development Goals include targets related to maternal mortality, fertility, infant and under-5 mortality, under 5 nutrition, birth weight vaccination access to safe water and sanitation (Knowles et al., 2009). To achieve these goals the Government of Vietnam and specifically its Ministry of Health have developed a series of national policies and strategies. The National Strategy for Reproductive Health Care 2001-2010 set forth seven specific objectives including education and counseling on reproductive health and family planning, provision of reproductive health services to decrease the fertility rate as well as

the rate of abortion, diagnosis and treatment of reproductive tract and sexually transmitted infection, and the reduction of maternal, infant and perinatal mortality through ensuring a package of care including antenatal and postnatal visits, delivery attendance, and institutional delivery. Subsequently the National Safe Motherhood Plan for the Period 2003-2010 complemented this strategy with a focus on providing both the equipment and human resources training required to provide high quality maternal and infant care. (Ha et al., 2010, Vietnam Delegation to the ASEAN Inter-Parliamentary Assembly, 2011, World Health Organization, 2013). National Clinical Guidelines on Reproductive Health further stipulate core and optional maternal care services further detailed in Chapter 4.

Both of these strategies aim to achieve reductions in the average incidence of maternal and child morbidity and mortality while also making specific provisions to address equity concerns particularly regarding the poor, ethnic minorities, and residents of disadvantaged areas. In 2011 they were both updated in the form of the 2011-2015 National Plan for Reproductive Health and the 2011-2015 National Plan on Safe Motherhood and Newborn Care. These later plans provide updated targets and modest technical revisions, such as a stronger recommendation for at least one ultrasound during pregnancy. However, as this study will focus on the period 2005-2011 (see Chapter 3 and 4) the first set are the most relevant.

2.2.3 Methodological Advantages

Focusing this analysis on healthy pregnancy and delivery has methodological advantages as well. First, focusing on healthy pregnancy and delivery allows comparability across cases based on clear, broadly accepted metrics for appropriate maternal care and good birth outcomes. Because examining efficiency requires comparing the outcomes achieved with similar resources it is essential to have some basis for judging which outcomes are superior.

For example, it would be impossible to compare health outcomes of a patient with diabetes to those of a patient with dengue—there is no common metric by which they can be judged. However, the measures of appropriate care such as basic tests, examinations and a minimum number of visits, and desirable outcomes, such as healthy birth weight or full term birth are very clear for healthy pregnancy and delivery. Second, because this analysis seeks to understand which social factors are associated with efficiency, or which groups are the most likely to be efficient, it is useful to consider a health issue which impacts people from a broad range of social backgrounds. If I were to consider a disease like Malaria which presently impacts only remote and poor populations in Vietnam, or obesity, which primarily impacts wealthier urban populations, it would be hard to determine the contribution of social factors since there is limited variation in the backgrounds of people who face this issue. This is obviously not the case for pregnancy, a condition which nearly half the population will experience over the course of a lifetime. As a result, improving efficiency in this area has the potential for large scale impacts both with respect to resource optimization and population health outcomes.

CHAPTER 3: **GENERAL METHODOLOGY**

This chapter lays out the methods I used to answer my research questions. Here I explain my mixed methods approach in general terms. In Chapters 4 and 5 I go into greater detail on the specific application of these methods to the data and context of healthy pregnancy in Ba Vi district, Vietnam.

3.1 Ethical and Administrative Approval

Prior to beginning this study I received ethical approval from University of Oxford's Central University Research Ethics Committee (CUREC): reference number MSD-IDREC-C1-2012-88. I also received ethical approval from my partner research institution in Vietnam, Hanoi Medical University. Finally, I received administrative approval to work in Ba Vi from the district health authorities.

As the first stage of my research used secondary quantitative data that was collected according to local and international ethical standards and already anonymized by the time I received it, there were no ethical concerns or further steps required. The second stage of my research involved qualitative interviews with subjects on personal, though not controversial, topics relating to the use of health resources to achieve healthy pregnancy. The main ethical issues for this section of the research were 1) ensuring that the women interviewed gave informed consent and understood their rights with regard to the interview process prior to beginning the interview and 2) ensuring that data remained confidential following collection. I developed informed consent packs which were approved by both Oxford's CUREC and Hanoi Medical University. These were translated into Vietnamese and discussed and signed by every subject prior to the interviews and focus groups. That form is attached as Appendix A. Following data collection, identifying details of participants (full names and addresses)

were removed from records and all members of my research team were briefed and agreed to terms of confidentiality.

3.2 A Mixed Methods Approach

Answering my research questions regarding conversion efficiency requires a mixed methods approach. The first two questions seek to identify each individual's level of efficiency and, subsequently, the relative association between social conversion factors and the likelihood that someone is efficient. I carried out the quantitative analysis in two steps: first I conducted a Technical Efficiency Analysis in order to determine each individual's efficiency at translating available health resources into health outcomes. Following that, I conducted multivariate logistic regressions using efficiency as the dependent variable to estimate the relative influence of conversion factors on the likelihood of a person being efficient. This strategy is further elaborated in the subsequent section on quantitative analysis.

My third research question, which asks how and why some people convert resources into outcomes more efficiently than others, requires qualitative methods as it is essentially concerned with how people engage with the social world around them. Using the framework of the Capability Approach, I sought to understand a subjective reality, namely how people perceive of and act on their opportunities and choices to convert health resource into health outcomes. In order to elicit this information I conducted focus group discussions and semi-structured interviews with recently pregnant women, as well as health professionals.

Research Question	Method	Result/Output of Each Method
1) How efficient is a population in converting health resources into health outcomes?	Technical Efficiency Analysis using Order-m Method Efficiency Analysis	An efficiency score for each individual representing how efficiently they converted health resources into health outcomes during their pregnancy; a distribution of scores for the population.
2) Are some groups of people more likely than others to be efficient?	Regression Analysis using multivariate logistic regression	An estimate of the relative influence of each social conversion factor included in the model on the likelihood that a person was efficient.
3) How and why do the social factors identified as significant influence conversion efficiency?	Focus Group Discussions and Semi-Structured Interviews	Qualitative feedback on how women from different backgrounds are able and choose to convert health resources into health outcomes.

Table 3.1: Summary of Methods Used to Answer Each Research Question

3.3 The Filabavi Health and Demographic Surveillance Site



Figure 3.1: Map of Vietnam Showing Ba Vi District

I carried out my research in Ba Vi district, Northern Vietnam. Ba Vi is a rural district in Northern Vietnam, roughly 60 kilometers west of the capital of Hanoi (see Figure 3.1).

Home to approximately 235,000 people, Ba Vi spans a range of geographies including lowlands, mountain and highlands. 91% of people in Ba Vi are from the Kinh ethnicity, the national ethnic majority. The Muong ethnic minority, a group considered to be the most closely related, both by ancestry and culture to the Kinh, comprise 8% while the Dao, Tay, Hoa and Khmer

ethnic minorities make up the remaining 1%. Like most rural districts in Vietnam where the

majority of people are engaged in agriculture, 81% of people in Ba Vi are farmers, primarily growing rice, corn, cassava, soybean and fruits. Other economic activities include forestry, handicrafts, small trade as well as a small percentage of employment in the formal sector, primarily in the public sector. With respect to education, 69% of adults have completed primary school, 21% have completed secondary school, 9% have completed high school and 0.5% have completed a higher qualification. Illiteracy is rare at just 0.4% (Chuc and Diwan, 2003). Given the trend of improving educational access in Vietnam, these averages are likely the result of higher education levels among younger adults and much lower education levels among older adults. With respect to healthy pregnancy outcomes, the baseline infant mortality rate in Ba Vi was 21.6/1000 live births. Other key outcomes for healthy pregnancy and delivery have not been measured at a district-wide level nor are national statistics disaggregated at the district level available.

The secondary data that I analyzed was collected as part of the Filabavi Health and Demographic Surveillance Site (HDSS). Ba Vi was selected as the site for this field laboratory because its geography, demographics, and health context are roughly representative of Vietnam, and particularly rural Vietnam as a whole. While the generalizability of any findings must be weighed carefully, the field laboratory was intended to be a microcosm of Vietnam at large (Chuc and Diwan, 2003). Table 3.2 compares statistics in Ba Vi with those for rural Vietnam as well as the national averages. In most cases, the statistics are comparable with the biggest difference being somewhat higher primary school completion rates in Ba Vi.

	Ba Vi District	Average for Rural Areas	National Average
Infant Mortality Rate	21.6/1000 in 2001 (Byass, 2003)	26.5/1000 in 2002 (Axelson et al., 2012)	24.5 in 2002 (World Bank Group, 2012)
Life Expectancy	75.2 in 2001 (Byass, 2003)	(Not Available)	72.4 in 2001 (World Bank Group, 2012)
% in Agriculture	81% in 2003 (Chuc and Diwan, 2003)	76.2% in 1998 VLSS (Fesselmeyer and Le, 2010) 63% in 2002 VLSS (Huong and Booth, 2013)	60-70% World Bank and FAO
% Ethnic Majority (Kinh)	91% in 2003 (Chuc and Diwan, 2003)	83% in 2002 VLSS (Huong and Booth, 2013)	86.2% in 1999 General Statistics Office, 1999 Census
% Completing Primary School	69% in 2003 (Chuc and Diwan, 2003)	(Not Available)	40.3% in 2000 (World Bank Group, 2013b)
% Completing High School	9% in 2003 (Chuc and Diwan, 2003)	(Not Available)	9.3% in 2000 (World Bank Group, 2013b)

Table 3.2: Summary Statistics for Ba Vi District, Rural Vietnam and All Vietnam

Established in 1999, FilaBavi (Field Laboratory **Ba Vi**) is operated by Hanoi Medical University in collaboration with international partners. Data is collected using a stratified random sampling approach to identify clusters and households for sampling. The resulting sample contains 67 clusters including roughly 11,000 households and 55,000 individuals (Chuc and Diwan, 2003, Tran, 2012).

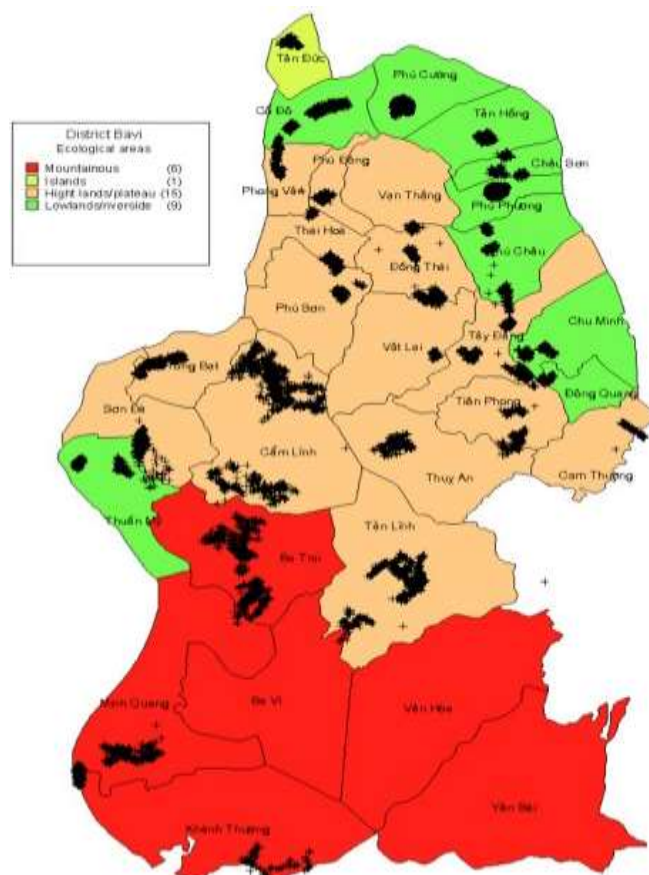


Figure 3.2: Map of Filabavi HDSS Showing Geographies, Communes and Clusters

Beginning in 1999, the Filabavi HDSS collected baseline data at the household level -- including household infrastructure, assets and distance to health facilities-- and individual level-- including demographic factors such as age, gender, education, employment, ethnicity and marital status. This complete set of data has since been re-collected every two years. Data on birth, death, migration, pregnancy, illness and care seeking are collected on a quarterly basis (Tran, 2012). The data is collected by field surveyors who are secondary school graduates hailing from the communities surveyed. Extensive training of surveyors, re-surveying and spot checking ensures data quality (Chuc and Diwan, 2003). More extensive background information on the Filabavi HDSS as well as a full variable list is attached as Appendix B.

3.4 Quantitative Methods

As discussed in Chapter 1, Technical Efficiency Analysis considers whether a set of inputs is converted into the maximum possible set of outputs. This approach is thus well suited to my research questions regarding the efficient conversion of health resources into health outcomes. For a discussion on why Technical Efficiency Analysis is more appropriate than alternative methods including models used in Social Epidemiology and Health Production Functions see Appendix C .

In order to answer my research questions I applied a robust non-parametric efficiency analysis known as the Order-m Method (Cazals et al., 2002) in order to generate an efficiency score for each pregnancy of each woman in the sample. The score reflects how efficiently each woman converted a set of government provided health resources into a set of health outcomes. I then used a variable, based on the efficiency score, designating

whether each woman was efficient or not as the dependent variable in a logistic regression analysis in order to determine how social factors influenced the likelihood that a woman was efficient. These methods are explained in general terms below, details on the specific application in Ba Vi, including variables used and results, are addressed in Chapter 4.

3.4.1 Order-m Method: Adapted for Robustness

The Order-m Method which I used to generate efficiency scores is similar to the non-parametric Data Envelopment Analysis (DEA) method described in Chapter 1 in that the Order-m Method generates efficiency scores by comparing each individual in the sample to an efficiency frontier determined by the best practice individuals (the people achieving the highest level of outcome per level of resource) (Binder and Broekel, 2011, Cazals et al., 2002). However, the Order-m Method makes 3 key adaptations to Data Envelopment Analysis which make it more robust (Binder and Broekel, 2011, Cazals et al., 2002).

First, as discussed in Chapter 1, Data Envelopment Analysis makes an assumption that the efficiency frontier is smooth, or that the efficiency frontier is represented by a constant function (e.g. linear or logarithmic) between any two observed outcome levels (Charnes et al., 1978, Binder and Broekel, 2011). While this assumption, also known as convexity, seems reasonable, it is hard to justify why it has to be the case (Binder and Broekel, 2011).

Furthermore it contradicts the driving principle of the approach which is to define optimal efficiency from the data rather than from *a priori* assumptions and hypotheses. Returning to the example from Chapter 1, consider the case of Hospitals A, B, C, D shown in Table 3.3 which represent the highest achieving hospitals with 1, 2, 3 and 4 doctors respectively.

Hospital	# of Doctors	# of Patients Treated
A	1	15
B	2	24
C	3	18
D	4	35

Table 3.3: Example Data for Hospitals A-D

Here the highest observed outcome for a hospital with 3 doctors (18 patients treated) is less than that for a hospital with 2 doctors. Since we know from the data that two doctors can treat as many as 24 patients, Hospital C is therefore not optimally efficient. In order to calculate an efficiency score in this case we need an estimate of optimal efficiency, or the efficiency frontier at this point. Data Envelopment Analysis, which assumes a constant slope (or change in slope) between two observed points (Binder and Broekel, 2011, Charnes et al., 1978), would estimate that frontier, half way between the maximum treated with 2 doctors and the maximum treated with 4.³ However, this estimate is based on the arbitrary assumption of a constant slope between observed points.

Free Disposal Hull is an alternative approach which eliminates this problematic assumption by setting the *efficiency frontier equal to the maximum outcome achieved by those with equal or less resources observed in the dataset* (Tulkens, 1993). In this case, the optimal output for a hospital with 3 doctors would be set at 24, the maximum observed achievement for a hospital with 3 or less doctors. This more modest assumption leads to a more conservative estimate of the efficiency frontier and one which is directly supported by the data. Figure 3.3 highlights this point showing the more conservative stepwise efficiency

³ Technically, there are different approaches to constructing the convex frontier using DEA. For simplicity's sake I have described a piece-wise linear approach. An alternative approach would generate a frontier for which the slope of the frontier changes smoothly over its course rather than allowing the slope to change more and less at certain points. The relevant issue, however, is that DEA is always convex or continuously increasing.

frontier generated from the FDH approach as opposed to the rounded frontier generated by DEA.

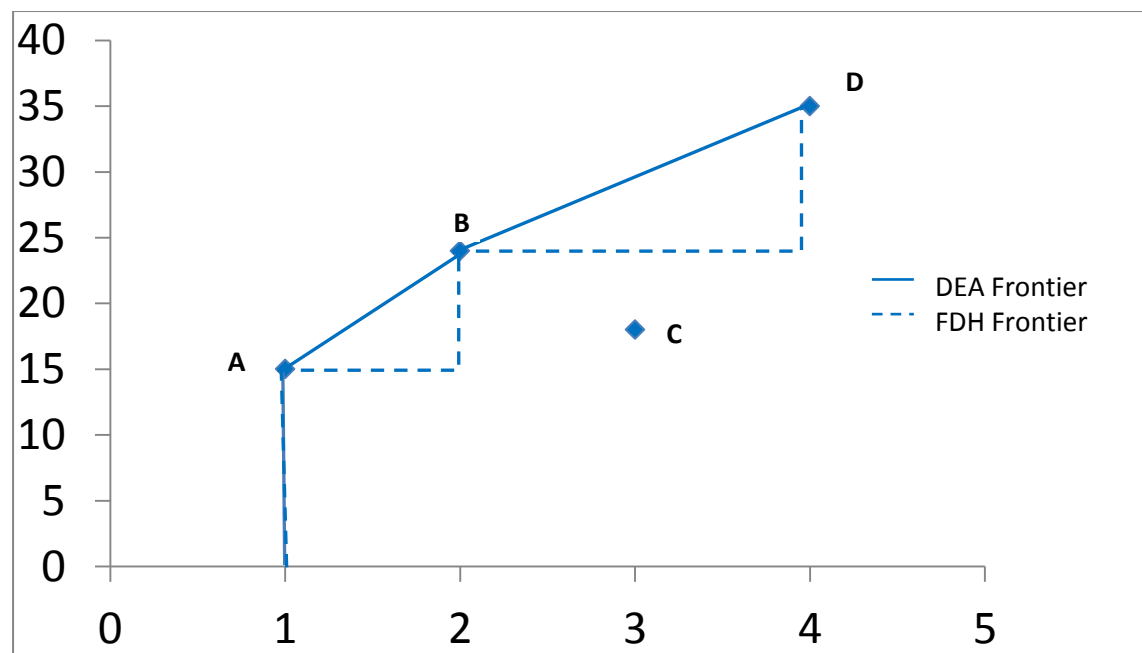


Figure 3.3: Comparison of DEA and FDH Efficiency Frontiers. Adapted from (Tulkens, 1993)

The second adaptation of the Order-m Method addresses the fact that while FDH makes the most conservative assumptions about the shape of the efficiency frontier it is still highly susceptible to outliers (Cazals et al., 2002, Binder and Broekel, 2011). Imagine a scenario where hospital B has incredibly focused, experienced doctors and serves a community in excellent health where patients seek care for only minor complaints. As a result, hospital B is able to treat 200 patients per day with just 2 doctors. This is an unlikely and non-representative scenario however it is not impossible. If the basic FDH approach is used in this case, most other hospitals would look inefficient against what is essentially an uncommon, unreasonable standard.

The Order-m approach takes two steps to prevent such outliers from distorting the efficiency scores of the entire population. First, rather than comparing each individual to all

other individuals in the sample with equal or less resources, the Order-m method compares each individual to a randomly selected subset of the population (Binder and Broekel, 2011, Cazals et al., 2002).

The formal equation for this approach is included below (Binder and Broekel, 2011). Here, $\tilde{\lambda}_m$ represents the efficiency score for the individual with resource level x_0 and outcome level y_0 . The efficiency score, $\tilde{\lambda}_m$, is identified by looking at a subset of the population comprising m observations of people with equal or less resources than x_0 and equal or greater outcomes than y_0 . The efficiency score is then defined as the ratio of Y_i , the outcome achieved by the highest achieving individual among the m individuals selected, to y_0 the achievement of the individual for whom we are generating an efficiency score. The value j denotes the dimension of the output set, I explain the multi-dimensional application of this approach further below.

$$\tilde{\lambda}_m(x_0, y_0) = \max_{i=1, \dots, m} \left\{ \min_{j, \dots, q} \left(\frac{Y_i^j}{y_0^j} \right) \right\}$$

Equation 3.1: Calculating the Order-m Efficiency Score (Binder and Broekel, 2011, Binder and Broekel, 2012)

To further ensure robustness the Order-m method generates a final estimated efficiency score, $\hat{\lambda}_m$, by calculating the order-m score, $\tilde{\lambda}_m$, a large number of times (B) and then taking the average (Binder and Broekel, 2011, Cazals et al., 2002). The formal equation for this final step is below:

$$\hat{\lambda}_m(x_0, y_0) = E[\tilde{\lambda}_m(x_0, y_0) | X \leq x_0] = \frac{1}{B} \sum_{b=1}^B \tilde{\lambda}_m^b(x_0, y_0)$$

Equation 3.2: Calculating the Final Estimated Efficiency Score by Iterating and Averaging B Order-m Scores (Binder and Broekel, 2011, Binder and Broekel, 2012)

3.4.2 The Multidimensional Application of the Order-m Method

Another advantage of Technical Efficiency Analysis, and specifically the Order-m method which I used, is that it is capable of carrying out a multidimensional analysis. The example which I used to illustrate efficiency analysis above – involving how efficiently a hospital converts the health resource number of doctors into the health outcome number of patients treated—is one dimensional. In this case the efficiency score is calculated as follows.

Referring back to Table 3.3, if we want to calculate the efficiency score for Hospital C which has 3 doctors and treats 18 patients we first look for the set of all hospitals that have 3 or less doctors and treats 18 or more patients. We find that Hospital B, which has 2 doctors and treats 24 patients, matches this criteria and thus dominates (is more efficient than) Hospital C. We then take the ratio of the outcome of the highest achieving hospital in the dominating group to the outcome of the hospital for whom we are generating the score:

$$\text{Efficiency Score for Hospital C} = \frac{24}{18} = 1.33$$

Thus 1.33 is the efficiency score for Hospital C which indicates that Hospital C needs to improve its output by a factor of at least 1.33 (or 33%) in order to become efficient.

I applied the Order-m Method to my research question in a multidimensional context considering multiple health resources and multiple health outcomes at the same time. In the multidimensional approach, an individual's set of resources is captured in a resource set, a series of values, which is then compared to the resource sets of other individuals. Outcomes are treated in the same way. The sets are compared using the principal of weak dominance. Weak dominance occurs where all of the values of one set are greater than or equal to all of the values of another set. If some values are higher and some are lower in each set, neither dominates.

In a multidimensional version of the example above imagine that we are trying to generate an efficiency score for Hospital A which has the resource set of 4 doctors, 2 nurses and 10 beds and the output set of treating 100 inpatients and 200 outpatients. We first identify all other hospitals which have 4 or less doctors AND 2 or less nurses AND 10 or less beds AND who treat 100 or more inpatients AND 200 or more outpatients. Any hospitals matching this criteria would be considered to weakly dominate, and thus be more efficient than, Hospital A. We then take a random subset of size m of this group. For this example say m is 4 so we consider Hospital A against 4 dominating (more efficient) hospitals in Table 3.4 .

	Resource Set (doctors, nurses, beds)	Outcome Set (inpatients treated, outpatients treated)
Hospital A	(4,2,10)	(100, 200)
Hospital 1	(4,2,8)	(110, 250)
Hospital 2	(3,1,10)	(105, 270)
Hospital 3	(2,2,7)	(115, 220)
Hospital 4	(3,2,9)	(120,280)

Table 3.4: A Multidimensional Example of Hospital A and 4 More Efficient Hospitals

We then calculate the ratios of Hospital A's outcome set to each other hospital's outcome set and take the minimum value across all dimensions. This step is represented in Equation 3.1 as:

$$\min_{j, \dots, J} \left(\frac{Y_i^j}{y_0^j} \right)$$

The calculation is shown in Table 3.5.

	Sets of Outcome Ratios	Minimum of Each Ratio Set
Hospital 1:Hospital A	(110/100, 250/200)= (1.1, 1.25)	1.1
Hospital 2:Hospital A	(105/100, 270/200)= (1.05,1.35)	1.05
Hospital 3:Hospital A	(115/100, 220/200)= (1.15, 1.1)	1.1
Hospital 4: Hospital A	(120/100, 280/200)= (1.2, 1.4)	1.2

Table 3.5: Calculating the Outcome Set Ratios for Hospital A

Next we take the maximum value from among this group of minimums in order to get the Order-m efficiency score. This two-step max/min procedure is expressed in Equation 3.1 as:

$$\tilde{\lambda}_m(x_0, y_0) = \max_{i=1, \dots, m} \left\{ \min_{j, \dots, q} \left(\frac{Y_i^j}{y_0^j} \right) \right\}$$

Thus In this case $\tilde{\lambda}_m$ for Hospital A = 1.2. This means that Hospital A must increase each dimension of its outcome set by a factor greater than 1.2 in order to become efficient, or ensure that no other hospital dominates it. Indeed, if we multiply each dimension of Hospital A's outcome set by a factor greater than 1.2 (say 1.21) we see that it is no longer dominated by Hospitals 1-4 (see Table 3.6).

	Outcome Set
Hospital A	(100 x 1.21, 200x 1.21)= (121, 241)
Hospital 1	(110, 240)
Hospital 2	(105, 270)
Hospital 3	(115, 220)
Hospital 4	(120,280)

Table 3.6: Comparison of Hospital A with Outcome Set Expanded to Hospitals 1-4

When Hospital A is expanded in each dimension by the efficiency score it dominates Hospitals 1 and 3 in that all dimensions of Hospital A's outcome set are greater than or equal to the corresponding dimensions of Hospitals 1 and 3. Hospital A does not dominate Hospitals 2 and 4 but it is also not dominated by Hospitals 2 and 4. Because it is not dominated by any other Hospital, Hospital A is now efficient.

In the last step, the final efficiency score is derived by calculating the order-m score a large number of times, and then taking the average of all the order-m scores generated (see Equation 3.2).

The Order-m method was originally developed by Cazals et al. (Cazals et al., 2002) and was recently applied to the welfare context by economists from the Max Planck Institute and Leibniz University in order to estimate conversion efficiency and the relative contribution of conversion factors within the Capability Approach paradigm (Binder and Broekel, 2011, Binder and Broekel, 2012). Tom Broekel assisted me in adapting and implementing the Order-m method to the context of this research. My study represents a novel application in three respects: 1) it is the first time this method has been applied specifically to health as opposed to broader welfare 2) it is the first time this method has been applied outside of the UK and 3) it is the first time it has been followed by a qualitative study to elaborate why and how the conversion factors identified as significant influence efficiency.

I used the software package R to generate efficiency scores and Stata IC 12.1 for all other quantitative analysis.

3.4.3 Estimating the Influence of Conversion Factors on Efficiency

The second stage of my quantitative analysis answers my second research question: are some groups of people more likely to be efficient than others? In order to answer this question, I conducted logistic regression analysis to estimate the influence of conversion factors on the likelihood that a woman was efficient at converting health resources into health outcomes.

Because my outcome of interest is achieving efficiency at converting health resources into a set of health outcomes, the dependent variable in my regressions was a dummy variable equaling 1 for women who were efficient and zero for women who were inefficient. I identified who was efficient and inefficient based on the efficiency scores generated through

the Order-m method explained in the preceding section. As explained in Chapter 1 and previously in this chapter, anyone with an efficiency score equal to 1 is, by definition, efficient, while anyone with an efficiency score of greater than 1 is inefficient. I used a series of conversion factors as my independent variables, whose contribution to the likelihood of being efficient I wanted to estimate. As discussed in greater detail in Chapter 4, I chose which social conversion factors to include based on both the global and Vietnam-specific literature.

I also included a set of control variables in order to control for several potential sources of bias, or several factors whose effects I wanted to distinguish from the effect of conversion factors on the likelihood of efficiency. Because my sample spans the years 2005-2011, a period of time when the health system and people's use of it has evolved, I controlled for changes in efficiency in each year using a dummy variable for each year. This allows me to separate out the effects that were due to broad trends over time and isolate the influence of social factors on conversion efficiency. I also controlled for the fact that a small number of women (85) appeared multiple times in the sample because they gave birth multiple times within the time periods included in my data. In order to ensure that this group was not biasing the results—i.e. because they might have had unique characteristics that would exert an outsized influence by appearing more than once—I also included a control dummy variable equaling 1 for women who had multiple births. Lastly I accounted for the fact that the survey was collected using a clustered sampling approach and, as a result, we would expect women within the same clusters to be more similar than an equally sized group of randomly selected women from all over the district. I ran a version of the model which accounts for this within group correlation producing an adapted estimation of the variance in the population resulting in cluster robust standard errors. This approach affects the statistical significance of coefficients though not direction or magnitude. In addition,

accounting for within cluster correlation in this way also accounts for the fact that women from the same cluster also all use a common health center. In this respect I also account for the fact that we would expect some greater similarities between women using the same commune health center due to differences in facilities as well as the overall quality of care.

The following equation represents the basic logistic model used in my regression analysis.

$$\log\left(\frac{p_{being\ efficient}}{1 - p_{being\ efficient}}\right) = \beta_0 + \beta_{1...n} conversion\ factors_{1...n} + \beta_{x...k} controls_{x...k} + \epsilon$$

Equation 3.3: Model for Logistic Regression Analysis

The results of this regression, a series of coefficients for each social factor directly respond to my research question by indicating the magnitude and direction of each factor's influence on the likelihood that a person is efficient. The interpretation of these coefficients, which represent the log odds, is addressed in greater detail where the results are presented in Chapter 4.

3.4.3.1 Identifying the most appropriate model

I chose to use a logistic regression with a binary dependent variable because this approach most directly corresponds to my research question: are some groups of people more likely to be efficient than others? In past applications both standard OLS (Binder and Broekel, 2011) and panel fixed effects regressions (Binder and Broekel, 2012) have been used to estimate the relative influence of conversion factors on a continuous efficiency score. In this application however, I employ a logistic regression with a binary variable for efficiency as the dependent variable. Using a binary dependent variable is theoretically appropriate as this analysis aims to determine whether some groups of people are more likely to be efficient than others – which is exactly what the results of a binary logistic regression tell us.

Conversely, if I used a continuous dependent variable the regression results would indicate the positive or negative influence of social factors on an efficiency score without distinguishing between the achievement of efficiency or just varying levels of inefficiency. This latter model would thus elide the comparison of efficient versus inefficient with the comparison of less inefficient versus more inefficient. Yet the first distinction seems more important conceptually and also lends itself to a more meaningful interpretation: the increased/decreased odds of being efficient is a more tangible finding than an x% increase or decrease in an efficiency score which cannot be directly interpreted given the multidimensionality of the resource and outcome sets used in this case.

To explore the alternative approach I also ran a linear regression with a continuous version of the efficiency score as the dependent variable. While the significance and direction of influence of the conversion factors was similar to those from the binary logistic model, the model was less well fit. Specifically the residuals were not normally distributed and heteroskedastic (meaning the variance was not constant). There were also influential outlying observations. While we cannot be sure why this was the case, one possibility discussed further in the context of the results in Chapter 4, is that there is stochastic noise, or a degree of randomness, in the continuous efficiency scores. While the relationship between health resources and health outcomes is well justified by both theory and empirical literature at the population level, there are other factors which may impact resources and outcomes independently of each other at the individual level. For example there are biological factors that could predispose some people to morbidities independently of their resource level.

Using the binary logit model which is theoretically preferable for the reasons described above, I was able to build a model that is well fit, appropriately specified and undistorted by

outliers or high-leverage observations. These findings are explained in more detail in the section entitled Model Diagnostics in Chapter 4.

3.5 Qualitative Investigation

The primary aim of my qualitative stage was to answer my third and final research question:

How and *why* do the factors identified as significant in the quantitative stage influence conversion efficiency? In particular, how do they influence individuals' capabilities and choices?

I also aimed to understand whether there were any additional factors that influence efficiency which I had not included in the quantitative stage either because the required data was not available in the Filabavi dataset or because the factors could not be captured appropriately in quantitative terms.

3.5.1 Focus Group Discussions and Interviews

My approach to the qualitative portion of my study is largely based on a grounded theory approach (Charmaz, 2006). I collected data from Focus Group Discussions and Interviews from which I identified themes that together lead to theories about how and why certain social factors are associated with a greater likelihood of efficiency (Kitzinger, 1995, Bryman, 2012, Britten, 1995). I sampled across the social factors identified as significant in the quantitative stage of my analysis (Coyne, 1997). Those factors and the resulting demographics of my qualitative sample are presented in detail in Chapters 4 and 5.

I began with Focus Group Discussions in order to get a large number of perspectives so that I could begin identifying themes and issues of interest to probe during in-depth interviews

(Kitzinger, 1995, Bryman, 2012). If a participant was more reluctant to participate in the focus group or made an interesting comment that I could not further explore in the context of the discussion, I asked her to stay for a follow-up interview after the discussion. After identifying preliminary hypotheses from the Focus Group Discussions, I undertook in-depth interviews to explore and clarify these themes (Britten, 1995).

3.5.2 Qualitative Research Team

Collaboration with local researchers from Hanoi Medical University not only made it possible for me to conduct qualitative research across national, cultural and linguistic boundaries, but also greatly enriched my understanding of the information gathered by adding local insight and context to the data. Translators provided me with real time translation in order to conduct the interviews and also provided background and explained feedback that required local context such as references to a local program or traditional beliefs or practices. I also audio recorded all interviews which were later transcribed by students from Hanoi Medical University and translated from Vietnamese to English by a written translator.

3.5.3 Topic Guides

I developed a topic guide which I piloted through four practice interviews. Piloting interview questions is considered particularly important in the cross-cultural, cross-language context (Squires, 2009). Based on the pilot interviews I re-phrased some questions, made some clarifications with the research assistants who conducted my interviews, and re-organized some of the questions into groups by health resources of interest so that I could better keep track of the conversation.

The topic guide begins with asking broad questions about the experience during pregnancy, what factors were important for health during pregnancy and what resources were important to use. I then picked up on specific resources (including health facilities, health care workers, health information) and probed for people's perceptions of each resource, as well as their opportunities and choices regarding the utilization of each resource to achieve outcomes. I also asked about people's health outcomes (including complications during pregnancy and delivery, health of the baby and mother) in order to understand the relationship between how they used resources and their outcomes achieved (i.e. their conversion efficiency). I probed on any other factors that people felt were important health resources outside of this health system, such as nutrition. Within this framework, I continued to make modifications throughout the qualitative stage to clarify questions and improve my strategy for hard to elicit answers – such as broad impressions of factors important for health. A sample topic guide is attached as Appendix D.

3.5.4 Informed Consent

Prior to beginning focus group discussions or interviews my research team introduced everyone present, explained the general purpose of the research and talked participants through an information sheet and informed consent checklist. The information sheet and informed consent checklist and signature form were approved by both Oxford's CUREC and Hanoi Medical University before being translated into Vietnamese. The English versions are attached as Appendix A. None of the research participants raised questions about the information sheet or informed consent documents and none declined to answer any of the questions posed during interviewing. This is likely due to two factors 1) Interview participants have participated in the Filabavi HDSS for as long as 12 years and are, at this stage, extremely comfortable answering questions about their lives and health for researchers and 2) While some of the questions for this research are personal, none of them

focus on topics of a controversial nature or issues that would be likely to cause negative repercussions for participants.

All participants were also asked for their consent to be audio recorded. All but one agreed. The participant who declined to be recorded was a Commune Health Center Worker who was reluctant to have a record of her comments about her professional life, colleagues and patients. However she agreed for me to take notes during the interview which I did.

3.5.5 Conducting FGDs and Interviews

Prior to beginning qualitative data collection, I discussed my research questions, preliminary quantitative findings and topic guide in depth with the research team in order to align our understanding of the project and its aims. We also discussed qualitative research methods including asking open questions, probing, clarifying questions without leading, developing a good rapport with the interviewee and appropriately responding to questions, particularly requests for advice. I continued to revisit these issues with the research team as needed over the course of the qualitative study. Again this close collaboration with research assistants/interpreters is considered particularly important in the cross-language, cross-cultural context (Edwards, 1998).

Focus groups and interviews were conducted in Vietnamese by Vietnamese researchers from Hanoi Medical University. One research assistant led my Focus Group Discussions while a translator provided me with real time summary translations. I limited my interjections to asking further questions or probes during breaks in the conversation or near the end of the session. I tried to avoid interrupting the flow of conversation as one of the distinguishing advantages of Focus Group Discussions is enabling group members to prompt

each other, build on each other and ultimately articulate perceptions and experiences that may not emerge in an individual setting (Kitzinger, 1995, Kitzinger, 2005).

Of the three FGDs, I conducted two in the homes of participants who had agreed to host while one was conducted in a Filabavi project office at the Ba Vi district hospital.

Filabavi Field Surveyors organized the Focus Groups and Interviews and provided introductions to all participants. It is possible that in this capacity the surveyors could have played a gate keeper role—identifying particular people for me to speak with or not. However, my impression was that they were simply trying to meet the demographic criteria I had requested among people who were available for interviews.⁴ I was not able to identify any bias in the participants selected or tendency towards selecting one type of respondent and not another.

I conducted in-depth interviews with the assistance of three different research assistants. I was able to play a more directive role during in-depth interviews wherein I would ask a question, my research assistant would translate in Vietnamese, the interviewee would respond in Vietnamese and then my research assistant would provide me with a summary translation so that I could follow-up with the next question.

All interviews were conducted at participants' homes or the home of a nearby neighbor.

⁴ Demographic criteria are detailed in Chapter 5.

3.5.6 Strengths and Limitations of FGDs and Interviews

3.5.6.1 *Assistance from Filabavi Supervisors and Surveyors*

Both the interviews and focus group discussions were well organized with participants arriving or available at the appropriate time, well aware of who we were and why we had come. The Filabavi Surveyors and Supervisors were also very effective in identifying people matching the demographic characteristics I had requested with respect to sampling across the social dimension identified as significant in the quantitative stage, and presented in Chapter 5. Participant recruitment is often regarded as one of the greatest pitfalls in conducting focus group research (Morgan, 1995) so this assistance was a significant advantage. Furthermore, respondents clearly had warm and trusting relationships with the Filabavi supervisors and surveyors. As external researchers coming in to the community, it was an advantage to be introduced and endorsed by the supervisors and surveyors who had already established trust and credibility (Bhopal, 2010). As a result, participants appeared comfortable and at ease almost instantly upon our arrival. In addition, there were several cases where surveyors and supervisors helped to reduce interruptions to the focus group discussions and interviews by entertaining restless children and babies or heading off and re-directing curious neighbors.

3.5.6.2 *In-home setting*

While there was a greater risk of distraction conducting focus group discussions and interviews in homes, these settings also had significant advantages. Firstly, the home setting seemed also to contribute to the ease and comfort of the participants. The one focus group which, for logistical reasons, we held in a Filabavi project office in Ba Vi hospital, took markedly longer to warm up and for conversation to begin to flow. This is in keeping with the methodological literature's acknowledgement that the participants' level of comfort in the setting can substantively enhance or detract from the interaction observed (Asbury,

1995). Additionally, conducting interviews in homes allowed me to learn a lot about people's socio-economic status, resources, environment, family and community structures and other important aspects that would have been difficult to ascertain verbally. It also gave me a sense of the differences in lived experience and environments across the different dimensions of focus.

3.5.6.3 Research Assistants/Interpreters

In general my research assistants also did an excellent job of establishing a relaxed and open rapport with participants. The assistant who conducted the focus groups was able to generate and maintain a good flow of conversation by threading quieter participants into discussion while not letting more talkative people dominate. The ability to maintain conversation and encourage interaction without being overly directive or interjecting more than necessary is noted in the literature as key moderator skills for successful focus groups (Morgan, 1995). Likewise, the assistant who conducted the majority of interviews, was able to get participants to elaborate and speak at length during interviews while guarding against getting too far off topic or away from interesting points we wanted to probe.

As a result of all of these factors I was impressed by the degree of candidness in most focus group discussions and interviews. Women spoke openly about subjects that were both highly personal—such as details of their reproductive health or their relationships with close family members-- and highly sensitive – such as feeling compelled to bribe health care workers to ensure quality care.

3.5.6.4 Commonalities across Research Team and Subjects

Another advantage for both FGDs and interviews was that the interview team including myself, the participants and the surveyors are all women of approximately the same age. Vietnam is a deeply hierarchical society where, particularly in rural areas, gender and age differences have significant implications for the social hierarchy that structures all interactions. In this case, being of the same gender and approximately the same age allowed for a more open and equal exchange as opposed to an interaction structured by authority or deference—neither of which is conducive to rich qualitative feedback. Moreover, the topic at hand -- pregnancy, birth and the health of mothers and children—deals with experiences common to all women across ethnic, national, linguistic, educational and socio-economic backgrounds. The methodological literature emphasizes the importance of social similarities (including socio-economic status, ethnicity, education, age, gender) among focus group participants for maximizing the likelihood of open exchange and lively discussion from the beginning of the focus group (Asbury, 1995, Krueger and Casey, 1994). It also highlights the potential advantages of women researchers working with women participants (Cotterill, 1992). Furthermore, while several participants acknowledged that my research assistants and I are more educated than they were, they were in a position to tell us about an important life experience (pregnancy, childbirth and motherhood) that they had undergone but we have not yet. Sometimes I would highlight this fact that we were there to learn from them which they seemed to both enjoy and take to heart. Again, my experience echoes the more recent methodological literature which has highlighted the fluidity of power and knowledge dynamics between researchers and participants (Cotterill, 1992).

3.5.6.5 Language Gap

The language gap between the research participants and me was in some respects a limitation though it also had advantages. The methodological literature highlights several

challenges to conducting qualitative research with a translator including the risk that the interpreter provides literal rather than conceptual translations which lose the fundamental or specific meaning of the original words (Esposito, 2001, Squires, 2009) or that the interpreter becomes a one-sided conduit for the researcher without also enhancing the participants' ability to express themselves, articulate their experience and perspectives and clarify their perspective (Edwards, 1998). In this case the fact that my interpreters were also research assistants and that they had experience in cross-cultural research helped alleviate some of these issues. First, my interpreters have significant experience in explaining the Vietnamese health system and related cultural factors to foreigners. They seemed adept at translating both technical and cultural terms in a way that was specific and made sense to me. Moreover, we worked in a way where the research assistants would make clarifications for both me and the participants, striving to express each side's intended meaning. This developed a dynamic wherein my interpreters demonstrated their role as one of helping the participant get their point across rather than just translating for me.

One limitation which I did experience was that while I received real-time summary translations, there were nuances of things that people said, or unusual or interesting phrasings that I was not able to pick up until I read the transcripts and therefore not able to probe. This case is less a focus of the literature which often assumes word-for-word real time translation. I chose not to do that because it would have interrupted the flow of participants' expression and reflection. It would also have created a dynamic where my understanding was prioritized over the participants' articulation of their experience and may have diminished the quality of the feedback (Edwards, 1998).

Where the methodological literature addresses advantages of conducting research across a language gap it tends to focus on the ability of interpretation to render often marginalized

and under-studied populations accessible (Squires, 2009), particularly in a context where the participants do not speak the majority language as with recent immigrants (Edwards, 1998, Esposito, 2001). While working across the language gap allowed me to access a population whose voice may otherwise not be heard in the English-speaking research world, I found additional functional advantages of working through an interpreter not commonly noted in the methodological literature. Specifically, the translation time allowed both me and the participants some time to think and reflect during the interviews and raise additional questions or points. The slower pace of the interviews that resulted from translation may very well have led to richer data.

3.5.6.6 Cultural Factors

One limitation that we struggled with especially in the initial focus groups and interviews was the tendency to ask leading questions. Research assistants had a tendency to translate questions as both more specific and more leading than the ones I had asked in English. As Vietnamese language is more direct and far more likely to phrase questions in a leading way than English, this may have been a result of a conceptual rather than literal translation which is generally an advantage (Squires, 2009) but in this case also a limitation. However this may also have been due to Vietnamese cultural norms. My interpreters/research assistants explained that they felt it was their responsibility to phrase the question so that the subjects could easily answer it – not to elicit a specific answer just to enable subjects to respond confidently and quickly. It was clearly very difficult for all parties to wait in silence for even a few seconds and contemplate an open question such as “what factors are important for health” or “is there anything else you’d like to share with us”. I suspect this pattern relates to the fact that Vietnamese culture is heavily influenced by a Confucian world view that structures the social world in terms of roles and reciprocal duties based on those roles (Inoguchi and Shin, 2009, Slingerland, 2003). Based on discussions with the research team, I

believe they felt that in their role as interviewer, their duty was to ask clear, direct, concrete, answerable questions. Proper execution of this role and duty in turn enabled focus group and interview participants to perform their duty of providing clear, appropriate, useful answers to questions. Therefore, if a subject struggled to answer a broad question, the researchers felt very much compelled to jump in and significantly narrow the question or start suggesting answers. We discussed why this is problematic for qualitative research and I tried to assure them that it was OK to let people think before answering. I also tried to assure them that I was open to a range of answers so neither they nor the respondent should be worried that they had failed in a duty by arriving at the wrong kind of answer. While they understood this intellectually, social habits and patterns of thinking are deeply ingrained and I'm not convinced we ever completely overcame this challenge. As a result, some questions were posed in a leading manner which I account for in my analysis and interpretation.

A final limitation that I encountered was the difficulty of eliciting rich responses and probing nuances with people of the lowest education levels. While there is literature regarding the methodological issues related to conducting qualitative research with populations whose education was constrained due to learning (Bos and Richardson, 1994) and intellectual (Beail and Williams, 2014) disabilities, I was not able to identify methodological literature discussing the challenges of eliciting rich feedback from people of average intellectual capacity who have simply had minimal formal schooling. Nonetheless, in my experience, it was at times hard to draw out the least educated people both in focus group discussions and interviews. In focus group discussions it seemed this was due partly to their deference to more knowledgeable participants. In two cases, I further interviewed the least educated FGD participant afterwards to try to elaborate on their perceptions and experiences. The two more intractable issues were that people with less education 1) often had more limited

means of expression including more limited vocabularies as well as more limited analytical and reasoning skills and 2) because education was linked to other factors such as poverty and marginalization, I suspected they had often not had the time for reflection and were not used to speaking out about their perceptions, experiences and preferences. I tried to address this by approaching questions different ways, by asking questions as briefly and concretely as possible, and by encouraging these subjects that their answers were interesting and helpful. I received some interesting feedback from women with lower education levels however it was not always as rich, analytical, logically coherent and reflective as those with more education.

CHAPTER 4: **QUANTITATIVE ANALYSIS & FINDINGS**

In this chapter I present the specifics of my quantitative analysis, using the Order-m Method and subsequent regression analysis, as well as my findings. This chapter will thus answer my first two research questions: are some people more likely to be efficient at converting health resources into health outcomes? Which groups of people are more likely to be efficient at converting health resources into health outcomes? I answer these questions for two separate analyses- the first considers the efficiency with which women convert available health resources into appropriate maternal care and the second considers the efficiency with which women convert available health resources into health outcomes for themselves and their baby. I have focused on both appropriate care and health outcomes as these are twin goals both nationally and internationally, as encapsulated in the Millennium Development Goals, to which both Vietnam and the global health community has committed, as well as Vietnam's National Health Strategies. First, I discuss the variables used in each stage of the analysis. I also present results for each stage of analysis and lastly, I interpret and discuss the significance of those results.

4.1 Sample Characteristics

The sample of focus for this analysis consists of women from the Filabavi HDSS who gave birth during Quarter 4 (October-December) of each year from 2005-2011. Quarter 4 is the time of year when the most births take place. This is because Ba Vi has a high rate of outmigration among young males who go to work in nearby cities and return home primarily during the Lunar New Year period, which takes place every year in January or February depending on the lunar calendar. As a result the highest number of babies are conceived during this time and delivered during Quarter 4. However, the fact that I am only able to look at babies born in the fourth quarter of the year leaves open the possibility that results

might be different at other times of the year. While seasonality of health outcomes is a well-documented phenomenon (Strand et al., 2011), it is hard to imagine why different people would be systematically more efficient at different times of the year. However, it is a factor worth considering with respect to the generalizability of results. Nonetheless even if my results were only to be valid for Quarter 4, they still tell us something that is accurate for that quarter which is important per se as this is when the highest percentage of births take place.

After excluding individuals with missing observations from the original sample of 1830, the sample for which efficiency scores were generated contained 1417 women for the appropriate care analysis and 1414 women for the healthy pregnancy and delivery analysis.

Because the order-m efficiency analysis automatically drops individuals with missing observations the sample only includes women who gave birth to a live baby and therefore have data entered for each measure in the outcome set. The relatively small number of women who had miscarriages (60) and the extremely small number of still births (5) are thus not considered in this analysis as they could not have observations for other outcomes such as birth weight. I also excluded women who chose to terminate their pregnancy (62) or who were mistaken about their pregnancy (31) as, in these cases, it was not their goal to convert health resources into the outcomes of appropriate care and healthy pregnancy. The remainder of the individuals were dropped for missing observations across other variables included in the analysis and discussed in detail below. The characteristics of the group dropped for missing observations differs somewhat from the group with complete observations who were retained in the analysis. Specifically the group dropped for missing observations were slightly less likely to reside in a lowland area and ranked slightly lower on the asset-based wealth index. I also compared the women who had live births to those who

had miscarriages and still births. The only statistically significant difference between these two groups was that the latter had a slightly lower mean level of education. This will be taken into consideration in interpreting my results. A detailed comparison of summary statistics for the groups with complete and missing observations as well as the groups with live births and non-live births is available in Appendix E.

The average age in the sample was 26 years old and the average education level was some post-secondary school. Just over 5% of the women in the sample were ethnic minorities (all but six of those Muong). Nearly all the women were married. Just over half the sample lived in the highlands with the remaining half evenly divided between mountains and lowlands. Complete summary statistics for the final sample can be found in Table 4.2, Table 4.3, Table 4.4 and Table 4.5.

4.2 Generating Efficiency Scores

As described in Chapter 3, I apply an Order-m Efficiency Analysis followed by regression analysis in order to 1) understand how efficient a population is at converting health resources into health outcomes and 2) estimate the relative contribution of social factors to the likelihood that someone is efficient.

In order to do this, I used the Order-m method to generate an efficiency score for each pregnancy in the sample. A small number of women (85) appear multiple times in the sample due to multiple pregnancies. As noted in Chapter 3, I account for this statistically. Thus while the hospital was the unit of observation in the illustrative example given in Chapters 1 and 3, the pregnant woman is the decision making unit of observation in this application.

In order to calculate the efficiency score for each woman I created both a health resource set and a health outcome set for each woman. The health resource set comprises a series of measures of the government provided health resources available to each woman. I use a different set of outcomes in each of two separate analyses, the first comprising measures indicating whether the woman achieved appropriate care as defined by the Government of Vietnam, and the second comprising measures of the health of the mother and newborn.

Table 4.1 lays out each of the variables I included in the resource and outcome sets for the two efficiency analyses that I conducted. Each of the sets and its components is discussed in greater detail below.

	Components of Health Resource Set	Components of Health Outcome Set
Efficiency Analysis of Conversion of Health Resources into APPROPRIATE CARE	Time to Commune Health Center, Time to District Hospital, Number of Doctors, Assistant Doctors, Nurses, Midwives, Pharmacists for ANC at nearest CHC	Number of core services received (At least 1 visit in the first trimester, at least 3 visits total, a skilled medical attendant at delivery, tetanus shot, weighed, measured, blood pressure taken, urine sample, abdominal check); number of recommended services received (blood sample, ultrasound, iron pills, vitamin A, pregnancy record)
Efficiency Analysis of Conversion of Health Resources into HEALTHY PREGNANCY & DELIVERY	Same as for the Efficiency Analysis of Appropriate Care above	No complications during pregnancy + spontaneous vaginal delivery + baby born at term + baby born at healthy birth weight

Table 4.1: Components of Health Resource and Health Outcome Sets

4.2.1 Health Resource Set Used for Efficiency Analysis

As seen in Table 4.1, I used the same measures of government provided health resources for both analyses. These measures aim to capture two different types of health resources or aspects of the health system differentially available to each woman: infrastructure and human resources. I had also hoped to include a measure or measures of health financing, a third critical type of health system resource. However, due to data limitations discussed below, I was not able to include a sufficient measure of this facet.

To capture the availability of health infrastructure, or health facilities, I used variables for time to closest commune health center and time to the district hospital to measure this dimension. Although, a measure of distance was available in the data, travel time required to reach the facility more closely reflects the women's actual access. This is particularly important in light of the geographic variability in Ba Vi district where living 1 kilometer from a health center on flat, paved lowland roads affords a different level of access than living 1 kilometer from a health center on steep, narrow, dirt roads in the mountains. This distinction likely explains the low correlation of .6 between the time and distance to health center variables.⁵

To capture the human resources for health available to each individual I included variables for the number of doctors, assistant doctors, nurses, midwives and pharmacists working on maternal health at the closest health center. The data on human resources for health at each health center was collected by Filabavi surveyors and supervisors directly from the health facilities and communities. The surveyors and supervisors also identified which health center was closest to each cluster. Thus I ultimately linked each woman, based on her cluster

⁵ A perfect correlation = 1. Generally a correlation greater than .8 is considered a high correlation.

to the closest health center and in turn to the corresponding number of each type of health worker.

The third type of health resource I had aimed to include, though was ultimately unable, was health financing. The Government of Vietnam provides health financing through a variety of mechanisms including budgets to health centers and hospitals, health insurance coverage for public sector employees, a partial contribution to the voluntary health insurance scheme as well as health care subsidies for the poor. However, due to limited variables in the existing Filabavi dataset, the only variable I was able to construct was whether people were eligible for the health care subsidy available for poor households. The Government of Vietnam has a policy to provide a 95% care subsidy to households designated as poor by their community (Government of Vietnam, 2008). However there is no variable in the Filabavi dataset indicating whether individuals actually received this subsidy, which would require a confirmation process at the commune level. Thus while I could generate a variable for eligibility based on the household's economic status, I could not determine whether the household actually received the subsidy. Furthermore, when constructed, this variable only included 3% of the population. Thus I ultimately decided it was not meaningful enough to include in my final analysis. It is worth noting however that the inclusion of this variable did not significantly change any of my findings. In future applications of this method to understanding the efficient conversion of health resources into health outcomes however it would be useful to include measures of health financing in the resource set.

Table 4.2 shows the summary statistics for the health resource variables.

Summary Statistics for Health Resource Variables				
	mean	sd	Min	Max
Travel Time to CHC (mins)	9.99	7.05	0.3	50
Travel Time to District Hospital (mins)	22.03	13.41	1.5	65
Doctors for ANC at Closest CHC	0.87	0.66	0.0	2
Assistant Doctors for ANC at Closest CHC	4.27	1.77	1.0	8
Midwives for ANC at Closest CHC	0.74	0.74	0.0	2
Nurses for ANC at Closest CHC	1.88	1.60	0.0	6
Pharmacists for ANC at Closest CHC	0.72	0.67	0.0	2
Observations	1417			

Table 4.2: Summary Statistics for Health Resource Variables. Data Source: Filabavi HDSS

As the summary statistics indicate, this is a district with relatively good coverage of basic infrastructure. The average time and distance to CHC was under 10 minutes travel time while the average distance to the district hospital is 22 minutes. There is some variation in the sample however with some people requiring as much as 50 minutes to get to a CHC and over an hour to get to the district hospital. It is also worth bearing in mind that the individuals living farthest from the health facilities would require transportation by a motorbike or car which has additional costs and challenges, particularly in more remote areas.

With respect to human resources for health, while every Commune Health Center has at least 1 Assistant Doctor, a medical staff with more generalized and basic training than a Doctor⁶, there is variation in the sample with some having as many as 8 and some having 1 or 2 Doctors as well. The number of nurses also ranges fairly widely from 0-6.

4.2.2 Health Outcome Variables Used for Efficiency Analysis

As indicated in Table 4.1, I conducted two separate efficiency analyses. The first estimates how efficiently women converted health resources into appropriate pregnancy care, as

⁶ I was not able to ascertain the specific differences in training between Doctors and Assistant Doctors from my colleagues. As the content of the respective training programs is less relevant for my study than the general acknowledgement of two different level qualifications, I did not persist in identifying Vietnamese language source documents and having them translated.

defined by Vietnamese national policy. The second estimates how efficiently women converted health resources into good health for themselves and their newborns.

4.2.2.1 Efficiency in Achieving Appropriate Maternal Care

The outcome set which I used to analyze the efficient conversion of available health resources into appropriate maternal care reflects the Government of Vietnam's definition of appropriate care. (Ministry of Health, 2009, Tran et al., 2012b). In keeping with national policy I include two types of variables: measures of core services and measures of recommended services. The core services include that every woman should have at least one ANC visit in the first trimester, at least 3 visits total, a skilled attendant at delivery as well as measurement of height, measurement of weight, blood pressure taken, urine test, abdominal examination and a tetanus vaccination. The recommended services include having a blood test, an ultrasound, receiving iron supplements, receiving vitamin A and having record of the pregnancy. I used a dummy variable for each element representing 1 where the standard was met and 0 where it was not. The core service variables were then summed into one number and, separately, the recommended variables summed into another number. I included the sum of core services and the sum of optional services as separate components so that an optional service could not be substituted for a core service in the total score of services received. Because the Government of Vietnam has prioritized the first set of services, based on both their availability and their importance for healthy pregnancy, I did not want to count someone who received 3 core services as equivalent to someone who received 2 core services and 1 optional service. Dividing the two types of services appropriately distinguishes the first individual as having received more appropriate care.

There are additional services recommended by the national guidelines, including vaginal examination and antenatal counseling, which are not available in the Filabavi dataset. Again this will be taken into account in interpretation. However the care variables available and included in the outcome set cover the majority of maternal care services recommended by the government as well as the international regulations that would be broadly relevant to this context (World Health Organization, 2006).

Summary statistics for the outcome set components in the appropriate care analysis are included in Table 4.3.

Summary Statistics for Appropriate Care Variables				
	Mean	sd	Min	Max
Weighed*	0.731	0.44	0	1
Height Measured*	0.568	0.50	0	1
Blood Pressure Measured*	0.754	0.43	0	1
Gave a Urine Sample*	0.533	0.50	0	1
Gave a Blood Sample†	0.389	0.49	0	1
Abdominal Examination*	0.908	0.29	0	1
Ultrasound†	0.874	0.33	0	1
ANC Visit in the 1 st Trimester*	0.733	0.44	0	1
At least 3 ANC Visits*	0.857	0.35	0	1
Tetanus Shot*	0.972	0.16	0	1
Took Iron Pills†	0.241	0.43	0	1
Received Vitamin A†	0.230	0.42	0	1
Skilled Attendant at Delivery*	0.998	0.05	0	1
Had a Record of Pregnancy†	0.278	0.45	0	1
Summed Set of Core Services	7.054	1.93	1	9
Summed Set of Recommended Services	2.011	1.11	0	5
Observations	1417			

Table 4.3: Summary Statistics for Appropriate Care Variables with Required Services Starred (*), Recommended Services (†). Data source: Filabavi HDSS

The summary statistics reveal that some of the services required for appropriate ANC and delivery care were received by very nearly the entire population while others have relatively low coverage.

The services with the highest coverage include “delivery with a skilled attendant” (99.7%) and “receiving a tetanus shot” (97.2%). Outside of extremely remote and rural areas the vast majority of births are attended by a skilled professional in Vietnam. UNICEF reports that nationwide, 88% of women had a skilled attendant at birth (UNICEF, 2013). Ba Vi district, while rural, is neither remote nor particularly poor so it is not surprising that their rates would exceed the national average. In addition, outside of extremely rural and remote areas, vaccination rates are generally high. UNICEF reports that at the national level, as of 2010 well over 90% of one year olds had received basic immunizations such as Polio, Measles and DPT, while 87% of newborns were protected against Tetanus (UNICEF, 2013). The approach to vaccination in Ba Vi, and in most of Vietnam, is aggressive and highly effective. Many participants in the qualitative stage related that Commune Health Centers hold established vaccination days (for example on the 5th of every month) and then broadcast from a loud speaker which mothers and babies are due for vaccination and should come to the health center on that day. Furthermore, the government has begun delivering tetanus vaccinations to all girls at the age of 15 through high schools. As high school enrollment is relatively high, this method captures a large proportion of future mothers as soon as they reach reproductive age.

The majority of women, 85% had an adequate total number of visits, defined here as 3 total visits, while the percentage of women who had at least one of those visits in the first trimester was somewhat lower at 73%. Among the remaining services there is large variation with the majority being weighed, having their blood pressure taken, having an ultrasound and having an abdominal examination. While the very high coverage of ultrasound may be surprising, Tran (2012) corroborates this finding in his research and, through qualitative methods, discovers that factors driving women to get ultrasounds include technology

preference, the proliferation of the private sector offering affordable ultrasounds, interest in knowing the sex of the baby and simply enjoying being able to see the baby (Tran, 2012). Conversely, less than 40% of the women received some of the other services such as blood tests. While conducting qualitative research, I was told that some of the Commune Health Centers were not able to offer this service until recently which may explain some of this gap. Furthermore, taking iron supplements, receiving post-partum vitamin A and having a medical record of pregnancy were all fairly uncommon with below 30% coverage. For both taking iron and receiving vitamin A there were significant portions of the population (19% for iron and 76% for Vitamin A) that answered that they didn't know if they had taken it. This was a strange answer and likely indicated they had not had the recommended treatment. It also indicates an issue with women not knowing about or not paying attention to the most basic services despite an almost universal focus on more advanced services such as ultrasound. This issue is addressed further in the qualitative results.

4.2.2.2 Efficiency in Achieving Healthy Pregnancy and Delivery Outcomes

The outcome set for the second analysis of how efficiently women convert available health resources into healthy pregnancy and delivery includes 4 widely used measures of maternal and neonatal health. These measures which are used in both low and high income countries as per the CDC and WHO (Dalenius et al., 2012, World Health Organization, 2006), include complications during pregnancy, method of delivery, term birth and healthy birth weight.

The first variable of my outcome set was a dummy variable equaling 1 if women reported no symptoms indicative of complications, during pregnancy.⁷ Complications during pregnancy, which can endanger both the mother and the fetus, are important indicators of maternal

⁷ It may seem intuitive that 1 would equal complications and 0 would equal no complications. However, this analysis requires that the larger number equals the better outcome. I re-coded variables accordingly which is why 1 is equal to no complications.

and fetal health which health systems aim to minimize. The CDC's summary of the most common pregnancy complications includes: anemia, urinary tract infection, mental health conditions, hypertension, gestational diabetes, obesity, infections and nausea and vomiting (Centers for Disease Control and Prevention, 2013). The Filabavi dataset includes questions about symptoms associated with complications (such as early labor, vaginal bleeding, swollen limbs, fever, convulsions or 'other symptoms'). It also includes a binary variable aggregating pregnancy complications. I used the binary variable for pregnancy complications in this analysis because the numbers of people with each individual symptom were extremely low (between 5 and 62 of the sample of 1400) and because roughly half of the women reporting complications fell into the 'other symptoms' category.

While using a dummy variable for symptoms of complications is the most accurate way to categorize the available data it is limited in that it cannot account for either the number or severity of complications. An ordinal variable identifying the number of complications and/or the severity of complications would allow for greater distinction between a woman who has a single symptom of a relatively minor complication and a woman who has multiple complications or symptoms of a complication that seriously threatens her health or the life of her fetus. While such an ordinal variable might be desirable it is also not clear how the severity of complications would be judged as no standard scale and no established methodology for determining the relative severity of complications exists. Establishing a scale that would assign an ordinal rating based on severity to different complications would thus require a review of the literature and consideration of several factors including long and short term risks of morbidity and mortality as well as implications for well-being and quality of life. However, even considering such a step would require additional data.

Another potential limitation of the symptoms of complications variable is that the symptoms are self-reported. While some symptoms, such as vaginal bleeding, are quite objective, others, such as experiencing dizziness, lightheadedness or nausea, are relative to how a woman feels normally. A better-off woman who is normally well-nourished and never experiences dizziness or lightheadedness might be more likely to recognize and report this as a complication during pregnancy than a less well-off woman who frequently experiences dizziness and lightheadedness associated with iron or energy deficiency. The latter woman may not recognize this symptom as a symptom because she is already inured to it as the status quo. The phenomenon wherein people adapt their estimation of their own well-being based on their experience and their perception of what is possible has been referred to as adaptive preference. Acknowledged by both Nussbaum and Sen (Nussbaum, 2001, Sen, 1999), adaptive preferences buttress a key critique of the welfarist or utilitarian approach to social justice, namely that subjective utility is an unreliable indicator of well-being, particularly among the worst-off. While there is evidence to suggest that self-rated or subjective measures of health do in many cases accurately reflect health both in terms of mortality risk, morbidity and overall health status (Benjamins et al., 2004, Goldberg et al., 2001, Kaplan et al., 1996, Wu et al., 2013), the possibility that adaptive preferences could create a systematic bias should caution our interpretation of self-reported variables. Thus, in the case of my study, it is possible that symptoms of complications have been under-reported by the least well-off women who may not recognize them as distinct from the status quo.

The second component of my outcome set is a dummy variable equaling 1 if a woman had a spontaneous vaginal delivery and 0 if her baby was delivered using instruments or by cesarean section. Whether the delivery involved intervention with instruments or cesarean section is an important health indicator for two reasons. First, intervention in delivery

suggests a complication during delivery, an important health outcome for which no other indicator exists in the Filabavi dataset. In the UK, 13% of deliveries in 2011-12 were assisted with instruments such as forceps or ventouse (Simms and Hayman, 2013). Indications for instrumental delivery may include delivery complications such as fetal distress, placental abruption, vasa previa or severe hypertension (Simms and Hayman, 2013). However instrumental delivery may also be used based on the somewhat more subjective criteria of 'presumed fetal compromise' or 'prolongation of labor' and thus may not necessarily indicate a delivery complication (Simms and Hayman, 2013). In Vietnam however, rates of instrumental delivery are significantly lower with 6.1% of deliveries in my sample using this method. Local medical practitioners with whom I consulted during my field work stressed that, in the local context, the use of instruments during delivery was largely reserved for and thus indicative of, delivery complications. While elective, or non-medically indicated, cesarean section is becoming increasingly common in Vietnam, this trend appears more pronounced in urban areas (Tran, 2012). Thus cesarean sections reported in the rural dataset used here are also likely reflective of complications during pregnancy and delivery.

Obstetric intervention during delivery may in turn lead to further complication or adverse health outcomes. At the macro level, while obstetric interventions including instrumental and C-section delivery have become more common in some high income countries, this has not reduced perinatal mortality (Dahlen et al., 2012). At the individual level, instrumental delivery and Cesarean section are associated with increased risks of morbidity for both mother and child (Dahlen et al., 2012, Clark and Silver, 2011, Hyde et al., 2012, O'Mahony et al., 2010). The Filabavi dataset includes a question which specifies method of delivery which I used to construct the dummy variable for this component.

The third component of my outcome set is a dummy variable equaling 1 where the birth took place at term and zero if the birth was either pre-term or post-term. Term birth, defined as between 37 and 42 weeks gestational time, is also a key global measure of healthy pregnancy (World Health Organization, 2011, Dalenius et al., 2012). While pre-term births are associated with increased risk of morbidity, disability and mortality, (World Health Organization, 2006, Dalenius et al., 2012) post-term births carry increased risk of soft tissue wasting, meconium aspiration and asphyxia during labor as well as neonatal hypoglycemia (Mannino, 1988). Term birth is also frequently used as an outcome measure in the literature assessing maternal health outcomes (Taylor and Nies, 2012, Gibbs et al., 2012b, Ramakrishnan et al., 2012). I calculated gestational time based on the date of last menstruation and the date of delivery variables available in the dataset. I then generated a dummy variable for term birth equaling 1 where the gestational time was between 37 and 42 weeks.

The fourth and final component of my outcome set is a dummy variable equaling 1 if the baby was born at a healthy birth weight and 0 if the baby was born with either a low or high birth weight. Global standards define a healthy birth weight as between 2500 and 4000g (World Health Organization, 2011, Dalenius et al., 2012). While low birth weight babies face an increased risk of mortality (Mathews and MacDorman, 2011) high birth weight babies are at greater risk for shoulder dystocia during delivery as well as overweight and obesity later in life (Zhao et al., 2012, Dalenius et al., 2012). Recent systematic reviews relating to maternal health indicate that some form of birth weight is considered as a key outcome in many if not most publications (Taylor and Nies, 2012, Ramakrishnan et al., 2012, Gibbs et al., 2012b). To generate the dummy variable for healthy birth weight I used the birth weight variable reported in the Filabavi data setting healthy birth weight equal to 1 for all weights greater

than or equal to 2500 and less than or equal to 4000 grams and 0 for both low birth weight (under 2500 g) and high birth weight (over 4000g) babies.

This variable is also self-reported and thus subject to the survey participant's recall. While this could pose a problem with accuracy, a study of birth weight in a more remote province of Northern Vietnam found that mothers are likely to accurately remember and report birth weight due to the cultural importance of this statistic. The same study also suggests there may be some stochastic noise (random error) in the birth weight data given that measurement techniques are still not completely standardized or completely accurate (Nguyen et al., 2013).

Because giving birth to twins is a unique case with separate standards and unique risks, particularly in relation to term birth and healthy birth weight, I exclude the small number of twin births in the sample (13) from the healthy pregnancy and delivery analysis. This is in keeping with the literature on term birth and healthy birth weight which also examines twin and singleton births as separate cases (Nguyen et al., 2004, Almond et al., 2005).

As with the core and recommended components of care, I treated the health outcomes set as a summed group. The advantage of using this approach can be illustrated by a case of two hypothetical women. The first reports no complications during pregnancy but has a baby that is post term and greater than 4000g by C-section. Her summed outcome measure would be 1 and her non summed outcome set would be (1, 0, 0, 0). A second woman reports a complication during pregnancy but delivers a baby at term who is a healthy birth weight with no intervention. Her summed outcome measure would be 3 and her non-summed outcome set would be (0, 1, 1, 1). In the summed case the second woman achieves a better outcome level than the first. However if we compare the outcome sets using weak

dominance they would be judged equal since neither has all values greater than or equal to the other. Yet, intuitively, it seems clear that the second woman whose baby is delivered without intervention, at a healthy birth weight and at term has achieved the better health outcome. Thus the summed outcome provides the more appropriate reflection of achieved health.

Summary statistics of the outcome measures included my analysis are below in Table 4.4.

Summary Statistics for Healthy Pregnancy and Delivery Variables				
	Mean	Sd	Min	Max
No Complications Reported During Pregnancy	0.837	0.37	0	1
Spontaneous Vaginal Delivery (No Intervention During Delivery)	0.840	0.37	0	1
Baby Born at Term (37-42 weeks)	0.774	0.42	0	1
Healthy Birth Weight (2500-4000g)	0.932	0.25	0	1
Summed Outcome Set	3.383	0.80	0	4
Observations	1414			

Table 4.4: Summary Statistics for Healthy Pregnancy & Delivery Outcome Variable. Data source: Filabavi HDSS

At first glance, the means among the outcome measures in this sample appear high, however they are likely appropriate in the Vietnamese context and unlikely to be due to bias particular to my sub-sample.

It is difficult to assess whether the rate of complications is low or high in this case as I have not been able to identify a similar measure of self-reported complications in a context similar to Vietnam. It seems that this rate of reporting may be low given the estimated prevalence of anemia alone among pregnant women was 32% in 2001 (Khoi et al., 2001). While it's possible the rate in Ba Vi is lower than the national average and that both have improved since 2001, the overall rate for all complications during pregnancy of 16.4% is still surprisingly low. That said, I have kept it in the analysis as it is an important measure of

pregnancy health however and, even if under-reported, important to consider for those who did report it.

The rate of spontaneous vaginal delivery in this sample is somewhat high for Vietnam however, likely not for the rural context. A large scale study of 9 Asian countries found that Vietnam had the second highest rate of Cesarean Sections 35.6% after China. Vietnam had the second lowest rate of operative vaginal delivery (2.2%) also after China. Both types of interventions were associated with higher risk of maternal morbidity and mortality although Cesarean Section in the case of breech presentation was associated with improved perinatal outcomes (Lumbiganon et al., 2010). While, based on this larger study, we might expect a higher proportion of delivery intervention in the Filabavi sample, the multi-country study includes the national capital. A separate study comparing Filabavi to an urban HDSS in Hanoi found significantly higher rates of C-section in the urban setting (Tran, 2012). At the same time Filabavi has experienced a rapid increase in the percentage of Cesarean Sections performed from 2.6% in 1999 to over 10% in 2010 (Nguyen et al., 2013). This latter finding seems compatible with the rate here of just over 15% delivery with intervention.

While the increase in Cesarean Sections may indicate that women requiring them are now receiving them, there is also a risk of perpetuating the trend where a risky procedure becomes more common than is likely to be clinically necessary, particularly if appropriate antenatal care is delivered throughout the pregnancy in order to reduce the likelihood of complications requiring cesarean section at birth.

There is relatively little data on the percentage of term births in Vietnam. One study of a larger cohort of children in Filabavi between 1999 and 2005 showed a roughly similar rate of 73.2% term births with 15.8% born preterm and 8.8% born post-term (Graner et al., 2010).

Another study conducted at the National Obstetrics and Gynecology Hospital in Hanoi found a rate of 11.8% preterm birth but did not consider post-term. (Nguyen et al., 2004) Together these indicate that the rate of term birth identified in this sample (77%) is likely a reasonable estimate for Ba Vi district.

While the prevalence of low birth weight is estimated at 16% in the developing world at large (UNICEF, 2004), it appears to be far less than that in Vietnam. A study in more remote Yen Bai province found a low birth weight prevalence of 7.4 % (Passerini et al., 2012). Meanwhile a study on a larger cohort of children in the same district as my research identified a roughly 5% rate of low birth weight among babies born between 1999 and 2010, a finding compatible with the rate of 6.9% combined low and high birth weight in this sample. In addition, the study in Yen Bai province found that health workers may be inclined to report a healthy birth weight to mothers whose children were in fact outside the healthy range in order to please them (Nguyen et al., 2013).

It is worth noting that nearly all of the articles on maternal and child health outcomes that address birth weight in Vietnam focus on low birth weight or small for gestational age. A pubmed search for “birth weight” and Vietnam resulted in 55 articles while a search for “high birth weight” in Vietnam resulted in 3. While low birth weight is an adverse outcome to be avoided, it is increasingly important to consider high birth weight as well which is also an adverse outcome associated with morbidities for both mother and child. As Vietnam continues to undergo nutrition and epidemiological transitions, including increased rates of overweight, obesity even in young children (Dieu et al., 2007) as well as cardiovascular disease (Huong et al., 2003) and diabetes, it will be essential to consider the spectrum of healthy birth weight avoiding high birth weight as well as low.

While the means of all outcome variables included in this analysis are relatively high, this is still an important analysis as each outcome carries significant risk of morbidity and mortality for mothers and children. As a result, even if only a minority of the population experiences those adverse outcomes, they can still have huge personal and social costs both economically and in terms of broader welfare.

I did not include in my outcome set maternal mortality or infant mortality, two prominent health outcome metrics which feature in Millennium Development Goals 4 and 5 as well as recent systematic reviews of the impact of policy interventions on maternal health (Dzakpasu et al., 2013, Taylor and Nies, 2012). While these are important measures globally, particularly in countries where maternal and child mortality remain high, in Vietnam and in Ba Vi district in particular they are increasingly rare and thus incomplete and undifferentiating measures of health outcomes. As noted above, maternal and infant mortality are both relatively low in Vietnam at 59/100,000 births and 12/1000 births respectively (World Bank Group, 2012). Furthermore, these deaths are likely to be concentrated in deeply impoverished and remote communities. As Ba Vi district is comparatively more affluent and integrated, it is no surprise that the maternal mortality and infant mortality rate are lower than the national average. In my sample of roughly 1400 women there were no maternal deaths and only 5 infant deaths at birth. Therefore, maternal and neonatal mortality are not useful health metrics to differentiate this sample.

While the four variables included in the outcome set are a meaningful reflection of healthy pregnancy and delivery they do not constitute an exhaustive list of potential indicators or important health outcomes. Additional measures such as complications during delivery including hemorrhage, maternal or infant infection and small for gestational age are also used to measure maternal and neonatal health. It is a limitation that these variables were

not available, or possible to derive, from the dataset. Moreover, it is hard to speculate who might have experienced these unobserved factors and thus how their absence might affect the efficiency scores derived. This uncertainty will also be taken into account in interpretation as a limitation of the study.

4.2.3 Distribution of Efficiency Scores

Thus using these health resource and health outcome variables, I generated two sets of efficiency scores: the first indicating how efficiently each woman converted health resources into appropriate care, the second indicating how efficiently each woman converted health resources into healthy pregnancy and delivery outcomes. The distribution for each set of scores is presented below. Recall from Chapters 1 and 3 that an efficiency score of 1 represents an efficient converter while a score of greater than 1 represents the factor by which that person must improve their outcomes to achieve efficiency.

4.2.3.1 Efficient Conversion of Health Resources into Appropriate Care

The efficiency analysis indicates that 39% (549) of the 1417 women in the sample were efficient at converting health resources into appropriate care. The mean score among inefficient women was 1.48 indicating that, on average, an inefficient woman would have to improve her output by 48% in order to achieve efficiency. A histogram of the efficiency scores (see Figure 4.1) demonstrates that the distribution is clustered near a score of 1 (indicating efficiency) with a long tail but relatively few observations above 2 indicating that most inefficient women had at least half as many of the services required for appropriate care as the most efficient woman at the same resource level. Due to the iterative and multidimensional nature of the methods we cannot directly interpret the scores more

specifically than this, however, they clearly indicate varying efficiency and room for improvement among the majority of the population.

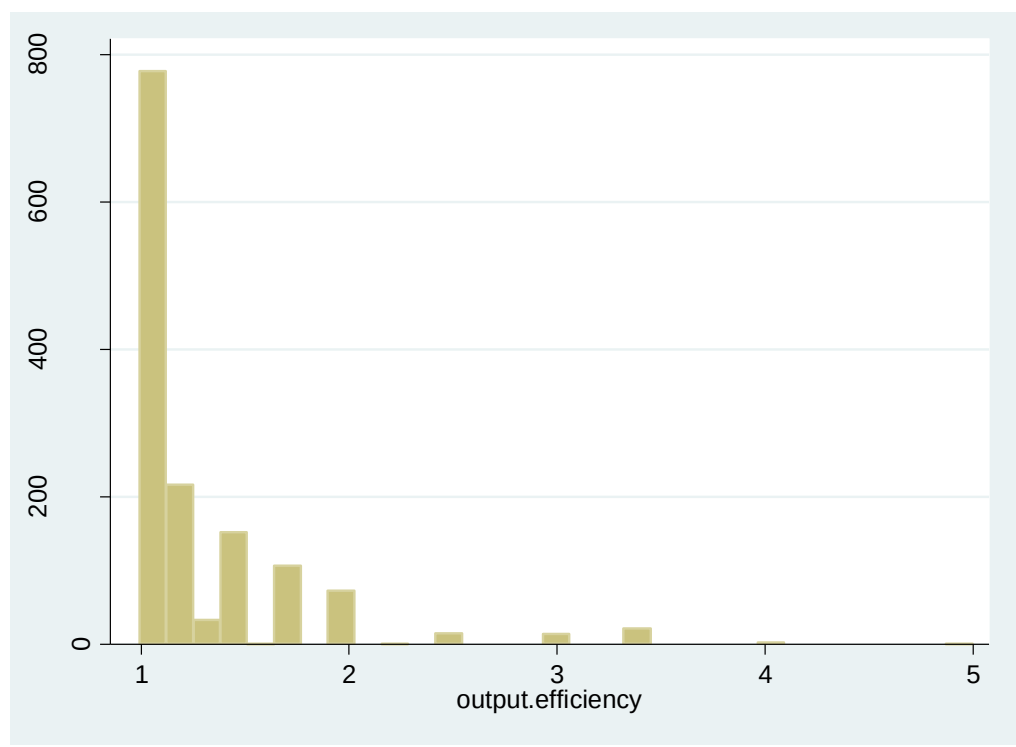


Figure 4.1: Histogram of Efficiency Scores for Achieving Appropriate Care

4.2.3.2 *Efficient Conversion of Health Resources into Healthy Pregnancy and Delivery*

With respect to health pregnancy and delivery, 56% of women were efficient with a mean score among inefficient women of 1.45 indicating that on average inefficient women needed to improve by 45% or nearly 2 of the 4 outcome measures. Again, it is clear that efficiency scores vary throughout the population and that efficiency at converting health resources into healthy pregnancy and delivery has not yet been optimized by nearly half of the women in the sample. See Figure 4.2 for a histogram of healthy pregnancy and delivery efficiency scores.

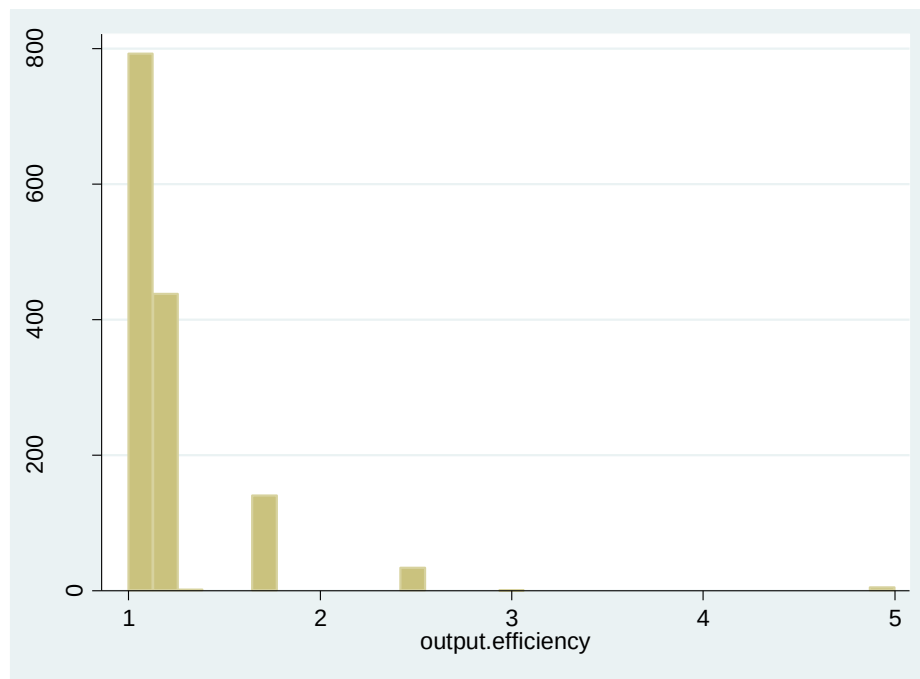


Figure 4.2: Histogram of Efficiency Scores for Achieving Healthy Pregnancy and Delivery Outcomes

4.3 Estimating the Impact of Conversion Factors on the Likelihood of Efficiency

The second stage of my quantitative analysis investigates the relative influence of conversion factors on the likelihood that a woman is efficient using regression analysis. In this stage, the efficiency scores generated in the previous section are converted into a binary variable equaling 1 for women who are efficient and 0 for women who are inefficient. Recall that being efficient is defined by the methodology as having an efficiency score equal to 1 and being inefficient is defined as having an efficiency score greater than 1. Conversion factors identified through both theory and literature are used as independent variables. In order to isolate the influence of the conversion factors of interest on the likelihood of being efficient, I also control for additional factors, including time effects, whether a woman appears multiple time in the sample due to multiple births in the time periods covered as well as the clustered sampling approach.

4.3.1 Model Development

I developed my models using a strategy of backwards elimination (Faraway, 2004). This strategy, also known as General to Simple is recommended as it minimizes the risk of omitted variable bias by considering all possible variables that are theoretically valid and eliminating them one by one (Greene, 2012). I broke potential independent variables into two groups: variables which were theoretically indispensable and thus I would not eliminate, and variables which were hypothesized to have an impact but not theoretically indispensable and could thus be eliminated.

Based on the global and Vietnam specific literatures described in Chapters 1 and 2, I considered the variables for wealth, education, ethnicity, geography, and sex of baby as indispensable. I also considered formal employment indispensable as this would confer significant benefits in terms of health insurance, a resource which I was not able to measure in generating the efficiency score.

I tested the following additional variables using backwards elimination but due to the lack of conclusive evidence of their relationship to health in Vietnam I eliminated them if they were a) non significant and b) did not significantly improve the fit of the model as measured by the diagnostics reported in Section 4.3.3. The variables in this dispensable group included: mean difference from age squared (a measure emphasizing any difference at the extremes of the age distribution), whether the household was in debt (a potential qualifier to wealth), the role of the woman in the household and family structure (whether she was head of household and whether she was a daughter in law), the age at first marriage (as a proxy of more traditional cultural values and, at the extreme young end, perhaps a lack of agency), and whether the woman had recently used the internet (which might open new sources of information).

In the appropriate care model I eliminated all of the dispensable variables while in the healthy pregnancy and delivery model I eliminated all dispensable variables except age, which proved very significant, as the global epidemiological literature would predict.

I also experimented with some different ways of capture wealth including continuous quintiles, quintile dummies, a grouping of the bottom 3 and top 2 quintiles and an interaction with education. As none of these was significant (as reported in the results in Section 4.3.3) I kept the simplest, continuous quintiles.

It is worth noting that the magnitude, direction and relative significance of the key findings remained the same throughout all versions of this model. The social factors identified as significant, and the direction and magnitude of their significance was robust throughout these iterations of the model.

4.3.2 Independent Variables for Second Stage Regressions

4.3.2.1 Conversion Factors

As noted above, the independent variables in the regression model are the conversion factors which I expect may have an influence on the likelihood of efficiency.

I was only able to identify two studies which empirically estimated the influence of conversion factors on conversion efficiency in health, both of which use data from the UK (Binder and Broekel, 2011, Binder and Broekel, 2012). Thus the direct evidence base for the selection of conversion factors in this context is fairly limited. As a result, I draw on the literatures regarding social determinants of health and social epidemiology globally as well as social determinants of health and health equity in Vietnam specifically. These literatures differ from my study in that they look at the influence of social factors on health outcomes rather than the efficiency with which they are achieved. However, because calculating

efficiency relies in part on the level of health outcomes achieved by individuals at various resource levels, it is possible that some of the same factors could be influential.

Furthermore, differentiating whether groups achieving the highest outcomes are also the most efficient makes a critical distinction: Are these groups achieving the best outcomes because they are taking better advantage of available resources or do they simply start off with a larger resource endowment? Thus based on the available literature, I consider the following conversion factors, each discussed in more detail below: wealth, ethnicity, education, geographic area, formal employment, gender of the baby, and, for the analysis of health pregnancy and delivery outcomes only, age.

As discussed in this chapter and the previous, wealth is clearly associated with health outcomes in the literatures on social determinants of health and social epidemiology (Kawachi and Kennedy, 1999, Marmot, 2005). The literature on health equity in Vietnam also cited earlier in this chapter highlights that there are significant health inequalities across the wealth spectrum (Axelson et al., 2012). Lastly wealth has been demonstrated as a determinant of appropriate ANC in Vietnam (Duc et al., 2011, Tran et al., 2012a). In light of the issues with measuring wealth through income discussed in Chapter 2, I chose to use an asset based wealth measure. Specifically, I used an asset-based wealth index derived through principal component analysis, a process which weights different assets based on the degree to which they vary in the population. An asset which has the greatest variance in the population is given the highest weight in order to produce an index that maximally spreads the population. Asset based principal component indices are commonly used to capture wealth in contexts where income and expenditure data is unavailable or unreliable (Filmer and Pritchett, 2001). The resulting asset index values are useful for comparison between individuals but have no meaning per se. In order to use the index in a way that facilitates comparison between wealth groups and allows for looking at each group independently, I

used an ordinal variable equaling 1 to 5 for each wealth quintile based on the wealth index scores. This approach is common among researchers using the Filabavi Data (Tran, 2012).

Education is also a factor clearly associated with health outcomes in the literature on social determinants globally as well as inequality in health outcomes in Vietnam (Schnittker, 2004, Woolf et al., 2007, Axelson et al., 2012). Over the past 20 years Vietnam has changed its national curriculum along with the number of years required for completion of each stage of schooling including primary, secondary, high school. Someone who had ten years of schooling under the old system would have completed the entire high school curriculum whereas under the new system this would require 12 years of schooling. Thus measuring education in years is not a good reflection of the level of education a person achieved. In light of this I have used a 5 point scale indicating the level of education rather than years of education as follows: 1 – completed primary school or less, 2- some secondary school, 3 – completed secondary school, 4- completed high school and 5 – more than high school. Due to the changes in the education system over the last two decades, studies using Filabavi data tend to classify education into the levels above or a slightly condensed 3 or 4 tier version (Tran et al., 2012a, Van Minh et al., 2008, Thuan et al., 2008).

Ethnicity is another factor associated with health in the social determinants and social epidemiology literature as well as in the literature on both health and health equity in Vietnam (Zsembik and Fennell, 2005, Krieger, 2000, Baulch et al., 2012). I have captured ethnicity in this dataset using a variable equal to 0 for ethnic majorities (Kinh) and 1 for ethnic minorities who, in this region are overwhelmingly (89%) Muong (Chuc and Diwan, 2003). The Muong are a minority ethnic group considered to be the most closely related to the ethnic majority in culture and lineage. In light of this , and the emerging argument that minority ethnicity is a largely social construct in Southeast Asia more broadly (Scott, 2009), it

is likely that the Muong in Ba Vi have distinct identities and traditions from the ethnic majority without distinct genetic heritage.

Geographic area is another well-established determinant of health both globally and in Vietnam. While the main distinction in health outcomes in Vietnam is often made along rural-urban lines there is also evidence that residents of lowland, highland and mountain areas experience systematic differences in health outcomes (Byass, 2003, Tran et al., 2012a). I use a dummy variable for lowland, highland and mountain areas. In my regression analysis, highland is the reference geography which is omitted from the regression in order to avoid the problem of perfect collinearity. This means that the coefficients on the mountain and lowland variables indicate the log odds that someone from these geographies is efficient as compared to someone from the highlands.

I also included type of employment as a social factor based on the evidence in the social determinants literature (Benach et al., 2007) as well as the literature on ANC in Vietnam (Tran et al., 2012a) and the UK study of conversion efficiency (Binder and Broekel, 2011). This variable seems particularly relevant in Vietnam where formal employment entails a level of financial security and social benefits including health insurance that would be rare among the informally employed. I generated a dummy variable for formal employment based on whether an individual's reported occupation would have qualified for the benefits of long term contract employment including protection under employment law and benefits. In consultation with local researchers familiar with the Filabavi data, I defined as formally employed people who reported being government workers, formal private sector workers, people working in mining and resource extraction and teachers. The remainder, which included farmers, handicraftsmen, traders, temporary laborers, people employed in the

informal service economy, students, housewives, minors, people who were retired, disabled or unemployed, I defined as not formally employed.

I also included a measure of age which has been associated with health outcomes for biological reasons as well as conversion efficiency for health outcomes. Systematic reviews have long agreed that there is an increased risk of adverse health outcomes in pregnancy at the extremes of the age distribution (Gibbs et al., 2012a, Hansen, 1986, Balasch and Gratacos, 2012). The increased risk for adverse pregnancy outcomes including complications, low birth weight, preterm birth and infant mortality is likely attributable to both biological and, particularly for very young mothers, social factors such as education and socioeconomic status (Finlay et al., 2011). However the systematic reviews concur that the age related risk is relatively low at the individual level and I have already controlled for several potential confounding social factors such as economic status and education. Thus, in order to capture the small effect at the extremes of the distribution I included the age variable as the square of the difference from mean age, which results in exponentially large values for the youngest and oldest women. This hypothesis about the relationship between age and efficiency is borne out by the results of my analysis of efficiency in achieving healthy pregnancy and delivery outcomes, discussed further below. Mean difference from age-squared was also found to be a significant conversion factor in the previous application of the Order-M method to understanding conversion efficiency (Binder and Broekel, 2011). The rationale and evidence linking age to appropriate care is less clear so I omitted it from my final estimation of the appropriate care analysis after confirming by statistical test that it was neither a significant factor nor did it improve the model.

Lastly, I included a variable for sex of the child as a conversion factor. While gender is a well-established social determinant of health, in a sample of pregnant women it is not a

distinguishing factor. However, in the Vietnamese case, the evidence suggests that the gender of the child is an important determinant of achieving appropriate ANC (Tran, 2012) and possibly subsequent health outcomes. This has been explained in light of two key factors. First, even in rural areas nearly every woman receives an ultrasound and identifies the baby's sex early in the pregnancy. Second, particularly in rural areas, son preference endures and some evidence suggests that it results in greater attention and care when a woman is pregnant with a boy (Tran, 2012). In order to include this factor I created a dummy variable equal to 1 when the baby was a boy and 0 when the baby was a girl.

Summary Statistics for independent variables can be found in Table 4.5.

Summary Statistics for Conversion Factor Variables				
	mean	sd	min	Max
Wealth Quintile¹	3.199	1.28	1.0	5.0
Education Level²	3.319	1.15	1.0	5.0
Ethnic Minority	0.053	0.22	0.0	1.0
Live in the Mountains	0.221	0.42	0.0	1.0
Live in the Highlands	0.542	0.50	0.0	1.0
Live in the Lowlands	0.236	0.42	0.0	1.0
Formally Employed	0.156	0.36	0.0	1.0
Baby is a Boy	0.542	0.50	0.0	1.0
Age of Pregnant Woman	26.079	5.20	15.2	47.9
Observations	1414			

¹ by asset-based principal component index divided into quintiles where 1 is least wealthy and 5 is wealthiest.

² 1 = primary school or less, 2 = some secondary school, 3 = completed secondary school, 4 = completed high school, 5 = more than high school.

Table 4.5: Summary Statistics for Conversion Factor Variables

Most of the means for the conversion factor variables are at or near expected levels. The population here is just slightly wealthier than the median quintile of 3. The average education level is higher than secondary school but lower than a high school diploma. Just over 5% of the sample are ethnic minorities, somewhat smaller than the 9% reported for the study population. However, there is no reason to expect the demographics of pregnant women to match the demographics of the total district population exactly. Roughly half the

population lives in the highlands with about a quarter each in the mountains and lowlands. Formal employment remains rare in this largely agricultural district with only 15.6% of the population. Lastly the average age of pregnant women is 26, also expected as women are officially encouraged to delay childbirth until after the age of 22 (Klingberg-Allvin et al., 2010) though having children before the age of 30 is still socially and culturally preferred.

The most interesting of the summary statistics is that over 54% of the children born in this sample were boys. In Europe and North America 51.3% of babies born are boys (Sen, 2003). A test of proportions reveals that the percentage of boys born in Ba Vi is statistically significantly greater than 51.3% at the 1% level. Despite the Government of Vietnam's efforts to curtail the practice of sex-selective abortion, the combination of decreasing total fertility, increasing availability of medical services and persistent social and cultural norms for son preference prevail. Recent evidence suggests that sex-selective abortion is on the rise in Vietnam (Guilmoto et al., 2009) while these summary statistics strongly suggest it is occurring in Ba Vi.

4.3.2.2 Control Variables

As discussed in greater detail in Chapter 3, I also included a series of control variables in order to control for several potential sources of bias, or several factors whose effects I wanted to distinguish from the effect of conversion factors on the likelihood of efficiency. These included a dummy variable for each of the years (2005-2011) included in my sample, a dummy variable equaling 1 for women who appear multiple times in the sample due to multiple births as well as a modeling approach which yields cluster robust standard errors.

4.3.3 Regression Results

4.3.3.1 Efficient Conversion of Health Resources in Appropriate Care

The results of the first regression analyzing the contribution of conversion factors to the likelihood that a woman was efficient at achieving appropriate care are shown in Table 4.6.

The results indicate that being an ethnic minority was positively associated at the 0.1% level with being efficient. Meanwhile, living in a mountainous area was negatively associated at the 0.1% level with the likelihood of efficiency. Being formally employed was also positively associated at the 5% level with being efficient at achieving appropriate care.

Relative Contribution of Conversion Factors to the Likelihood of Efficiency at Achieving APPROPRIATE CARE					
	Coefficient	95% Confidence Interval	Adjusted Odds Ratio	95% Confidence Interval	p-value
Wealth Quintile	0.018	-0.107,0.142	1.018	0.899,1.153	0.777
Ethnic Minority	1.410***	0.668,2.153	4.097***	1.949,8.611	0.000
Lives in Mountains	-1.113***	-1.751,-0.476	0.328***	0.174,0.621	0.001
Lives in Lowlands	0.431	-0.084,0.947	1.539	0.919,2.577	0.100
Education Level	0.083	-0.031,0.197	1.087	0.970,1.218	0.149
Formally Employed	0.468*	0.084,0.853	1.597*	1.088,2.346	0.018
Baby is a Boy	0.217	-0.008,0.443	1.243	0.992,1.558	0.059
N	1407				

* for $p < .05$, ** for $p < .01$, and *** for $p < .001$

Table 4.6: Relative Influence of Conversion Factors to the Likelihood of Efficiency at Achieving Appropriate Care

4.3.3.2 Efficient Conversion of Health Resources into Healthy Pregnancy & Delivery Outcomes

Results of the regression analysis of the contribution of conversion factors to the likelihood of being efficient at achieving health pregnancy and delivery are presented in Table 4.7.

Again, being an ethnic minority is associated at the 1% level with a greater likelihood of being efficient. Perhaps even more surprisingly, being more educated is associated at the 5% significance level with a lesser likelihood of efficiently converting health resources into

healthy pregnancy and delivery outcomes. Difference from mean age squared is also significant at the 5% level, with a very small negative effect at the extremes of the distribution suggesting very young or very old women are less likely to be efficient. Sex of the child is marginally significant at the 10% level, with a small negative effect on the likelihood of efficiency for having a boy. Wealth quintile is again completely insignificant but remains in the model for theoretical reasons given the preponderance of evidence linking wealth and health.

Relative Contribution of Conversion Factors to the Likelihood of Efficiency at Achieving HEALTHY PREGNANCY & DELIVERY					
	Coefficient	95% Confidence Interval	Adjusted Odds Ratio	95% Confidence Interval	p-value
Wealth Quintile	-0.029	0.120,0.062	0.971	0.887,1.064	0.527
Ethnic Minority	0.669**	0.245,1.093	1.952**	1.277,2.984	0.002
Lives in Mountains	-0.167	-0.433,0.098	0.846	0.649,1.103	0.213
Lives in Lowland	-0.149	-0.459,0.160	0.861	0.632,1.174	0.339
Education Level	-0.128*	-0.237,-0.019	0.880*	0.789,0.981	0.022
Difference from Mean Age Squared	-0.002*	-0.004,-0.000	0.998*	0.996,1.000	0.037
Formally Employed	-0.037	-0.357,0.283	0.964	0.700,1.327	0.820
Baby is a Boy	-0.202	-0.430,0.027	0.817	0.651,1.027	0.083
N	1394				

* for $p < .05$, ** for $p < .01$, and *** for $p < .001$

Table 4.7: Relative Influence of Conversion Factors to the Likelihood of Efficiency at Achieving HEALTHY PREGNANCY AND DELIVERY

4.3.3.3 Model Diagnostics

After running the regression models described above, I ran standard diagnostic tests in order to ensure that the results appropriately reflect the data. First, I tested to see whether the models were appropriately specified, that is whether the logistic form of the function is appropriate, whether there are neither too many nor too few independent variables and whether the linear combination of those variables specified is adequate (Institute for Digital Research and Education: UCLA). In order to determine this, I ran a link test on the models

whose results strongly indicated that the current specification was appropriately predictive of the data and that an alternative specification was unlikely to better predict the data for both models. This is indicated by the highly significant p-values for the β_1 coefficient and the non-significant p-values for the β_2 coefficient in the tables below.

	Coefficient	t	P> t	[95% Conf. Interval]	
β_1	1.202268	4.03	0	0.607375	1.797161
β_2	0.2693289	1	0.323	-0.27004	0.808701
β_0	-0.0215575	-0.17	0.862	-0.2675	0.224385

Table 4.8 Linktest Results for Appropriate Care Model

	Coef.	t	P> t	[95% Conf. Interval]	
β_1	1.049523	4.23	0	0.554133	1.544913
β_2	-0.08813	-0.26	0.792	-0.75385	0.577594
β_0	0.002243	0.04	0.972	-0.12451	0.128992

Table 4.9 Linktest Results for Healthy Pregnancy and Delivery Model

Secondly, I tested the goodness of fit of each of the models, or how well the model corresponds to and predicts the actual data (see Table 4.10). The Hosmer-Lemeshow goodness of fit χ^2 statistics reported below have insignificant p-values indicating that the models are well fit (Hosmer Jr et al., 2013, Institute for Digital Research and Education: UCLA).

	Hosmer Lemeshow χ^2	P values
Appropriate Care	9.74	0.2836
Healthy Pregnancy & Delivery	3.17	0.9229

Table 4.10 Hosmer Lemeshow Chi Squared Test Results

I also tested both models for multicollinearity, the case where a high correlation between two or more of the independent variables makes it impossible to determine which is responsible for the variance reflected by the coefficient (Greene, 2012). The measure of collinearity is a Variance Inflation Factor or (VIF) which is equal to 1 if the variables are completely uncorrelated. Generally a VIF greater than 20 is considered problematic (Greene, 2012). As shown in Table 4.11, all of the variables in both models have VIF's well below 10 and often much closer to 1. This suggests there are no concerns about multicollinearity in the model.

Variable	VIF in Appropriate Care Model	VIF in Healthy Pregnancy Model
Wealth Index	1.21	1.22
Ethnic Minority	1.22	1.22
Lives in Mountains	1.3	1.30
Lives in Lowlands	1.13	1.13
Education Level	1.46	1.49
Formally Employed	1.29	1.29
Baby is a boy	1	1.01
Difference From Mean Age Squared		1.03

Table 4.11 VIF scores for independent variables in both models

Lastly, I considered whether there were any outliers or highly influential values which biased the results away from the trends observed in the rest of the population. I considered Pearson residuals (Colin and Trivedi, 2005, Greene, 2012) as well as leverage values. Generally, a residual value whose absolute value is greater than 2 is considered problematic (Greene, 2012). Neither model had problematically larger residuals as seen in Table 4.12.

	Minimum Pearson Residual	Maximum Pearson Residual
Appropriate Care	.06	0.87
Healthy Pregnancy and Delivery	- 1.9	1.45

Table 4.12 Min and Max Pearson Residuals for Both Models

Given that these residuals are small in value it is not surprising that there were also no concerns regarding leverage, or single observations distorting the trends identified in the model. The largest leverage value was .2 for the appropriate care model and .05 for the Healthy Pregnancy & Delivery Model.

Another statistic which is sometimes used to understand the predictive power of the model, or how much of the variance is explained by the model is the R-squared values. It is not possible to calculate R-squared on a logistic model where the variance is inherently fixed. However there are several ways of estimating a pseudo R-squared which measures the proportion of the log likelihood (the probability which serves as the dependent variable) explained by the model. However, no approach to estimating a pseudo-R squared is considered definitive and results of different methods vary. As a result, pseudo R-squared values are useful for comparing two similar versions of the same model but they are not independently meaningful values (Institute for Digital Research and Education: UCLA). Key econometrics texts vary between discussing Pseudo R-squared but cautioning strongly against using it as a general measure of fit (Colin and Trivedi, 2005, Greene, 2012) and dismissing its usefulness entirely (Wooldridge, 2002). Furthermore, because I ran my model accounting for the clustered sampling strategy, it is not strictly possible to estimate a pseudo R-squared which assumes that all observations are independent and equally distributed.

These statistical tests do not indicate on their own whether a model is acceptable or not. However, they can provide further support and confirmation for a model which is theoretically well grounded, or conversely, indicate an issue for further consideration.

4.4 Discussion of Quantitative Findings

Thus my quantitative analysis answers my first two research questions: First, in this population, some people *are* more efficient than others at converting health resources into health outcomes. A distribution of efficiencies exists wherein 39% of the population is efficient at converting available health resources into appropriate antenatal care and 56% of the population is efficient at converting available health resources into healthy pregnancy and delivery.

Second, some groups of people are significantly more likely to be efficient than others. Ethnic minorities, women living in non-mountainous areas, and formally employed women were more likely to be efficient at converting available health resources into appropriate care. Ethnic minorities and less educated women were more likely to be efficient at converting health resources into the outcomes of healthy pregnancy and delivery. Women at the extremes of the age distribution were less likely to be efficient at converting resources into health outcomes though this effect was small in magnitude.

I will focus my analysis going forward on the two most significant conversion factors from each analysis: ethnicity and geography for appropriate care, and ethnicity and education for healthy pregnancy and delivery.

At first glance, the results that ethnic minorities are more efficient at converting health resources into appropriate care and healthy pregnancy and delivery and that the less educated were more efficient at achieving healthy pregnancy and delivery seems counterintuitive. In many cases the global and Vietnam-specific literature have documented that these social factors are associated with poorer health outcomes (Teerawichitchainan and Phillips, 2008, Jemal et al., 2008, Karlsen et al., 2011). For example, the Young Lives longitudinal study of children in Vietnam found dramatically higher rates of both underweight and stunting among ethnic minority children while Hong et al. (2003) found that ethnic minority carers were less likely to give ORS or seek healthcare for children with diarrheal disease (Hong et al., 2003, Duc et al., 2011). Likewise, Huong et al (2006) find higher levels of education associated with higher overall survival rates (Huong et al., 2006b). With respect to pregnancy and delivery care and outcomes specifically, an analysis of the 2000-2001 National Household survey found that both ethnic minorities and less educated women were less likely to receive antenatal and delivery care (Sepehri et al., 2008). Meanwhile a study of pregnant women from 1999 -2004 in Ba Vi district found that ethnic minorities and less educated women were more likely to deliver at home while ethnic minorities were more likely to have a still born child (Graner et al., 2009). More recent studies have suggested some of these gaps may have narrowed. For example, a recent multivariate analysis of a more expansive Ba Vi dataset has indicated no relationship (positive or negative) between ethnicity and appropriate ANC utilization (Tran et al., 2012b). This study further found that ethnic minorities even outperformed the ethnic majority on some elements of care, having on average more ANC visits as well as their first ANC visit earlier in the pregnancy (Tran et al., 2012b). However no studies, to my knowledge, indicate that ethnic minorities or less educated women received more appropriate care or achieve better health outcomes overall.

This raises an interesting question: should we expect that the people who achieve the best outcomes are also the most efficient? A preliminary analysis examining the relationship between conversion factors and raw outcomes (as opposed to efficiency which looks at the ratio of outcomes to resources) in my data suggests, maybe not.

In some cases the same people who were less likely to be efficient also had statistically significantly lower mean outcomes. Simple, bivariate analyses suggested that women in mountainous areas had worse care outcomes and more educated women appeared to have worse healthy pregnancy and delivery outcomes. However, considering the outcomes of ethnic minorities reveals a different pattern. While ethnic minorities were more likely to be efficient at converting resources into appropriate care and healthy pregnancy and delivery, two-sided t-tests revealed no statistically significant difference by ethnicity in the means of the summed set of core care services, the summed set of recommended care services or the summed set of healthy pregnancy and delivery outcomes.⁸

Clearly, these simple bivariate analyses of social factors and outcomes are not comparable in rigor or precision to the multivariate models used to estimate the influence of conversion factors on efficiency in the previous section. Rigorously estimating the relationship between these social factors (geography, education, ethnicity) and appropriate care and health outcomes is beyond the scope of this investigation but merits consideration in future research.

However, while the bivariate comparisons do not control for all relevant social factors simultaneously, they do suggest an important point: the people who are the most efficient

⁸ Detailed output for all bivariate statistical tests mentioned in this section are included in Appendix G.

at converting health resources into outcomes are not necessarily the people with the best health outcomes on average.

In my sample, there is no indication that ethnic minorities achieve better maternal care or healthy pregnancy and delivery outcomes on average. It is only when we look at efficiency – the level of outcomes achieved in comparison to those of equal resources– that ethnic minorities do better. Thus the finding presented here does not necessarily contradict previous findings suggesting equal or lesser health outcomes among ethnic minorities. Rather it nuances those findings by suggesting that, while in this sample ethnicity is not a significant determinant of better outcomes, it is significantly associated with efficiency. In other words, while ethnic minorities are not, on average, achieving better outcomes overall, they are more likely to achieve the best outcomes compared to those with comparable resources.

This finding raises two important points. The first is that measuring demand side efficiency is in no way a substitute for measuring care adequacy and health outcomes—rather it is a complement providing additional useful information. In this case, multiple groups of people have similar or the same outcomes, yet, systematically, some groups achieve those outcomes more efficiently. As a result, understanding how and why those groups achieve their outcomes more efficiently has the potential to inform two separate pathways for improving health: 1) improving the efficiency of inefficient converters who have not yet optimized available resources and/or 2) devoting additional supply-side resources to the efficient converters to further improve their outcomes.

The second point is that there are fundamental methodological differences between Technical Efficiency Analysis and statistical models most commonly used to measure the

relationships between social factors and outcomes. Regressing a health outcome on social factors identifies the relationship between the two by finding a line of best fit that plots a path through the middle of the variance in the data, or by determining the most likely relationship based on the data. The standard regression model $y = \beta_0 + \beta_1 x_1 + \epsilon$ is telling us that, *on average* a one unit increase in x_1 is related to a β_1 change in y . Technical Efficiency Analysis, on the other hand, is not looking at averages at all. Rather Technical Efficiency Analysis is a formalized approach to positive deviance which traces the frontier of the maximum possible outcome and then measures everyone else's distance from that maximum (at each resource level). As discussed above, efficiency fundamentally differs from outcomes in that it integrates both outcome and resource measures. Furthermore the approach to measuring efficiency here also differs in that it seeks out the best cases and uses them as a benchmark for the population rather than trying to estimate the average or the trend at the middle of the population.

Given these fundamental differences, it is not surprising that the most efficient groups, based on technical efficiency's positive deviance approach, are not necessarily the same as those with the highest average outcomes. The measures are derived in entirely different ways and thus tell us entirely different, though both useful, things.

Specifically, by distinguishing the best performers—the people who systematically achieve the best outcomes at their level of resource-- this type of efficiency tells us whom we can talk to in order to understand how and why some people achieve better outcomes with their resources than others. How do they use those resources differently, or what additional factors might mediate the relationship between their resource endowment and their outcomes?

The following chapter reports the results of my qualitative investigation of these questions among recently pregnant women across the social dimensions identified as significant predictors of efficiency-- ethnicity, education, and geography.

CHAPTER 5: QUALITATIVE INVESTIGATION & FINDINGS

The qualitative portion of my research aims to answer my third research question: how and why are some groups more likely to be efficient at converting available health resources into health outcomes? In light of the specific findings from the two quantitative efficiency analyses, this question takes on two parts: 1) How and why are ethnic minorities and women in non-mountainous areas more likely to be efficient at converting health resources into appropriate care? and 2) how and why are ethnic minorities and less educated women more likely to be efficient at converting available health resources into healthy pregnancy and delivery outcomes?

It is important to bear in mind that these questions refer to the specific type of efficiency explained in Chapters 1 and 3 and measured empirically in Chapter 4. This is not cost effectiveness, i.e. achieving the maximum outcome per dollar spent, nor is it efficient utilization, i.e. achieving the maximum outcome per use of health resources (such as per ANC visit). Rather my study is concerned with how efficiently people convert their endowment of publicly provided health resources-- including health facilities and human resources for health-- into health outcomes—including appropriate care and healthy pregnancy and delivery. In this case, people who have equal or lower resource endowment but better outcomes are more efficient whereas people who have greater resource endowment and weaker outcomes are less efficient. Thus the question I aim to answer here can also be stated as: Why are some people more likely to achieve better outcomes with equal or lesser resources?

This is not a question that can be addressed head on. Asking people how their education level or ethnicity affects their efficiency at achieving health outcomes is both far too abstract and far too speculative. Instead I sought to identify perceptions and behaviors, opportunities

and choices which differed across the social dimensions of interest (geography, ethnicity and education) and may also have implications for efficiency. To do this, I sampled across the three social dimensions and asked respondents about how they pursued and achieved good care and good health during their pregnancy.

In this chapter, I first present my strategy for sampling across ethnicity, geography and education levels. I then focus on themes which explain different perceptions and behaviors across the key social dimensions. Lastly I discuss the implications of each theme for efficiency.

5.1 Sampling Strategy

In order to understand how and why certain groups of women were more likely to be efficient at converting health resources into health outcomes, I spoke to 3 different types of people in Ba Vi: recently pregnant women, medical staff from the commune health centers, and Filabavi HDSS surveyors.

The large majority of women I spoke to (30 of 35) were women who had been pregnant in the last five years. I focused specifically on women who had been pregnant within the last 5 years in order to facilitate rich recall of experiences and perceptions at the time of pregnancy. Their perceptions of resources, opportunities and desired outcomes as well as their preferences and processes for decision making provided the core information for addressing the main aims of my qualitative stage. With the help of the Filabavi surveyors and supervisors who recruited both focus group discussion and interview participants, I constructed the sample of pregnant women for maximum variation across the three

dimensions identified as significantly associated with the likelihood of being efficient: geography, ethnicity and education.

In addition to interviewing recently pregnant women I also spoke to medical workers from two commune health centers to get their perspective both on the service they provide and on the different experiences, perceptions and behavior patterns of different types of patients.⁹ In order to capture different perspectives, I spoke to health workers from different professional and geographic backgrounds. One was a nurse from a highland commune health center and one an assistant doctor from a mountain commune health center. By coincidence, both were women.

For similar reasons of understanding different health perceptions, priorities, experiences and outcomes of different sub-populations, I also interviewed three Filabavi field surveyors, one from each geographic area. In addition to living in the communities included in the HDSS, each had worked for Filabavi gathering quarterly data at the household level for more than 10 years. As a result, they have had a unique opportunity to observe patterns across the populations in their respective catchment areas. Again, by coincidence, all three were women.

Participants for focus group discussions and interviews were identified and recruited by the Filabavi supervisors and surveyors according to the criteria I set in order get a varied sample. Specifically, for the focus group discussions I requested and carried out 1 focus group in each of the three geographic areas: lowland, highland and mountains. Each included 7 women

⁹ I interviewed health workers and surveyors in order to get their overarching perspective and their impressions of the differences between patients of different backgrounds. However, my research questions do not focus on the perceptions of health workers or surveyors, but rather on the perceptions, behaviors, opportunities and choices of pregnant women. Consequently I spoke to only a couple of health workers and surveyors, focusing instead on achieving saturation among a much larger sample of pregnant women.

with varied educational backgrounds. In the mountains, where the majority of ethnic minority women live, I requested that the group include 4-5 ethnic minority women. Following each focus group discussion, I interviewed one Filabavi surveyor from each geographic area who was involved in organizing the focus groups. In two cases, I also conducted in-depth follow up interviews of women from the focus groups who both had a unique ability to comment on the evolution of health systems and perceptions because they had had several children over a long span of time. These two women also had comparatively lower education levels than the rest of the group and were quieter during the focus groups themselves, at times deferring to more educated, articulate participants. Conducting follow-up interviews allowed me to further draw out their perceptions, perspectives and experiences.

After the completion of the focus group discussions and related follow-up interviews, I conducted twelve further interviews. Again, I specified the demographic characteristics of women to be recruited for interviews in order to get a broad representation of geographic, educational and ethnic backgrounds. Ten of the additional interviews I carried out were recently pregnant women and two were health workers.

My final sample included nearly equal representation across the three geographical areas, women of educational levels ranging from 2nd grade to university level. The sample also included 23% (8 of 35) Muong ethnic minority women, an overrepresentation given that they comprise only 10% of the population and only live in one of the three geographic areas. The demographics of the sample are summarized in Table 5.1.

	Dimension	Type	# of FGD participants	# of Interviewees
Recently Pregnant Women	Geography	Mountain	7	6
		Lowland	7	3
		Highland	7	3
	Education	Grade 1-5	1	1
		Grade 6-8	3	1
		Grade 9-10	10	5
		Grade 11-12	4	2
		Post High School	3	3
	Ethnicity	Kinh	17	8
		Muong	4	4
CHC Health Staff	Geography	Mountain		1
		Highland		1
Filabavi Surveyors	Geography	Lowland		1
		Highland		1
		Lowland		1

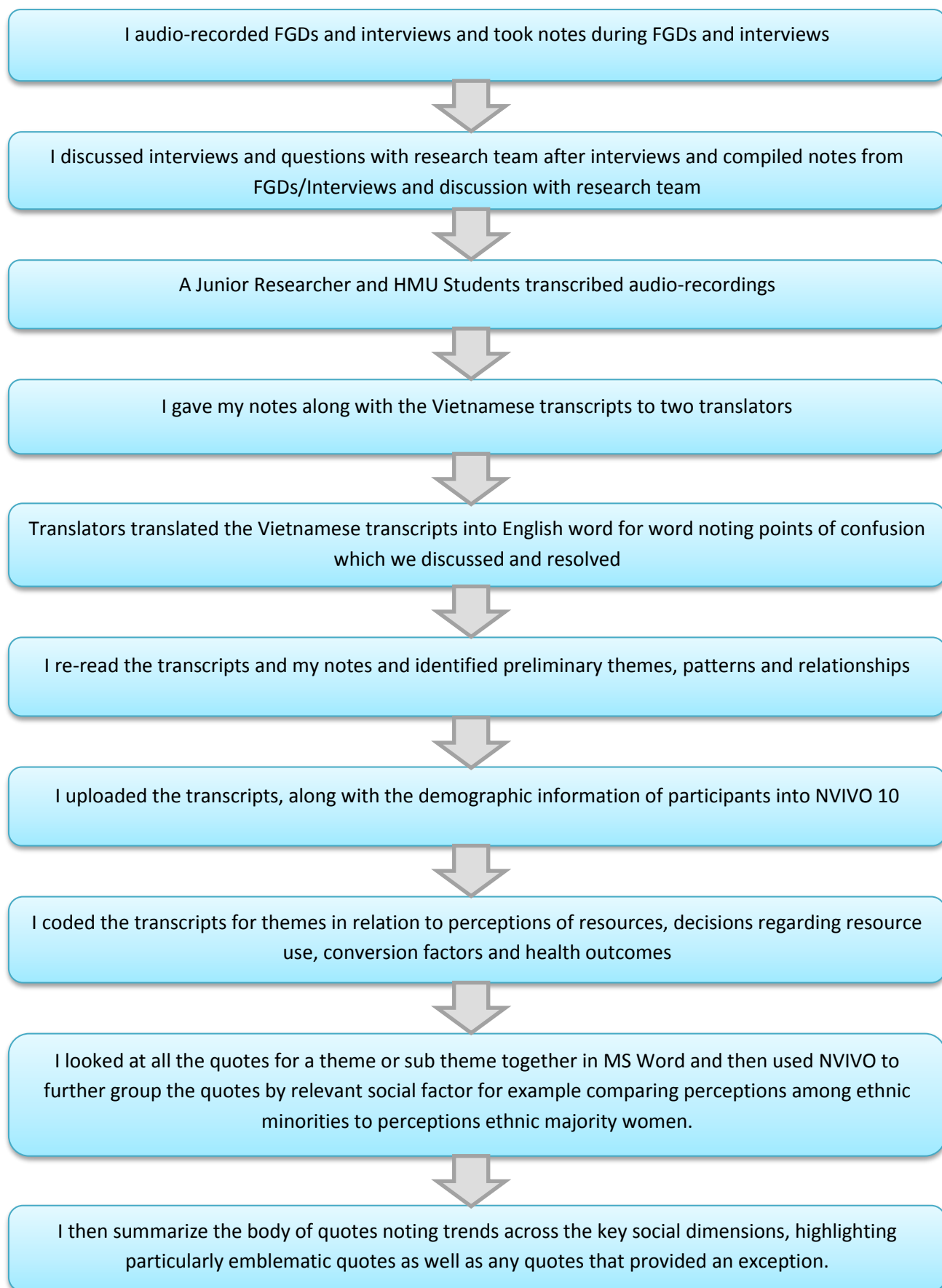
Table 5.1: Demographics of Qualitative Sample

In addition to achieving a sample with adequate variation across the 3 key dimensions, I also continued interviewing until I felt I had achieved data saturation. I judged saturation as the point at which no new themes had emerged for the last one or two interviews.

Before presenting the themes which emerged from these discussions and interviews, I first briefly discuss understandings of good health among the respondents and whether such understandings aligned with those in the quantitative analysis.

5.2 Qualitative Data Processing & Analysis

The steps I used to record, process and analyze data are described in the flowchart below.



5.3 Women's Perceptions of Good Health Outcomes

In order to understand how and why some groups were identified as less likely to be efficient in the quantitative stage, it is necessary to understand whether women were trying to achieve the outcomes included in those analyses. If the women, or if certain groups of women, held a different perception of good care and health outcomes this would have important implications for understanding the process by which resources are converted into the outcomes measured. Thus a first question to be answered is: were women actually trying to use available resources in order to achieve the outcomes captured in my outcome sets or were they trying to achieve other goals all together?

With respect to appropriate care, while many women mentioned additional factors for good health, such as ensuring good nutrition and generally being careful (avoiding accidents, dressing appropriately for the weather) they all held an essentially biomedical view of health and believed that appropriate maternal care was among the most important factors for a healthy pregnancy. Furthermore their perception of appropriate care included the elements which are recommended in the national guidelines and included in the outcome sets of my appropriate care analysis. Women's understanding and achievement of the appropriate number and timing of visits as well as the relative priority of various services differed in some cases and is discussed in greater detail below. However their intentions for care matched well with those included in my appropriate care analysis; it seems unlikely that women were less efficient because they were trying to achieve different care outcomes entirely.

Women also articulated a view of positive and negative pregnancy and delivery outcomes that was largely biomedical in nature. Their set of important health outcomes

was broader than but included the most common global metrics and, specifically, those included in my healthy pregnancy and delivery analysis. These include complications during pregnancy, healthy birth weight, term birth and method of delivery. While understandings of the exact weights and number of weeks that constitute healthy birth weight and term birth, as well as the biological mechanisms underlying these outcomes differed, in general women were trying to use health resources to achieve the outcomes I measured in the healthy pregnancy and delivery analysis. Additional health outcomes which the women felt were important but which I was not able to include in my outcome set were the relative pain or ease of delivery as well as whether the child was born with birth defects.

That women held a universally biomedical understanding of good care and health outcomes is itself an interesting finding. Research in rural and mountainous communities in Vietnam as well as in other rural and indigenous communities worldwide has revealed that the biomedical view of health is not universal. Rather understandings of achieving and maintaining health can be based on a concept of spiritual appeasement and compatibility of natural treatments as documented among ethnic minorities in remote Lao Cai province of Vietnam (Rheinlander et al., 2011) or in achieving social and environmental harmony as documented in Chiapas, Mexico (Ariana, 2012) . Thus it is noteworthy that everyone, including those living in the mountains, ethnic minorities and women with education levels as low as the 2nd grade, expressed a biomedical view of health as well as a good knowledge of recommended care procedures and good health outcomes. While several women spoke of using Chinese, Vietnamese or Muong traditional herbal medicines these were never used as a substitute but only as a supplement to clinical medicine.

The high and consistent level of health knowledge is a testament to two unique and interesting facets of this Vietnamese context. The first is the dissemination of information through commune level institutions including the commune health center as well as the People's Committee and sub-committees such as the Women's Organization. Many of the women spoke of receiving public health information and support through these sources both before and after pregnancy.

There has been propaganda activities recently . . . (by) people in the Women's Organization in the commune. Every month, if you come to the commune cultural building, you will be offered iron and information about feeding your baby.

– Highland FGD¹⁰

Nurses and people in people community also came to my house to ask about my health, how I am raising my child. They cared for me... Even after delivery, they still came to me, cared for me and my child. They asked how I raise my child, what medicine I took after delivery, whether I used things to maintain good hygiene every day or not . . . many things. They asked carefully... sisters in the People Committee also came to ask about how I ate, what medicine I took, was there anyone sick or was my child sick or did he take medicine already....They cared a lot.

– Lowland FGD

The second facet which has contributed to the effective diffusion of public health information is a pervasive sense of solidarity and duty to others emanating in part from the guiding ideologies of Communism and Confucianism. Women mentioned how communities would organically ensure that all mothers and children received necessary vaccines by sharing information and checking up on neighbors. While some communes

¹⁰ While I captured demographic information of participants in focus groups it was not possible to associate that information to specific quotes in the transcripts of the sessions. As a result quotes from focus groups are attributed only to a general focus group discussion (Mountain, Highland and Lowland) whereas quotes from individuals are attributed to the geography, ethnicity and education level of the speaker.

widely announced which days and times vaccines would be offered, other respondents explained they simply received information from their neighbors.

At my commune, there is no announcement. People just tell one another to go... For example, if there were no announcement, then when I visit my neighbors' houses, they would remind me about that date.

– Highland FGD

Better off women and more educated women also talked about sharing information and encouraging good health practices among those they perceived as less well-off and less knowledgeable.

It's like the woman who was here a while ago, she knows almost nothing; she only knows things when I tell her. Otherwise she doesn't... She doesn't go for checkups; she doesn't know that she should get checkups regularly when she's pregnant . . . she doesn't have information... I have to tell her. Sometimes I let her go with me or ask her to come over to my house for a chat, so that she will know a little bit.

- Muong (Ethnic Minority) Woman, Postgraduate Education, Mountains

Thus a general biomedical view of health and a specific understanding of appropriate maternal care and healthy pregnancy outcomes which align to global standards has been thoroughly diffused through Ba Vi district thanks to both formal channels driven by the commune government and informal channels driven by an ethos of solidarity and communal responsibility. Yet extrapolating this finding from the Ba Vi context to other rural contexts in Vietnam requires caution. While Ba Vi is rural, it is not remote, it is far more affluent and integrated than extreme rural areas. Furthermore, while Ba Vi includes a mountainous region and ethnic minorities these are neither highly inaccessible areas nor highly marginalized or excluded peoples. Although the ethnic minorities in Ba Vi are systematically less wealthy and less educated than their majority

counterparts, these differences are modest in magnitude and are not accentuated by a major cultural or language gap.¹¹

Given that, at least in Ba Vi, the intended care and health outcomes align with those used in the preceding quantitative analysis, we can turn to focus on the question: how and why were some groups more likely to achieve those outcomes efficiently, that is, with a lesser endowment of health system resources? Several themes emerge from the qualitative feedback with implications for efficiency.

5.4 Technology Preference

In discussing how they used health resources to achieve health outcomes, many women expressed a perception that higher levels of technology and specialization indicated higher quality care. This perspective often came up in discussions around the different types of health facilities. Women expressed some level of concern that the Commune Health Centers lacked equipment, higher level technology and highly trained and specialized staff.

The specialist knowledge of doctors and nurses [at the CHC] in caring and carrying out delivery [should be improved]. The equipment is very spare. It lacks many things.

- Lowland FGD

In my opinion, I will choose district hospital because it has much more quality and equipment than at CHC.

- Lowland FGD

Respondent: Overall, there should be sufficient facilities so we don't have to go far.

Interviewer: Right. What kind of equipment specifically? For example at the CHC, what facilities do you want them to have?

Respondent: Ultrasound service and doctors specialized in pediatrics.

¹¹ For a comparison of mean education and wealth quintiles by ethnicity see Appendix H.

- Kinh Woman, Gr 9, Mountains

A nurse from a highland commune explained how this technology preference was particularly pronounced among the more educated patients.

For example, sometimes when I see older patients, or people who have higher levels of education than me, in general they are... some people are very hard to please, so we must be relaxed and gentle to explain to them and make them understand that the CHC's facility only allows such a level of work. We cannot pass that level. For example, there are certain things we can do at the CHC, but there are things we can't do, which must be transferred to the district level. Some people even say very rude things, but we have to stay calm, because we're supposed to serve the community, so we must stay very calm.

– Nurse at Commune Health Centre, Highland

When probed on what kind of service the more educated patients are requesting that may not be available at the Commune Health Centre the nurse elaborated:

For example endoscopy or ultrasound services, or blood tests, which the CHC isn't yet able to perform...Usually only people with high level of education ask for such things. Other than that, normally when people come here, we tell them that in fact those things are not really necessary. When necessary, we'll refer them. But people with high education level want those things, they want to be satisfied . . .

– Nurse at Commune Health Centre, Highland

As some of the quotes above indicate, the general preference for technology tends to translate into a specific focus on receiving ultrasounds. Many women felt that this was the most important antenatal service for assessing and assuring the health of the fetus.

If pregnant, first I will go for ultrasound and check-up . . . If something happened, I would go for more ultrasounds. The result of an ultrasound is clearer than that of a check-up. In a normal check-up, you cannot detect birth defects. Ultrasound is the best, we can detect birth defect of the baby, the heart beat and the development of the fetus thanks to ultrasound. Normal check-ups only provide heartbeat of the fetus but not the inside problem, ultrasound is better.

- Mountain FGD

While nearly all women spoke of the importance of ultrasounds, the technology preference was most pronounced among the most educated women who specifically sought the most advanced ultrasounds.

The CHCs don't have 4D ultrasound equipment; they only have black and white sonography, so it's a limitation to people.

- Kinh Woman, Lowland, University Student

Now a lot of people go to the private sector for 3D and 4D ultrasounds. At the CHC, it's only black and white.

- Muong Woman, Mountains, University Student

Likely as a result of the overarching technology preference, the focus on ultrasounds, and the belief that this was the most important ANC service, several women described a potentially excessive use of ultrasound services.

During the first phase of maternity period, I went (for an ultrasound) once every three weeks, then one time per month in the next phase. During the last months, I went one time per week.

- Highland FGD

I had so many (ultrasounds) I could not count.

- Lowland FGD

However, the less affluent, more rural and less educated women were less likely to report overusing ultrasounds.

As for regular prenatal check-ups which were to be done once every few months, while I was pregnant with this boy, I also went two or three times for check-ups, I also had ultrasounds and such; that was all; I felt the fetus was normal, it was fine so why go for checks? In the countryside, to be honest, we only go to hospital a few times at most.

- Kinh Woman, Gr 9, Highland

This respondent explains that she chose not to pursue a large number of ultrasounds feeling that as long as the fetus appeared healthy, there was no additional value for excess checking. However it is also possible that some less affluent, more rural and less educated women might have preferred more ultrasounds but not have been able to spare the time and expense required. Although no women in my sample expressed this perspective, one Filabavi surveyor spoke to this point.

The rich have the economic means for ultrasound tests and examinations, in contrast, the poor do not.

– Filabavi Surveyor, Highlands

While all of the women I spoke to had at least one ultrasound and felt this was an important service, for reasons of both opportunities and choices, overuse was skewed to the more affluent, better educated, less rural and often ethnic majority women.

5.4.1 Implications for Efficiency

My finding regarding overuse of ultrasounds, particularly among more urban and more affluent patients, is in keeping with previous research. A 2007 study found women in Hanoi had over 6 ultrasounds on average and that 20% of women had 10 or more (Gammeltoft and Nguyễn, 2007). Another study comparing an urban district of Hanoi and Ba Vi district found that women received on average 6 and 3.5 ultrasounds over the course of their pregnancy respectively (Tran et al., 2011). The literature links the

overuse of ultrasounds to two factors. The first is a perception on the part of both doctors (Gammeltoft and Nguyễn, 2007) and patients (Gammeltoft and Nguyễn, 2007, Tran et al., 2011) that ultrasounds are critical to good antenatal care. As with the women in my sample, those in previous studies expressed the view that ultrasounds are critical to monitoring the growth and development of the baby (Tran et al., 2011) (Gammeltoft and Nguyễn, 2007). The second reason noted in the literature is the provider's economic incentive to provide ultrasounds in order to generate revenue (Gammeltoft and Nguyễn, 2007). These incentives may be particularly influential within the private sector where the combination of a profit motive, little to no oversight and potentially high margins on service provision exist. Studies of the emerging private sector substantiate that both over-prescription and over-servicing occur in the private health sector in Vietnam (Dang et al., 2007, Nguyen, 2011). At the same time these trends are also responsive to, and can thus be mediated by, more informed patient preferences and demand (Nguyen, 2011).

While there is little theoretical reason or empirical evidence to suggest that ultrasounds are harmful per se, a recent study in the US found that having an ultrasound to estimate fetal weight in the last month of pregnancy significantly increased the likelihood of a Cesarean delivery (Little et al., 2012). Rigorously executed, this study controlled for confounding factors including biological and social factors that would increase the likelihood of Cesarean including birth weight, previous cesarean, maternal age, parity, obesity and ethnicity as well as the type of health care provider. That the study found an effect of having an ultrasound to estimate fetal weight on likelihood of Cesarean even after controlling for biological indicators including birth weight indicates that the ultrasound itself had some impact on clinician behavior and decision making. It suggests that identifying a potential problem via ultrasound made the clinicians more

likely to identify a complication during delivery and quicker to order a Cesarean as a result (Caughey, 2012).

Cross-country differences in clinician training and preferences as well as facility resources, medical culture and national guidelines make it problematic to directly generalize these findings to the Vietnamese context. However, the phenomenon in which over-testing for medical issues, particularly using technologies with low predictive power, leads to over-identification of medical issues and unnecessary interventions has been identified across disease areas and geographic contexts (Stein and Marostica, 2007, Ochoa Prat and Pérez Dettoma, 2009, Gunatilake, 2012, Ronco et al., 2012, Esserman et al., 2013, Strøm et al., 2013). As a result, it seems plausible that the excessive use of ultrasounds in Vietnam could result in unnecessary interventions increasing the risk of adverse outcomes including Cesarean section.

Excessive use of ultrasounds would certainly be a source of inefficiency according to traditional cost effectiveness metrics which look at costs per outcome. Having ten ultrasounds is ten times as costly as having one ultrasound and, except in rare cases, it is unlikely to result in a better outcome. Rather, as per the studies cited above, it may increase the likelihood of the adverse outcome of Cesarean section. The relationship with efficiency as I have measured it – in terms of the conversion of health resources into health outcomes-- is more subtle but still important. In my sample, women who are more affluent, more educated and ethnic majorities tend to have greater resource

endowments.¹² Specifically they have better access to health facilities with more human resources. These women are also more likely to excessively use ultrasounds and, according to the research above, may be more likely to encounter over-diagnosis and overtreatment specifically resulting in Cesarean delivery, one of the adverse outcomes in my healthy pregnancy and delivery analysis. There is no evidence linking the overuse of ultrasounds to pregnancy complications, healthy birth weight or term birth (the other healthy pregnancy and delivery outcomes in my analysis) however a lesser outcome in one component could still make an individual inefficient. Thus technology preference and the overuse of ultrasound is one pathway which may explain why more affluent and educated women, who are likely to have equal or more resources are also likely to have poorer outcomes, or a lesser likelihood of being efficient with respect to healthy pregnancy and delivery.

There is no evidence linking excessive use of ultrasounds to appropriate care outcomes, however it does seem possible that a focus on ultrasounds, and a belief that this is the most important service, may result in a woman overlooking or not prioritizing other maternal care services. Likewise, pursuing an excessive number of ultrasounds could take time and money away from pursuing other services. Lastly, it also seems possible that women with a strong technology preference would overlook or underestimate the importance of some basic but critical services such as being weighed, measured, having an abdominal examination or simply talking with health care providers. Again, while evidence documenting this dynamic is lacking, it does seem a theoretically plausible

¹² Basic bivariate analysis of the quantitative data indicates that more educated and more affluent women had equal or greater endowments of both health infrastructure and human resources for health than less educated and less affluent women. The bivariate relationship between ethnicity and resources was ambiguous although when controlling for geography (which is reasonable because nearly all ethnic minorities live in one geographic area – the mountains) it was very clear that ethnic majorities had a greater endowment of all health resources measured. For specific results of these statistical analyses see Appendix I.

pathway through which technology preference and the focus on ultrasound results in women with more resources (more affluent, educated, ethnic majority women) being less likely to achieve appropriate care.

5.5 Private Sector

While there were exceptions, the preference for technology and specialist training and the resulting lack of trust and safety concerns at the CHC, were more pronounced among people who were more educated, less rural and generally more affluent. These women tended to avoid the CHC. Yet while most women acknowledged that the CHC was less equipped and had less specialized health staff, some women felt that the services were sufficient for primary care which, in combination with greater convenience and lesser cost, led them to choose to seek care at the CHC.

Other women placed more specific emphasis on the quicker and more attentive service offered by the private sector, in addition to the technological advantages.

Using the service at private clinics saves my time and the staff there are very polite and gentle.

– Highland FGD

It's faster at the private clinics. If we go to the district hospital, we will need a lot of documents, it takes very long. If we go to the private sector, we can get the ultrasound or tests right away if we want.

- Muong Woman, Mountains, University Student

One, comparatively affluent and highly educated lowland woman who described a positive experience using the Commune Health Centers for ANC and delivery care during her first pregnancy 5-6 years ago responded to the question “would you do anything differently for

your next pregnancy” by saying she would seek care at the private sector. Her comments exemplify the rapid rise in both the number and acceptance of private clinics. Furthermore she expresses the appeal of the private sector for those who can afford it: the impression of better qualified health workers and a proliferation of modern technologies.

I'll try private clinics together with the health center to compare between them, because nowadays private clinics also have a lot of equipment, and are very modern;

-Kinh Woman, Lowlands, University Student

When probed on why she would try private clinics now when she did not use them in her previous pregnancy five years ago the respondent explained:

Now there are a lot of private clinics around, plus their services are very good; other people who have been there said that they were very good, so I'm interested in trying them out to see how good they are. And thanks to the socio-economic development, private clinics are equipped with a lot of facilities, and health services are provided by well-qualified doctors and nurses.

-Kinh Woman, Lowland, University Student

When asked what services should be offered or improved at the community health centres, the respondent indicated the need for more technology and cites the private sector as an optimal example:

Ultrasound service. 3D or 4D ultrasound services have been available now. Speaking about things in the reproductive health area, in the past there was no such thing as fallopian tube ultrasound. There is, now. Ultrasound to check the release of the eggs. . . Nowadays private clinics have started to have better things.

– Kinh Woman, Lowland, University Student

5.5.1 Implications for Efficiency

Thus the qualitative feedback from this study suggests that a combination of technology preference, particularly with respect to ultrasounds, as well as financial means, has resulted in women who are more affluent, less rural and more educated being more likely to use the private sector services. This finding is corroborated by a recent quantitative study in two provinces of Vietnam. The study found that women who were farmers, had low incomes, had more than 2 children or lived in rural areas were more likely to use the commune health centers. Their more affluent, urban counterparts were more likely to use either hospitals or private sector providers (Ngo and Hill, 2011). Yet although the women whose economic resources allow them more options prefer the private sector, there are serious concerns about the quality of services offered. A study of health system resources in another province of Northern Vietnam found that while private sector providers outnumber public sector providers almost two to one, less than 20% of private providers were registered with the government. An alarming 11% had no professional qualification whatsoever. The private sector had poorer infrastructure based on the range of equipment and medicine available and the quality of providers was significantly poorer as assessed by their responses to basic medical questions relating to the diagnosis, treatment and management of common conditions (Tuan et al., 2005).

Perhaps unsurprisingly, use of the private sector has been linked to a lesser likelihood of receiving appropriate antenatal care. A study conducted in both Ba Vi and an urban district of Hanoi found that in both locations women who sought ANC exclusively in the private sector were less likely to receive adequate care by the same Vietnamese standards used in my study (Tran et al., 2012a). Another study conducted in three provinces also found that women who received ANC in the private sector tended to receive fewer of the services and information set forth in the national guidelines (Trinh et al., 2007). Thus the fact that more

affluent women, likely to have access to greater public health system resources, were more likely to use the private sector and that increased reliance on the private sector has been linked to a poorer standard of care means that these more affluent women may be less likely to be efficient at achieving appropriate care outcomes. Conversely, ethnic minority women, who were systematically less affluent, would be less likely to use the private sector and in turn more likely to achieve better outcomes despite their lesser resource endowment. This may partially explain why ethnic minorities were more likely to be efficient in achieving appropriate maternal care.

Evidence suggesting lower quality of facilities and practitioners, as well as the increased likelihood of receiving inadequate care in the private sector supports the hypothesis that healthy pregnancy and delivery outcomes would also be worse among people relying primarily on the private sector. Thus it may also explain my findings in the healthy pregnancy and delivery analysis. However, despite many studies on care utilization patterns and quality of care, I was not able to identify any studies examining the link between the type of health provider (i.e. private or public) and actual pregnancy and delivery health outcomes in Vietnam. Moreover, I was unable to identify any studies rigorously linking the type of health care provider to broader health outcomes with respect to any health issue in Vietnam. This seems a significant gap in the literature, and as a result, it is more difficult to draw conclusions about the role of this theme in the efficient conversion of available health resources into health outcomes.

5.6 Commune Health Centers – Continuity of Care

While some women preferred the private sector, less affluent, educated, more rural and ethnic minority women tended to rely more on the Commune Health Centers for a variety of

reasons. When asked why they sought care at the CHC one less affluent, less educated, ethnic minority woman in the mountains responded:

[I went to the CHC] Because my house is close to the CHC, and it's free of charge so I went there for checkups. I will have to pay if I go to the hospital, and secondly the check-up services are quite similar; when the women [at the CHC] examined me, I felt it was at the same level. It's not that up there [at the hospital] the quality is better or anything.

Yes, talking about illnesses, for serious illnesses, of course up there [at the hospital] the doctors have better expertise; as for simple checkups such as monthly gynecological checkups, now the women here [at the CHC] have also been trained and so they also know about such things, when I had them examine me, I felt it was quite the same.

- Muong Woman, Mountains, Gr 2

This respondent explains several reasons why she prefers the Commune Health Center including its proximity to her, its affordability and her belief that the quality is adequate and comparable to other facilities at least for basic procedures and package of care.

Furthermore, women who sought care at the Commune Health Centers, either because they preferred the Commune Health Centers or because they could not afford an alternative, described receiving continuous care from a single, or small group of health care workers, from pregnancy throughout delivery.

Yes, one person on duty is available at CHC to guide us how to do things from the beginning of the pregnancy until labor.

– Lowland FGD

In addition to this continuity of care, women described personal relationships with the health workers at the Commune Health Centre

In general, health staffs at CHC are more enthusiastic and easier to talk. They are more interested. . . so it makes us more comfortable at CHC than at district hospital.

– Lowland FGD

Some women made a direct comparison between the more open and personal communication at the Commune Health Centers and the less personalized manner of providing care at the district hospital.

In this matter, in general, the bigger the hospital is, the more patients they have, and so they are not as devoted to us. Now at the CHC here, there are fewer patients and so they know us better, so they're more enthusiastic; for example if we have any problem, they will explain to us with more enthusiasm. It's a matter of fact. When we go to the big hospital, we're not familiar with the place and we don't know them very well, and we won't know much about the illness or what to do or how; of course at the CHC, they will explain to us in more details, while in big hospitals they only tell us what disease it is, they won't tell us in detail when we ask them about the disease.

– Mounng Woman, Gr 2, Mountains

Some women explained that because Commune Health Center staff are also members of the communities they have ongoing relationships extending beyond the health care context.

They're still nice as usual, or maybe ... because it's near so I know a lot of the staff up there; most of them are from this village or the commune, very near, so usually they know me. So usually I didn't have any problem; I feel it was all fine.

–Muong Woman, Mountains, Postgraduate Student

Women described a very different experience at the district hospital. While some women had positive impressions and appreciated the expertise and demeanor of the health staff at the hospital, many complained that hospital based health staff were busy, abrupt and failed to provide sufficient explanation.

Doctor [name removed] at hospital, I think you all know him, right. He only put the machine on my belly for a very short time then finished the ultrasound check very quickly. I was very disappointed. He did not say anything. For example, he should have told me that my baby had a good heartbeat. He only did it very quickly, told me that I would deliver soon then he left. I was disappointed very much. I was very irritated because I wanted to know the status of my baby but he did not say anything.

– Lowland FGD

Doctors at hospital here are tired too. ..Doctors don't have time to advise. There are a lot of patients waiting for them.

- Highland FGD

In addition to limited discussion, advice and engagement which were the hallmarks of relationships with health workers at the CHC, some women described interactions with doctors at the hospital which were outright disrespectful and humiliating.

The doctor (at the hospital) was male. I was too shy to take off my pants. But he told me: "Take them off quickly. I've seen naked female bodies thousands of times". I was embarrassed and my face turned red.

– Mountain FGD

Only one woman described receiving critical support from a senior doctor at the district hospital with whom she had a personal relationship.

The head of the obstetrics ward, the hospital vice president, he knew me, he saw that it (the delivery) was too complicated so he sent me to a c-section.

– Kinh Woman, University Graduate, Lowlands

She later explained that she knew the hospital vice-president through a family contact. This woman hailed from an unusually affluent and well-connected background, she held a University Degree and a rare Civil Servant job. Her personal relationship with a high level hospital official, and the personal attention she received as a result would not be indicative of most people's experience.

Lastly, women who sought care in the private sector generally described positive interactions with health staff in particular describing them as polite and gentle and, in some cases, willing to give advice.

Using the service at private clinics saves my time and the staff there are very polite and gentle.

– Highland FGD

I can ask them a lot, they are free to answer. Not like hospital, sometimes being asked, they become angry at patients.

- Mountain FGD

While the women described similarly positive interactions with health workers in the private sector they did not seem to establish ongoing relationships with private sector workers. No one described receiving care from a private sector health worker throughout pregnancy and delivery. On the contrary, several women described using a range of different private sector providers over the course of their pregnancy out of curiosity, convenience or to shop around for highest quality.

Interviewer: Do you change doctors?

Respondent: Yes, I do.

Respondent: Actually, I often go to many places (in the private sector) to get ultrasounds during my pregnancy.

– Lowland FGD

When I had been pregnant 5 months, I went to Mrs [name removed] in Son Tay. If you want to discover the birth defect, you go there. Though in my opinion, when Mr [name removed] did the ultrasound, the image of my baby was very clear and I could see it. But when Mrs [name removed] was doing the ultrasound, the image of my baby was not as clear as that of Mr [name removed], I could not see anything.

- Highland FGD

5.6.1 Implications for Efficiency

Thus, women who were more engaged with the Commune Health Center appear to have been more likely to develop a relationship with a single (or small number) of health workers and, as a result, receive better continuity of care. Continuity of care and having a personal relationship with a healthcare provider has long been thought to improve health outcomes – this is the animating principal behind the primary care and GP approach of many public health systems including the UK, Australia and Canada (Kristjansson et al., 2013, Gray et al., 2003). Systematic reviews of the evidence find that continuity of care, and particularly relational continuity-- where a personal relationship between patient and provider is maintained over time-- leads to positive outcomes including improved use of preventative care, reduction in hospitalization and emergency visits, better management of chronic disease and better adherence to treatment plans over time (Gray et al., 2003, Cabana and Jee, 2004). There is further evidence that continuity of care contributes to improved health outcomes specifically with respect to healthy pregnancy and delivery. Several of these findings address outcomes included in my healthy pregnancy and delivery analysis including delivery intervention/cesarean section, healthy birth weight and term birth. A randomized controlled trial (RCT) showed that a community-based continuity of maternity care model resulted in a significantly lower rate of cesarean section deliveries (Homer et al., 2001). Likewise a systematic review of randomized trials found that midwife-led continuity of care models resulted in lower rates of instrumental delivery and higher rates of spontaneous vaginal delivery (Hatem et al., 2008). Another RCT found that a program which provided community based continuity of care through home visits resulted in higher birth weights and fewer preterm births (Olds et al., 1986).

There is also some evidence that continuity of care can lead to improved maternal care with respect to some of the factors included in my appropriate care analysis such as number of

antenatal visits. A study of a midwife-based program which offered improved continuity of care found that participating women had more prenatal visits, longer duration of visits, and felt their care was more personalized (De Koninck et al., 2001). However, given that this study's quasi-experimental approach could not fully control for selection bias, the results should be interpreted with some caution.

With respect to efficiency, systematic reviews also identify that continuity of care has the potential to reduce costs and increase cost-effectiveness from a service provision standpoint. Gray et al. cite a series of studies demonstrating that providing both pediatric and elderly care was less costly where the patient consistently saw the same provider. This held true even for patients from the lowest socioeconomic group (Gray et al., 2003).

Multiple systematic reviews concur that continuity of care leads to reduced cost generally by avoiding morbidity through increased uptake of preventative services and in turn, more specifically, by reducing hospital visits, hospital admissions and hospital stays which are costly both financially and in terms of other health system resources (Gray et al., 2003, Sans-Corrales et al., 2006).

The evidence that greater continuity of care both improves health outcomes and reduces costs suggests increased efficiency at both the health care system and individual level.

However they consider efficiency in terms of the cost to the health system, or in the US case to the individual/insurer, per outcome whereas I consider efficiency in terms of how well individuals convert public health system resources into outcomes. While there are no studies which approach demand-side efficiency in this way, it is likely that continuity of care would positively impact this type of efficiency as well. In this case, the women who are the less well off, less educated and ethnic minorities are the most likely to receive continuous care through the Commune Health Centers. In turn, because that greater continuity of care

is likely to improve preventative care, reduce emergency incidents and, specifically within the context of maternity care, reducing the likelihood of cesarean section, pre-term birth and low birth weight as suggested above, then these women may also be expected to have better outcomes. Women who are likely to have a lesser endowment of public health resources but achieve better outcomes are, by definition, more likely to be efficient at achieving healthy pregnancy and delivery. By the same logic, continuity of care may also explain why ethnic minority women, who may have been more likely to rely on the CHCs and thus achieve greater continuity of care, were also more efficient at achieving appropriate care. However, the evidence linking continuity of care to improved likelihood of appropriate care is more limited and methodologically less robust than the evidence linking continuity of care to health outcomes.

5.7 Nutrition

Nearly every woman interviewed spoke of nutrition as a critical factor for a healthy pregnancy and good pregnancy outcomes. Most women described discussing nutrition with their health care provider, gathering additional information and then translating that input, as best as possible into dietary practice that in turn impacts health outcomes.

Unsurprisingly, women who were less educated, more rural, ethnic minorities and generally less affluent tended to express limitations to optimizing their diet, concerns that they received inadequate nutrition and a belief that with more resources they could have achieved better nutrition.

If I had more money, I would eat sufficient nutrients.

– Kinh Woman, Mountain, Gr 9

Because I live in the countryside, my [economic] conditions didn't allow me to follow all the doctors' advice . . . of course when I went for checkups, the doctors told me to eat and drink certain things but my [economic] conditions didn't allow me to follow their recommendations.

– Muong Woman, Mountain, Gr 2

As for the diet, in this rural area, where could I find the food? It was not enough. I knew it; they (health workers) advised me so, but I wasn't able to afford it.

–Kinh Woman, Highland, Gr 9

More educated, less rural, ethnic majority women who were generally more affluent were unlikely to express these concerns. They were more likely to be confident they had achieved optimal, or at least good, nutrition. When asked about what she did to ensure good health during pregnancy one more affluent, more educated, less rural respondent answered.

I kept myself warm (during the winter), and followed a proper diet; it's one way to maintain good health. . . . during pregnancy in particular, I supplemented my diet with more foods. I mean I drank milk at night, and during the day I could eat 1-2 additional small meals.

–Kinh Woman, Lowland, University Student

However, when I probed the women to describe their actual diet and food sources the opposite picture emerged. The women who were less well-off, more rural, less educated and ethnic minorities described eating a fairly balanced diet.

Yes, overall because of our economic condition, I just ate whatever we had in the family, we just ate like normal. ...Overall, we had vegetables, meat and fish. But sometimes we had meat, sometimes we had fish, we didn't have all in every meal.

– Kinh Woman, Mountain, Gr 9

Rich people have better (economic) conditions, poor people like me just tried to make use of as much as I could: such as vegetables in my garden, rice from my field. Sometimes, my husband bought some meat for me to eat. That's all.

– Highland FGD Participant

Ethnic minorities and more rural people were also more likely to focus on eating fresh, organic food from their own fields.

I took vitamin supplements and ate food grown by our family which was more organic; it helps the baby grow more healthily and better. And we grow a lot of our food, so I didn't have to buy many things, and home- grown food is very good. . .

- Muong Woman, Postgraduate Student, Mountain

When probed further on what she meant by good food the respondent elaborated:

I think good food means eating home- grown food which doesn't have preservatives, unlike things we buy from the market which are not very safe, because food from outside sometimes contains chemicals and stuff; it's good to eat home-grown food... Free-range chickens and birds in the mountains, young bamboos from the mountains, vegetables from the mountains; they contain a lot of vitamins and proteins; plus field crabs, shrimps and snails which are abundant, and we have fish in our pond.

- Muong Woman, Postgraduate Student, Mountain

Conversely, some of the more affluent women in the more urban lowland areas described overeating, eating too many sweets and relying more on processed foods and nutritional supplements.

For example during pregnancy, I ate... quite a lot, way too much, so my glucose was too high.

-Kinh Woman, University Graduate, Lowland,

This respondent ultimately described encountering a series of complications consistent with overnutrition-related conditions such as gestational diabetes and possibly preeclampsia¹³ including pre-term delivery, delivery complications resulting in Cesarean

¹³ Preeclampsia is a pregnancy complication related to high blood pressure and kidney malfunction. It can have adverse effects for the placenta as well as the mother's kidney, heart and liver. It can also result in dangerous seizures known as Eclampsia.



Figure 5.1: A Common Brand of Pregnancy Milk Marketed in Vietnam

section, falling unconscious during delivery and possibly a large for gestational age baby.

This respondent also mentioned consuming a large amount of 'pregnancy milk', a quasi-pharmaceutical product marketed heavily in Vietnam often by the makers of infant formula.

Pregnancy milk is a powdered substance promoted on the grounds that it is high in nutrients recommended for pregnant women including Calcium, Vitamin A and DHA (see Figure 5.1).

While most brands of the milk do contain these nutrients they are also high in sugars and salts. One well-known brand, Enfamama, contains 450 mg of sodium per serving of which 3 per day are recommended. Thus recommended consumption of pregnancy milk would result in a woman receiving nearly 60% of the NHS's recommended daily allowance of sodium from the milk alone.

Priced between 8-15 USD per 900g can, pregnancy milk is an expensive commodity for most people living in Ba Vi. Due to the price, more affluent women were both more likely to drink pregnancy milk and likely to drink more of it.

At first, I drunk Enfamama milk . . . I moved to a Vietnamese milk product, the Dielac milk for pregnancy. Drinking that milk, I felt very strong; I drank it three times a day, in the morning, at noon and in the evening.

- Kinh Woman, Lowland, University Graduate

Whereas less well-off women and those living in more rural areas might have liked to drink this milk but could not afford it.

Other women have milk when being pregnant, but we did not, only normal meals. We are living at rural areas, our economic conditions are not good as (other) people here (in the district).
- Mountain FGD

One Muong woman spoke directly to the fact that, due to resource constraints she is not able to drink the pregnancy milk although she would choose to drink it if she could. Specifically she described how she drank pregnancy milk during a previous pregnancy (though a relatively small amount) but that, due to more limited finances during her current pregnancy, she had given it up. Interestingly though, in contrast to the women above who spoke about receiving health information from the commune health centers and the promotion activities of the people's committee, this respondent explains that she received information on pregnancy milk from TV, likely TV advertising.

The TV said that we should drink (pharmaceutical) milk to get nutrients such as DHA or something which were good for the development of the baby's height, or brain or bones or . . .
-Muong Woman, Mountain, Gr 12

While her quote reflects her interest and her faith in the biological information provided, it also evinces a certain amount of confusion as to exactly why and how this product benefits the baby. I will return to this issue of information sources at the end of the chapter.

Thus it seems most women would choose to use this product if their financial resources allowed. Yet ironically, given its nutritional contents it is likely to cause more nutritional harm than good. Because of the high levels of sugar and salts, getting nutrients from processed pregnancy milk is likely less healthy than getting them from less expensive, fresh food.

5.7.1 Implications for Efficiency

The qualitative feedback thus echoes the trend predicted by the nutrition transition—that as developing countries and their citizens become wealthier and more urban, overnutrition related problems, particularly the overconsumption of fats, sugars and salts through processed foods, will emerge. In particular, it resonates with research showing that the nutrition transition is underway in Vietnam (Khan and Hoan, 2008). As nutrition transition theory predicts, Vietnam has seen an attendant rise in overnutrition related health conditions in particular overweight and obesity, hypertension and diabetes (Khan and Khoi, 2008). Cardio-vascular disease has become a leading cause of morbidity and mortality in Ba Vi specifically (Hoang et al., 2006, Minh et al., 2006).

These issues not only threaten the health of the general population but they also have implications for pregnancy. Specifically, women who are overweight or obese during pregnancy are at greater risk for pregnancy complications including preeclampsia and gestational diabetes as well as delivery complications such as Cesarean section and infection (Henriksen, 2006, Sui et al., 2012). Overweight and obesity are also associated with adverse outcomes for the infant including large for gestational age and high birth weight, even after controlling for gestational diabetes, as well as neural tube deformation (Henriksen, 2006) (Galtier-Dereure et al., 2000). Gestational diabetes itself, is in turn associated with adverse pregnancy outcomes including large for gestational age, high birth weight, preeclampsia and cesarean section (Wendland et al., 2012). Lastly, hypertension also carries an increased risk of pregnancy and delivery complications including preeclampsia and in turn, low-birth weight, pre-term birth and in severe cases where eclampsia occurs, maternal heart, liver and kidney damage as well as maternal and perinatal mortality (National Institutes of Health, 2013).

Thus, overweight and obesity, gestational diabetes and hypertension, three conditions resulting from the nutrition transition highlighted in the qualitative feedback, and documented as increasing in the literature on Vietnam and Ba Vi, are strongly associated with negative outcomes in all of the four components captured in my healthy pregnancy and delivery analysis: complications during pregnancy, healthy birth weight, term birth and spontaneous vaginal delivery.

The nutrition-related conditions appear to affect the more affluent, more urban, more educated, ethnic majority portion of the population. Thus, once again, this segment of the population which has a greater endowment of resources is also likely to have worse health outcomes, in turn leading to lower efficiency.

It is worth noting that undernutrition related issues including both caloric and micronutrient deficiencies persist in Vietnam (Khan and Khoi, 2008) and are likely experienced by the poorest in Ba Vi. While poor women tended to describe more balanced, fresh, organic diets as discussed above, it was not possible to ascertain whether their total food intake was adequate from the qualitative feedback. Antenatal undernutrition also increases the risk of adverse pregnancy outcomes including pregnancy complications such as anemia, pre-term birth and low birth weight (Carmichael and Abrams, 1997, Black et al., 2008), which are all components of my healthy pregnancy and delivery analysis. However it is also possible that my analysis may have missed other adverse effects of undernutrition, particularly micronutrient deficiencies. For example, two respondents in the qualitative survey, noted that they developed goiters, a condition associated with iodine deficiency, during or shortly after pregnancy. Iodine deficiency is associated with adverse pregnancy outcomes including cretinism, intellectual impairment, infant hypothyroidism and miscarriage (Pearce, 2012). However, my quantitative data did not include the first three of these outcomes, and, as

previously discussed, miscarriages were dropped from the healthy pregnancy and delivery analysis due to missing observations in the other components. Thus, while iodine deficiency may have mediated the efficient conversion of health resources into health outcomes differentially among less affluent (more rural, ethnic minority) women in the sample, this specific effect would not have been fully captured in my analysis due to lack of data. With respect to the adverse outcomes not captured in my analysis, it is worth bearing in mind that, as discussed in the previous chapter, less educated women were also more likely to have a miscarriage than more educated women (see Appendix E). An important nuance to my findings is that while more educated women were less likely to be efficient in my healthy pregnancy and delivery analysis lesser educated women continue to be more likely to experience the rare but worst-case scenario outcomes of miscarriage and still birth. It is also possible that they are more likely to experience undernutrition related complications not measured here.

5.8 Mental Health

Mental health was another dimension which emerged as a potentially differentiating factor across social dimensions from the qualitative data.

The importance of mental and emotional wellbeing for healthy pregnancy and delivery was hardly ever mentioned by ethnic majority respondents whereas the ethnic minorities interviewed raised it repeatedly as an important component of good health. Only one Kinh woman mentioned the relationship between emotional and physical health during a focus group.

If we are always worried and anxious we might get illness easily. If we are healthy, we feel happy though we have to work everyday.

– Lowland FGD

In contrast, mental and emotional health seemed to be a more integral part of wellbeing among ethnic minority respondents. One Muong woman commented that emotional wellbeing was important for health of both mother and fetus.

I think the mother should feel relaxed and comfortable in their mind and carefree, which would lead to a healthy body, plus a good diet; that way it would help the fetus grow better.

– Muong Woman, Postgraduate Student, Mountains

When asked how women can have a healthy pregnancy and delivery she responded:

Ah! Firstly the mental health, secondly conditions of the living location, living space, mental health in relation to family, husband and children; the husband should be supportive; poverty is not as important as mental health; even if you're rich but you don't have mental health, you'll be stressed. In the city, some women work too much so they're under a lot of pressure; that's what I think.

– Muong Woman, University Student, Mountains

Another Muong woman describes the benefits of Muong traditional medicine as specifically relating to mental health. She explains it is useful for treating conditions frequently associated with stress and anxiety and for promoting relaxation and sound rest.

When we have diseases such as a stomach ulcer, or insomnia, we can drink [traditional Muong] herbal medicine. If we cannot sleep, herbal medicine will help us relax and sleep sound. In short, it helps us eat and sleep well.

– Muong Woman, Gr 9, Mountain

5.8.1 Implications for Efficiency

The qualitative feedback suggests that, possibly for reasons having to do with culture or traditional concepts of health, ethnic minorities were more aware of the importance of maintaining mental health and potential interconnection between physical and mental health, particularly during pregnancy. As a result they may be more careful to maintain

mental health. Global evidence has linked mental and emotional health issues, particularly stress, anxiety and depression, to adverse pregnancy outcomes including several of those included in my healthy pregnancy and delivery analysis. A recent systematic review of global evidence on this topic identified strong evidence linking stress, particularly chronic stress, to preterm birth and low birth weight. It also identified a strong linear relationship between anxiety and pre-term birth as well as a consistent link between depression and low birth weight (Dunkel Schetter and Tanner, 2012). While a majority of the literature on this topic focusses on developed countries, a recent meta-analysis identifies that the increased risk of low birth weight associated with depression is significantly higher in the developing world (Grote et al., 2010). More specifically relevant to my study, a recent study in Ba Vi district found that, controlling for other risk factors, common antenatal mental disorders (particularly depression and anxiety) were associated with an increased risk of low birth weight and preterm birth (Niemi et al., 2013). Furthermore, as the respondents suggest, a systematic literature review conducted by WHO indicates that relationships and support from family including the partner and peers can improve mood, reducing depression and anxiety during pregnancy (WHO, 2009).

Thus it is possible that a greater attention to mental health may be another factor which made it more likely for ethnic minorities to achieve healthy pregnancy and delivery outcomes despite the fact that they likely had equal or less public health resources available to them.

There is little to no evidence linking mental and emotional health to appropriate care outcomes aside from the case of extreme psychological disorders, particularly schizophrenia (Shah and Christophersen, 2010). However, while empirical evidence is lacking, it seems theoretically possible that mental health issues such as stress, anxiety and depression could

adversely impact a woman's likelihood of converting available resources into appropriate care. It seems plausible that these conditions could detract from the focus, empowerment, drive and engagement required to secure all of the services required for appropriate care.

5.9 Sources of Information

A final factor which may also partially explain the observed relationships between social factors and the likelihood of efficiency were the sources from which people received health information. In general, women who were more educated, less rural, ethnic majority and generally more affluent were more likely to describe getting health information from sources such as books, magazines, TV and the internet. One highly educated woman (who was however Muong from a rural area) quoted above described how she had learned about the advantages of pregnancy milk from the TV. Another Muong woman explained that her more educated Kinh friend read lots of books about pregnancy whereas she did not. Likewise participants in the highland focus group discussion spoke of getting information from the internet, though they also conceded that information on the internet could be contradictory and confusing. One woman offered the following simple, though not necessarily reliable solution to this issue:

There are a lot of websites on internet. If many websites post the same information, I will follow it.

—Highland, FGD

Globally, studies confirm that women in both high income and emerging middle income countries are increasingly getting health information from sources such as magazines as well as the internet in both developed and developing countries (Gao et al., 2013, Lima-Pereira et al., 2012). These sources have been found to be critical to women's decision making regarding health issues during pregnancy (Handfield et al., 2006, Lagan et al., 2010).

Evidence also suggests that information from such informal sources can be incomplete, misleading and contribute to negative trends in care-seeking and health outcomes. For example, a study in Brazil, a country with some of the world's highest elective cesarean section rates looked at information about cesarean sections in women's magazines. They found that while many articles cited a health source and that risks of cesarean section were noted, a majority of the articles were incomplete often failing to talk about the long term and perinatal risks of cesarean section in addition to short term risks for the mother (Torloni et al., 2011).

I was not able to identify any studies looking at the relationship between sources of information and appropriate antenatal care or pregnancy outcomes. However, the fact that women are increasingly consuming information which may be inaccurate, and that that information figures strongly in their decision making, suggests that these sources may mediate the conversion of health resources into health outcomes.

Furthermore, magazines, TV and the internet are also major vectors of advertising which can promote products with questionable or outright negative health effects. One notorious instance of product advertising negatively affecting maternal and child health outcomes was the marketing of infant formulas, now banned or heavily restricted in many countries. However other potentially dangerous products are promoted in similar ways. A recent analysis of a large scale US dataset found media and the internet to be common sources of information among mothers giving their children potentially harmful dietary botanical supplements and teas (Zhang et al., 2011). Throughout Vietnam and specifically in Ba Vi, promotion and advertising of the aforementioned pregnancy milk is increasingly common. While this advertising exists on public billboards and stores the product is also promoted

online by many suppliers using pseudo-scientific evidence, reasoning and arguments which may particularly appeal to more educated consumers. An example is included Appendix F.

While the primary factor determining whether or not, or how much, pregnancy milk women consumed seemed to be their ability to afford it, repeated exposure to marketing and particularly the more elaborate scientific style arguments presented on the internet and in written media may stoke demand among more educated women as articulated by the two university educated respondents above.

5.9.1 Implications for Efficiency

Thus while robust evidence linking sources of information or product advertising to the appropriate care or health outcomes measured in my analysis is lacking, it seems at least possible that the proliferation of information, and particularly unreliable sources of information such as advertising and the internet, has not necessarily helped the more affluent women who access it. On the contrary, as the case of pregnancy milk indicates, it may even be harmful.

Meanwhile the women from the generally less affluent group, whose health information is more limited to core public health messaging propagated by the Commune Health Center and, in some cases, the people's committees, may actually be at another advantage, explaining once again why they achieve better outcomes with equal or less resources.

5.10 Summary of Findings

Thus my qualitative investigation has raised several potential explanations of how and why ethnic minorities were more likely to be efficient at converting health resources into

appropriate care and healthy pregnancy and delivery and less educated women were also more likely to be efficient at achieving healthy pregnancy and delivery outcomes. First, while women across the spectra of ethnicity and education described a technology preference with respect to health care, this was more pronounced among the less rural, ethnic majority, more educated and generally more affluent women. As a result of their greater technology preferences as well as their ability to afford more costly services, these women were more likely to overuse ultrasound technology, to seek care predominantly in the private sector and, as a result to experience less continuity of care. The qualitative feedback also revealed that these more urban, ethnic majority, more educated women also described nutrition habits and related morbidities consistent with the nutrition transition including increased consumption of processed foods, fats, sugars and sodium as well as overweight, gestational diabetes and hypertension. Ethnic minorities also demonstrated a particular concern and awareness for mental and emotional health which may have led to lower rates of stress, anxiety and depression during pregnancy. As demonstrated in the literature, overuse of ultrasound, use of the private sector, lack of continuity of care, overnutrition related morbidities and poorer mental and emotional health have been associated with poorer maternal care and healthy pregnancy and delivery outcomes. As a result of these factors, the more affluent, educated, ethnic majority populations, who are also likely to have an equal or greater endowment of public health resources, would also be likely to achieve poorer outcomes. In other words these factors explain, at least in part, how and why they were less likely to be efficient.

My qualitative investigation did not provide especially rich insight as to why women in mountainous areas were less likely to be efficient at achieving appropriate care. Feedback suggested that some of the commune health centers in the mountainous areas did not offer some of the core and recommended services (such as urine tests or blood tests) until the

last few years. This would imply that a woman in the mountains with equal resources in terms of health infrastructure (distance to clinics) and health resources at those clinics, would not have been able to access the same services as a woman with comparable infrastructure and human resources as women in a highland or lowland area where those services were offered. This point highlights the fact that a variable indicating equipment available or services offered at closest health center might be a useful resource measure to include for future analysis.

Qualitative feedback revealing themes in perceptions, preferences and behaviors combined with literature suggesting outcomes shown to be associated with those behaviors suggests certain pathways and underlying mechanisms through which some groups of women are more likely to be efficient than others. This is however, only a first, exploratory step. In order to say definitively that greater reliance on the private sector is driving lower efficiency at achieving appropriate care or that overnutrition is the cause of lower efficiency at achieving healthy pregnancy and delivery, I would need to return to quantitative methods to show statistically significant relationships in a causal model such as a path analysis.

Nonetheless, the qualitative investigation has shed significant light on the somewhat surprising quantitative findings that women from systematically lower socio-economic backgrounds—ethnic minorities and less educated women – were the most efficient. At the broadest level, the qualitative investigation has pointed to several factors related to economic development and its attendant health transitions as part of the explanation for the lower efficiencies of the more affluent. The imperative as well as the challenges of appropriately adapting public health approaches to the transition environment is further explored in the concluding chapter.

CHAPTER 6: DISCUSSION & CONCLUSION

6.1 Overview of Findings

My study has responded to each of my research questions. Through quantitative analysis, it has identified that some groups of people are indeed more likely to be efficient at converting available health system resources into health outcomes. Specifically, people living in non-mountainous areas and ethnic minorities were most likely to be efficient at converting health resources into appropriate maternal care. Ethnic minorities and people who were less educated were more likely to be efficient at converting health system resources into healthy pregnancy and delivery.

Qualitative investigation revealed several patterns of perceptions and behaviors which may explain how and why these groups are more efficient. The themes of technology preference, use of the private sector, lack of continuity of care, over-nutrition, less focus on mental and emotional health were all more prominent among more affluent, more educated and ethnic majority women. Furthermore each of these themes is linked to adverse care and/or health outcomes in the literature. Thus as a result of these factors, the more affluent populations, who also have a greater endowment of public health resources, would be less likely to achieve good outcomes. In other words these factors may explain, at least in part, how and why they were less likely to be efficient.

Broadly these findings underscore two important points. The first is that, particularly in a context like Ba Vi, Vietnam has had marked success at addressing the health issues and improving the health of the more rural, ethnic minority, less educated and generally less well-off populations particularly through the commune health systems. This study, in keeping with the broader literature, suggests that the health outcomes among the less

affluent, less educated and ethnic minorities is, in many respects, catching up to that of their better-off peers. Moreover, this study contributes the novel insight that these groups are also more likely to be efficient at translating health system resources into good health outcomes. It appears that one critical factor for the greater efficiency of less affluent groups is their greater engagement with the commune health system and its public health approach. Conversely, the more affluent groups were less efficient largely due to shifts in behavior and risk patterns associated with economic development including the emergence of a private health sector as well as epidemiological and nutrition transitions.

This finding leads to the second key point which is that populations at the higher end of the development spectrum are encountering transitions associated with new threats to health. This raises a significant challenge to the traditional view of vulnerable or at-risk populations. In the context of health financing, Vietnam has targeted ethnic minorities and those in marginalized geographic areas as the most vulnerable populations (Somanathan et al., 2013, Government of Vietnam, 2008). Meanwhile development partners such as USAID define rural and remote communities, the urban poor, the disabled, victims of human trafficking and natural disasters as vulnerable populations in Vietnam (USAID, 2013). There is no doubt that these populations face substantial risks and challenges to their health and well-being. Likewise it seems clear that the differential focus on these populations has contributed to reductions in poverty and improvements in health and health care access among these groups. However, the second key point underscored by my research is that, at this stage in the development process, populations in transition are also vulnerable and at-risk due to a new set of health threats. The emerging threats of chronic health conditions caused by increasingly sedentary lifestyles and nutritional shifts including overconsumption of fats, sugars, sodium and processed foods pose potentially disastrous implications for both health outcomes and the efficiency with which they are achieved. Looking specifically at the

context of maternal and infant health it is clear that conditions such as overweight and obesity, hypertension and gestational diabetes are resource intensive to manage and increase the likelihood of adverse outcomes. Thus my findings present a development paradox: the people whose resources allow them greater opportunities and a wider range of choices are less likely to achieve the health outcomes they themselves say they value, specifically optimal health care, leading in turn to a healthy pregnancy, an easy uncomplicated delivery and a thriving infant.

6.2 My Findings and the Capability Approach: Tensions and Insights

Taking a step back from the specific Vietnamese context, my findings regarding the shifts in behaviors and attendant implications for health and efficiency of transition populations highlight several tensions in the application of the Capability Approach to Human Development and specifically to Public Health. At the core of the Capability Approach is Sen's contention that, capabilities, what people are able to be and do, are the fundamental unit of moral importance. As a result, social justice depends not on the equal and fair distribution of goods, as in the Rawlsian paradigm, or even the happiness or welfare derived from those goods, as in the utilitarian paradigm, but rather on the distribution of capabilities, the real opportunities people have to achieve the ends they value and have reason to value (Sen, 1980, Sen, 1985a). In turn, the Capability Approach views development as the process of increasing people's capabilities, expanding the set of opportunities from which people choose what to be and do (Sen, 1999). However, in this case, expanding people's opportunities does not make them more likely to achieve the outcomes they value. Thus while increasing opportunities is morally important and necessary for development, it is also, in some cases insufficient for achieving justice and meaningful improvements to well-being.

In the broadest sense, it seems that the Capability Approach's emphasis on opportunities rather than outcomes may, in some cases, be problematic in the context of public health. In some contexts, Sen's focus on opportunities seems well-justified. In comparing a man who is hungry because he cannot afford to buy food and a man who is hungry because he chooses to fast, only the first suffers an injustice. In order to remedy this injustice and achieve an acceptable state of development we need only be concerned that we assure every person has the opportunity or ability to eat sufficient calories, not that he chooses to do so. A similar argument seems to hold if we look at a human development issue such as education. We need only assure that every person has the opportunity to pursue education. We need not ensure that every individual chooses to complete a university degree in order for justice to be served. However in the context of public health we often have reason to be concerned with not just the opportunity but also the outcome. Using the example of a vaccine program, we are not simply concerned with people's ability to be vaccinated for polio but that they actually receive the polio vaccine. Part of the reason that we care about the outcome pertains not just to the individual, whom one could argue has a right to make choices not in his own interest, but to the other people affected by his choices. One individual's failure to be properly vaccinated in turn risks exposing a second individual to disease and in turn limiting that second individual's ability to live a life free from debilitating disease, an outcome that second individual may justifiably value.

The Capability Approach's focus largely on the individual level has been a major point of criticism by those arguing that collective capabilities are critical for both community and individual well-being (Deneulin, 2007). I raise a related but distinct concern about the Capability Approach's focus on the individual in that individual choices have implications for both other individuals and the collective. Sen acknowledges the fact that there are limits to

an individual's entitlement to capabilities and choices where those capabilities and choices may negatively affect the freedom of another person. For example, it is morally acceptable to limit an individual's capability to smoke in a closed space on the grounds that the exercise of this freedom negatively impacts the ability of other individuals to avoid harmful second hand smoke. Yet while this concession is a footnote of the Capability Approach, the case where one person's choice impacts another person's freedom is not an occasional case in public health. Rather the fact that health cannot be achieved in a purely individual context but must also be addressed at the population level is the animating principle behind this discipline. Thus while applying the Capability Approach to the context of public health is useful in providing a theoretical framework for understanding the process by which resources are converted into outcomes, the importance it places on opportunities over outcomes and the individual over the collective may not always be appropriate and requires careful consideration in each case.

However, with respect to my study, the pregnant women in Ba Vi are not like the individual who chooses to forgo vaccination. The issue is not that the Vietnamese women in my study are able to achieve good care and health outcomes but are not choosing to do so because they value some other outcome. Rather the issue is that their choices are not always well aligned to their own aims. This raises a question regarding another key facet of the Capability Approach—the emphasis placed on agency. As Sen elaborates his Capability Approach he attributes a critical role to agency, or an individual's ability to pursue the achievements he values. Sen emphasizes that while agency is very likely, perhaps almost inevitably, linked to well-being it also has intrinsic moral value. In his early work, Sen also concedes that an individual's agency or “the power to form and pursue their own perception of the good” can also have a negative impact on personal well-being (Sen, 1985b). One can imagine this being the case where an individual makes personal sacrifices in order to serve

the good of their family, community or country. However this is also a very different case from the one at hand in Vietnam. The more affluent women in Ba Vi have, by all accounts, the greatest freedoms both in terms of the capability set conferred on them by their resources and in terms of agency to pursue their goal of achieving good health for themselves and their infant. Furthermore, by all accounts these women are pursuing this goal head-on. They are not, as in the example above, sacrificing the achievement of this goal to another competing or superseding conception of the good. Nevertheless, they are not achieving their stated goals, or at least not achieving them efficiently.

Thus ultimately, this research underscores an important qualification that Sen himself has acknowledged more recently: while expanding opportunities and increasing agency may be indispensable for both social justice and meaningful development, they may also be insufficient on their own. Sen addressed this issue in a recent lecture wherein he presented analysis showing that increases to women's education and agency has failed to solve the problem of missing women—higher male to female ratios in countries with strong gender bias such as India, China, Taiwan and Singapore (Sen, 2013). To this point, Sen notes that rising levels of education and agency among women has contributed to lower infant mortality and has closed the gap in male-female age specific mortality to rates equivalent to those in countries without this type of gender bias. Yet the ratio of men to women in the society remains similarly skewed because the rise in medical technologies and the household incomes to afford them has led to an increase in sex-selective abortion. With evidence suggesting son preference is at least as strong if not stronger among women of child bearing age as it is among other segments of the society, Sen points out that women's agency has not only failed to resolve the Missing Women problem, on the contrary it is now driving it.

Sen ultimately uses this example to highlight the need to cultivate not just agency but 'enlightened agency' informed by a process of public discussion and reasoning "denouncing the privileges of ignorance and championing the rights of reason" (Sen, 2013). Specifically, Sen asserts that public discussion must focus on the drivers of the problem at hand (in this case population imbalance as a manifestation of gender bias) and what needs to be changed to address it (in this case reduction in sex-selective abortion).

The need for informed or enlightened agency seems an important and useful adaptation of the Capability Approach's original treatment of the concept. Furthermore the example of the Missing Women provides a compelling illustration of how agency alone can be insufficient and a directed public discussion and information diffusion may stimulate the enlightenment necessary to address a social problem. However this proposition leaves several critical questions unanswered. First, who gets to decide what constitutes a social problem and what constitutes enlightenment- what ignorance needs to be denounced and what reason given right? One can imagine a religious state or community which terms non-belief or alternative beliefs or traditions as ignorance and conformity to a particular religious doctrine as reason and enlightenment. Enlightened agency would then promote alignment with religious doctrine and in turn improving the society and societal well-being by the state's own standards though not necessarily by the standards of a secular and pluralist society. One potential response to this issue is to define social justice as the Capability Approach would in terms of the fairness and equality of the distribution of freedoms that people value and have reason to value. Yet one of the major criticism of Sen's formulation of the Capability Approach is that he largely demurs on the point of who decides which freedoms people value and have reason to value. Again on this point, Sen defers to a process of public deliberation for determining the most valuable capabilities and furthermore, those which one may have reason to value. This view once again places a

degree of faith in the process of public deliberation and reasoning which is hard to justify. Public deliberation can and has led to democratic solutions which optimize equality, justice and well-being though it has also led to gross injustices such as the persecution of minorities and the curtailment of individual rights. A woman in China, Taiwan or Korea could even argue consistently that she has reasons (personal, cultural or economic) to value having a son and that, if we accept a woman's right to choose an abortion at all, it is unjust to seek to curtail her ability to ensure a son through sex-selective abortion and misguided to try to enlighten her to change her preferences or values.

Thus the assertion of the need for not just agency but enlightened agency is vulnerable to the same criticism as the Capability Approach writ large: a lack of clarity as to who decides what is reasonable, valuable and how to safeguard against the errors of public deliberation. On the one hand the Capability Approach convincingly argues that the value placed on outcomes must be relative and subjective, on the other hand it fails to provide a clear and specific safeguard against the pursuit of outcomes which violate our sense of universal morals and basic rights. That Sen fails to tread the slippery slope between relativism and absolutism with completely sure footing is a shortcoming which requires attention and additional consideration when applying the Capability Approach. However it hardly renders the framework useless. The research undertaken here exemplifies how the Capability Approach can be useful in many respects by structuring and informing investigation of the process by which people convert resources into outcomes. Furthermore, despite the issues around which choices and outcomes qualify as enlightened, the concept of a need for enlightened agency provides a broader theoretical context for my findings and a direction for future directions of both research and policy.

6.3 Implications for Policy

As in Sen's example with the missing women, my study finds that increasing education and agency have led to an uptake of new products, health care services and technologies that ultimately have some adverse effects for women and their society. The women whose education and socio-economic status should afford them the greatest degree of agency are making choices —excessively using ultrasounds, seeking care in the private sector, consuming questionable nutrition products, and seeking and following information from non-health system sources including the internet and advertising—that jeopardize the achievements of good health care and outcomes which they value. Moreover, these choices lead to inefficiencies. As measured in this study, these inefficiencies derive from the fact that the women who are more educated, ethnic majority and systematically more affluent, who in turn have the greatest endowment of public health resources do not systematically achieve better care or health outcomes. Rather, despite their greater resource endowment they are more likely to achieve inferior outcomes due to a combination of sub-optimal care choices and adverse health conditions associated with the epidemiological and nutrition transitions which affect these women more than their less affluent counterparts. This measured inefficiency makes intuitive sense in that someone who suffers from chronic health conditions which require ongoing monitoring and care and raise the likelihood of adverse outcomes will require higher levels of health system resources. Furthermore, even with the higher level resources required to manage chronic conditions these groups may still be less likely to achieve good outcomes than those who avoid chronic conditions in the first place.

Thus my study provides an additional example of a case where agency is necessary but not sufficient. As Sen suggests, what is needed to address this problem is informed agency.

Furthermore, as Sen suggests, it seems a public discussion targeting the underlying causes of the problem could lead to more enlightened agency better aligned to individual and societal well-being.

In this case, the public discussion would both have to target the population in transition and focus on the health issues of transitions. Possible policies and strategies to address the issues identified could include adapting information campaigns for the more highly educated emerging middle class, greater regulations accompanied by greater partnership with the private health care sector as well as regulation and market intervention around consumer products with key health impacts. Each is discussed in greater detail below.

However before addressing specific policy remedies it is worth noting that addressing the issues identified through policy provides a double benefit. First it has the potential to improve maternal care and health outcomes. Second it could also improve the efficiency with which existing resources are converted into health outcomes, allowing the users of the health system to get greater, or more consistent benefits, from the public investment already made in health resources. At the national level, it could enable Vietnam to ensure that their health system is having the maximum impact.

6.3.1 Policy Recommendation 1: Transition Related Health Promotion

As discussed in the previous Chapter, qualitative feedback demonstrated both a high level of basic health knowledge and frequently credited commune-level outreach. This feedback, and in particular its consistency across the geographic, ethnic, educational and attendant socio-economic spectra, speaks to Vietnam's success with health promotion at the commune level. As seen in Figure 6.1 which shows a Commune Health Center in the mountains flying a banner with information about the use of Vitamin A mothers and



Figure 6.1: A Commune Health Center in the mountains in Ba Vi flying a banner promoting Vitamin A for mothers and children.

children, health promotion campaigns have largely focused on poverty related issues including under-nutrition and micronutrient deficiency, the need for minimum antenatal visits and skilled attendance at delivery. This pro-

poor approach was well grounded in the evidence of health risks to marginalized populations and well aligned with national and global development goals such as the MDGs. In order to continue to maintain reductions in poverty related issues, this type of health promotion should continue. At the same time, my findings suggest that new health risks, preference and behaviors affecting populations in transition also pose a significant risk to both outcomes and efficiency. Effectively targeting these emerging health issues and the populations most affected will require additional health promotion efforts with a shift in both content and approach.

While health transitions and the attendant risks for both general and maternal and child health are by now well documented in Vietnam, public health information about them remains somewhat scarce. A recent study in Ho Chi Minh City identified significant confusion and inaccurate information among pregnant women regarding gestational diabetes. Qualitative feedback demonstrated that pregnant women who had been diagnosed with the condition did not understand its causes, origins or implications, held negative feelings of guilt and anxiety regarding their diagnosis and, perhaps most concerning, held misconceptions about the optimal management of the condition (Hirst et al., 2012). The low level of critical health knowledge among women in this urban epicenter of the nutrition and epidemiological transition who were pregnant and who had received a

diagnosis of gestational diabetes bodes ill for the level of knowledge in the general population of child-bearing age in Vietnam. The women surveyed in the Ho Chi Minh City study cited magazines, the internet, friends and a health hotline as their main sources of health information. They suggested that small group discussions with health workers and detailed pamphlets providing information would be a welcome and useful way to get more information about their condition (Hirst et al., 2012).

Another recent study undertaken in Ba Vi district lends further support to the recommendation for transition-related health promotion. In this case researchers used a quasi-experimental approach to estimate the effectiveness of a community-based health promotion and lifestyle behavior change intervention on key cardio-vascular disease risk factors including high risk behaviors (salty food consumption, smoking, physical inactivity and excessive alcohol use) as well as biological endpoints (blood pressure, hip circumference, waist circumference and BMI) (Nguyen et al., 2012c). The intervention resulted in reduced salt consumption and decreased blood pressure, both important risk factors for cardiovascular disease. It did not however positively impact physical activity, smoking, drinking or measures of adiposity. The lack of impact on smoking and drinking is not relevant in the context of maternal health as less than 1% of women engage in these activities, though it is worth noting that addictive behaviors are among the least responsive to health promotion (Nguyen et al., 2012c). Despite the fact that the intervention was not effective across all outcomes, the fact that it significantly improved a key risk behavior and outcome which have direct implications for healthy pregnancy suggests that health promotion is one strategy that may limit the adverse effects of health and lifestyle transitions on maternal health outcomes in the Vietnamese context.

Thus evidence from Vietnam suggests both that women lack critical health information and that health promotion activities have the potential to mitigate the adverse behavioral and epidemiological changes in relation to transitions. The combination supports a shift to expand health promotion and communication strategies to include transition related health issues.

However, given my findings—specifically regarding the lack of engagement of the transition populations with the commune health system and their broader range of sources of information-- it is also worth considering how and through what channels that health promotion should be conducted. The health promotion intervention for CVD in Ba Vi district described above followed much the same pattern that traditional health promotion has followed in Vietnam. Their two pronged approach implemented in one lowland (high transition) commune involved targeted treatment and counseling to hypertensive patients through the commune health center as well as an information campaign diffused to the general commune population through pamphlets, broadcasts and meetings (Nguyen et al., 2012c). While this approach was successful and has been effective at promoting basic health in the past, it may not be fully aligned to transition populations. The women with gestational diabetes expressed that they would like information through meetings and pamphlets however they also said they had sought information through magazines, the internet and phone hotlines. This resonates with the feedback from my study where, particularly the women most likely to be affected by transitions, were seeking information from print and online sources.

Thus health promotion targeting transition related health issues should also develop online resources and information diffusion strategies. This could be an additional cost-effective way to reach the most relevant populations. While research in this area is still developing,

systematic reviews and meta-analysis suggest that internet based interventions have been successful at addressing key health transition issues such as reducing blood pressure (Liu et al., 2013), increasing physical activity (Davies et al., 2012), and behavior change and self-management of chronic conditions (Murray, 2012). While meta-analyses reveal effect sizes are small and concerns over equity of access to online resources persist, evidence suggests that well designed and targeted internet-based interventions may prove a useful complement to more traditional approaches to health promotion.

In addition to global evidence highlighting the usefulness of particular online approaches, Vietnam can also draw on the successful examples of marketing and information diffusion from outside the health sector. Both qualitative feedback from my study as well as product use and purchasing patterns have demonstrated that transition populations are receptive to the science and evidence-based approach currently being used, however speciously, to promote pregnancy milk. While extremely simple health messages have been useful in reaching the poorest populations and addressing issues around undernutrition and basic care seeking, more detailed explanations of biological processes and scientific evidence may be better received by the more affluent and educated populations facing transition issues. Furthermore, such an approach would actually leverage higher levels of education, transforming education from an inhibiting conversion factor into an asset for addressing health transitions.

Health promotion which improved the prevention and management of chronic conditions related to the nutrition and epidemiological transitions would have the potential to impart the type of double benefit described above. It could improve health outcomes through avoided morbidity as well as minimizing sequelae of chronic conditions. It could also improve the type of demand side efficiency which is the focus of my study. Specifically,

patients who avoid chronic conditions such as diabetes or hypertension would require less total support as well as less specialized support from the health system. The absence of chronic disease would make it more likely that they could achieve optimal health outcomes with occasional support at a primary care level, or a more modest endowment of health system resources. Likewise, patients who still develop chronic conditions but manage them well would be less likely to suffer acute and emergency adverse outcomes such as severe diabetes complications, stroke, heart attack or in the case of pregnancy, preeclampsia and other complications resulting in emergency delivery. In turn the patients with well-managed chronic conditions would be less likely to need the intensive resources required to manage emergency situations, including a large number of highly trained health workers at a well-equipped and very proximate higher-level facility. Thus effective health promotion would not only improve health outcomes but would allow those outcomes to be achieved with lesser health system resources thereby also improving efficiency.

6.3.2 Policy Recommendation 2: Regulate and Engage the Private Health Sector

A second policy recommendation based on my findings is both to regulate but also to engage further with the private sector health providers. Vietnam has committed to allowing a private health sector which provides both additional health system capacity and a preferred alternative to public care for many patients. However, with a growing number of people, particularly, as per my study, those in transition populations, seeking care in the private sector, it is critical to ensure the quality of care they receive. As many have noted, it is imperative that the Government of Vietnam implement a greater level of regulation and quality assurance of private sector providers (Tuan et al., 2005, Trinh et al., 2007, Tran, 2012).

Regulating the private sector can be achieved through the imposition and enforcement of diagnostic and treatment protocols and other requirements. However, an approach which provides not just oversight but also training, engagement and collaboration with the private sector may provide additional value by not just minimizing harm but actually optimizing the potential of the private sector to provide the highest quality care. Early forays into this type of engagement with the private health sector, including training, collaboration and supervision, in Vietnam have focused on private pharmacies. Evaluation of interventions to improve the knowledge, skills, and practices of private pharmacists suggest that a combination of training and supportive supervision has the potential not only to improve provider knowledge (Chalker et al., 2002, Minh et al., 2013) but also to significantly shift practice towards a better standard of care (Chalker et al., 2005, Minh et al., 2013). Specifically, these interventions significantly reduced the percentage of pharmacists providing hazardous products such as illegal steroids and low dose antibiotics as well as increasing pharmacists engagement with their patients in terms of asking questions and providing advice about key symptoms and side-effects (Chalker et al., 2005, Minh et al., 2013).

In terms of engagement and collaboration with the private sector for broader health care delivery, both in Vietnam and globally, public private mix (PPM) strategies have featured most prominently in the context of Tuberculosis (TB) programs. At least 58 countries including Vietnam have undertaken an intersectoral approach to TB diagnosis and treatment. Based on literature reviews and analysis of national program data, evidence suggests that these approaches can be effective at increasing case-detection as well as successful treatment rates (Dewan et al., 2006, Lal et al., 2011). While India, China, Nigeria and the Philippines have all received praise for successful PPM TB programs, Vietnam's experience with this approach is more mixed. While a public private mix strategy wherein

the national TB program supported private sector providers with training, supervision, referral links and financial incentives in Ho Chi Minh City increased case detection, the quality of care provided through the private sector was significantly inferior to the public sector. Only 60% of patients were successfully treated in the private sector which did not employ a directly observed treatment approach and also did not provide an adequate level of diagnosis and health information to patients (Quy et al., 2003, Lönnroth et al., 2004). Proposed explanations for the private sector failures included the fact that medicines were not subsidized in the private sector and that regulations were not enforced (Quy et al., 2003). This study raises important considerations for collaboration with the private sector towards public health goals and underscores that the approach is not a panacea. However, this specific study in Vietnam was conducted ten years ago when the entire health system and population health knowledge were significantly weaker. Furthermore, it focused on a disease which requires a six month course of daily treatment, a far more intensive and expensive service than providing basic maternal care for uncomplicated cases.

Additionally, qualitative feedback from a study in Southern Vietnam has suggested that both private and public sector providers had a generally positive view of stronger intersectoral collaboration for outpatient treatment, particularly in light of increasing care-seeking in the private sector (Duc et al., 2012). High acceptability among the health workers bodes well for the feasibility of such an intervention.

While the specific design of a program to enforce regulations and promote collaboration with the private sector around maternal care would require more investigation, it seems a necessary step to maintain quality as well as a potential opportunity to improve care, particularly for transition populations more likely to visit the private sector. Again, improving quality and coordination with the private sector also has the potential to improve efficiency

in several respects. First, improving the primary source of care for transition populations has the potential to prevent and manage transition related morbidities thereby reducing the amount of ongoing and higher level care required. The populations currently accessing the private sector would simply derive greater benefit, and be more likely to achieve good health outcomes from the resources they are already using. Second it would also maximize the benefit of existing resources by better incorporating the private sector into the health system rather than requiring the public sector to duplicate capacity and try to compete with the private sector as a preferred provider for certain procedures and populations. While improving the quality and coordination with the private sector would require some investment, it has the potential to improve health outcomes while essentially keeping the number of providers and facilities in the health system constant—again leading to improved efficiency as measured in my study.

6.3.3 Policy Recommendation 3: A Market-based Approach to Nutrition

In addition to providing support for increased regulation and engagement with the private health sector, my study also underscores the fact that health outcomes are also influenced by factors outside of the health sector. In particular the feedback from my study highlights the role of food, food availability and the marketing of nutritional products in relation to the emerging health threats to transition populations. Policies regulating the market and marketing for food and nutritional supplements as well as levers such as taxes and subsidies could be used to limit the uptake of harmful products and increase generally healthier diets and lifestyles.

As noted in the previous chapter, with respect to specific products such as pregnancy milk, it may be useful to follow a similar approach to the one taken with infant formulas which regulates marketing and promotion of the product. This may be particularly important for

the version of this product marketed to young children, also a processed powdered milk high in sugars and fats which, like infant formula, risks crowding out both breast milk and natural milk during a critical stage in the child's development. Beginning with the International Code of Marketing of Breast Milk Substitutes and extending to more localized laws still being enacted with increasing severity throughout the world, infant formula is regulated in terms of how, where and when it can be promoted. There are also restrictions regarding the use of misleading information and labeling requirements (World Health Organization, 1981). In countries where the code has been strictly enforced such as Norway, both the percentage and duration of breastfeeding are high—in the case of Norway 80% of mothers are still breastfeeding after 6 months. In countries where the ban is less fully enforced and advertising is common, much lower percentages of women breastfeed and an association between exposure to advertising and likelihood and duration of using infant formula has been demonstrated (Basch et al., 2013). While a constellation of social, cultural and economic factors influence breastfeeding practices, it is clear that marketing of infant formula as well as the regulation thereof can also have a significant effect. Vietnam would do well to consider a similar approach regulating how and where related processed powdered milk products for mothers and children can be marketed. It may be one strategy to head-off and reduce some of the adverse health trends likely to be exacerbated by these products.

Another strategy for improving nutrition and mitigating the ill effects of the nutrition transition is to use market mechanisms to incentivize the consumption of healthy foods and/or dis-incentivize the consumption of foods such as those high in saturated fats or sugary drinks. This can be done by subsidizing, and thereby reducing the cost of foods such as fresh fruit and vegetables and/or by taxing unhealthy foods. The latter intervention, often referred to as a 'fat-tax' is presently the subject of much debate among both academics and

policymakers in high income countries. Analyses of the impact of fat-taxes, as well as taxes on sugar-sweetened beverages identify a reduction in the purchase of the target foods though the effect size is modest. Analysis of data from Denmark which briefly instituted a fat tax found that consumption of targeted fats decreased by 10-15%, at least in the short run (Jensen and Smed, 2013). A study looking at state level food and drink taxes in the US also found a significant link between interventions and the decreasing prevalence of obesity (Kim and Kawachi, 2006). Likewise, modeled estimates based on consumer purchasing data suggest that a tax on sugar sweetened beverages would reduce consumption by as much as 20%. This latter study also investigates the net impact on calorie consumption after substitution effects accounting for products that the consumer may purchase instead of sugary drinks following a price increase. The authors find that, even accounting for substitution, the tax would result in a decrease in calories consumed and a cumulative weight loss of 2.9 pounds per person (Finkelstein et al., 2013). However, like most of the studies in this field, this one uses modeling rather than analysis of actual data. One of the few studies using actual data, again from state-based taxes in the US, found only weak links between certain kinds of taxes (on vending machine drinks) and decreased consumption among certain risk groups (high risk teens) (Powell et al., 2009).

In addition to the modest size of the effects on consumer behaviors and the potentially narrow context specificity of those effects, taxes on unhealthy foods and beverages face a number of other challenges as well. The tax on saturated fats introduced in Denmark was repealed after just a year due largely to political unpopularity resulting from an adverse effect on businesses and a reduction in consumer purchasing power (Strom, 2012). Such taxes have also been criticized for being regressive and racially discriminatory, in that they weigh most heavily on those of lower socio-economic status and minority ethnicity who are

more likely to consume unhealthy foods targeted in high income contexts (Craven et al., 2012, Traill, 2012).

However some of these concerns may pose less of a problem in the Vietnam. First the tax would not necessarily be regressive as it appears to be those who are MORE affluent who are consuming processed foods and sugar sweetened beverages. Second, there may be somewhat less political opposition if Vietnam is able to pre-empt unhealthy lifestyles rather than trying to change deeply ingrained lifestyle habits of an unhealthy population, the challenge currently faced in the high income context. Lastly, there may be additional advantage where the proceeds from taxation of unhealthy foods and beverages could be put towards funding health promotion and health system components such as insurance for both marginalized and transition populations. Even when unpopular, fat taxes have been lucrative; the Danish Government received 216 million USD in new revenue in the year it imposed its tax (Strom, 2012). As a result the tax may provide a way to deter health risks associated with economic development while also raising more funds for a health system now facing new challenges. In addition, the revenue gained from the tax can also help to offset the modest cost of imposing and enforcing such a tax contributing to cost-effectiveness even if the effects are small. Indeed, such taxes are generally viewed as cost effective (Traill, 2012). Thus while the rate of tax, the specific goods to be taxed and potentially locations of focus would all require detailed analysis as well as piloting, evaluation and adaptation, taxation of unhealthy foods and beverages represents another promising policy direction which the Vietnamese policymakers should consider to address the emerging threats to maternal and infant health, and perhaps population health more broadly, as a result of health transitions.

Like the previous two policies, market interventions to improve nutrition – or at least discourage the greatest drivers of poor nutrition—has the potential not only to improve health outcomes, by reducing morbidity but also by allowing people to achieve those outcomes with fewer, less specialized health resources.

None of the policies recommended is fool proof and none is a panacea for the challenges of health transitions. Indeed, each of these policy approaches would require extensive evidence review, contextualization as well as piloting, evaluation and adaptation. What is clear at this stage however is that new approaches are needed to support new types of populations in using available resources to manage newly emerging threats. Vietnam's previous health strategy of delivering basic health services targeted to poverty related concerns through a commune level system has been helpful, and is indeed a key reason that less well-off populations are achieving improved outcomes more efficiently. This approach should continue and can be expected to be valuable for less affluent populations. Furthermore it is likely still needed in light of the fact that less educated women are more likely to encounter the rare but worst-case outcomes of miscarriage and still birth. At the same time however this strategy alone will not be adequate to meet emerging threats which may both inhibit future progress and undermine progress achieved to date among populations negotiating a transition. The risk comes from new threats to health outcomes as well as the way in which these threats sabotage the efficient use of health system resources to achieve good outcomes such as those related to appropriate maternal care and healthy pregnancy and delivery examined in this study.

Thus investigating which groups are most likely to efficiently convert health resources into health outcomes and why has not only underscored critical shifts in the public health landscape caused by rapid economic development, it has also highlighted policies which can

improve public health in two respects: first by improving outcomes, and second by allowing those outcomes to be achieved with the minimum health system resources possible. Seen from another perspective, policy interventions targeting efficiency barriers have the potential to complement the current health system by optimizing the level of public health it affords the population.

6.4 Conclusion

6.4.1 Strengths and Limitations of This Study

As discussed in greater detail in previous chapters, this study had several strengths and weaknesses. The first is the strength of the Filabavi dataset to which I had access. The dataset's size and scope allowed me to focus on a particular health issue, using methods that required several types of variables and still have a sufficiently large sample (over 1400) in order to identify trends and statistically significant patterns. The rigor with which this data was collected minimized the need for data cleaning and increases confidence that findings accurately reflect people's real world conditions and experiences. The fact that it was a multiyear sample allowed me to consider effects over time and also gives confidence that my results are not skewed by any temporary aberrations. Lastly the fact that this dataset was carefully constructed to be representative of Ba Vi district supports the inference that these results are generalizable through the district. In turn, the fact that the district is relatively representative of the Vietnamese context at large, at least at the mean if not at the extremes of the distribution, also allowed me to derive findings which should be considered relevant, if not 100% generalizable, at the national scale.

Another strength of my quantitative analysis is the robust approach of the first step of the methodology wherein I generated efficiency scores. Because this approach is both stochastic

and iterative, as discussed in Chapter 3, it produces a robust and very conservative estimate of who is inefficient. Consequently, we can be quite confident that those more affluent groups who, surprisingly, were less likely to be efficient – namely the more educated and the ethnic majorities —really were less efficient even by the weakest assumptions and most conservative estimates. Furthermore this approach allowed me to analyze the data from a unique perspective—identifying the best performers rather than trends at the median.

In terms of the qualitative portion of my study, the facilitation from local researchers in Vietnam was a major strength. Through the collaboration of the Filabavi surveyors, I was able to sample across the spectra of geography, ethnicity and education with good precision. The surveyors also provided introductions to respondents which put the respondents very much at ease and facilitated the candidness of their feedback. The facilitation from HMU-based research assistants who acted as translators and interview and focus group facilitators was also a strength. I was able to discuss the aims of my study and align goals and approaches with these research assistants before interviews. As a result the manner in which they conducted the interviews was generally, if not perfectly, well-aligned to both the aims of my study and the methods I wanted to use. Lastly, I was also able to debrief with these research assistants, discussing the details and implications of feedback, getting their general impressions of the tenor – in addition to the verbatim meaning- of feedback and contextualizing that feedback with local knowledge.

Another strength of the study overall was that I was able to repeatedly gather feedback and test whether results resonated with a large group of local researchers from a variety of health related disciplines. This enabled me to know whether my piecing together of the quantitative findings and the qualitative feedback had created a picture that correctly understood the health system and common trends in public health. It also allowed me to

assess whether my conclusions about the dynamics of opportunities and choices relating to health were reasonable and plausible in the Vietnamese context. While the six months I spent in Vietnam gave me significant insight into the culture, context, systems and challenges, the ability to check my interpretations and understandings with people who had a far deeper native understanding of the context lends confidence to my findings.

While using a large scale, comprehensive, rigorously collected dataset was a strength of the study, the fact that this was secondary, and not purpose-collected data, was also a limitation in some respects. Although the dataset contained the key types of variables required- namely information on health resources, health outcomes and conversion factors- there were additional variables which would have strengthened the analysis. Specifically, in terms of health resources it would have been ideal to include additional variables for health financing such as a measure of voluntary insurance, insurance for government workers and even commune or health center level budgets. This would have allowed for a more complete picture of the government investment in public health beyond health facilities and health workers. In terms of health outcomes, it would have been ideal to have additional outcome variables reflecting healthy pregnancy and delivery for example the exact number and type of complications during pregnancy, specifics of complications during delivery, size for gestational age/intrauterine growth rates and/or Apgar scores are additional outcomes. Additional variables, particularly ordinal or continuous variables, rather than binary variables would have enabled a more comprehensive and also more differentiated picture of the relative achievement of appropriate care and healthy pregnancy and delivery.

Another potential limitation in terms of data availability was the lack of biological factors to include as potential conversion factors, or as controls whose effects we want to isolate from the associations of social factors and the likelihood of efficiency. On the one hand, it seems

desirable to want to include any biological factors, such as maternal health conditions, body mass index or history of cesarean section, which might be expected to influence the outcomes (and in turn efficiency) for the healthy pregnancy and delivery analysis. On the other hand, biological factors would fall into one of two categories: the first we don't need to control for, and the second we wouldn't necessarily want to isolate. The first category includes biological factors which we would expect to be randomly distributed throughout the population, such as physiological or anatomical indications which impede delivery and thus increase the likelihood of cesarean section. Particularly in the context where ethnicity is essentially a social rather than racial construct, there is no reason to expect one social group based on ethnicity, geography, socio-economic status or education level to be more likely than another to have this characteristic. In turn, if the biological factor is randomly distributed throughout the population and across the social groups of interest, it would not affect the regression results. Such a factor would impact efficiency scores at the individual level but not the associations between social factors and efficiency at the population level.

The second category of biological factors necessarily includes those which are not randomly distributed in the population. For many reasons it is possible-- and as the results indicate in my sample it is likely-- that some groups of women were more likely to be overweight or to suffer from hypertension or gestational diabetes which would influence pregnancy outcomes. However if we controlled for all of these factors we would eliminate the resulting variation across social factors. Yet, the greater likelihood of some groups to have biological characteristics, or for that matter behaviors, that influence efficiency is exactly what this study is trying to identify. Thus the inability to control for biological factors due to lack of data may reduce the explanatory power of the regression models however it seems unlikely to jeopardize the aims of the study which is to identify which groups are most likely to have characteristics and behaviors that affect their overall conversion efficiency.

Another limitation of the quantitative analysis was that I was only able to access data for children born in the fourth quarter of the year. It is worth bearing in mind that seasonal effects have been shown to influence health outcomes which in-turn may influence efficiency particularly as resources would remain constant throughout the year. However, it is hard to justify why seasonal factors would differentially influence the outcomes of one social group over another making them comparatively more likely to be efficient in one season and comparatively less likely to be efficient in another. Thus while we must allow for the possibility that results could differ in a different quarter, it seems theoretically unlikely that this would be the case to any significant degree.

There were also limitations to the qualitative portion of my study. One key limitation was the language barrier between myself and respondents. As a result, I had to rely on research assistants to conduct interviews and focus groups while providing summary translation. While we were able to achieve relatively good alignment in goals and methods with my research assistants, questions not always asked in the way that I would have preferred. Specifically for reasons of culture and language discussed in greater depth in Chapter 3 they were often too concrete or too leading. Additionally, because I received only summary translation on the spot there were details or interesting phrasings which I only discovered when reading the verbatim translations and, as a result, I was not able to probe with respondents.

6.4.2 Directions for Future Research

This study leads to three main directions for future research. The first is to expand on the analysis I conducted here by collecting additional data in the same or similar context in order to account for variables that I was unable to include. Perhaps the most useful among these

would be health financing as a health system resource. This would require collecting data and including variables for the budget allocation of each health center or the broader health budget for the commune, which would include funding for health promotion activities. Additional health resource variables capturing how well equipped each facility is—for example does it have the equipment required for ultrasounds and blood testing --could also be included to give a fuller picture of the endowment of health system resources. In terms of additional outcome measures, in the appropriate care analysis it would be ideal to include all of the elements of maternal care required by Vietnamese policy some of which were not available for this analysis, such as whether the women received antenatal counseling. For the healthy pregnancy and delivery analysis it would be ideal to include variables more finely reflecting the mother's nutritional status, such as maternal BMI, appropriate maternal weight gain and any micronutrient deficiencies, as well as variables more clearly delineating the severity and type of pregnancy and delivery complications. Variables giving a more detailed and stratified reflection of fetal/neonatal health such as intrauterine growth, Apgar scores and neonatal morbidities or distress would also give a more comprehensive picture of the health status achieved.

In addition to increasing the number of variables, another adaptation on this research could include indexing sets of variables such as human resources for health rather than comparing each resource using weak dominance as I have here. In my approach an individual whose health center has 4 doctors and 1 nurse is not considered to have more resources than an individual whose health center has 1 doctor and 4 nurses. While this approach relies on the weakest assumptions and yields the most conservative estimate of which individuals have greater resources, it does not differentiate between individuals whose resource endowments are quite different, as in the example here. An alternative approach would be to create a summed index of resources. This index could simply be additive though in the

case of human resources for health it seems inappropriate to count 4 doctors and 1 nurse the same as 1 doctor and 4 nurses. It may be more appropriate to multiply each resource by a scalar deemed equivalent to that resource's potential benefit. For example if we assume doctors are a more critical resource because of their greater training we multiply each doctor by 2 and each nurse by 1. Or we could multiply doctors by 1 and nurses by 2 under the justification that nurses provide the majority of maternal care with doctors making only an occasional contribution in more complicated cases. Such an indexing approach would distinguish the two individuals above who indeed have different resource endowments. However, the use of scalars would have to be well justified by precedent in the literature and/or theory. Given the difficulty of definitively justifying one specific indexing approach over all others, a range of scaling approaches could be tried and compared in a type of sensitivity analysis.

Another way to extend this specific study would be to conduct a decomposed analysis estimating efficiency scores and conversion factors within each of the social groups identified as likely to influence efficiency. For example, considering only people who live in the mountains or only ethnic majorities, what is the distribution of efficiency and what conversion factors increase the likelihood of being efficient? While this analysis would require a larger dataset with more observations for each group, it could inform even more precise policies and programs targeting the least efficient.

The second opportunity for further research is to apply this methodology to a different disease area and/or different context. For example, considering the efficient conversion of health resources into appropriate care and health outcomes with respect to Malaria in Sub-Saharan Africa would require identifying a new set of resource variables, outcome variables and conversion factors. In addition to health facilities, human resources and financing it

would also be useful to include as resource variables proximity to pharmacies (which dispense the majority of malaria treatment) as well as the availability of effective treatment and reliable diagnostics at each of these sites. Care outcomes may include receiving microscopic or immunologic confirmation of diagnosis, appropriate treatment, completion of treatment regimen and counseling regarding future prophylaxis. Health outcomes may include resolution of symptoms, confirmation of parasite clearance, and resolution of any side effects or sequelae. Furthermore, in the second stage different conversion factors would have to be included— for example factors such as nomadism/sedentarism, language group and religion which were not relevant in the Vietnamese context, may be important conversion factors in this case. Thus while the methodology applied here theoretically could be adapted to another context it would require careful consideration of the theory and literature in order to inform the choice of appropriate variables.

The third potential avenue for future research is to investigate the policy recommendations proposed. At the first stage this would involve a complete systematic review of each of the remedies proposed as well as analysis relevant to the Vietnamese context. For example, in the case of market interventions to mitigate the nutrition transition it would be necessary to conduct a systematic review and ideally, a meta-analysis of data, on the intervention of interest (tax, subsidy etc.). Secondly, it would be ideal to use Vietnamese market data to model the effects of possible interventions with respect to both consumer behavior and resulting health outcome in order to determine which products should be targeted and at what rate of tax or subsidy. Next, researchers could pilot the intervention, ideally in an experimental context which enables causal inference regarding the behavioral and health impacts of the intervention. This stage could also include cost-effectiveness analysis in order to determine whether the intervention generates more benefit than an alternative approach, for example, more traditional health promotion regarding nutrition. Using the

methods presented here, the evaluation of the pilot could consider not just the effect of the intervention on health outcomes but also the resulting changes in conversion efficiency among target populations. As a result, it would be able to determine whether the intervention does in fact allow more people to achieve optimal health using available health system resources.

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APPENDICES

Appendix A Information & Informed Consent for Respondents

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Participant Information Sheet

My name is Elizabeth Radin. I am a doctoral (PhD) student at the Department of Public Health, University of Oxford, UK. I am conducting a study to understand how people in Filabavi District make use of available health resources (such as clinics, medicines, health workers, pharmacies) in order to achieve good health.

The goal of this study is to understand how policies and programs can make it easier for people to use health resources and ultimately live healthy lives.

Project Title: A Capabilities Approach to Understanding the Efficient Conversion of Health Resources into Health Outcomes: Piloting a Methodology in Vietnam

Description of the study: For this study I would like to ask you about your experiences with health and your use of health services and resources. The length of the interview will depend on your experiences but should not take longer than 2 hours. I have requested to interview you because I have selected your commune as one of several areas of focus to try to understand the situation across Filabavi District as a whole.

Confidentiality and data protection: The information that you provide will not be shared with anyone else. Interview notes and recordings will be locked in cabinets at Hanoi Medical University and destroyed or erased after transcription. Any information entered into a computer for analysis will not be entered with details that could identify you—for example your full name and address. All data will be stored in password protected databases. Your identity will not be disclosed in any reports, publications or conferences.

The findings of this research will be written up as a thesis. Information you provide may be included but your identity will not be revealed in connection with that information. On successful submission of the thesis, it will be deposited both in print and online in the University archives, to facilitate its use in future research. The thesis will be published with open access meaning anyone can read the document through the internet.

The University of Oxford is committed to the dissemination of its research for the benefit of society. In support of this commitment, the University has established an online archive of research materials. This archive includes digital copies of student theses successfully

submitted as part of a University of Oxford postgraduate degree program. Holding the archive online gives easy access for researchers to the full text of freely available theses, thereby increasing the likely impact and use of that research.

Risks and benefits: Apart from the time required to participate in this interview or focus group discussion, there is no risk to participating in this study. However, your time and your inputs will be very valuable to understanding how to improve people's access to important health resources, particularly in your community.

Project approval: This research project has been reviewed and approved by the University of Oxford's Central University Research Ethics Committee: Ref _____

Voluntary participation: Participation in this study is completely voluntary. You are free to refuse to participate in total or refuse to answer any question or opt out of the study at any time. Refusal to participate or to answer any of the questions will not have any negative impacts on you.

Complaints procedure: If you have a concern about any aspect of this project, please speak to the researcher concerned, Elizabeth Radin, (local telephone number) who will do his/her best to answer your query. If you remain unhappy and wish to make a formal complaint, please contact the Research Ethics Committee at the University of Oxford (ethics@medsci.ox.ac.uk; Medical Sciences Inter-Divisional Research Ethics Committee, Medical Sciences Divisional Office, Level 3 John Radcliffe Hospital, Oxford, OX3 9DU , UK).

If you are willing to participate in this study please provide your consent by signing the consent forms.

Thank You,
Elizabeth Radin (Student Researcher)

Department of Public Health

University of Oxford

Rosemary Rue Building, Old Road Campus, Headington, Oxford

OX3 7LF UNITED KINGDOM

Tel: +44 (0)1865 28920 Email: enquires@dph.ox.ac.uk



CONSENT FORM

Project Title: A Capabilities Approach to Understanding the Efficient Conversion of Health Resources into Health Outcomes: Piloting a Methodology in Vietnam

Researcher: Ms. Elizabeth Radin, Doctoral (PhD) Student, Department of Public Health, Elizabeth.Radin@dph.ox.ac.uk or (local phone number)

Purpose of Study: This study aims to understand how people in Filabavi District make use of available health resources (such as clinics, medicines, health workers, pharmacies) in order to achieve good health. The goal of this study is to inform policies and programs can make it easier for people to take advantage of health resources and ultimately live healthy lives.

How the survey responses will be used: The data collected from this interview will be used in the researcher's doctoral thesis, which will be published on-line at the University of Oxford's digital archive. Information you provide may be included but your identity will not be revealed in connection with that information.

Please initial the box at the end of each line.

I understand how my responses to these questions will be used. ☐

I have had the opportunity to ask questions about the study and have received satisfactory answers to the questions, and any additional details requested. ☐

I understand that I may withdraw from this study without penalty at any time by advising the researchers of this decision. ☐

I understand that this project has been reviewed by, and received ethics clearance through, the University of Oxford Central University Research Ethics Committee. ☐

I understand that my responses will be included in a doctoral thesis and this thesis will be stored in the University of Oxford's digital archive, which is accessible to the public. ☐

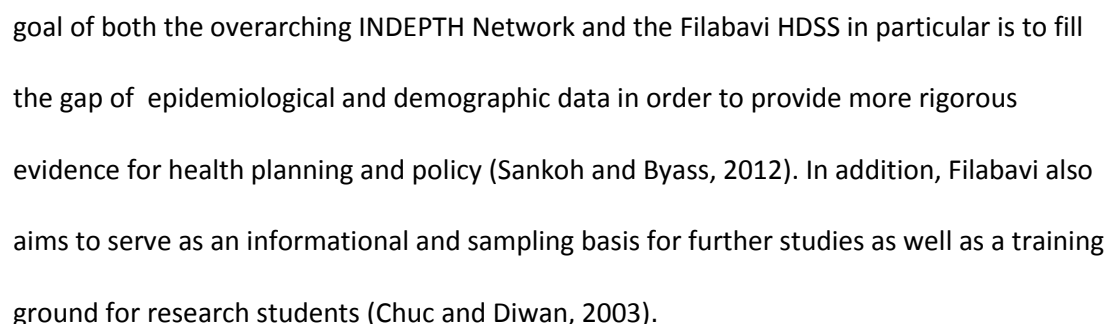
I agree to participate in this study. ☐

If you have a concern about any aspect of this project, please speak to the researcher concerned, Elizabeth Radin, (local telephone number) who will do his/her best to answer your query. If you remain unhappy and wish to make a formal complaint, please contact the Research Ethics Committee at the University of Oxford (ethics@medsci.ox.ac.uk; Medical Sciences Inter-Divisional Research Ethics Committee, Medical Sciences Divisional Office, Level 3 John Radcliffe Hospital, Oxford, OX3 9DU, UK).

Signature of Participant: _____

Date: _____

Established in 1999, FilaBavi (**Field Laboratory Ba Vi**) is operated by Hanoi Medical University in collaboration with Karolinska Institute, Umea University and Nordic School of Public Health with funding from SIDA. It is part of the International Network for the Demographic Evaluation of Populations and their Health (INDEPTH) which currently includes 43 Health and Demographic Surveillance Sites (HDSS) in 36 countries across Africa, Asia and Oceania (Sankoh and Byass, 2012). The



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clusters and households for sampling. The resulting sample contains 67 clusters including roughly 11,000 households and 51,000 individuals (Chuc and Diwan, 2003, Tran, 2012).

Since the start of data collection in 1999, the sample has grown to include roughly 55,000 individuals.

Beginning in 1999, the Filabavi HDSS collected baseline data at the household level -- including household infrastructure, assets and distance to health facilities-- and individual level-- including demographic factors such as age, gender, education, employment, ethnicity, marital status etc. The complete set of baseline data has since been re-collected every two years. Data on birth, death, migration, pregnancy, illness and care seeking are collected on a quarterly basis (Tran, 2012).

The data is collected by field surveyors who are secondary school graduates hailing from the communities surveyed. Each surveyor is responsible for three to four hundred households. Surveyors are trained and re-trained to ensure data quality. Field supervisors, also residents of Ba Vi, most of whom have some medical training, oversee groups of roughly seven field surveyors each. The supervisors further ensure quality by addressing questions and challenges raised by surveyors, reviewing data before entry and conducting re-interviews on 10% of the total surveys as spot checks. A further 5% of spot checks are performed by research students and 20% of questionnaires are reviewed for omissions or contradictions at the central office level before entry (Chuc and Diwan, 2003).

Feedback from the communities received informally during qualitative research suggested strong relationships between survey households and field surveyors. Rather than seeing the data collection process as a nuisance, people participating in the survey viewed it as an act of caring. They expressed appreciation that the Filabavi surveyors came to check in on them

and see how they were doing on a regular basis. They described missing the time with field surveyors after the close of data collection in December 2012.

The Filabavi dataset includes demographic information at the household and individual level, epidemiological information regarding morbidity, mortality, pregnancy and birth and health seeking behavior as summarized in the table below.

Survey Section	Variables		Survey Section	Variables
Household	Cooperation in Research		Household Follow Up	HH opened, closed, change resident
	Type of Roof			Split/New HH
	Type of Walls			Reason No Data this Round
	Type of Floor			In Migrants (separate survey)
	Area of House			Out Migrants (separate survey)
	Source of Light			Anyone travel >10 days
	Source of Energy			Marriage
	Water Source			Pregnancy
	Distance to water			Birth
	Type of Latrine			Death
	Type of Disposal			Illness/Injury (4 weeks)
	Bathroom			Symptoms
	Children under five			Duration in Days
	Cost of goods			First Health Service Used(type)
	Money spent last month			All Other Health Services Used
	Typical of spending?		Death	Cause of Death (ill, age, accident)
	Avg spend on food			HH Head
	Other expenditures			New HH Head
	How often meat		Marital Event	Name of People Involved
	Rice shortage			Type of Change (married, divorced)
	Debt			In/Out Migration
	Why Debt		Pregnancy	Name of woman
	How large agri land			Date last period
	Income sources			Still pregnant
	Assets			Outcome of pregnancy
	Overall Econ			Date end of pregnancy

	status
Individual	Name
	ID Number
	DOB
	Sex
	Ethnicity
	Religion
	Occupations
	Education Level
	Parents Names
	Marital Status
	Spouse Name
	Age First Marriage
	Age First Birth
	Current Smoker
	Internet Access
	Main Decision Maker

ANC	Any ANC Care
	ANC Card or MCH Book
	Where ANC Care
	How many times ANC Care
	Tests done at least once
	Any Complications
	Type of Complication
	Response to Complication
	Given Tetanus shot ?
	How many times shot
	Ever given shot previous pregnancy
	Given Iron tablets
	how many days tablets taken last month
	day vision difficulty
	night blindness
	health check following birth
	how many days after delivery
	where did post-delivery check take place
	did you receive vitamin A after delivery
	HIV test during pregnancy
	If yes, how was it offered
	Do you have result
	Did you pay for HIV test
New Born	Name/ID
	Parents Name/ID
	Sex
	Live birth?
	Twin?
	Place of delivery
	Attendant at birth
	weight
	normal/complication/operation
	size at birth compared to avg

References

- CHUC, N. T. K. & DIWAN, V. 2003. FilaBavi, a demographic surveillance site, an epidemiological field laboratory in Vietnam. *Scandinavian Journal of Public Health*, 31, 3-7.
- SANKOH, O. & BYASS, P. 2012. The INDEPTH Network: filling vital gaps in global epidemiology. *International Journal Of Epidemiology*, 41, 579-588.
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Appendix C Discussion of Alternative Models

Statistical Models Used in Social Epidemiology

As discussed in Chapter 1, the literatures on social determinants of health and social epidemiology have employed various analytical techniques to identify how social factors influence health outcomes directly and as mediating and confounding factors. While these models can determine the influence of social factors on health outcomes, and even the pathways through which they act, none of them specifically analyzes the efficient use of resources. They cannot identify what portion of the population is efficiently achieving health outcomes with a set of health resources. Furthermore, they cannot generate a measure of efficiency for each individual and thus are unable to determine whether some groups of people are more likely to be efficient than others.

Health Production Functions

While health production functions can determine the relative contribution of both resources and social factors, and thereby the optimal or efficient mix of each factor, they also have several methodological shortcomings. As parametric approaches, they require the specification of a functional form based on a hypothesized relationship between the independent variables and health outcomes. In this case, there is little basis on which to choose one functional form—for example assuming whether each factor contributes additively or multiplicatively—over another. Second, as parametric approaches, they assume the same production function for all individuals which is problematic given the disparities in health outcomes in Vietnam and the implication that some people are taking better advantage of public resources than others. Thirdly, because health production

functions treat all inputs as substitutable, the influence of resources could potentially become insignificant. This is problematic both intuitively, where it seems no amount of social factors would allow the achievement of health outcomes in the absence of basic health resources, and from the point of view of this study, where the interest lies specifically in how efficiently people utilize resources to achieve outcomes. Lastly health production functions can only look at a single health outcome at a time which fails to reflect the multidimensional nature of good health.

Appendix D Sample Topic Guide

Topic GUIDE

RESEARCH QUESTION: How and why are some people more efficient at converting health resources to health outcomes?

Would you do anything different next time?

- What is important for good health during pregnancy and having a healthy baby?
- Story of the pregnancy and delivery
 - Note which types of resources used (do they mention clinic, dr, health insurance, others)
- Which **infrastructural resources** (hospital/chc/private/clinic/pharmacy) used and why?

Example question: you mentioned you went to the hospital/clinic/chc etc. . . .why did you go there?

Probe: How often, why?

Probe: Were there other places you went, when use which?

Probe: Which (if any) infrastructural resources NOT used and why?

Example question: Are there other clinics/hospitals in this area? Why did you go where you went?

For each question understand: Capabilities and Choices – which resources were people ABLE to use and which did they CHOOSE to use. What is there perception of their abilities and what is the rationale for their choices.

- Which **health financing resources** (insurance/oop spending) used and why?

Example questions: you mentioned health insurance, how did you find out about health insurance (if they know about it),

Probe: what is their perception of health financing (expensive, inexpensive, beneficial, not beneficial etc).

Probe: Which health financing resources not used and why?

Probe: How did you cover the costs of your pregnancy, what are perceptions around cost and ways of covering it.

For each question understand: Capabilities and Choices – which resources were people ABLE to use and which did they CHOOSE to use. What is their perception of their abilities and what is the rationale for their choices.

- Experiences with and perception of **human resources** for health

Probe: Which types of health workers seen (drs/nurse/midwife/tba)

Probe: Perceptions of health workers seen

- Other resources (**medicines/health advice**) used and why?
- Overall perceptions **of quality of care, accessibility of care (if not covered above)**
- Influence of Institutions

Example question: what do **local institutions** (such as the people's committee/women's group) do?

Probe: Perception of these interventions

- Outcomes

Try to get some understanding of care received and outcomes achieved

Concerns/Complications and responses – what done/not done/why?

Perception of outcomes (good, not so good)?

- Would you do anything differently next time?
- Is there **ANYTHING ELSE** they want to share about their experience

Appendix E Complete v Missing Observation Groups & Live Birth v Not Live Birth Groups

Comparison of Groups with Complete v Missing Data

	Complete Data N=1412	Missing Data N=419	Difference in Means/ Proportions	p-value
Wealth Quintile	3.200	2.772	0.428	1.57e-08***
Education level¹	3.319	3.387	-0.0679	0.281
Age of pregnant woman	26.07	26.10	-0.0236	0.933
Ethnic minority	0.0531	0.0310	0.0221	0.0635
Mountain	0.220	0.177	0.0436	0.0542
Highland	0.545	0.592	-0.0473	0.0874
Lowland	0.235	0.172	0.0633	0.00606**
Formally Employed	0.157	0.158	-0.000183	0.993
Male Baby	0.542	0.556	-0.0138	0.643

* for $p < .05$, ** for $p < .01$, and *** for $p < .001$

¹ Education Levels Defined As: 1=Primary or Less, 2= Some Secondary, 3=Completed Secondary, 4=Completed High School, 5= Beyond High School

Comparison of Means/Proportions for Live Birth vs Not Live Birth

	Live Birth N=1765	Miscarriage or Stillbirth N=65	Difference in Means/ Proportions	p-value
Wealth quintile	3.110	2.968	-0.142	0.412
Education	3.350	2.938	-0.411	0.00399**
Age of Mother	26.04	27.15	1.114	0.0813
Ethnic Minority	0.0482	0.0462	-0.00200	0.941
Mountain	0.208	0.262	0.0530	0.303
Highland	0.557	0.508	-0.0492	0.433
Lowland	0.222	0.200	-0.0215	0.681
Formally Employed	0.158	0.154	-0.00375	0.935

* for $p < .05$, ** for $p < .01$, and *** for $p < .001$

Appendix F Example of Pregnancy Milk Marketing


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Importance of DHA during pregnancy

Docosahexaenoic acid, or DHA for short, is an omega-3 fatty acid that is found everywhere in our bodies, but with the highest concentration in the brain, eyes and heart. While nutrients such as folic acid and calcium are well known to be important during pregnancy, a growing number of studies have indicated that DHA is also an important nutrient for pregnant and nursing women. Babies cannot efficiently develop their own DHA and must rely on their mothers for this nutrient during pregnancy and after birth. Therefore, an increased amount of DHA in a mother's diet leads to increased levels of DHA available to the unborn baby and also to a child via breastfeeding.¹ Why is an increased amount of DHA important? Recent research suggests that DHA contributes on a wide variety of levels – from supporting a baby's brain development and playing a role in helping postpartum depression in mothers. This has led to Dr. William Sears, a leading expert of child health and development, and host of DHADOC.com, to state that "DHA is the most important brain-building nutrient at all ages, especially during the pregnancy and the pre-school years when the child's brain is growing the fastest".



Benefits of DHA

Adequate amounts of DHA is needed for the development of the brain, eye and nervous system of infants. DHA represents 93% of all omega fats in the retina and is needed for the correct formation of photoreceptor cells – cells in the eye that recognize light and transmit information about it to the brain.

DHA is especially important during the third trimester, where rapid brain growth of the unborn baby takes place. A 2003 study published in *Pediatrics* journal showed that children whose mothers took DHA supplements while pregnant scored higher on intelligence tests at age four than children whose mothers did not take DHA supplements.

Some studies show that supplementing a mother's diet with DHA can improve a child's development in areas such as eye-hand coordination, motor skills and increase their attention spans. In a 2004 study published in *Child Development*, mothers with high levels of DHA during delivery had children with advanced attention spans. DHA levels are also associated with more mature sleep patterns in young children, according to one study.

Recommended daily intake of DHA during pregnancy

Findings on the benefits of DHA have increased awareness of this nutrient, and many health experts are beginning to educate expecting and breastfeeding women about the importance of DHA to their child's brain development. DHA levels depend on a person's diet, and scientists today are working on setting a recommended daily intake of DHA. Meanwhile, some experts recommend between 200-300mg of DHA per day for pregnant and nursing women.

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Do you buy organic baby food?

Would (or do) you buy organic baby food? If you do, is it because you think it's better for your baby?

xiaping5174 - 1 day ago

caru-cara meningkatkan disiplin anak

Anak saya kalau marah dia akan membuang/membaling benda yang ada di sekitarnya. Contohnya, dia tidak mahu...

cheahoon - 1 day ago

Sestages 100% Nutritionland

wah, bagus... saya suka hadiah misteri...

kameiwong - 3 day ago

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Appendix G Statistical Analyses of Conversion Factors with Health

Outcome Measures

Two-sided T-tests comparing Mean Appropriate Care Scores for Ethnic Minority and Majority

```
. ttest corecareindex, by(ethnicminor)
```

Two-sample t test with equal variances

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]	
0	1342	7.040984	.0531027	1.945328	6.93681	7.145157
1	75	7.28	.1941115	1.681055	6.893224	7.666776
combined	1417	7.053634	.0513365	1.932462	6.952931	7.154338
diff		-.2390164	.229285		-.6887915	.2107587

```
diff = mean(0) - mean(1)                                t = -1.0424
Ho: diff = 0                                             degrees of freedom = 1415
```

```
Ha: diff < 0                Ha: diff != 0                Ha: diff > 0
Pr(T < t) = 0.1487          Pr(|T| > |t|) = 0.2974          Pr(T > t) = 0.8513
```

```
. ttest reccareindex, by(ethnicminor)
```

Two-sample t test with equal variances

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]	
0	1342	2.011923	.0303696	1.112538	1.952345	2.0715
1	75	2	.12592	1.0905	1.749099	2.250901
combined	1417	2.011291	.0295142	1.111007	1.953395	2.069188
diff		.0119225	.1318703		-.2467597	.2706047

```
diff = mean(0) - mean(1)                                t = 0.0904
Ho: diff = 0                                             degrees of freedom = 1415
```

```
Ha: diff < 0                Ha: diff != 0                Ha: diff > 0
Pr(T < t) = 0.5360          Pr(|T| > |t|) = 0.9280          Pr(T > t) = 0.4640
```

Two sided T-Tests comparing Mean Appropriate Care Scores for Mountainous and Non-Mountainous People

```
. ttest corecareindex, by(mountain)
```

Two-sample t test with equal variances

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]	
0	1104	7.15308	.0587508	1.952085	7.037804	7.268356
1	313	6.702875	.1029669	1.821671	6.500278	6.905473
combined	1417	7.053634	.0513365	1.932462	6.952931	7.154338
diff		.4502043	.1232121		.2085063	.6919023

```
diff = mean(0) - mean(1)                                t = 3.6539
Ho: diff = 0                                             degrees of freedom = 1415
```

```
Ha: diff < 0                Ha: diff != 0                Ha: diff > 0
Pr(T < t) = 0.9999          Pr(|T| > |t|) = 0.0003        Pr(T > t) = 0.0001
```

```
. ttest reccareindex, by(mountain)
```

Two-sample t test with equal variances

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]	
0	1104	2.103261	.0338129	1.123485	2.036916	2.169606
1	313	1.686901	.0566424	1.002107	1.575451	1.79835
combined	1417	2.011291	.0295142	1.111007	1.953395	2.069188
diff		.4163599	.0703042		.2784482	.5542717

```
diff = mean(0) - mean(1)                                t = 5.9223
Ho: diff = 0                                             degrees of freedom = 1415
```

```
Ha: diff < 0                Ha: diff != 0                Ha: diff > 0
Pr(T < t) = 1.0000          Pr(|T| > |t|) = 0.0000        Pr(T > t) = 0.0000
```

Two-sided T-Test comparing Means of Healthy Pregnancy and Delivery Outcomes by Ethnic minority and Majority

Two-sample t test with equal variances

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]	
0	1339	3.378641	.0216922	.7937674	3.336086	3.421195
1	75	3.466667	.1028133	.8903891	3.261807	3.671527
combined	1414	3.38331	.0212504	.7990821	3.341624	3.424995
diff		-.0880259	.0948236		-.2740362	.0979844

```
diff = mean(0) - mean(1)                                t = -0.9283
Ho: diff = 0                                             degrees of freedom = 1412
```

```
Ha: diff < 0                Ha: diff != 0                Ha: diff > 0
Pr(T < t) = 0.1767          Pr(|T| > |t|) = 0.3534        Pr(T > t) = 0.8233
```

Bivariate Regression of Healthy Pregnancy and Delivery Outcomes on Education

```
. reg hpdindex education
```

Source	SS	df	MS	Number of obs =	1414
Model	3.26529949	1	3.26529949	F(1, 1412) =	5.13
Residual	898.980811	1412	.636671962	Prob > F =	0.0237
				R-squared =	0.0036
				Adj R-squared =	0.0029
Total	902.24611	1413	.638532279	Root MSE =	.79792

hpdindex	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
education	-.0419312	.0185154	-2.26	0.024	-.078252	-.0056105
_cons	3.522478	.0650123	54.18	0.000	3.394947	3.650009

Appendix H Comparison of Mean Wealth and Education by Ethnicity

	Mean for Ethnic Majority	Mean for Ethnic Minority	Difference in Means	p-value
Wealth Quintile	3.123	2.750	0.373	0.0112 [*]
Education Quintile	3.364	2.739	0.626	0.0000 ^{***}

* for $p < .05$, ** for $p < .01$, and *** for $p < .001$

Appendix I Health Resource Endowments by Geography, Ethnicity and Education

Relationships between **ETHNICITY and each health resource** (infrastructure and human resources) included in my resource set are modeled below. Results suggest that, controlling for geography, ethnic minorities have significantly lesser endowment of all health resources except pharmacists.

Time to District Hospital

```
. reg timehosp mountain lowland ethnicminor
```

Source	SS	df	MS	Number of obs =	1501
Model	11811.191	3	3937.06365	F(3, 1497) =	23.44
Residual	251401.039	1497	167.936566	Prob > F =	0.0000
				R-squared =	0.0449
				Adj R-squared =	0.0430
Total	263212.23	1500	175.47482	Root MSE =	12.959

timehosp	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
mountain	-4.206641	.920905	-4.57	0.000	-6.013042	-2.40024
lowland	4.496994	.8291731	5.42	0.000	2.870529	6.123458
ethnicminor	6.425719	1.654605	3.88	0.000	3.180129	9.671309
_cons	21.50754	.4512158	47.67	0.000	20.62246	22.39263

Time to CHC

```
. reg timechc mountain lowland ethnicminor
```

Source	SS	df	MS	Number of obs =	1501
Model	5318.26991	3	1772.75664	F(3, 1497) =	38.77
Residual	68446.054	1497	45.722147	Prob > F =	0.0000
				R-squared =	0.0721
				Adj R-squared =	0.0702
Total	73764.3239	1500	49.1762159	Root MSE =	6.7618

timechc	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
mountain	-.0068112	.4805134	-0.01	0.989	-.9493623	.9357399
lowland	-4.239882	.4326492	-9.80	0.000	-5.088545	-3.391219
ethnicminor	1.869108	.8633461	2.16	0.031	.1756115	3.562604
_cons	10.73017	.2354371	45.58	0.000	10.26835	11.19199

Number of Doctors at Closest CHC

```
. reg ancdrscloschc mountain lowland ethnicminor
```

Source	SS	df	MS	Number of obs =	1806
Model	361.972675	3	120.657558	F(3, 1802) =	525.19
Residual	413.990226	1802	.229739304	Prob > F =	0.0000
				R-squared =	0.4665
				Adj R-squared =	0.4656
Total	775.962901	1805	.429896344	Root MSE =	.47931

ancdrsclos~c	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
mountain	1.184339	.0311362	38.04	0.000	1.123273	1.245406
lowland	.2269067	.0281881	8.05	0.000	.1716219	.2821914
ethnicminor	-.2709778	.0572526	-4.73	0.000	-.3832662	-.1586894
_cons	.58317	.0150316	38.80	0.000	.5536888	.6126513

Number of Assistant Doctors at Closest CHC

```
. reg ancasstdrcloschc mountain lowland ethnicminor
```

Source	SS	df	MS	Number of obs =	1806
Model	3713.68221	3	1237.89407	F(3, 1802) =	1133.57
Residual	1967.83274	1802	1.09202705	Prob > F =	0.0000
				R-squared =	0.6536
				Adj R-squared =	0.6531
Total	5681.51495	1805	3.14765371	Root MSE =	1.045

ancasstdrc~c	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
mountain	3.739055	.0678835	55.08	0.000	3.605916	3.872193
lowland	.225787	.061456	3.67	0.000	.1052545	.3463196
ethnicminor	-1.012238	.1248228	-8.11	0.000	-1.257051	-.7674257
_cons	3.43761	.0327722	104.89	0.000	3.373334	3.501885

Number of Nurses at Closest CHC

```
. reg ancnuresscloschc mountain lowland ethnicminor
```

Source	SS	df	MS	Number of obs =	1806
Model	1291.61877	3	430.539588	F(3, 1802) =	237.49
Residual	3266.80261	1802	1.81287603	Prob > F	= 0.0000
				R-squared	= 0.2833
				Adj R-squared	= 0.2822
Total	4558.42137	1805	2.5254412	Root MSE	= 1.3464

ancnuressc~c	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
mountain	2.147886	.0874644	24.56	0.000	1.976344	2.319428
lowland	-.302063	.079183	-3.81	0.000	-.4573631	-.1467629
ethnicminor	-1.674482	.1608279	-10.41	0.000	-1.98991	-1.359053
_cons	1.561158	.0422253	36.97	0.000	1.478343	1.643974

Number of Midwives at Closest CHC

```
. reg ancmidwcloschc mountain lowland ethnicminor
```

Source	SS	df	MS	Number of obs =	1806
Model	362.957473	3	120.985824	F(3, 1802) =	343.33
Residual	635.005428	1802	.35238925	Prob > F	= 0.0000
				R-squared	= 0.3637
				Adj R-squared	= 0.3626
Total	997.962901	1805	.552888034	Root MSE	= .59362

ancmidwclo~c	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
mountain	1.130759	.0385619	29.32	0.000	1.055128	1.206389
lowland	-.122279	.0349107	-3.50	0.000	-.1907488	-.0538092
ethnicminor	-.4833764	.0709069	-6.82	0.000	-.6224449	-.344308
_cons	.5318914	.0186166	28.57	0.000	.495379	.5684037

Number of Pharmacists at Closest CHC.

```
. reg ancpharmacloschc mountain lowland ethnicminor
```

Source	SS	df	MS	Number of obs =	1806
Model	65.3978579	3	21.799286	F(3, 1802) =	48.32
Residual	812.970359	1802	.451148923	Prob > F	= 0.0000
				R-squared	= 0.0745
				Adj R-squared	= 0.0729
Total	878.368217	1805	.486630591	Root MSE	= .67168

ancpharmcl~c	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
mountain	.220846	.0436322	5.06	0.000	.135271	.3064211
lowland	-.3446	.039501	-8.72	0.000	-.4220725	-.2671275
ethnicminor	.0065021	.0802301	0.08	0.935	-.1508517	.1638559
_cons	.7777522	.0210644	36.92	0.000	.7364391	.8190653

Relationships between EDUCATION and each health resource (infrastructure and human resources) included in my resource set are modeled below. Results suggest that:

- **Education is associated with lower times to District Hospital and CHC (ie greater health infrastructure endowment)**

Source	SS	df	MS	Number of obs =	1501
Model	2817.64774	1	2817.64774	F(1, 1499) =	16.22
Residual	260394.582	1499	173.712196	Prob > F =	0.0001
				R-squared =	0.0107
				Adj R-squared =	0.0100
Total	263212.23	1500	175.47482	Root MSE =	13.18

timehosp	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
education	-1.196755	.2971509	-4.03	0.000	-1.779631	-.6138792
_cons	25.92084	1.040869	24.90	0.000	23.87912	27.96255

. reg timechc education

Source	SS	df	MS	Number of obs =	1501
Model	3717.80772	1	3717.80772	F(1, 1499) =	79.56
Residual	70046.5162	1499	46.72883	Prob > F =	0.0000
				R-squared =	0.0504
				Adj R-squared =	0.0498
Total	73764.3239	1500	49.1762159	Root MSE =	6.8358

timechc	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
education	-1.374692	.1541183	-8.92	0.000	-1.677002	-1.072381
_cons	14.3965	.5398504	26.67	0.000	13.33756	15.45544

- **Education is associated with greater or (statistically) equal human resources for health**

. reg ancdrscloschc education

Source	SS	df	MS	Number of obs =	1806
Model	1.96186404	1	1.96186404	F(1, 1804) =	4.57
Residual	774.001037	1804	.429047138	Prob > F =	0.0326
				R-squared =	0.0025
				Adj R-squared =	0.0020
Total	775.962901	1805	.429896344	Root MSE =	.65502

ancdrsclos~c	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
education	.0290818	.0136	2.14	0.033	.0024084 .0557553
_cons	.7762449	.0478891	16.21	0.000	.6823209 .8701689

. reg ancasstdrcloschc education

Source	SS	df	MS	Number of obs =	1806
Model	.825678383	1	.825678383	F(1, 1804) =	0.26
Residual	5680.68927	1804	3.14894084	Prob > F =	0.6087
				R-squared =	0.0001
				Adj R-squared =	-0.0004
Total	5681.51495	1805	3.14765371	Root MSE =	1.7745

ancasstdrc~c	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
education	.0188666	.0368442	0.51	0.609	-.0533953 .0911284
_cons	4.172981	.1297379	32.16	0.000	3.918529 4.427434

. reg ancursesclscloschc education

Source	SS	df	MS	Number of obs =	1806
Model	2.14487944	1	2.14487944	F(1, 1804) =	0.85
Residual	4556.27649	1804	2.52565216	Prob > F =	0.3569
				R-squared =	0.0005
				Adj R-squared =	-0.0001
Total	4558.42137	1805	2.5254412	Root MSE =	1.5892

ancursesclsc~c	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
education	-.0304081	.032997	-0.92	0.357	-.0951243 .0343082
_cons	1.971255	.1161907	16.97	0.000	1.743373 2.199138

```
. reg ancmidwcloschc education
```

Source	SS	df	MS	Number of obs =	1806
Model	.023534832	1	.023534832	F(1, 1804) =	0.04
Residual	997.939367	1804	.553181467	Prob > F	= 0.8366
				R-squared	= 0.0000
				Adj R-squared	= -0.0005
Total	997.962901	1805	.552888034	Root MSE	= .74376

ancmidwclo~c	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
education	-.0031852	.0154426	-0.21	0.837	-.0334726	.0271021
_cons	.7326569	.0543774	13.47	0.000	.6260076	.8393062

```
. reg ancpharmacloschc education
```

Source	SS	df	MS	Number of obs =	1806
Model	12.3006905	1	12.3006905	F(1, 1804) =	25.62
Residual	866.067527	1804	.480081777	Prob > F	= 0.0000
				R-squared	= 0.0140
				Adj R-squared	= 0.0135
Total	878.368217	1805	.486630591	Root MSE	= .69288

ancpharmcl~c	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
education	.0728202	.0143862	5.06	0.000	.0446049	.1010355
_cons	.5052876	.0506573	9.97	0.000	.4059345	.6046408

Relationships between **WEALTH** and each health resource (infrastructure and human resources) included in my resource set are modeled below. Results suggest that:

- **Wealth is associated with lower times to District Hospital and CHC (ie greater health infrastructure endowment)**

```
. reg timehosp Q_z_pcw
```

Source	SS	df	MS	Number of obs =	1489
Model	815.808797	1	815.808797	F(1, 1487) =	4.67
Residual	259936.889	1487	174.806247	Prob > F =	0.0309
				R-squared =	0.0031
				Adj R-squared =	0.0025
Total	260752.697	1488	175.237028	Root MSE =	13.221

timehosp	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
Q_z_pcw	-.5803808	.2686565	-2.16	0.031	-1.107367 -.0533948
_cons	23.7861	.9265033	25.67	0.000	21.9687 25.60349

```
. reg timechc Q_z_pcw
```

Source	SS	df	MS	Number of obs =	1489
Model	3584.24389	1	3584.24389	F(1, 1487) =	76.61
Residual	69565.6349	1487	46.7825386	Prob > F =	0.0000
				R-squared =	0.0490
				Adj R-squared =	0.0484
Total	73149.8788	1488	49.1598648	Root MSE =	6.8398

timechc	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
Q_z_pcw	-1.216515	.1389827	-8.75	0.000	-1.489138 -.9438924
_cons	13.74634	.4793033	28.68	0.000	12.80615 14.68652

- **Wealth is associated with greater or (statistically) equal human resources for health**

```
. reg andrscloschc Q_z_pawi
```

Source	SS	df	MS	Number of obs =	1789
Model	3.55578134	1	3.55578134	F(1, 1787) =	8.30
Residual	765.386645	1787	.428308139	Prob > F =	0.0040
				R-squared =	0.0046
				Adj R-squared =	0.0041
Total	768.942426	1788	.430057285	Root MSE =	.65445

andrclos~c	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
Q_z_pawi	.0330592	.0114737	2.88	0.004	.010556	.0555625
_cons	.770106	.0387771	19.86	0.000	.6940528	.8461591

```
. reg ancasstdrcloschc Q_z_pawi
```

Source	SS	df	MS	Number of obs =	1789
Model	17.1980152	1	17.1980152	F(1, 1787) =	5.48
Residual	5607.66839	1787	3.13803491	Prob > F =	0.0193
				R-squared =	0.0031
				Adj R-squared =	0.0025
Total	5624.86641	1788	3.14589844	Root MSE =	1.7714

ancasstdrc~c	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
Q_z_pawi	.072705	.0310566	2.34	0.019	.0117939	.1336162
_cons	4.008901	.1049605	38.19	0.000	3.803042	4.214759

. reg ancnursesclschc Q_z_pcw

Source	SS	df	MS	Number of obs =	1789
Model	.104607607	1	.104607607	F(1, 1787) =	0.04
Residual	4515.49852	1787	2.52685983	Prob > F =	0.8388
				R-squared =	0.0000
				Adj R-squared =	-0.0005
Total	4515.60313	1788	2.52550511	Root MSE =	1.5896

ancnursescl~c	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
Q_z_pcw	.0056703	.0278687	0.20	0.839	-.0489883	.0603289
_cons	1.849952	.0941862	19.64	0.000	1.665225	2.034679

. reg ancmidwclschc Q_z_pcw

Source	SS	df	MS	Number of obs =	1789
Model	.708921961	1	.708921961	F(1, 1787) =	1.28
Residual	986.829088	1787	.552226686	Prob > F =	0.2574
				R-squared =	0.0007
				Adj R-squared =	0.0002
Total	987.53801	1788	.552314323	Root MSE =	.74312

ancmidwcl~c	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
Q_z_pcw	-.0147613	.0130282	-1.13	0.257	-.0403134	.0107908
_cons	.7690535	.0440307	17.47	0.000	.6826964	.8554105

. reg ancpharmclschc Q_z_pcw

Source	SS	df	MS	Number of obs =	1789
Model	3.53382512	1	3.53382512	F(1, 1787) =	7.29
Residual	865.77864	1787	.484487208	Prob > F =	0.0070
				R-squared =	0.0041
				Adj R-squared =	0.0035
Total	869.312465	1788	.486192654	Root MSE =	.69605

ancpharmcl~c	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
Q_z_pcw	.032957	.012203	2.70	0.007	.0090234	.0568907
_cons	.648008	.0412418	15.71	0.000	.5671207	.7288953