New Frontiers in Regional Science: Asian Perspectives 38

Amitrajeet A. Batabyal
Yoshiro Higano
Peter Nijkamp *Editors*

Disease, Human Health, and Regional Growth and Development in Asia

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In approaching the house, I was seized by a strange feeling, I could hear nothing, I stood still. In the trees there was not even a breath of air. "What is the matter with me then?" I said to myself. . . . What was it? Was it a presentiment? That mysterious presentiment which takes hold of the senses of men who have witnessed something, which, to them, is inexplicable? Perhaps?

Who Knows? Guy de Maupassant.

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This book would not have been possible without the assistance of several scholars dispersed throughout the world. Therefore, we would like to thank the contributors of the individual chapters of this book for their enthusiastic participation in this time-consuming project. The enthusiasm of the contributors is richly on display in the thought-provoking chapters they have written on various aspects of the subject matter of this book, namely, disease, human health, and regional growth and development in Asia.

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Part I
Introduction

Chapter 1
Introduction to Disease, Human Health, and Regional Growth and Development in Asia

Amitrajeet A. Batabyal, Yoshiro Higano, and Peter Nijkamp

Abstract We have two objectives in this book. First, we bring together in one place, original research that sheds light on the myriad connections between disease, human health, and regional economic growth and development. Second, given the contemporary salience of Asia in world affairs, we concentrate on the trinity of disease, human health, and regional economic growth and development in different regions within Asia. Following this introductory chapter, there are nine chapters and each of these chapters—written by an expert or by a team of experts—discusses a particular research question or questions about disease, human health, and regional economic growth and development within Asia.

Keywords Asia · Disease · Economic development · Human health · Regional growth

1.1 Preliminaries

The systematic study of research questions in what is now called health economics began with a prescient paper by Selma Mushkin in 1962 which asked readers to think of health as an investment. This paper was quickly followed by two other

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papers that collectively laid the foundations of modern health economics. The first of these two papers was by Kenneth Arrow in 1963, and this paper looked at the nexuses between uncertainty and the welfare economics of medical care. The second of these two papers was by Grossman in 1972. This second paper focused on the notion of health capital and then proceeded to analyze the connections between health capital and the demand for health.

Today, health economics is a burgeoning field within economics, and it is fair to say that economists working in many different fields have studied questions concerning, *inter alia*, the allocation of medical resources, the organization of healthcare markets, the spatial distribution of diseases, and, importantly for this book, the connections between disease, human health, and economic growth. There are two central findings in this literature.[1] The first finding is that the relationship between human health and economic growth is *bi-directional* in nature. What this means is that although advances in human health positively influence economic growth, economic growth, in turn, helps humans become healthier. The second finding is that although improvements in human health have an instrumental value in that they promote economic growth, these improvements are valuable in and of themselves, quite apart from their instrumental value.

What are some of the ways in which human health affects economic growth? First, there is the direct productivity effect. This means that individuals who are healthier are able to work more effectively from both physical and mental standpoints. In addition, Weil (2007) points out that adults who are healthier as children typically acquire more education-based human capital. Apart from this direct productivity effect, Kalemli-Ozcan et al. (2000) and Hazan (2009) show that better health in the form of mortality reductions raise the return on human capital investments which, in turn, increase the level of schooling and positively influence economic growth. Kalemli-Ozcan (2002) points out that from a parental perspective, reduced mortality leads to a reduction in the number of surviving children, and hence this permits higher investment in human capital which, presumably, affects economic growth in a positive way.

It is important to recognize that most of the extant studies about the nexuses between human health and economic growth have focused on *countries* as the unit of analysis. Although there exists some research on the connections between human health and economic growth in *regions* where the word *region* refers to geographical entities that are smaller than nations,[2] neither economists nor regional scientists have studied the nexuses between the trinity of disease, human health, and regional economic growth and development in a systematic manner. Given this lacuna in the extant literature, the first of two objectives in this book is to bring together in one

[1] See Bloom and Canning (2008) and Weil (2014) for a more detailed corroboration of this claim. In addition, a comprehensive overview of studies of health differences between rural and urban areas can be found in Ishikawa et al. (2015).

[2] See, for instance, Deaton and Paxson (2001), Thomas and Frankenberg (2002), and Lawton Smith et al. (2016).

place original research that sheds light on the myriad connections between disease, human health, and *regional economic growth and development*.[3]

Several observers such as Mahbubani (2008) and Batabyal and Nijkamp (2017) have pointed out that in the last two centuries, as the West (North America and Western Europe) was holding sway on the world stage, Asian nations were largely bystanders, reacting to progressive surges of Western commerce, thought, and power. However, there is now an ongoing shift in the global center of gravity. Specifically, geopolitical and economic power are steadily moving away from the West to Asia, and therefore Asia is returning, according to Mahbubani (2008), to the global center stage it occupied for eighteen centuries before the rise of the West.

As pointed out by Allison (2017) and Rachman (2017), this state of affairs has led to a significant amount of hand-wringing and soul-searching in the West. Specifically, the rise of Asia has led to some rebalancing in America's foreign policy and in particular to President Obama's pivot to Asia and now to President Trump's trade war with China.[4] The geopolitical and economic rise of Asia raise important questions about disease, human health, and regional economic growth and development in this vast continent. In addition, given the contemporary salience of Asia, Sen (2001) has rightly observed that lessons learned about regional economic growth and development in Asia are likely to prove useful for the design and implementation of apposite policies in other parts of the world. This state of affairs provides a rationale for the second of our two objectives, and that is to analyze disease, human health, and regional economic growth and development in *Asia*.

Following this introductory chapter which comprises Part I of the book, there are nine chapters, and each of these chapters—written by an expert or by a team of experts—discusses a particular research question or questions about disease, human health, and regional economic growth and development in Asia. For ease of comprehension, we have divided the present volume containing ten chapters into four parts. Part II of this book focuses on South Asia, and this part consists of five chapters. Chapter 2 provides a detailed discussion of interstate and rural-urban disparities in the consumption of food, the intake of calories, and undernourishment in India. Chapter 3 sheds light on the geography of excess weight in urban regions across a variety of states in India. Chapter 4 discusses the nature of health systems and the productivity effects of changes in health expenditures in the post-reform period in various Indian states. Chapter 5 utilizes a survey to examine the nature and the effects of gender perspectives on what this chapter calls a "health-related situation" in a rural region in northern Bangladesh. Finally, Chap. 6 also uses a

[3] Batabyal and Nijkamp (2017) note that irrespective of what region in the world one looks at, if one is interested in lifting large numbers of people out of poverty, then it is essential to design and implement policies that promote economic growth. This line of thinking is now so much a part of orthodox thinking that it features standardly in the literature on economic growth. For instance, in a prominent textbook, Ray (1998, p. 47) points out that of "all the issues facing development economists, none is quite so compelling as the question of economic growth."

[4] See Batabyal (2018a, b, c) for additional details on this last point.

survey to comment on the nature of the "health-related situation" confronted by elderly people in a couple of remote villages in northern Bangladesh.

Part III concentrates on Southeast Asia and this part of the book consists of two chapters. Chapter 7 looks at international trade policy and asks what impacts reforms in trade policy have on nutritional intake and food security in different regions within Indonesia. Chapter 8 analyzes the nature of health inequities in the Philippines between the richer and the poorer regions on the one hand and between Muslim majority and non-Muslim majority areas on the other.

Part IV focuses on East Asia, and the single chapter (Chap. 9) in this part of the book uses a questionnaire survey and propensity scores to shed light on the nature of medical expenditures in clinics and hospitals by individuals living in the Kanto region of Japan. The focus of Part V of this book is on Oceania. The final Chap. 10 utilizes household survey data from 2009 to 2010 merged with geospatial data from the United Nations to analyze the connections between distance to healthcare facilities, health, and healthcare usage in Papua New Guinea. With this preliminary discussion out of the way, we now proceed to comment on the intellectual contributions of the individual chapters in this book.

1.2 South Asia

1.2.1 Undernourishment in India

When it comes to describing India's economy, there is no gainsaying the fact that there is an incongruity between macro and micro metrics. When we look at macro metrics such as aggregate economic growth rates, increases in per capita income, and declines in poverty rates, the country performs impressively. However, as noted by Dreze and Sen (2013), when we look at micro metrics concerning the health of children, the extent of undernourishment, and the availability of medical care and social services such as sanitation, the country's performance is much less laudatory.

Given this state of affairs, Chap. 2 focuses on food consumption in India, the nutritional implications of this consumption, and the related points of calorie intake and undernourishment. A key aim of this chapter is to shed light on the roles played by the public distribution system (PDS) and the midday meal scheme (MDMS) in alleviating the extent of undernourishment. To undertake this exercise, the chapter uses detailed information about household consumption and expenditure on food and non-food items contained in the unit records of the 68th round (July 2011 to July 2012) of India's National Sample Survey (NSS). In particular, 101,651 households are surveyed, and this round of the NSS provides detailed information on food consumption and expenditures on approximately 170 food items.

The analysis conducted in this chapter generates a number of salient findings. First, it is shown that there exist significant *spatial differences* in food consumption. For instance, it is shown that some of the southern states such as Tamil Nadu and eastern states such as Assam consume much higher levels of rice and lower levels of

wheat relative to western states such as Maharashtra and Gujarat. Even so, within a particular state, the data do *not* reveal any major rural-urban differences in food consumption.

Next, this chapter sheds light on regional differences in the prevalence of undernutrition (POU) in India. We learn that because rural poverty, in general, is higher than urban poverty, the rural POU rates are also higher than the urban POU rates when looked at from an "all India" perspective. This finding does *not* always hold when we look at rural-urban differences in individual states. Somewhat counterintuitively, this chapter shows that POU rates in the relatively wealthy states of Gujarat and Tamil Nadu are *higher* than the corresponding rate in the relatively poorer state of Bihar. Finally, although evidence in favor of the PDS as a welfare program is mixed, the same cannot be said about the MDMS. In particular, the latter program appears to be doing a good job of reducing undernourishment among participating households.

While Chap. 2 rightly concentrates on the analysis of undernourishment in India, it is also true that parts of India now face the problem of unhealthy weight levels and the associated health risks. To what extent do these issues constitute real public policy challenges? This question has recently been much discussed in the Indian press—see Anonymous (2007) and Verma (2016)—and it is also the subject that is addressed in Chap. 3.

1.2.2 Excess Weight in Urban India

In many parts of India, the health-related issue that increasingly requires attention has little to do with undernourishment and more to do with unhealthy food consumption habits. Chapter 3 begins its analysis of the geography of excess weight in urban India with two sobering observations. First, it points to the twin problems of excess weight and obesity on the one hand and the excess weight and obesity driven *rise* in the incidence of noncommunicable diseases on the other. Second, it notes that lifestyle changes such as the higher likelihood of eating meals outside one's home and the increasing use of labor-saving devices such as washing machines have together contributed to a situation in which India now ranks third behind the United States and China in terms of the number of people who are either overweight or obese.

Next, this chapter uses the most recent, i.e., the 2011–2012 round of the Indian Human Development Survey (IHDS2) to analyze patterns in excess weight and obesity rates for adult men and women in urban India. The key metric that is used to delineate an individual's weight status is his or her body mass index (BMI) which is defined to be the ratio of an individual's body weight in kilograms divided by the square of his or her height in meters. We are told that even though the number of overweight or obese individuals is rising in rural areas, the problem is particularly acute in *urban* areas, and this explains why the emphasis of this chapter is on urban India.

The analysis is conducted for groups of states in India that together represent most of the nation. There are clear regional differences across a whole host of health and literacy measures across different parts of India. In particular, there is a considerable amount of *regional* variation in the proportion of men and women who fall into different weight classes. This notwithstanding, it is disquieting to learn that of all the regions that are studied in this chapter, there is *not* a single region in which the fraction of individuals who are either overweight or obese is less than 25%. In addition, when one looks at men and women in the four different weight classes by region, 13% (12%) of urban males (females) are underweight, 58% (53%) have normal weight, 24% (25%) are overweight, and 6% (10%) are obese or morbidly obese. An implication of these and other findings is that from an overall standpoint, there are more *women* than men who are either overweight or obese.

Given the above findings, the chapter next discusses possible explanations for the observed variation in weight across the regions that are studied. We learn that, *inter alia*, differences in diets, differences in the extent to which people are engaged in the labor market, and differences in the utilization of a variety of labor-saving devices explain the regional variation in weight.

Why focus on excess weight and obesity? The chapter notes that this focus is justified because the incidence of a variety of noncommunicable diseases such as cardiovascular diseases in general and diabetes is higher in individuals with what the chapter calls an "unhealthy BMI." The policy lesson to grasp is that "excessive nourishment" is a problem, and addressing this problem will require policymakers to focus on strategies that promote active lifestyles and, particularly in the south of India, diversify diets so as to reduce the excessive current reliance on rice consumption.

1.2.3 Productivity of Public Health Expenditures in India

The recommendations made by the so-called Bhore committee in 1946 and the subsequent adoption of the National Health Policy in 1982–1983 suggest that for quite some time, the government of India has been attempting to provide more equitable access to healthcare and to generate improved health outcomes across the different states.

Looked at in the aggregate, the government's *share* of total health expenditures increased from 22.5% in 2004–2005 to 29% in 2014–2015. During this same time period, out-of-pocket expenditures as a percent of total health expenditures decreased slightly from 69.4% to 62.6%. Finally, private expenditures on health insurance as a percent of total health expenditures increased from a minuscule 1.6% to an only slightly less minuscule 3.7%. Clearly, the *increase* in the government's share of total health expenditures and the *decrease* in out-of-pocket expenditures as a percent of total expenditures together tell us that there has been an uptick in the financial protection available to households as far as healthcare payments are

concerned. Even though this is a good thing, we still know relatively little about the *productivity* of public health expenditures.

Given this state of affairs, the basic objective of Chap. 4 is to contribute to the extant literature on health efficiency studies in India by analyzing changes in the productivity of public health expenditures undertaken by the major states in the nation. To this end, the chapter first measures the health system productivity change (HSPC) and the health expenditure productivity change (HEPC) for 17 prominent states for the time period from 2004–2005 to 2015–2016. The two major health outcomes that also are the two key outputs are the crude death rate (CDR) and the infant mortality rate (IFR).

Next, this chapter utilizes three inputs and the two (undesirable) outputs mentioned above to set up and solve a linear programming problem where the goal is to ascertain the efficiency of input use in alternate states. The analysis demonstrates that there are unambiguous *differences* in HSPC during the study period. In particular, the interstate differences have become more pronounced after 2009, and we learn that the disparity in what this chapter calls "health system productivity change" has risen from 2004–2005 to 2014–2015.

As far as the HSPC ranks of the individual states are concerned, the analysis shows that of the 17 states under study, 9 have improved their ranks over the pertinent time period, 2 have held their ranks, and 6 have gotten worse. The picture is only a little different when one looks at changes in HEPC ranks. Specifically, in the 2004–2005 to 2014–2015 time period, ten states improved their ranks, one state held its rank, and the remaining six reached lower ranks.

The central message emerging from the analysis undertaken in Chap. 4 is that even though the productivity changes studied in the pertinent time period are mixed, when one looks at the coefficient of variation, these productivity changes are particularly *volatile*. The chapter contends that a partial explanation for this volatility lies in the way in which health expenditures are allocated in the individual state revenue and capital accounts.

1.2.4 Gender and Health in Rural Bangladesh

Moving on from India to its eastern neighbor Bangladesh, Chap. 5 begins the proceedings by reminding the reader that when one considers a health-related problem, it is *not* sufficient to look narrowly at health alone. Instead, one needs to focus on a whole host of cultural, demographic, and socioeconomic factors that have a direct bearing on an individual's access to healthcare. As such, this chapter sheds light not just on health-related problems in rural Bangladesh but also on what this chapter calls the "health-related situation."

Specifically, this chapter uses surveys to interview the male and the female residents of a remote village named Kathalbari in northern Bangladesh about the health-related situation that confronts them. Of the 303 households in Kathalbari, some declined to answer the personal questions contained in the interviews, and

hence their nonparticipation left the author of this chapter with usable responses from 199 individuals.

The first finding in this chapter is that the socioeconomic circumstances of a Kathalbari resident have a significant impact on the health-related situation that (s)he confronts. In this regard, we learn that the extent to which a resident is aware of diseases and health issues more generally and the likelihood that this resident will seek medical services when needed is fundamentally dependent on the resident's age, occupation, and income. That said, because over 90% of the households being studied in this chapter earned about US$183 per month, it is extremely *difficult* for these households to lead a healthy lifestyle. This basic difficulty is compounded by the facts that more than 70% of the households in Kathalbari live in what are essentially mud houses and that almost 50% of them have *no* sanitary toilets in their houses.

Clearly, the maintenance of hygiene is a challenge in Kathalbari. This is, in part, responsible for the prevalence of several diseases such as diabetes, stomach problems, and what this chapter calls "female diseases." Somewhat surprisingly, we learn that even though the doctors staffing the government health centers and hospitals are disproportionately male, female respondents do not think of this as a barrier, and they unhesitatingly discuss their health problems with the various male doctors. Even so, we learn that some of the practices employed by menstruating women—unwittingly, in an attempt to maintain hygiene—may well increase the likelihood of infections and female diseases in the long run.

Two key lessons emerge from the analysis conducted in Chap. 5. First, the government needs to do all it can to ensure that Kathalbari residents have access to sanitary toilets. Second, the health condition of a male depends primarily on his ownership of land. In contrast, the health condition of a woman depends mainly on her consumption of proteins, the nature of the house she lives in, and her use of contraceptives. Therefore, *gender-differentiated* policies are required to ameliorate the health situation confronting Kathalbari residents. How might things change if one were to focus not on the gender dimension of the health-related situation but, instead, on the geriatric aspects of this situation? This topic is addressed in Chap. 6.

1.2.5 Geriatric Health in Rural Bangladesh

Like Chap. 5, Chap. 6 concentrates on health issues in rural Bangladesh, and it also sheds light on the so-called health-related situation confronting individuals and not just on health *per se*. The focus in this chapter is explicitly on geriatric health. To this end, the chapter uses questionnaires to conduct face-to-face interviews in five villages—Hiramanik, Atbil, Dhaknai, Fakirtari, and Haribhanga—with men and women aged 56 years and older.

The completed questionnaires give rise to empirical data, and Chap. 6 utilizes this data to conduct statistical analyses and particularly to test two specific hypotheses about the health-related situation confronting the elderly in the above five villages.

First, it is shown that irrespective of gender, age-class, or income-class, elderly people in the five villages being studied differ significantly in the quality of life they experience. In this regard, the quality of life experienced is assumed to be a function of how satisfied one is with one's occupation, housing, sanitation and personal hygiene, transport facilities, old-age allowance, and the provision of social policy services.

Chapter 6 demonstrates that many of the elderly people being studied have *no* savings and that their monthly expenditures typically *exceed* their monthly income. Therefore, they have to take loans, and the resulting loan repayment constitutes a significant burden on them, and, in addition, it prevents them from having a good quality of life. As such, it is no surprise to learn that quite apart from gender and age-class considerations, there is a nontrivial positive correlation between an elderly person's monthly income and the quality of life that (s)he is able to enjoy.

Chapter 6 concludes by noting that elderly people get little attention or respect and that their plight continues to worsen over time. Therefore, this chapter argues in favor of creating what it calls an "Ageing Welfare Ministry" that will be responsible for, *inter alia*, increasing the old-age allowance and widow benefits, providing informal education, providing health cards, and establishing old-age homes for the destitute and the disabled. With this discussion of the five chapters about South Asia that comprise Part II of this book out of the way, we now turn to the two chapters on Southeast Asia that make up Part III of this book.

1.3 Southeast Asia

1.3.1 Trade Reforms and Nutrition in Indonesia

Chapter 7 begins by asking the reader to consider a particular staple food that is imported into a nation. It then points out that if trade policy either raises the price or bans the import of this staple food, then it is likely that poor people who rely on this food will either reduce their consumption of this staple food or switch to other low-cost food items with potentially *lower* nutrient content. If this happens then this chain of events may well lead to increased nutritional deficiencies in the affected country.

Next, this chapter analyzes the implications of the above chain of events in the context of Indonesia—the largest country in Southeast Asia and the fourth most populous nation in the world. The focus on Indonesia arises from a variety of public health-related concerns. In this regard, we learn that poor hygiene practices, inadequate sanitation, and food insecurity have collectively contributed to malnutrition in Indonesia, and some of the relevant metrics here are alarming. Consider two such metrics. In 2016, the dietary energy consumption of 18 million Indonesians fell *below* the minimum required to maintain a healthy life. In addition, 20% of preschool children in the nation suffer from *acute* vitamin A deficiency.

Because of the complexities involved in quantifying the variety of non-tariff barriers to trade, Chap. 7 concentrates on tariff barriers exclusively. It then points out that even though tariffs are set at the national level, this chapter is interested in ascertaining the impact of tariffs on a representative household in individual *districts*. Given this interest, the chapter constructs two measures that capture the output and the input tariff exposures faced by individual districts in Indonesia.

The econometric analysis conducted in this chapter leads to several fascinating results. For instance, the structural model reveals that a causal connection exists between the tariff barriers and nutrition status. In addition, we learn that a one standard deviation *decrease* in the average tariff rate leads to a 0.59 standard deviation *increase* in the nutrition status variable. This basic result is reinforced by the Lagrange multiplier test indices which show that the estimated impact of the "TradeBarriers" variable on the "NutritionStatus" variable possesses the expected negative sign and that it also is highly significant statistically.

This chapter rightly concludes on a cautious note. It points out that the *total* impact of openness to trade is likely to include channels that have not been formally modeled in the chapter because of data limitations. We are told that subject to data availability, a fuller accounting of the above mentioned total impact will involve the analysis of a more general model that permits a researcher to simultaneously consider the positive and the negative impacts of trade reforms in an integrated manner.

1.3.2 Health Imbalances in the Philippines

After Indonesia, we move to the Philippines in Chap. 8. The central objective of this chapter is to discuss the factors that are responsible for the continued presence of health inequity in the Philippines. The chapter forcefully argues that inequalities in health and avoidable health outcomes are collectively responsible for the persistence of all manner of health inequities. This notwithstanding, we learn that it is *not* possible to divorce a study of these inequities from underlying considerations of extant social injustices in the Philippines.

The analysis conducted in this chapter demonstrates that both life expectancy at birth and maternal mortality rates have, respectively, improved and reduced over time. These advances have been made possible because of enhancements in medical technologies, particularly in the treatment of communicable diseases. This salubrious state of affairs notwithstanding, we continue to see pockets of health deprivation. To drive home this point persuasively, the chapter focuses on Mindanao. We learn that relative to babies born in the National Capital Region (NCR), babies born in the Autonomous Region of Muslim Mindanao (ARMM) are twice as likely to die in the first 5 years of their lives.

One of the issues this chapter concentrates on is the role that out-of-pocket health expenditures play in impoverishing the typical Filipino household. The discussion in this chapter paints a gloomy picture of the extent to which out-of-pocket expenses

can be catastrophic for low-income households in different parts of the Philippines. We are told that even though the level of expenditure that would be classified as catastrophic is clearly a function of the income threshold one uses for such a classificatory purpose, even for relatively conservative thresholds, large numbers of the Filipino population are vulnerable to catastrophic health expenditures. Therefore, in order to avoid such catastrophic health expenditures, households commonly minimize their use of healthcare facilities, and this, in turn, leads to undiagnosed diseases with potentially greater negative consequences further down the road.

This chapter concludes by noting that three points deserve a lot more attention in the Philippines than they currently get. First, even though the decentralization of the provision of health services to the individual provinces is in principle a good idea, the outcome of this decentralization needs to be monitored frequently. The outcome of such monitoring will sometimes mean intervention by the central government to appropriately target the worst performing provinces. Second, the present lack of health professionals, their unequal distribution across the Philippines, and insufficient investment to improve the nation's healthcare infrastructure need to be addressed urgently. Finally, the services provided by PhilHealth, the nation's primary social insurance platform, will need to be combined effectively with those provided by private insurance companies to increase both utilization rates and payments for the cost of hospitalizations. This completes our discussion of the two chapters that comprise Part III of this book. We now shift gears and proceed to discuss medical expenditures in Japan, the topic that is covered in the single chapter that makes up Part IV of the book.

1.4 East Asia

1.4.1 Medical Expenditures in Japan

As noted by Akiyama et al. (2018) and many others, with a rapidly aging population, healthcare costs in Japan are on the rise. To combat these rising costs, the Japanese government has been attempting to reform the healthcare system by, *inter alia*, promoting clinical specialization and collaboration. This state of affairs raises the following question: compared to patients who choose to receive care in a clinic, do patients who go to a hospital pay more? Because this question has not been studied thus far, Chap. 9 uses a questionnaire survey to interview individuals in the Kanto region of Japan and sheds light on this question.

The reader will note that, in a way, the key question of interest in Chap. 9 is a study of out-of-pocket health expenditures, an issue that has already been deemed to be significant in the context of the Philippines in Chap. 8. That said, it turns out that in Japan, the extent of the out-of-pocket expenditure one incurs is significantly a function of one's *age*. Specifically, children under age 6 and individuals over 70 years of age pay 20% of actual medical expenses, whereas people over 75 years of age pay only 10% of the actual medical expenses.

The analysis conducted in Chap. 9 is based on data from a questionnaire survey administered to individuals in the Kanto region which consists of the Tokyo metropolis and the prefectures of Ibaraki, Tochigi, Gunma, Saitama, Chiba, and Kanagawa. We are told that the direct application of a regression model to the data is likely to be *misleading* because individuals with higher healthcare needs—such as those with chronic conditions—are likely to visit hospitals more frequently and hence have higher out-of-pocket expenses. To get around this problem, Chap. 9 uses the concept of a propensity score where the *probability* of a hospital visit is viewed as a propensity score and the basic idea is to match propensity scores to concentrate on how the clinic versus hospital distinction—and not other variables—affects out-of-pocket health expenditures.

The analysis conducted leads to several interesting findings. First, we learn that individuals who own their own home and those who are more focused on the *quality* of healthcare received are more likely to visit a hospital rather than a clinic. That said, region and location-specific variables are very important. For instance, individuals who live closer to a hospital choose to visit hospitals. In addition, those who live close to a railway station tend to choose clinics over hospitals.

The central policy lesson emanating from this chapter is that if the Japanese government would like to promote the use of clinics over hospitals, then it needs to be aware of the point that locational attributes are *more* important than personal characteristics in determining the likelihood of a visit to either a clinic or to a hospital. In other words, *where* people live matters more than *who* they are. This concludes our discussion of the single chapter about medical expenditures in a Japanese region that comprises Part IV of this book. We now turn to the single chapter that makes up the final Part V of this book.

1.5 Oceania

1.5.1 Health and Healthcare in Papua New Guinea

We know from the analysis in Chap. 9 that accessibility to healthcare facilities—clinics and hospitals—affects the use of such facilities by individuals. What Chap. 10 shows is that this matters not just in a relatively wealthy nation such as Japan but much more so in a poor, relatively isolated, and largely rural country such as Papua New Guinea. Specifically, this chapter takes data from the 2009–2010 Household Income and Expenditure Survey (HIES) and merges this data with geographical data on health facilities to study the ways in which distance from healthcare facilities and the quality of the extant transportation services influence the utilization of healthcare facilities. In addition, this chapter also studies how the access to and the utilization of healthcare facilities vary by *gender* and by whether an individual seeking care is from a rural or from an urban area.

The conceptual model employed in this chapter is based on the prominent work of Grossman (1972). This model thinks of individuals as being endowed with an initial

stock of health at birth. This initial stock of health depreciates over time until death occurs. However, individuals have the ability to take concrete actions to modify the rate of depreciation of the initial stock of health. Individuals select the intertemporal utility maximizing levels of the health stock and total consumption in each time period subject to, for instance, production, resource, and budget constraints. A suggestion emanating from the model being utilized is that distance and travel time to healthcare facilities reduce the *demand* for healthcare.

The econometric analysis undertaken in Chap. 10 shows that for the entire sample under consideration, an increase in the distance to the closest healthcare facility *negatively* affects both facility utilization and individual health. That said, factors other than distance and travel time also materially influence an individual's health status. Specifically, in both rural and urban areas, men report health complaints less frequently than women. However, the analysis in this chapter does generate some puzzling results. Here are two examples. First, the impact of having improved toilet facilities is *different* in rural and urban areas. Second, when either injured or sick, urban residents are *less* likely than rural residents to visit a healthcare provider. These baffling results point to the need for conducting more research to clearly comprehend the determinants of both healthcare facility use and an individual's health status in Papua New Guinea.

1.6 Conclusions

Issues at the interface of the trinity of disease, human health, and economic growth and development are of central concern to regions located in many different parts of Asia. After many millennia of uneven growth and development, the Asian continent in general now has great opportunities for accelerated regional economic growth and development. As pointed out in Sect. 1.1, the geopolitical and economic rise of Asia gives rise to salient questions about the nature and the effects of rapid economic growth and development in this part of the world. In addition, given the contemporary significance of Asia, lessons learned about the nexuses between disease, human health, and the salutary impacts of healthy human beings on regional economic growth and development in Asia are likely to prove useful for the design and implementation of disease-targeting and health-enhancing policies in other parts of the world.

Given this state of affairs, our objective in this book is to demonstrate how regional economic growth and development can be promoted by effectively targeting diseases and, in the process, enhancing the health of the population in a variety of different regions within Asia. We have done so by providing analytic accounts of many of the pertinent research questions written by experts. These experts have great credibility because of two important reasons. First, they are active researchers themselves. Second, they are also some of the leading contemporary voices on public policy concerning the positive impacts of human health maintenance on regional growth and development in Asia.

In this introductory chapter, we have attempted to provide a holistic and coherent context within which one may view the emergence and the study of the different research questions that are dealt with here. In addition, a perusal of the individual chapters plainly demonstrates the significance and the policy relevance of the research questions that are analytically studied in this book. Consequently, in the coming years, one may look forward to many stimulating and policy-relevant developments concerning the trinity of disease, human health, and regional economic growth and development in Asia that are directly or indirectly related to the topics studied in this book.

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Part II
South Asia

Chapter 2
Food Consumption, Calorie Intake and Undernourishment in India: The Recent Evidence on Role of Welfare Schemes

Ranjan Ray and Kompal Sinha

Abstract This paper focusses attention on the spatial differences in food consumption in India, examines differences in the pattern of consumption of the main food items between the major states and between the rural and urban areas within each state and reports the implied rates of undernourishment based on the unit records from the most recent (68th) round of the National Sample Survey. The spatial comparisons are supplemented by comparisons between the female-headed households, those belonging to scheduled castes and tribes and the rest. The study also contributes to the recent discussions on the effectiveness of the public distribution system (PDS) and the midday meal scheme (MDMS) as targeted systems that are designed to enhance food security and the welfare of the poor. This study provides strong evidence in favour of the MDMS by showing that, in the rural areas, the 'prevalence of undernourishment' (POU) rates recorded by households that report participation in the MDMS are sharply lower than those that do not. The evidence in case of PDS is, however, much more mixed. Notwithstanding the change in food habits in India due to the fast-changing lifestyle brought about by a rapid pace of growth, the PDS items, rice and wheat, still provide a dominant share of the total calorie intake by the household. The paper also explores the likely impact of the universal basic income (UBI) recently favoured by several leading economists and concludes that more work is required before UBI is adopted.

Keywords Undernourishment · Public distribution system · Midday meals · Calories

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2.1 Introduction

There has generally been a mismatch between the macro indicators and several of the microeconomic welfare indicators in India. The positive performance on growth rates, increase in per capita income and decline in poverty rates stands in sharp contrast to India's record on child health, undernourishment, access to education, sanitation, etc. This extends to the spatial context within India as well. For example, during the period since the 1990s when significant economic reforms were undertaken in India, the country has recorded high-growth rates that withstood the Asian financial crisis in 1997 and the global financial crisis in 2008. Though there have been several years when the growth rate dipped, including recently following demonetisation and the introduction of the GST, India has recorded throughout the period since the early 1990s one of the highest growth rates in the world, second only to China. For example, in the latest Economic Survey (2018) tabled in the Indian Parliament recently, the growth rate has been predicted to increase to 7.5% in the second quarter of the year which, if it comes about, will make India the fastest growing country in the world overtaking China. While this has been accompanied by a steady decline in absolute poverty rates, however measured, India's performance on child health and undernourishment continues to be among the worst in the world. For example, Ray and Mishra (2012) have shown that on a bilateral comparison between the two countries, China outperforms India on both maternal and child health. This finding has been extended to the case of a trilateral comparison between China, India and Vietnam in Ray and Sinha (2015) who found that India records dismal performance on access to drinking water, electricity and literacy. This is accompanied by little progress on sanitation, and, as many have argued recently, the lack of toilet facilities and the widespread practice of open air defecation in India are contributing to her lack of progress on child health. It is perhaps significant, and somewhat disappointing, that the successive Economic Surveys of India omit any mention of the country's performance (or lack of it) on nutrition, health, access to basic amenities, etc. and give only a partial 'Economic Survey' of the past 12 months. The latest Economic Survey (2018) addresses this partially by including topics such as 'Gender and Son Meta-Preference' and 'Social Infrastructure, Employment and Human Development', which cover welfare issues relating to gender bias in schooling and employment that have not been covered in the past.

Probably, the greatest contradiction lies between India's performance on growth rates and most money metric indicators on one hand and her anthropometric indicators and access to basic amenities in living. The dissonance between macro indicators and anthropometric measures in India extends to the intra-country context. For example, Gujarat has been held as a 'model state' for recording high-growth rates and a sharp increase in its per capita income, and, yet, as Dreze has argued in an op-ed piece

(http://www.thehindu.com/opinion/op-ed/the-gujarat-muddle/article5896998.ece), this does not hold for Gujarat's performance in child health, nutrition and several other welfare indicators. More generally, Maitra and Ray (2013) have shown that there are significant spatial differences in child health in India and that such differences are not always consistent with differences in economic growth between the regions. Mishra and Ray (2011) have shown that the relatively affluent states in India do not all that well if we focus on inequality or food consumption alone.

The latter theme, namely, food consumption in India and its nutritional implications for calorie intake and undernourishment, is the subject matter of this paper. In India, the issue of calorie intake and calorie requirements has figured prominently in policy formulation since the poverty line was originally anchored on the cost of obtaining the minimum calorie requirements. While the poverty line was subsequently updated in line with inflation, the calorie basis of the poverty line was lost sight of in the successive experts committees' recommendations on setting the poverty line. Evidence on this is provided in Ray (2007) which documented the sharp differences between the poverty rates and undernourishment rates both in absolute magnitudes and in trend right across the major Indian states. Ray and Lancaster (2005) have provided evidence of how much out of step the official poverty line has become in relation to the poverty line that would have been adopted if one maintained the calorie basis of the original poverty line. In other words, the official poverty line is no longer able to buy the original quantum of calories specified as minimum calorie requirements. This has resulted in a divergence between the head count poverty rates and the rate of 'prevalence of undernutrition' with the latter measuring the proportion of households who cannot meet the calorie norm used to specify the original poverty line.

The delinking of the poverty line from the original calorie norm has been justified by some as reflecting the belief that the calorie requirements have come down over the years due to lower requirements of physical labour in various occupations. This type of criticism does not have much operational significance since, to our knowledge, no serious physiological study exists, at least in the Indian context that seeks to scientifically quantify and revise the calorie requirements over time. As Sen (2005:4612) argues, 'although it is true that both the population structure and the intensity of labour effort have changed for the population as a whole, there is no evidence to show that such is the case for the population around the poverty line'. A related defence of the delinking of the poverty line from the minimal calorie requirement is based on the claim that there is no evidence to show that reduced calorie intake by the individual leads to a decline in work effort and output. This is of course an odd argument since the idea behind a calorie norm-based poverty line was to ensure that the individual lives a healthy life and not how 'productive' that individual could be on the recommended nutritional intake. Though it is difficult to establish a causal relationship between nutritional intake and anthropometric outcomes, Maitra et al. (2013) have provided evidence based on NFHS data from India that is 'able to identify a co-movement of declining nutritional intake for both adults and children and a lack of progress in improving nutritional outcomes of children'.

The downplaying of the calorie basis of the poverty line changed recently with the recommendation of the Rangarajan Committee report on the poverty line that resurrected the link between the poverty line specification and the minimal calorie requirements, though in somewhat modified form. This provides the backdrop to the present study which revisits the link between food consumption and the implied calorie intake in India with attention paid to the spatial heterogeneity in food preferences and consumption between the different regions in India, especially between the rural and urban areas.

The main motivation of this chapter is fourfold: (a) provide evidence on differences in food consumption in India between the Indian states based on the latest NSS large sample round (NSS 68th round), (b) present the calorie intakes corresponding to the observed food consumption levels, (c) report the estimates of the 'prevalence of undernourishment' based on minimal calorie requirements recommended by the Indian Council of Medical Research and (d) provide evidence on the importance of the public distribution system (PDS) and the midday meals in helping the household to stay nourished and reduce the rates of undernourishment. With regard to (d), while Ray (2007) provided evidence on the former, namely, on the role of the PDS in reducing undernourishment in the earlier rounds (43and 57), this chapter updates that evidence for the most recent period covered by the 68th round of the NSS. Moreover, to our knowledge, this chapter is among the first to provide corresponding evidence for the midday meal scheme (MMDS) for each of the major states in India and separately for the rural and urban areas in each state. Previous studies on the effectiveness of the MDMS in improving child welfare include the studies by Afridi (2010) and more recently by Singh et al. (2013). Both these studies are conducted on the data set from a single region in India. While Afridi (2010) examines the nutritional impact of MDMS for schoolchildren in Madhya Pradesh based on a data set collected by the author for that study, Singh et al. (2013) examine the impact of MDMS on anthropometric indicators of children in Andhra Pradesh using the Young Lives data which is restricted to that state from South India. Note, also, that neither of these studies is based on a representative sample unlike the NSS that is used here.

Though the MDMS was launched in the mid-1990s, it became fully operational much later with the Supreme Court order on 28 November 2001, requiring all government schools and government-assisted primary schools to provide midday meals to the schoolchildren. This chapter also compares the record of the PDS and the MMDS in impacting on the undernourishment rates. The policy interest in our results stems from the questions that have been raised on the effectiveness of both the MDMS and the PDS in delivering the intended outcomes and whether they are reaching the targeted households. Critics of the MDMS have argued that the effectiveness of the MDMS in improving nutrition is hampered by (a) the content of the meals being hijacked by the manufacturers in favour of processed items that are nutritionally not that effective and (b) MDMS that leads to many households simply substituting money that they would have spent on meals at home in favour of spending on other items. Critics of the PDS have argued that corruption often leads to a large leakage in the supply of food grains from the Food Corporation of India

(FCI) godowns to the ration shops and that they are often diverted by some of the unscrupulous ration shop owners to the open market where they fetch a much higher price. The issue has recently acquired further importance with the introduction of Aadhaar cards and reports of denial of access to PDS and MDMS for failure to produce evidence of Aadhaar enrolment. While the focus of Ray (2007) was on both temporal and spatial comparisons of expenditure poverty and undernourishment rates in the Indian context, the current focus is entirely on the spatial comparison of the latter, i.e. undernourishment, between the major states in India and between the rural and urban areas within each state.

In the concluding part of this study, it uses counterfactual analysis to examine the effectiveness of the recently proposed 'universal basis income (UBI)' in increasing nutrient intake and reducing POU. The UBI 'is typically described as a new kind of welfare regime in which all citizens (or permanent residents) of a country receive a regular, liveable and unconditional sum of money, from the government. From that it follows, among other things, that there is no state requirement to work or to look for work in such a society. The payment is also, in such a pure basic income, totally independent of any other income.'[1] While the idea of UBI has a long history, it was mooted recently in the Indian context by a group of economists. This includes India's chief economic adviser, Arvind Subramanian, who raised the idea, in India's Economic Survey, 2016–2017, of paying every adult and child a 'basic income' unconditionally to cover their 'basic needs'. While the UBI idea is quite attractive, however, in the context of India with government resource constraint, the provision of an unconditional basic income to all, regardless of work or income status, must require curtailment of existing targeted transfer strategies such as MDMS and PDS. This raises the issue of comparison of the nutrient-enhancing effects of the MDMS and PDS vis-a-vis the UBI. That is what is attempted in the concluding part of this study. To do so, the UBI is set at a hypothetical value of 20% above the official poverty line. The examination of the UBI as an anti-undernutrition, and not just antipoverty, strategy consists of comparing the nutritional status of households below the poverty line (BPL) with those in the narrow band between the poverty line and 20% above the poverty line. The idea is that with a UBI, all BPL households will see an increase in their expenditure by 20% of the poverty line so that they will move from the former subgroup to the latter. For the purpose of this analysis, the poverty line was set at values recommended by the Tendulkar Committee, namely, a monthly per capita expenditure of Rs.1000 in urban and Rs. 816 in rural areas in 2011–2012.

The rest of the chapter is organised as follows. Section 2.2 contains a brief history on the poverty line in independent India and a critical review of the Rangarajan Committee report that has brought renewed attention to the link between calorie norm and the poverty line. Section 2.3 describes the NSS data sources used in this study and how the calorie, protein and fat intakes were constructed from the unit records on household consumption of the food items. Section 2.4 reports the results

[1] https://en.wikipedia.org/wiki/Basic_income

on the spatial differences in food consumption, calorie intake and undernourishment rates in India and the evidence on the comparative effectiveness of the PDS and MDMS in enhancing nutrition. Section 2.5 concludes the chapter.

2.2 The History of the Setting of Poverty Lines in India[2]

The recently released report of the Rangarajan Panel on poverty measurement has put the spotlight back on an issue which grabs media headlines periodically as one 'expert committee' after another releases a new set of poverty lines in India. The latest such committee, namely, the Rangarajan Expert Committee, was set up as a knee-jerk reaction to the adverse publicity generated by its predecessor, namely, the Tendulkar Expert Committee which proposed a new methodology for poverty measurement that generated a set of rural and urban poverty lines that was deemed to be too low. The Tendulkar Committee's recommendations would probably have been consigned to history without much fanfare but for an overzealous Planning Commission which made an affidavit to the Supreme Court in September 2011 that stated that households with per capita consumption of more than Rs 32 in urban areas and Rs 26 in rural will not be treated as poor. Such a claim was bound to be controversial since, to many people, this suggested restricting the subsidies such as the PDS offered to households below these lines. In a panic reaction to the media frenzy that followed, the then Planning Minister set up another expert committee in May 2012, barely a year after the Tendulkar Committee's report was made public, to revisit the issue of poverty measurement. After missing a few deadlines, the Rangarajan Committee finally submitted its report.

The history of expert groups can be traced back to 1962 when a working group was set up by the Planning Commission to devise a methodology of poverty estimation. This was followed by the setting up of a 'Task Force' in 1977 under the chairmanship of Dr. Y K Alagh. This committee provided for the first time poverty lines anchored to minimum nutritional requirements, namely, 2400 daily kcals in rural areas and 2100 daily kcals in urban areas. This was a modification to the results of Dandekar and Rath who in 1971 formed the view, based on NSS data from 1960 to 1961, that the minimum calorie requirements were 2250 daily kcals in both rural and urban areas and can be achieved by households with annual per capita expenditure of Rs. 170.80 in rural and Rs. 271.60 in urban areas. The next committee, the first of three 'expert committees', that was set up under the chairmanship of D T Lakdawala submitted its report in 1993. While sticking to the idea of poverty lines based on minimum nutritional requirements, this committee suggested that state-specific poverty lines should be constructed and these should be updated using the Consumer Price Index of Industrial Workers (CPI-IW) in urban areas and

[2]This section is based on Ray and Sinha (2014). The reader is referred to that article for a more detailed exposition.

Consumer Price Index of Agricultural Labour (CPI-AL) in rural areas. There was no attempt to take note of changing food preferences, nor whether the updated poverty lines were sufficient to buy the originally specified calorie requirements in the rural and urban areas. Consequently, large divergences opened up between the poverty rates calculated by 'direct' method on the basis of actual calorie intakes vis-a-vis the minimum requirements and the 'indirect' method based on per capita expenditures vis-a-vis the periodically updated poverty lines[3] [see, e.g. Patnaik (2004), Ray and Lancaster (2005), Ray (2007)]. Consequently, while the former, referred to as 'prevalence of undernourishment' (POU) rates increased, the latter (the expenditure-based poverty rates, POV) declined. As Ray (2007) documented, for example, a significant percentage of households above the expenditure-based poverty line were unable to meet the minimum calorie requirements. This called into question the practice of defining a 'poor household' solely on the basis of its per capita monthly expenditure vis-a-vis a poverty line expenditure cut-off without considering the household's access to a wide set of dimensions on which there is information available in India today, some in the NSS itself. While debate rages between economists as to which is the 'correct' approach, the rates of 'stunted' and 'wasted' children in India refused to show much improvements unlike in other Asian countries such as China and Vietnam [Ray and Sinha (2015)].

The next expert committee, set up under the chairmanship of Prof S Tendulkar, submitted its report in 2009. The Tendulkar Committee is significant in at least two respects both of which marked retrograde movements from the work of the previous task force/expert committees. It delinked poverty lines from calorie requirements disowning the body of work that can be traced back to Dandekar and Rath and even earlier. Moreover, it abandoned the practice of using two separate poverty line baskets for deriving rural and urban poverty lines. It used the all-India urban poverty line basket to derive state level rural and urban poverty lines. The methodology adopted by the Tendulkar Expert Committee constituted another radical departure in that it started with an 'acceptable' all-India urban poverty rate of 25.7% in 2004–2005 and worked backwards in specifying poverty lines that generated such a poverty rate. This is the very reverse of the universal practice of first specifying poverty lines and then working out the poverty rates. It is against this background that the latest expert committee was set up under the chairmanship of Dr. C. Rangarajan barely a couple of years after the Tendulkar Committee submitted its report.

The poverty line proposed by the Rangarajan Committee has three components: (a) the food poverty line that is based on the 'average' requirements of calories, fat and protein; (b) normative requirements of the basic non-food expenses of clothing, housing, mobility and education based on the median fractile values; and (c) observed other non-food expenses of the 'fractile classes that meet the nutrition requirements'.

[3]See Saith (2005) for a critique of an exclusive reliance on a one-dimensional poverty line for identifying the poor.

The restoration of the link of the poverty line with calorie norms marks a positive move forward, though no justification has been provided for sharply reducing the rural daily calorie requirement from 2400 kcals to 2155 kcals. Since Ray (2007) has shown that many of those not meeting their daily calorie requirements in rural India are quite close to the 2400 kcal level, the lowering of the calorie requirements by around 10% may have led to a significant understatement of poverty. It is also not clear either why the Committee ignored micronutrient requirements especially, because, in India iron deficiency is a significant cause for anaemia and maternal ill health. The report's claim that nutritional deficiency has no effect on a child's health is contradicted by Indian evidence provided in Maitra et al. (2013). A policy implication of the results in this study is the need to provide mothers with young children extra dietary assistance to prevent their ill health from being transmitted to their off springs, as aspect that needs to be recognised in the poverty line calculations. Another implication is the need to draw separate poverty lines for families differing in size and composition, as they do in the USA. For example, smaller families, such as female-headed households, do not enjoy the benefits of economies of scale that are experienced by the larger households. The Rangarajan Committee ignores the issue altogether.

2.3 Data Sources

This study uses detailed information on household consumption and expenditure on a food and non-food items, household size, composition and other household characteristics contained in the unit records from NSS 68th Round (July 2011–July 2012) of India's National Sample Survey. This is a thick round based on a sample of 101,651 households from India. This survey collects information on consumption and expenditure on around 170 food items based on a combination of 30-day recall and 7-day recall period for all items.

The nutrient consumption information used here is not available in the NSS data sets. The present analysis uses total consumption quantity for computing the total monthly intake of calorie, protein and fat for each food item by using the food nutrient conversion norms based on 'Nutritive Values of Indian Foods' by C. Gopalan and co-authors (Gopalan et al. 1980, 1993). This household level calorie consumption information is thereby used to obtain the nutritional status of household using the official poverty line of 2100Kcal per capita consumption in urban areas and 2400Kcal per capita consumption in Rural areas. The household size deflator to obtain 'per capita' values is corrected for the household's demographic composition by using adult male equivalence scales. The scaling factor considers an adult female to be equivalent to 0.8 of an adult male and a child to be equivalent to 0.5 of an adult male. Therefore, a family with 1 male, 1 female and 2 children will have an adult male equivalent household size of 2.8 adult males.

In addition to being the only nationally representative data set for household level consumption and expenditure in India, there are some unique features of the 68th

National Sample Survey which we will be using in our analysis, namely, individual level information on source of meals consumed outside home; the source of acquiring food consumed by the household, i.e. whether home grown, purchased from market or from subsidised shop; and demographic characteristics of household members and their social status. Details of how we use these features are as follows:

The survey collects person-wise information on consumed breakup of meals taken during the year, number of meals taken during the last 30 days, number of meals taken away from home, number of meals purchased, number of meals prepared at home and number of meals taken free of cost from employer, free of cost from school, Balwadi, employer or others. The present analysis uses this information to analyse the effect of India's midday meal program (MDMS) on calorie consumption. We make use of this information in the context of school-aged children by separating households into midday meal households (MDMS) and non-midday meal households (non-MDMS). For the analysis in this chapter, we only consider households with children in school-going age. Using individual level information of meals source, we categorised a household as a midday meal consuming household if any member of the household reported having meals at schools; otherwise it was a non-MDMS household.

The Public Distribution Scheme (PDS) is the largest food safety net program anywhere that supplies food grains to poor households at subsidised prices. The NSS records consumption of food commodities by source of consumption – whether it was home grown or purchased from the market or from a PDS shop. Using this information, for our analysis, we separate the households into PDS households and non-PDS households. If a household reports purchasing food item from a PDS shop, it is called a PDS household, and if a household does not report consuming food item from a PDS shop, it is called a non-PDS household.

The other subgroups considered for comparison between themselves are 'non-female-headed and female-headed households' and 'scheduled caste/scheduled tribe (SC/ST) and non-SC/ST households'. In the instance that information on the gender of household head or the caste status or information on midday meal at school is missing for a household or households do not have school-aged children, that household is removed from the sample. The sample of remaining households is analysed under the column heading 'All' in all tables.

2.4 Food Consumption, Calorie Shares and Rates of Undernourishment

2.4.1 Regional Differences in the Pattern of Food Consumption

The estimated monthly per capita food consumption in the major states in India in NSS round 68 is presented in Tables 2.1 (Rural) and 2.2 (Urban). The sharp regional

heterogeneity in the pattern of food consumption is evident from these tables. The southern states such as Andhra Pradesh and Tamil Nadu and eastern states such as Assam, Orissa and West Bengal record much higher levels of rice consumption and lower levels of wheat consumption than the western states such as Gujarat, Rajasthan and Maharashtra. Note, however, that there is no generalised North-South divide in this pattern, for example, Jammu and Kashmir in the north records much higher level of rice consumption than many of the western and southern states. The same observation holds for rural Jharkhand and rural Chattisgarh. In contrast, there is no evidence of significant rural-urban heterogeneity in food consumption in each state. A comparison between Tables 2.1 and 2.2 fails to establish any systematic pattern of rural-urban differences in food consumption that hold for all states. The magnitude of rural-urban difference is not that large for any item, especially the smaller food items. There is weak evidence in favour of greater consumption of rice in the rural areas though this is not true for each state. Table 2.3, which reports the food consumption and expenditure shares, at the all-India level does not reveal any large or systematic rural-urban difference in the pattern of food consumption. The only observation that is worth making is that in both quantity terms and in expenditure share, rice is more important in the food basket of the rural consumer than the urban. It should be noted, however, that the food quantities recorded in the NSS, especially for Rice, in the rural areas are probably an underestimate of consumption due to the possibility of consumption out of own production that does not exist in the urban areas. The figures on the composition of the cereal items between rice and wheat presented in Table 2.4 do not reveal much rural-urban heterogeneity either, but this is not true for 'other cereals' which record a much greater share in the rural areas.

2.4.2 Calorie Shares of the Food items

Table 2.5 reports the calorie share of the various food items in the rural and urban areas. The rural-urban heterogeneity in case of the calorie share of rice is now quite evident with this item recording a higher share in the rural areas, though this heterogeneity weakens in case of the other food items. Table 2.5 shows that rice is an important source of calories in the rural areas with nearly a third of total calorie intake coming from rice alone. The split in the calorie share between rice and wheat is much more even in the urban areas. Both areas agree that, together, rice and wheat are the dominant source of calorie intake, with over 50% of the calories coming from these two items alone. Since PDS is the source of subsidised rice and wheat provided by the ration shops, this points to the importance of the PDS in helping the household meet the minimal calorie requirements. We provide direct evidence on this issue in the following section.

Table 2.6 shows how for the total intake of calories for each item is spread between the households in the three expenditure percentiles. A few interesting observations can be made from these numbers. First, the spread of the distribution

Table 2.1 Per capita food consumption (kg/30 days) in rural areas (NSS 68th round)

State	Rice	Wheat	Other cereals	Pulses and products	Dairy	Edible oil	Meat, fish and egg	Vegetables	Fruits	Salt	Sugar and spices	Dry fruits
Andhra Pradesh	12.32	0.91	2.55	0.71	8.86	1.93	1.21	1.75	0.85	0.74	0.31	0.43
Assam	13.93	1.27	1.13	0.68	4.57	1.45	1.52	2.61	1.50	0.77	0.35	0.43
Bihar	9.03	7.71	1.81	0.79	12.53	1.60	1.94	3.89	1.92	0.81	0.35	0.35
Chattisgarh	16.52	2.67	1.50	0.91	6.73	1.71	1.68	2.51	0.87	0.80	0.40	0.56
Gujarat	3.28	6.42	7.36	0.58	11.58	2.91	1.46	1.88	1.41	0.53	0.43	0.55
Haryana	2.22	16.86	2.46	0.44	30.72	1.47	1.79	3.19	2.33	0.64	0.88	1.15
Himachal Pradesh	6.95	6.92	5.93	0.62	20.56	1.44	1.43	2.58	1.42	0.55	0.55	0.63
Jammu and Kashmir	16.78	5.58	7.12	0.55	17.28	2.29	1.85	3.32	2.00	0.97	0.56	0.76
Jharkhand	13.69	5.85	2.62	0.69	10.35	1.35	1.92	3.33	1.98	0.74	0.31	0.32
Karnataka	6.11	1.37	6.92	0.52	8.63	1.84	1.84	1.42	0.52	0.72	0.35	0.47
Kerala	8.97	1.19	2.22	0.46	6.34	1.26	3.85	1.37	0.84	0.61	0.38	0.43
Madhya Pradesh	4.64	14.62	4.31	0.80	11.82	1.77	1.24	2.24	1.38	0.68	0.51	0.53
Maharastra	4.56	5.85	3.49	0.60	8.18	2.56	1.32	1.60	1.03	0.60	0.53	0.74
Orissa	13.09	1.77	1.91	0.65	5.45	1.00	1.54	2.42	1.03	0.79	0.25	0.42
Punjab	2.39	12.54	1.77	0.45	26.35	1.66	1.21	3.14	2.16	0.56	1.02	1.14
Rajasthan	1.18	18.72	12.87	0.49	18.96	1.82	1.78	2.32	2.00	0.76	0.69	0.99
Tamil Nadu	10.99	1.03	1.62	0.52	9.77	1.32	1.42	1.29	0.48	0.76	0.29	0.48
Uttar Pradesh	10.27	11.43	2.55	0.81	17.27	1.73	1.65	3.15	2.89	0.65	0.52	0.55
Uttaranchal	8.95	7.57	2.61	0.55	17.69	1.92	1.12	3.01	1.65	0.55	0.56	0.58
West Bengal	11.98	2.53	1.37	0.55	5.28	1.66	1.59	2.92	1.27	0.80	0.30	0.41

Table 2.2 Per capita food consumption (kg/30 days) in urban areas (NSS 68th round)

State	Rice	Wheat	Other cereals	Pulses and products	Dairy	Edible oil	Meat, fish and egg	Vegetables	Fruits	Salt	Sugar and spices	Dry fruits
Andhra Pradesh	11.40	1.18	1.57	0.67	9.16	1.99	1.10	1.68	0.93	0.69	0.31	0.41
Assam	13.04	1.43	0.55	0.66	3.79	1.58	1.48	2.34	1.04	0.72	0.35	0.35
Bihar	8.25	7.13	1.44	0.76	11.46	1.64	1.72	3.67	1.89	0.75	0.35	0.37
Chattisgarh	12.09	3.58	0.97	0.92	8.32	2.00	1.73	2.68	1.26	0.79	0.44	0.47
Gujarat	2.41	6.10	2.78	0.49	9.20	3.12	1.26	1.83	1.43	0.49	0.41	0.45
Haryana	2.76	10.27	1.13	0.42	15.77	1.61	0.90	3.08	2.42	0.59	0.70	0.82
Himachal Pradesh	6.73	5.79	3.92	0.60	10.92	1.44	1.37	2.56	1.45	0.50	0.53	0.65
Jammu and Kashmir	16.82	5.08	2.94	0.51	13.42	2.38	1.90	3.22	1.78	0.83	0.52	0.65
Jharkhand	9.23	5.74	1.56	0.68	10.54	1.52	1.95	3.14	1.81	0.71	0.35	0.44
Karnataka	6.04	1.48	4.62	0.50	8.01	1.97	1.67	1.41	0.66	0.68	0.34	0.42
Kerala	8.79	1.24	1.56	0.48	6.29	1.35	3.86	1.41	0.84	0.62	0.39	0.42
Madhya Pradesh	3.77	10.47	1.02	0.76	9.20	2.03	1.21	2.16	1.62	0.65	0.51	0.46
Maharastra	4.12	4.90	2.02	0.58	8.31	2.60	1.40	1.58	1.11	0.57	0.48	0.61
Orissa	10.43	2.31	0.77	0.72	6.95	1.19	1.53	2.32	0.86	0.73	0.27	0.40
Punjab	3.05	9.80	1.40	0.44	18.06	1.65	1.13	2.89	2.06	0.54	0.78	0.90
Rajasthan	1.57	13.03	4.18	0.42	13.04	1.99	1.31	2.24	2.00	0.68	0.61	0.80
Tamil Nadu	10.10	1.11	1.13	0.51	9.39	1.36	1.28	1.27	0.54	0.69	0.29	0.43
Uttar Pradesh	7.43	7.92	0.96	0.66	12.03	1.77	1.58	2.84	2.23	0.59	0.50	0.51
Uttaranchal	8.42	6.39	1.03	0.49	10.09	1.88	1.37	2.70	2.05	0.54	0.53	0.58
West Bengal	7.62	2.67	1.31	0.47	4.34	1.68	1.63	2.40	0.91	0.66	0.30	0.26

Table 2.3 All-India mean consumption and expenditure share

Food item	NSS 68	
Consumption/capita (kg/30 days)	Urban	Rural
Rice	8.74	10.85
Wheat	4.74	6.11
Other cereals	2.30	4.44
Pulses and prod	0.57	0.63
Dairy	9.28	11.79
Edible oil	1.85	1.68
Meat, fish and egg	1.75	1.84
Vegetables	2.17	2.45
Fruits	1.21	1.31
Sugar and spices	0.42	0.43
Beverages	1.09	0.84
Processed	0.36	0.28
Dry fruits	0.51	0.59
Share of total food expenditure (%)		
Rice	24.97%	25.09%
Wheat	13.54%	14.14%
Other cereals	6.58%	10.26%
Pulses and prod	1.62%	1.45%
Dairy	26.54%	27.26%
Edible oil	5.28%	3.89%
Meat, fish and egg	5.01%	4.25%
Vegetables	6.20%	5.67%
Fruits	3.46%	3.03%
Sugar and spices	1.19%	0.99%
Beverages	3.11%	1.94%
Processed	1.03%	0.66%
Dry fruits	1.46%	1.37%

Table 2.4 Composition of cereals consumption in quantity and expenditure terms (%) NSS 68

	Quantity	
Cereal item	Urban	Rural
Rice	47.11%	46.1%
Wheat	49.43%	47.6%
Other cereals	3.46%	6.3%
	Expenditure	
	Urban	Rural
Rice	53.91%	51.98%
Wheat	42.03%	41.32%
Other cereals	4.07%	6.70%

Table 2.5 Calorie share (%) of various food items NSS 68

NSS round	Rice	Wheat	Other cereals	Pulses and prod	Dairy	Edible oil	Meat, fish and egg	Vegetables	Fruits	Sugar and spices	Beverages	Processed	Dry fruits
Rural	35.11%	24.49%	3.54%	4.70%	8.57%	10.24%	1.06%	5.24%	0.56%	5.52%	0.03%	0.01%	0.95%
Urban	28.97%	26.14%	1.79%	5.29%	10.25%	12.71%	1.24%	5.44%	0.77%	6.01%	0.07%	0.01%	1.30%

Table 2.6 Calorie share (%) of various food items by expenditure class in NSS 68th round

Sector	MPCE group	Rice	Wheat	Other cereals	Pulses and prod	Dairy	Edible oil	Meat, fish and egg	Vegetables	Fruits	Sugar and spices	Beverages	Processed	Dry fruits
Rural	Bottom 30%	44.94%	39.22%	32.67%	33.76%	21.75%	32.57%	24.62%	40.50%	22.35%	29.76%	6.46%	37.51%	16.90%
	Middle 30%	31.17%	33.08%	39.24%	33.12%	32.92%	34.13%	32.26%	31.74%	30.79%	33.60%	20.45%	31.33%	35.74%
	Top 30%	23.89%	27.70%	28.09%	33.11%	45.33%	33.30%	43.12%	27.76%	46.85%	36.65%	73.09%	31.16%	47.36%
Urban	Bottom 30%	45.94%	43.37%	42.36%	35.87%	24.42%	34.90%	28.38%	39.27%	20.00%	35.06%	6.87%	30.19%	22.70%
	Middle 30%	31.58%	32.61%	33.79%	33.46%	35.26%	34.21%	33.51%	32.45%	33.42%	34.49%	25.15%	29.04%	35.14%
	Top 30%	22.48%	24.02%	23.85%	30.67%	40.32%	30.89%	38.11%	28.28%	46.58%	30.45%	67.97%	40.77%	42.17%

of calories is quite uneven for both rice and wheat with the ultra-poor consuming nearly two fifths of the total calories supplied by both rice and wheat. The share drops to just over a fifth for the relatively affluent households. This is further indication of the importance of the PDS in providing subsidised rice and wheat to the poor. Second, and in sharp contrast, the distribution of calories in case of meat, fish and eggs and fruits is skewed in favour of the more affluent households. Third, a particularly interesting case is that of beverages where the rich consume the dominant share of total calories supplied by this item. This is true in both the rural and urban areas. Since the quality of calories supplied by beverages is likely to be inferior to that supplied by the other items, this result points to the problem of obesity that is becoming quite a significant issue in India. In fact, the large share of the poor households in the total calories supplied by sugar and spices and processed foods suggests that the issue of obesity and related health problems due to changing food preferences is not restricted to the affluent households alone. As the country records high-growth rates, and the incomes of the middle income and the richer households increase, there is a tendency on the part of these households to follow the lifestyles of the developed countries. The poor tend to do likewise by following the changing food habits of the affluent households, and the 'imitation' effect spreads across the whole economy. This largely explains the increase in the 'price of calories' over time noted in Ray and Lancaster (2005) as the dietary habits shift towards items that are more expensive sources of calories unlike the traditional calorie sources such as rice and wheat and other cereal items. India, thus, suffers from the twin problem of undernourishment leading to 'stunted' and 'wasted' children on one hand and unhealthy food habits leading to obesity and heart problems on the other. There is need for government action to alleviate both sets of problems, though the nature of the policies will need to be quite different in the two cases.

2.4.3 Prevalence of Undernutrition (POU)

Table 2.7 (rural) and Table 2.8 (urban) report the rates of undernourishment (POU) implied by the calorie intakes from the quantities of the consumption of the various food items reported in Tables 2.1 and 2.2. The POU rates in these two tables refer to households that are unable to meet the minimal daily calorie requirements, namely, 2400 kcals in the rural areas and 2100 kcals in the urban areas. The POU rates reported in Tables 2.7 and 2.8 are in line with the poverty rates in India. In 2012, the Indian government stated that **22%** of its population is below its official poverty line. The World Bank estimated that in 2011, **23.6%** of Indian population, or about 276 million people, lived below **$1.25 per day** on purchasing power parity of the Rupee. The rural POU rates are somewhat higher than the urban POU rates which are in line with the fact that rural poverty is higher than urban poverty.

Note, however, that this apparent agreement at the all-India level between the traditional poverty statistics and the POU rates that we have calculated does not hold

Table 2.7 Percentage of rural households undernourished in NSS 68th round

		Meals at school		Household head		SC/ST		PDS	
State	POU[a]	Non-MDMS	MDMS	Non-female head	Female head	Non-SC/ST	SC/ST	Non-PDS	PDS
Andhra Pradesh	23.67%	25.50%	19.67%	23.97%	14.06%	19.95%	24.47%	30.13%	22.89%
Assam	24.63%	30.45%	12.82%	24.70%	20.00%	21.51%	27.17%	23.04%	25.15%
Bihar	13.76%	17.87%	7.43%	13.95%	5.56%	12.72%	14.06%	12.18%	16.47%
Chattisgarh	23.67%	29.08%	19.40%	23.62%	26.32%	25.40%	23.55%	23.11%	24.11%
Gujarat	30.55%	35.44%	20.39%	30.76%	14.29%	31.28%	30.37%	29.36%	33.05%
Haryana	12.98%	12.90%	13.33%	13.04%	10.00%	10.24%	14.97%	11.01%	20.19%
Himachal Pradesh	7.16%	10.56%	3.81%	7.45%	0.00%	6.80%	7.50%	14.29%	6.88%
Jharkhand	20.02%	28.35%	14.29%	20.24%	8.33%	19.71%	20.05%	18.87%	22.36%
Karnataka	36.76%	41.06%	32.62%	37.28%	16.67%	46.03%	34.29%	35.76%	37.14%
Kerala	46.83%	47.77%	44.21%	48.68%	25.00%	39.66%	49.21%	39.16%	48.55%
Madhya Pradesh	22.00%	25.34%	17.67%	21.83%	33.33%	19.64%	22.46%	20.55%	24.43%
Maharashtra	24.06%	28.92%	18.30%	24.06%	23.81%	18.89%	26.91%	20.34%	28.81%
Orissa	24.43%	30.51%	18.93%	24.76%	8.33%	22.99%	24.79%	23.63%	24.91%
Punjab	14.14%	14.48%	13.33%	14.12%	15.00%	6.52%	19.54%	11.79%	21.16%
Rajasthan	12.32%	12.69%	11.65%	12.60%	2.08%	9.85%	12.76%	11.15%	15.57%
Tamil Nadu	44.10%	46.09%	39.01%	44.63%	23.81%	53.57%	43.94%	58.97%	43.74%
Uttar Pradesh	12.60%	14.73%	7.03%	12.76%	3.70%	10.19%	13.17%	12.03%	14.07%
Uttaranchal	8.43%	10.24%	6.63%	8.44%	8.33%	8.13%	8.91%	5.88%	8.72%
West Bengal	26.47%	34.07%	18.61%	26.68%	16.28%	24.37%	29.06%	24.74%	28.31%
All India	26.47%	26.11%	17.85%	22.82%	14.47%	21.44%	23.54%	22.42%	24.55%

[a]In the instance that information on the gender of household head or the caste status or information on midday meal at school is missing for a household or households do not have school-aged children, that household is removed from the sample

Table 2.8 Percentage of urban households undernourished in NSS 68th round

		Meals at school		Household head		SC/ST		PDS	
State	POU[a]	Non-MDMS	MDMS	Non-female	Female head	Non-SC/ST	SC/ST	Non-PDS	PDS
Andhra Pradesh	18.08%	16.54%	29.35%	16.63%	54.24%	15.31%	19.47%	19.66%	16.91%
Assam	18.16%	18.81%	15.69%	16.53%	61.11%	17.96%	18.37%	18.58%	17.72%
Bihar	8.75%	9.30%	6.67%	8.60%	15.79%	8.27%	8.94%	9.15%	7.75%
Chattisgarh	16.04%	17.05%	13.43%	14.90%	47.06%	11.30%	17.53%	19.63%	11.43%
Gujarat	19.87%	19.91%	19.54%	19.94%	15.38%	17.41%	22.11%	19.24%	25.53%
Haryana	9.01%	8.87%	11.43%	8.72%	23.08%	7.02%	11.37%	6.99%	20.62%
Himachal Pradesh	6.81%	5.10%	14.71%	6.74%	7.69%	6.11%	8.33%	5.36%	7.41%
Jharkhand	17.12%	18.37%	13.01%	17.69%	0.00%	14.65%	17.95%	16.31%	23.88%
Karnataka	23.31%	23.28%	23.39%	22.41%	59.26%	20.69%	24.24%	23.62%	23.01%
Kerala	36.97%	35.21%	43.85%	38.08%	21.31%	36.00%	37.24%	30.24%	39.46%
Madhya Pradesh	13.69%	13.06%	17.10%	13.43%	25.00%	13.58%	13.77%	12.93%	15.57%
Maharashtra	18.01%	20.30%	9.27%	18.11%	13.33%	17.35%	18.65%	17.98%	18.14%
Orissa	16.84%	16.54%	17.46%	15.28%	63.16%	16.49%	17.01%	16.34%	17.65%
Punjab	10.71%	10.33%	14.12%	10.31%	24.00%	8.93%	12.76%	10.35%	13.21%
Rajasthan	9.35%	9.79%	5.71%	9.27%	12.50%	8.36%	9.87%	8.90%	11.11%
Tamil Nadu	29.66%	29.72%	29.36%	29.72%	28.07%	30.88%	29.61%	51.13%	27.68%
Uttar Pradesh	9.88%	9.91%	9.59%	10.08%	1.96%	8.96%	10.34%	9.05%	12.74%
Uttaranchal	4.73%	5.05%	2.94%	4.95%	0.00%	3.97%	5.99%	6.38%	3.96%
West Bengal	24.31%	26.26%	16.91%	24.03%	31.91%	24.61%	23.71%	23.78%	25.55%
All India	16.38%	16.49%	16.50%	16.07%	26.57%	15.15%	17.22%	17.14%	17.86%

[a]In the instance that information on the gender of household head or the caste status or information on midday meal at school is missing for a household or households do not have school-aged children, that household is removed from the sample

at the state level. Inspection of the figures presented in the first column of numbers in Tables 2.7 and 2.8 reveals a surprising finding. The affluent states such as Gujarat and Tamil Nadu record POU rates that are higher than those in the less affluent states such as Bihar. There is considerable heterogeneity in the POU rates between the states. There is a certain irony in these results. Gujarat is held up as a 'model state' by the 'right', while Kerala and, more recently, Tamil Nadu are given as examples of 'model state' by the 'left', but all of them record high rates of undernourishment in these tables.

Columns 2 and 3 in Tables 2.7 and 2.8 record the impact of the midday meals in alleviating undernutrition in the rural areas (Table 2.7) and in the urban areas (Table 2.8). The evidence in favour of the MDMS as an important vehicle in improving the nutritional status of households with children is quite mixed, recording impressive reduction in some states, much less in others. The average figures over all the 19 states reported in the last row in Tables 2.7 and 2.8 show, while MDMS reduces the POU rate quite sharply in the rural areas, there is hardly any change in the urban. The rural evidence is consistent with the evidence in Afridi (2011) for Madhya Pradesh and Singh et al. (2013) for Andhra Pradesh. The last two columns in Tables 2.7 and 2.8 provide corresponding evidence on the role of the PDS in alleviating undernutrition. Like the MDMS, the evidence on PDS is mixed with some states recording significant reduction in POU, while in many cases, the non-PDS households are better nourished than the PDS households. The latter may simply be reflecting the fact that more affluent households are turning away from the PDS in favour of the open market. It is probably safe to say from Table 2.7 that in the rural areas where the bulk of the poor and undernourished households live, MDMS plays a stronger role than the PDS in enhancing nutritional status. Note that, unlike the MDMS, the PDS is a targeted welfare scheme targeting the BPL households, and this limits its effectiveness in reducing the POU rates, given that it doesn't reach many undernourished households who happen to be APL (above the poverty line). This is evident from the fact that in the southern state of Tamil Nadu which has 100% coverage of the PDS and not restricted to BPL households, the POU rates for the PDS households are sharply lower. This is true in both rural and urban areas of Tamil Nadu. Another state that, from Table 2.7, records a sharp decline in POU from non PDS to PDS households is Andhra Pradesh. Though it operates a targeted PDS, a report in the Indian Express dated 2 March 2018 notes that the government has digitised 'the targeted public distribution system, from tracking the stocks that reach the fair price shops to how much quantity a consumer has bought.... in all the 13 districts of Andhra Pradesh, people who rely on ration card supplies to cook daily meals, can access their allotted rice, sugar, daal and wheat flour with an assurance of transparency'. In contrast, in the more affluent state of Gujarat, and the much poorer state of Bihar both of which implement a targeted PDS scheme, the reverse is the case. In other words, many households that need nutrient-enhancing schemes are shut out of the PDS. The MDMS is, however, not a targeted scheme based on the BPL/APL divide, and its effectiveness is therefore much greater, though it is restricted to households with school-going children.

Table 2.9 Average per capita monthly nutrient consumption in rural households in NSS 68th round (2011–2012)

	Calorie		Protein		Fat	
State	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.
Andhra Pradesh	64,526	62,297	1642	1565	1387	1248
Assam	61,090	59,519	1565	1501	860	772
Bihar	65,733	63,557	1874	1805	1204	1069
Chattisgarh	61,613	59,441	1488	1420	935	817
Gujarat	58,357	55,982	1542	1471	1891	1783
Haryana	69,535	66,457	2115	1978	1995	1813
Himachal Pradesh	77,324	72,514	2268	2132	2017	1712
Jharkhand	59,630	59,379	1551	1517	885	756
Karnataka	57,509	55,309	1524	1436	1293	1203
Kerala	54,283	51,493	1661	1522	1057	934
Madhya Pradesh	64,143	60,905	1896	1805	1338	1191
Maharashtra	63,244	61,156	1710	1648	1777	1628
Orissa	62,098	60,950	1513	1471	734	644
Punjab	70,716	67,880	2042	1930	2121	1954
Rajasthan	68,203	64,760	2074	1977	1825	1632
Tamil Nadu	55,426	53,552	1477	1404	1138	1031
Uttar Pradesh	64,162	61,543	1844	1758	1296	1143
Uttaranchal	73,821	70,566	2067	1986	1747	1608
West Bengal	61,359	58,777	1553	1469	1024	906
All India	63,830	61,370	1758	1673	1396	1255

The remaining columns compare the POU rates between the female-headed households and the male-headed households and that between the SC/ST households and the others. The evidence on household head is quite contradictory between the rural and urban areas. In the former (rural), the female-headed household is better nourished than the male-headed household; the reverse is generally the case in the latter (urban). Tables 2.7 and 2.8 provide some evidence, though not a strong one, that SC/ST households experience higher undernourishment than the rest of the population.

Tables 2.9 and 2.10 report the monthly intake (with standard errors) of calories, protein and fat by states in the rural and urban areas, respectively, corresponding to the state-wise figures on monthly food consumption reported in Tables 2.1 and 2.2. If one recalls the daily minimal calorie requirements of 2400 kcals (rural) and 2100 kcals (urban) that translate to monthly requirements of 72,000 kcals (rural) and 63,000 kcals (urban), it is significant that the 'average household' was not meeting these requirements in several states in the most recent round of the NSS. Tables 2.9 and 2.10 also show marked variation between states in the calorie intakes ranging from a 'high' intake of 77,324 in rural Himachal Pradesh to a 'low' intake of 54,283 in rural Kerala. Table 2.10 records evidence of similar variation in the urban areas. Tables 2.9 and 2.10 also record evidence of variation in the protein and fat content of

Table 2.10 Average per capita monthly nutrient consumption in urban households in NSS 68th round (2011–2012)

	Calorie		Protein		Fat	
State	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.
Andhra Pradesh	59,507	59,102	1539	210,515	1506	1351
Assam	59,528	58,973	1540	237,654	1482	937
Bihar	64,608	62,228	1823	299,718	1745	1138
Chattisgarh	61,607	59,915	1587	261,854	1505	1061
Gujarat	59,477	57,813	1534	228,240	1515	2026
Haryana	66,818	63,915	1929	272,666	1857	1931
Himachal Pradesh	71,456	71,591	2089	231,726	2074	1856
Jharkhand	61,647	60,644	1721	258,294	1669	1105
Karnataka	54,991	54,570	1477	225,064	1434	1319
Kerala	54,056	50,125	1690	194,613	1521	975
Madhya Pradesh	63,010	60,836	1809	259,618	1748	1429
Maharashtra	59,049	58,588	1643	242,561	1619	1756
Orissa	58,651	59,087	1513	228,127	1469	804
Punjab	66,047	63,717	1898	266,422	1815	1922
Rajasthan	64,928	63,590	1901	275,967	1843	1792
Tamil Nadu	51,881	52,596	1401	184,388	1399	1151
Uttar Pradesh	62,482	59,666	1796	288,524	1717	1334
Uttaranchal	70,342	69,389	1973	288,203	1936	1653
West Bengal	56,281	55,992	1510	205,672	1487	1189
All India	61,388	60,123	1704	245,254	1650	1407

the dietary habits between states, though the variation is less than that of calories. Note, incidentally, that there is evidence of a weak correlation between calorie, protein and fat intakes.

Further evidence on the effectiveness of the MDMS is provided in Tables 2.11 and 2.12 which compare the intakes of calorie, protein and fat between households that report some participation in MDMS and those that do not. One can see that the MDMS is associated with higher intake of calorie, protein and fat in nearly all the states, with the size of the increase varying between states. There is no obvious regional pattern in the size of the effect of MDMS on the intakes. It is also worth noting that in nearly all the states, the MDMS seems to be more effective as a nutrient-enhancing program in the urban areas compared to the rural, with the size of the increase in intake recording much higher magnitudes in the former. The apparent inconsistency with the overall picture from Tables 2.7 and 2.8 can be explained by the fact that in view of the higher POU rates in the rural areas with a large number of households at the POU cut-off, a smaller increase in the calorie intake in the rural areas can lead to large reductions in POU compared to the urban areas. Taken together, the results underline the positive role that the MDMS is playing in enhancing intakes of the principal nutrients even though it is not always showing up in sharp reductions to the POU rates.

Table 2.11 Average per capita monthly nutrient consumption for MDMS and non-MDMS rural households – NSS 68th round (2011–2012)

	Calorie		Protein		Fat	
State	Non-MDMS	MDMS	Non-MDMS	MDMS	Non-MDMS	MDMS
Andhra Pradesh	57,319	60,935	1445	1550	1103	1268
Assam	59,185	59,233	1503	1517	761	823
Bihar	60,323	64,422	1718	1845	1021	1172
Chattisgarh	56,509	62,365	1356	1531	800	960
Gujarat	52,120	56,317	1384	1495	1554	1845
Haryana	58,758	68,772	1732	2108	1538	1950
Himachal Pradesh	66,795	74,189	1957	2183	1539	1886
Jharkhand	55,951	60,101	1461	1573	770	910
Karnataka	51,485	55,924	1360	1483	1108	1272
Kerala	45,369	51,579	1367	1584	769	1009
Madhya Pradesh	56,862	60,880	1707	1800	1095	1282
Maharashtra	56,688	61,885	1534	1688	1491	1727
Orissa	56,744	60,918	1368	1499	600	716
Punjab	60,937	71,236	1742	2068	1627	2139
Rajasthan	60,029	68,324	1836	2071	1461	1865
Tamil Nadu	47,501	52,306	1233	1404	878	1061
Uttar Pradesh	59,443	62,435	1713	1798	1059	1262
Uttaranchal	67,333	71,372	1874	2004	1472	1678
West Bengal	57,057	61,371	1432	1564	866	1011
All India	57,179	62,345	1564	1724	1132	1360

Tables 2.13 and 2.14 provide speculative evidence on the effect of UBI, if introduced, on the POU rates in the rural and urban areas, respectively, with the 'basic income' fixed at 20% above the Tendulkar poverty line. In both sectors, the UBI leads to a significant increase in intake of all the three nutrients. However, if one recalls the daily per capita minimum calorie requirements of 2400 kcals (rural) and 2100 kcals (urban), which translate to monthly figures of 72,000 kcals (rural) and 63,000 kcals (urban), the size of the increase is quite modest and not large enough anywhere for the average in any state to cross the minimum calorie requirements. This is confirmed by the last two columns which show two things: (a) there is near prefect correlation between a household's BPL status and POU status in the rural areas, less so in the urban areas, and (b) UBI has much greater impact in the urban areas than in the rural. While on the present definition of the UBI at 20% above the poverty line, the reduction in POU is barely noticeable in the rural areas in any state, there are several cases of significant reductions in the urban areas. This is the reverse of the experience with MDMS seen from Tables 2.7 and 2.8. Examples of impressive reductions in POU due to UBI are urban Jharkhand and urban Bihar. The policy message is that initial introduction of UBI should be restricted to urban areas given that welfare schemes such as MDMS are working reasonably well in the rural areas.

Table 2.12 Average per capita monthly nutrient consumption for MDMS and non-MDMS urban households – NSS 68th round (2011–2012)

	Calorie		Protein		Fat	
State	Non-MDMS	MDMS	Non-MDMS	MDMS	Non-MDMS	MDMS
Andhra Pradesh	44,915	57,078	1107	1476	912	1340
Assam	51,846	58,464	1288	1513	737	1005
Bihar	53,824	62,415	1519	1758	857	1236
Chattisgarh	51,282	58,707	1252	1508	833	1177
Gujarat	48,132	56,634	1284	1476	1396	2043
Haryana	50,231	62,364	1434	1803	1151	1905
Himachal Pradesh	56,070	69,015	1623	1997	1288	1892
Jharkhand	50,851	59,938	1391	1688	698	1235
Karnataka	46,408	54,820	1219	1465	1055	1418
Kerala	43,239	51,675	1235	1620	776	1100
Madhya Pradesh	50,648	60,002	1508	1721	1033	1485
Maharashtra	55,221	57,087	1527	1593	1582	1777
Orissa	51,581	57,168	1240	1501	583	963
Punjab	52,791	61,651	1482	1779	1356	1882
Rajasthan	56,710	62,087	1718	1831	1398	1812
Tamil Nadu	44,565	50,965	1162	1385	836	1161
Uttar Pradesh	52,620	59,413	1529	1716	967	1385
Uttaranchal	57,560	68,112	1636	1915	1140	1701
West Bengal	50,671	55,632	1302	1513	845	1231
All India	51,009	59,117	1392	1645	1023	1460

2.5 Conclusions

This paper focusses attention on the spatial differences in food consumption in India, examines differences in the pattern of consumption of the main food items between the major states and between the rural and urban areas within each state and reports the implied rates of undernourishment based on the unit records from the most recent (68th) round of the National Sample Survey. The spatial comparisons are supplemented by comparisons between the female-headed households, those belonging to scheduled castes and tribes and the rest. The results don't show and provide any conclusive evidence that suggest that such households are more undernourished than the rest.

The study also contributes to the recent discussions on the effectiveness of the public distribution system and the midday meal scheme as targeted systems that are designed to enhance food security and the welfare of the poor. A significant feature of this study is that it goes beyond the calorie figures and also provides evidence on the spatial differences in fat and protein intake in India implied by the food consumption figures.

Table 2.13 Average monthly nutrient consumption in rural households with universal basic income – NSS 68th round (2011–2012)

	Calorie		Protein		Fat		POU Rates	
State	BPL	UBI	BPL	UBI	BPL	UBI	BPL	UBI
Andhra Pradesh	43,851	50,512	1023	1197	772	898	100.00%	97.54%
Assam	48,870	53,523	1155	1300	518	606	99.41%	98.89%
Bihar	50,420	57,742	1399	1637	698	881	97.90%	92.47%
Chattisgarh	50,439	57,201	1165	1338	551	729	96.33%	89.47%
Gujarat	38,095	45,375	1012	1213	966	1150	100.00%	100.00%
Haryana	44,477	50,042	1299	1455	939	1088	100.00%	95.56%
Himachal Pradesh	54,063	58,536	1531	1620	953	1141	100.00%	94.87%
Jharkhand	48,827	55,195	1195	1405	538	677	99.35%	93.40%
Karnataka	39,848	44,621	998	1120	816	934	100.00%	100.00%
Kerala	31,181	36,455	788	927	454	564	100.00%	100.00%
Madhya Pradesh	49,270	55,852	1443	1652	795	1027	96.38%	92.29%
Maharashtra	41,486	48,852	1079	1304	796	1132	100.00%	99.11%
Orissa	53,351	60,370	1227	1433	466	611	95.68%	85.42%
Punjab	49,454	49,500	1480	1448	1102	1120	100.00%	100.00%
Rajasthan	48,159	52,530	1510	1628	848	1077	99.29%	98.51%
Tamil Nadu	38,588	43,403	942	1087	601	733	100.00%	99.47%
Uttar Pradesh	51,066	57,243	1444	1639	750	966	98.30%	92.63%
Uttaranchal	50,888	58,721	1396	1636	839	1073	96.67%	96.43%
West Bengal	47,655	52,229	1119	1261	568	710	99.29%	95.89%
All India	46,315	51,995	1221	1384	735	901	98.87%	95.89%

The rates of undernourishment are in line with the official poverty rates on using the per capita daily calorie norms of 2400 kcal (rural) and 2100 kcals (urban). This study provides evidence in favour of the MDMS by showing that the POU rates recorded by rural households that report participation in the MDMS are sharply lower than those that do not. However, the evidence is much weaker in the urban areas. This evidence is supplemented by estimates of the intake of calorie, protein and fat that record a significant increase in each nutrient as we move from non-MDMS to MDMS households. While the increase is larger in the urban areas, the size of the increase is not large enough to make a significant dent to the POU.

The study records evidence that shows that the PDS is also playing a significant role in improving food security. However, while the evidence is almost unequivocal in case of the MDMS, as all the states agree on its positive role in enhancing nutritional security often by a large margin, in case of the PDS, the evidence is much more mixed with some states recording marginal improvement or no improvement at all. Moreover, the size of the reduction in the POU rates is generally much greater in case of MDMS than for the PDS. Note, however, that this comparison should be treated with some caution since while MDMS only targets households with school-going children, the PDS targets a much larger group of households. The PDS is one of the largest targeted programs aimed at enhancing food security

Table 2.14 Average monthly per capita nutrient consumption in urban households with universal basic income – NSS 68th round (2011–2012)

	Calorie		Protein		Fat		POU Rates	
State	BPL	UBI	BPL	UBI	BPL	UBI	BPL	UBI
Andhra Pradesh	42,651	48,826	1005	1153	803	1003	95.48%	93.90%
Assam	47,355	52,112	1114	1271	552	625	96.99%	88.89%
Bihar	50,831	57,498	1417	1623	721	957	89.01%	72.73%
Chattisgarh	49,406	53,964	1166	1332	656	804	87.16%	75.86%
Gujarat	44,935	50,112	1221	1382	1047	1312	100.00%	98.64%
Haryana	46,781	51,014	1330	1495	1066	1161	95.08%	96.36%
Himachal Pradesh	52,705	56,590	1510	1633	916	1075	81.25%	73.33%
Jharkhand	46,268	54,826	1225	1501	572	881	94.66%	64.21%
Karnataka	39,732	44,514	964	1123	868	1009	99.06%	97.71%
Kerala	34,592	40,395	929	1108	513	666	98.97%	98.61%
Madhya Pradesh	48,315	56,950	1395	1644	907	1215	91.75%	75.24%
Maharashtra	41,860	45,795	1080	1185	1234	1415	99.48%	92.31%
Orissa	50,264	55,499	1176	1363	489	687	86.12%	72.92%
Punjab	43,638	46,644	1251	1346	1071	1137	98.33%	97.83%
Rajasthan	46,682	52,639	1422	1579	990	1288	96.99%	92.23%
Tamil Nadu	42,373	42,285	1022	1080	752	801	96.68%	98.10%
Uttar Pradesh	48,803	55,211	1398	1594	845	1112	92.84%	82.09%
Uttaranchal	53,074	56,691	1487	1588	955	1063	88.33%	82.98%
West Bengal	44,833	48,797	1087	1242	664	831	97.57%	93.33%
All India	46,058	51,072	1221	1381	822	1002	93.99%	86.70%

anywhere in the world. Recently, the PDS has been featured in the media because of issues of corruption due to ration shop owners diverting the PDS items, rice and wheat, to the open market. Moreover, anecdotal stories have emerged of denial of legitimate access by households below the poverty line to the PDS due to them not having the recently introduced Aadhaar cards. The paper provides evidence in support of the PDS by reporting that notwithstanding the change in food habits in India due to the fast-changing lifestyle brought about by a rapid pace of growth, the PDS items, rice and wheat, still provide a dominant share of the total calorie intake by the household. The states that have not operated a narrowly targeted system of PDS have generally seen greater evidence of the POU reduction brought about by the PDS. The policy message is that the PDS should be expanded to cover a wider cross section of the population, not just to the BPL households, and that the items for distribution should include nutrient-enhancing items besides rice and wheat to increase the effectiveness of the PDS. The National Food Security Act, 2013, which integrates the principal welfare schemes, namely, the midday meal scheme (MDMS), the integrated child development scheme (ICDS) and the public distribution system (PDS) which, when fully implemented, will cover nearly 2/3 of the whole population, is clearly a step in the right direction.

The paper also contains exploratory analysis of the role that UBI (universal basic income) can play in reducing POU rates. The initial evidence suggests that UBI is

likely to be more effective in the urban areas than in the rural areas. One, however, needs considerable further work involving randomised control trials before definitive conclusions can be drawn on the welfare enhancing effectiveness of the UBI, especially since it will be accompanied by the curtailment of existing welfare schemes such as the MDMS and the PDS.

The next step in this investigation is to examine if there is any link between undernutrition and ill health. Unfortunately, the NSS data does not provide any information on the health status of the members of the household. Such information is available in the National Family Health Survey (NFHS). As we write up this chapter, the NFHS-4 has just been made publicly available. A follow-up of this study is to construct pseudo-panel data combining the expenditure and the nutritional information from the NSS with the anthropometric information from the NFHS that will allow one to bring in the health aspects in the context of food insecure and calorie-deficient households. Such an investigation is best left for further work.

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Chapter 3
The Geography of Excess Weight in Urban India: Regional Patterns and Labour Market and Dietary Correlates

Archana Dang, Pushkar Maitra, and Nidhiya Menon

Abstract This paper examines the patterns and correlates of excess weight among urban adults in different parts of India. Incidence of excess weight is most prevalent in the North-Western and the Southern States of the country, and among women than men in urban India. Association of weight with expenditure is mostly positive across the different parts of the country. Easy and abundant availability of rice from the PDS in the South is strongly correlated to unhealthy weight levels. Sedentariness, whether at work or at home, is an important correlate of overnutrition, particularly in the North-West. Additionally, we find that individual who are overweight or obese are more likely to report having a non-communicable disease. The proportion of individuals reporting heart disease and high blood pressure is highest in the North-Western states of India, whereas reporting diabetes is highest in the Southern states.

Keywords BMI · Overweight or obese · Labor market engagement · Non-communicable diseases · Regional variation · India

3.1 Introduction

The focus of health economics in poor countries has understandably been the deficient levels of nutrition suffered by large swaths of the population including vulnerable sections such as women and very young children (Tarozzi and Mahajan

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2007; Maitra et al. 2013 among others). However, the fact that many developing countries have been steadily exhibiting a bimodal distribution, with sizable density at both low and high levels of nutrition, has so far not been on most economists' radars. Research on the phenomenon of overweight and obese in relatively poor countries is now growing, with attention being paid to the concomitant rise in the incidence of non-communicable diseases (NCDs) such as blood pressure and diabetes that often accompanies unhealthy weight levels (Gaiha et al. 2010). Scholars now understand that problems of excess weight, and the associated health risks are no longer issues restricted to developed countries. This paper contributes to the literature by analysing the topic of excess weight among adults in urban India using a regional lens.

Proportions of those who are at unhealthy weight levels in India are startling. India comes third behind the United States and China in terms of numbers of people who are overweight or obese, with one in five adults in this excess weight category (Lancet 2014). There are several contributing factors including increases in income; lifestyle changes (higher propensity to eat outside the home, greater likelihood of owning labour-saving devices like washing machines and assets like cars and bikes and the increased availability of household help); aggressive advertising that promotes the consumption of foods high in oil, sugar and fat; dietary preferences including reliance on foods like rice that are high in starch; and more sedentary work profiles that often accompany structural transformation of the labour market as countries develop. Perhaps underlining the importance of increases in income as an important factor, in India, the prevalence of excess weight is most evident among those in the higher-income echelons. This is in contrast to developed countries like the United States where overweight and obesity are most evident among the poor.

We use the most recent 2011–2012 round of the Indian Human Development Survey (henceforth IHDS2) to analyse patterns in overweight and obesity rates for adult men and women in urban India, using regions of India as a common denominator. We find that the incidence of overweight and obese is most prevalent in the North-West and the South and is more evident among women than men in urban India.[1] The income, labour market and dietary correlates that we investigate reveal that each has a role to play in explaining the patterns that we document. In particular, per capita expenditure (proxy for permanent income) and measures of a sedentary lifestyle like hours spent watching television and possession of cars, bikes and scooters, as well as availability of domestic help (again, proxies for income), are correlated with weight patterns in the North-West. What appears to matter most in predicting excess weight in the South is dietary markers such as monthly per capita rice consumption, especially rice that is sourced from the public distribution system (PDS). Our results therefore complement that of Upadhyay (2012) who argues that economic growth, an expanding middle-class population, growing urbanization and an increasingly sedentary lifestyle all contribute to the ever-increasing importance of overnutrition as a major health challenge in India.

[1] See Figure 3.7 for a categorization of the states into region.

To emphasize the urgency of the problem, we analyse the influence of being overweight or obese on the individual incidence of weight-related NCDs such as blood pressure, diabetes and heart disease. Understandably, the impact of these diseases on household budgets is likely to be substantial. It is argued that, in India, the risk of impoverishment due to NCDs like heart disease is about 40% higher as compared to communicable diseases and households in India with a heart disease patient are estimated to spend up to 30% of their annual income on health-care expenses (Engelgau et al. 2012). We find that the underlying correlations between weight status and NCDs are substantial. We offer a few ameliorative strategies to tackle this epidemic but, given the multitude of contributory factors, conclude that there is no single magic bullet solution to the regional patterns evident in India.

3.2 Parameters of This Paper

This section lays out the parameters along which we examine the question of excess weight in India. First, the measure that we use for gauging individual weight status is their body mass index (BMI), which is defined as the ratio of weight in kilograms to the square of height in meters. An individual can be categorized into different weight groups based on their BMI. The World Health Organization (WHO) categorizes individuals as being underweight if BMI < 18.5, of normal weight if BMI $\in[18.5,25)$, overweight if BMI $\in[25, 30)$, obese if BMI $\in[30, 40)$ or morbidly obese if BMI ≥ 40. For the purposes of this analysis, we focus on individuals who are overweight or obese (BMI ≥ 25). This group is therefore a composite category comprised of individuals that are overweight, obese or morbidly obese.[2]

Second, despite evidence that rates of overweight and obese are rising in rural India, our focus here is on urban settings where this increase has been particularly pronounced (Maitra and Menon 2019). Further, underlying causes are likely to differ by sector; hence studying both rural and urban areas may confound factors, thus clouding judgement on policy prescriptions. Adequate attention to increases in unhealthy weight levels in rural areas is important of course, but for the purposes of this paper, we focus on urban areas as trends here are most magnified and appear to be of first-order importance.

Third, for reasons outlined below, we study patterns of excess weight by regional aggregations. The regions that we create cover all parts of India and include the major states that encompass the majority of the population. In particular, "North" includes Uttar Pradesh, Uttarakhand, Rajasthan, Delhi, Madhya Pradesh and

[2]WHO (2004) argues that these general cut-offs might not be appropriate for the Asian population: in particular, Asian populations have different associations between BMI, percentage of body fat and health risks compared to the European population. WHO (2004) suggests new cut-offs so that individuals are underweight if BMI is less than 18.5, normal weight if BMI is 18.5 but less than 23, overweight if BMI is 23 but less than 27.5, obese if BMI is 27.5 but less than 32.5 and morbidly obese if BMI is 32.5 or higher. Results are stronger with these cut-offs and are available on request.

Chhattisgarh; "North-West" includes Jammu and Kashmir, Himachal Pradesh, Punjab and Haryana; "West" spans Maharashtra, Gujarat and Goa; "East" includes Assam, Bihar, Jharkhand, Orissa and West Bengal; and "South" denotes Tamil Nadu, Kerala, Karnataka and Andhra Pradesh. See Fig. 3.7 (in the Appendix). We do not consider states individually given that there are 29 of them and each is distinct from the other. We also exclude union territories like Daman and Diu and Dadra and Nagar Haveli as they are relatively small. Finally, we do not consider states in the Northeast as there is evidence that patterns and behaviour there are measurably different from the rest of India (Dreze and Sen 2013).

3.3 Data and Selected Descriptive Statistics

Our analysis uses the second wave of the Indian Human Development Survey (or IHDS2) data, which was collected in 2011–2012. The first wave of the survey (the IHDS1 data) was a nationally representative multi-topic survey of 41,554 households in 1503 villages and 971 urban neighbourhoods across India collected by the National Council of Applied Economic Research and the University of Maryland. Eighty-three percent of the households from IHDS1 were resurveyed in IHDS2. The response rate was more than 90% for both waves. The survey collected information on health, education, employment, economic status, marriage, fertility, gender relations and social capital. While both rounds of the survey collected data on height and weight of women, the data for men was collected systematically only in IHDS2. Given we are interested in gender differences in weight, we use the IHDS2 data alone for our analysis. We cannot consider intertemporal effects as there is no panel dimension for men.

Descriptive statistics for the IHDS2 urban sample are presented in Table 3.1. We restrict ourselves to adult males (columns 1–2) and females (3–4) aged 18–60. The average age is 37 years for both men and women, and 71% of men are married, compared to 79% of women. Overall 29% of men are overweight or obese compared to 34% of women. There is considerable gender difference in educational attainment and labour market engagement. Ten percent of men have no schooling, 12% have some primary schooling, 60% have completed primary but less than secondary schooling, and 19% have completed secondary schooling or higher. The corresponding proportions for women are 22%, 14%, 52% and 12%, respectively. Almost 34% of men work for salary and 24% in a business; the corresponding percentages for women are 10% and 6%. Indeed, while 42% of men report not working, this percentage is considerably higher at 83% for women. About 60% of women report having their first child by the age of 25. On average, women spend 3 h a day watching television compared to 2 h a day for men.

In terms of household characteristics, men and women appear to reside in similar households. These households are primarily Hindu, with an average size of six

Table 3.1 Descriptive statistics: cross-sectional sample

	Male		Female	
	Mean	SD	Mean	SD
Age	37.578	12.498	37.005	11.392
Married	0.709	0.454	0.785	0.411
Underweight	0.135	0.342	0.128	0.334
Normal weight	0.574	0.495	0.532	0.499
Overweight/obese	0.291	0.454	0.340	0.474
No schooling	0.096	0.294	0.216	0.412
Primary school	0.122	0.328	0.140	0.347
More than primary school	0.596	0.491	0.520	0.500
Secondary school or higher	0.186	0.389	0.124	0.329
Age at first birth 16–20			0.263	0.440
Age at first birth 21–25			0.338	0.473
Age at first birth 26–30			0.130	0.336
Age at first birth 31–35			0.033	0.178
Age at first birth others			0.229	0.420
Works for salary	0.339	0.473	0.099	0.298
Works in business	0.243	0.429	0.064	0.245
Not working	0.418	0.493	0.831	0.375
Average hours TV watching	1.876	1.159	2.705	1.493
Expenditure Q1	0.201	0.401	0.211	0.408
Expenditure Q2	0.242	0.428	0.251	0.434
Expenditure Q3	0.273	0.446	0.269	0.443
Expenditure Q4	0.284	0.451	0.270	0.444
Household size	5.373	2.442	5.666	2.624
Hindu	0.797	0.402	0.783	0.412
Muslim	0.142	0.349	0.158	0.364
Christian	0.034	0.181	0.033	0.177
Household has flush toilet	0.165	0.372	0.184	0.387
Household has piped water	0.721	0.449	0.711	0.453
Household owns car	0.068	0.252	0.074	0.262
Household owns motor cycle	0.486	0.500	0.462	0.499
Household has domestic help	0.055	0.227	0.068	0.251
Share of expenditure on processed food	0.107	0.092	0.111	0.091
Share of expenditure eating out	0.056	0.107	0.059	0.118

Notes: Sample restricted to 18–60-year-old urban residents. IHDS2 data only

members, not particularly likely to have a flush toilet but fairly likely to have access to piped water and equally likely to own a car or a motorcycle. Approximately 6% to 7% of households report having domestic help.

3.4 Regional Dimensions

Documenting weight patterns by region in India is important, given how large and heterogeneous the country is. Indeed, research demonstrates that disaggregate entities like states and even regions within states are so varied that most "one-size-fits-all" strategies designed and implemented at the national level often fail to address problems effectively (Krishna and Abusaleh 2011). As Dreze and Sen (2013) note, variations across areas reflect differences in history, politics, economics and geography but also in religion and social institutions like caste and class. This is evident from Table 3.2 that constructs regional median values of income, health, literacy and overall level of development measures based on statistics reported in Dreze and Sen (2013). Focusing on average household expenditure per capita in 2009–2010, Table 3.2 reports that states in the North-West have the highest levels across both rural and urban areas. The next highest levels are reported in the South and West. Correspondingly, poverty rates as measured by the headcount ratio are lowest in the North-West followed by the South.

Health and literacy measures also show marked variation by region. The infant mortality rate in 2011 is lowest in the South, followed by the West and the North-West. The highest rates of literacy for men and women are found in the West and South. The lowest rates for women are recorded in the North and for men in the East. Gender-related measures such as the sex ratio in 2011 are highest in the South across both sets of ages considered. Finally, measures of aggregate development such as location of the source of drinking water and whether electricity is the source of lighting also show differences across regions. The lowest rates for those who report that the source of drinking water is far away in 2011 are found in the North-West, West and South, in that order. Using access to electricity as the indicator of progress shows that the most advanced regions in India are the North-West and the South. The data presented in Table 3.2 imply that valuable insights may be lost if we ignore using a regional lens to understand the issue of excess weight in India.

3.4.1 Patterns of Distribution of Weight by Region

In light of the regional variation along different socio-economic dimensions, it is not surprising that there is considerable regional variation in the proportion of men and women in different weight categories. The incidence of overweight or obese by region and gender is reported in Fig. 3.1. Note that no region is the proportion of those who are overweight or obese lower than 25%. By these computations, the lowest proportion of people with excess weight are in the West with 28%, and the highest proportions are in the North-West and South with 45% and 37%, respectively. Hence in the North-Western states of Jammu and Kashmir, Himachal Pradesh, Punjab and Haryana, close to one in two people is overweight or obese. In the southern states of Tamil Nadu, Kerala, Karnataka and Andhra Pradesh, more

Table 3.2 Variation across regions in socio-economic indicators

	Average household expenditure per capita (rupees/ month) 2009–2010		Headcount ratio 2009–2010		Infant mortality rate 2011	Literacy rate ages 7 or above 2011 (%)		Sex ratio 2011		Drinking water source: far away 2011 (%)	Electricity as source of lighting 2011 (%)
	Rural	Urban	Rural	Urban		Female	Male	All ages	0–6 years		
North	903	1663	39	24	52	60	81	930	899	26	67
North-West	1523	2215	12	15	40	69	83	888	853	11	94
West	1132	2173	28	18	33	73	89	922	885	13	87
East	825	1584	40	26	44	64	79	947	943	27	43
South	1197	2146	22	15	29	71	85	994	945	13	93

Source: Dreze and Sen (2013). Table A.3. There are no statistics available for Delhi (North) or Goa (West). The infant mortality rate is the number of infants who were born alive but died in the first 11 months, expressed in per 1000 live birth. The sex ratio is the number of females per 1000 males

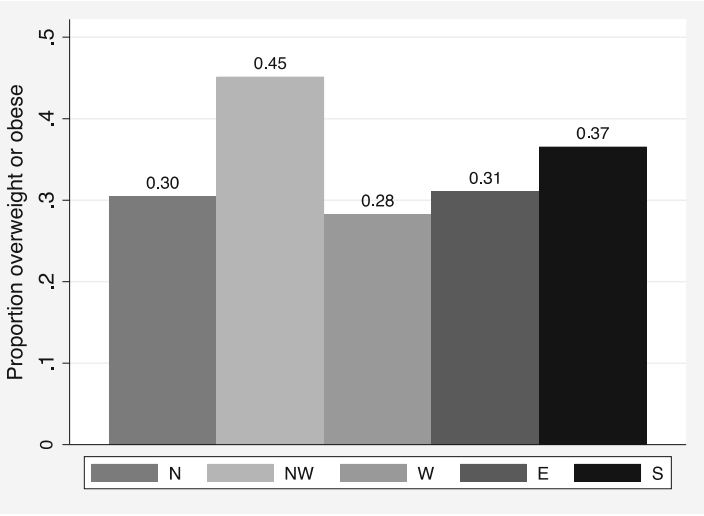


Fig. 3.1 Regional variation in proportion overweight or obese by region
Note: Authors' calculations using IHDS 2

than one in three people are in this category. These are unacceptably high numbers for a lower middle-income country.

Table 3.3 presents the proportion of men and women in the different weight categories by region. Overall 13% of urban males are underweight, 58% are normal weight, 24% are overweight, and 6% are obese (or morbidly obese). The corresponding proportion of females in the four categories are 12%, 53%, 25% and 10%, respectively. Consistent with the proportions presented in Table 3.1, overall, more women than men are categorized as overweight or obese. There is however considerable variation across regions. This is made clear in Fig. 3.2, which presents the proportion of urban males and females in the different regions of the country categorized as overweight or obese. In every region, the proportion of women who are overweight and obese exceeds that of men. Up to 49% of urban women residing in the North-West states are categorized as overweight or obese, down to 29% of urban women residing in the West. The gender differential varies from a low of about 2% in the West to a high of approximately 10% in the North-West. The second highest proportion of women with unhealthy weight levels is found in the South at 38%. The North-West and the South are the same regions that report the highest proportions for men of 38% and 35%, respectively. The lowest proportion of men with excess weight is in the North at 24%.

Table 3.3 Proportion in different weight categories by region and gender

	Male				Female			
	Underweight	Normal Weight	Overweight	Obese	Underweight	Normal Weight	Overweight	Obese
North	19.10	56.64	20.00	4.26	14.83	51.42	23.68	10.06
North-West	12.51	49.77	28.68	9.05	8.92	42.38	31.43	17.27
West	12.68	60.00	21.28	6.04	11.61	59.53	21.76	7.10
East	13.54	60.48	21.85	4.14	12.47	53.91	25.54	8.07
South	9.22	56.25	27.99	6.53	10.90	51.24	26.56	11.30
Total	13.02	57.5	23.8	5.67	12.18	53.09	24.86	9.86

Note: Authors' calculations using IHDS 2

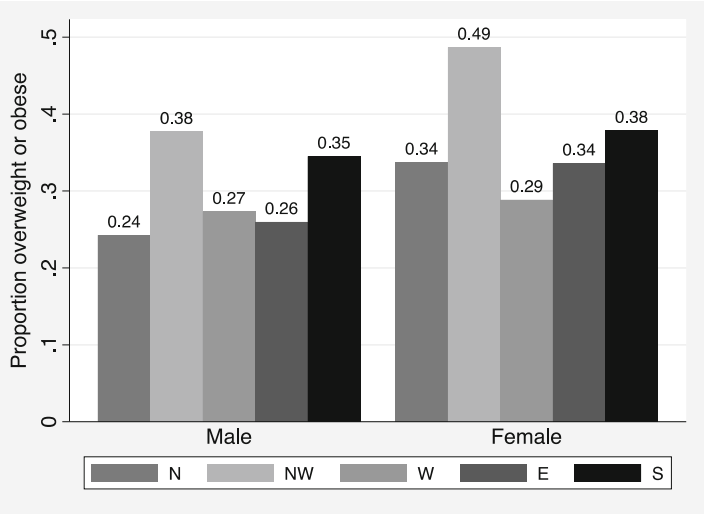


Fig. 3.2 Proportion overweight or obese by region and gender
Note: Authors' calculations using IHDS 2

3.5 Understanding Regional Variation in Weight

It is unlikely that there is any one factor that can explain the variation in weight across regions. Instead we look at regional variations in a few factors including permanent income, dietary patterns, labour market engagement and use of labour-saving devices, to gauge their contribution to regional differences in weight.

3.5.1 Differences in the Effect of Permanent Income

As we show in Table 3.2, there is considerable variation in per capita household expenditure across regions. This is consistent with what we find at the household level using the IHDS2 data. The average per capita expenditure (our measure of permanent income of the household) in our sample varies from Rs. 41,263 in the North-West to Rs. 26,235 in households residing in the East. To what extent does this difference in permanent household income contribute to the regional variation in weight? To examine this issue, we compute and present in Fig. 3.3 the lowess plots for the non-parametric regression of BMI on log per capita household expenditure, separately for urban males and females aged 18–60. In general, and not surprisingly, there is a positive correlation between log per capita household expenditure and BMI for both urban males and females in all regions of the country. There are of course variations: for example, the relationship has an inverted u-shape for women in the Southern states of the country and an inverted u-shape for males in the North-West

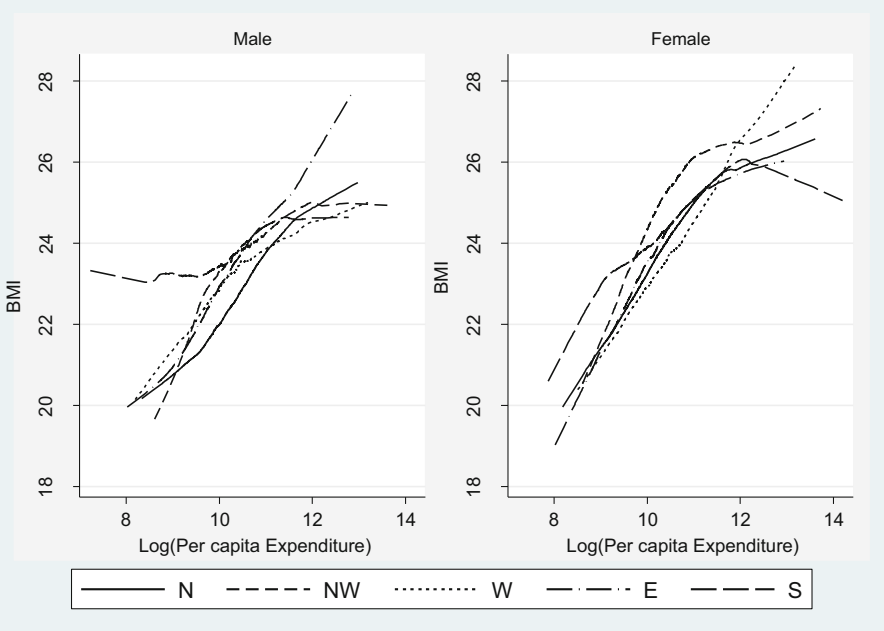


Fig. 3.3 Lowess plot of BMI and log per capita expenditure
Note: Authors' calculations using IHDS 2

of the country. Men in the East exhibit an almost positive and linear association between BMI and log expenditure. A similar linearity is found for women in the West. Hence, while there might be regional differences in the pattern of weight, it appears that the extent of association of weight with expenditure is mostly positive across the different parts of the country.

3.5.2 Differences in the Effect of Diet

Reflecting heterogeneity in preferences arising from geographical and sociocultural and historical differences, estimates of expenditures on items as shares of total food expenditure also show variation across regions. These are reported in Table 3.4. Consider first grains such as rice and wheat. Conditional on serving size, white rice has more calories, more starch and fewer proteins and fibres than wheat. Brown rice is healthier than white rice, but it is the latter that is more widely consumed. In particular, there is evidence that whole grains such as wheat, brown rice and barley may reduce the risk of cardiovascular disease (Hallfrisch et al. 2003). Turning to Table 3.4, as expected, highest shares of expenditures on rice peak are in the East and South, whereas consumption of wheat and other cereals is highest in the North

Table 3.4 Share of total food expenditure by region

Region	Rice	PDS rice	Wheat/cereals	Dairy/fish/meat	Oil/sugar	Process/eat out
North	0.068	0.003	0.122	0.278	0.137	0.039
North-West	0.044	0.005	0.113	0.343	0.122	0.042
West	0.058	0.004	0.115	0.261	0.161	0.064
East	0.175	0.006	0.086	0.241	0.120	0.057
South	0.145	0.006	0.056	0.295	0.108	0.057

Note: Authors' calculations using IHDS 2

followed by the West and the North-West. In consequence, expenditure shares on wheat are lowest in the South. Shares of expenditures on rice from the PDS are highest in the East and South and lowest in the North.[3] Hence, from a nutrition standpoint, the relatively high share of rice and the relatively low share of wheat and other cereals in the Southern diet is supportive of the argument that starch and carbohydrates underlie the excess weight patterns that characterize this region of India. We discuss rice in greater detail below.

In terms of consumption shares on dairy including milk and dairy products (clarified butter, butter, ice-cream, milk power, yoghurt and cheese), eggs, fish and meat, the estimates are highest in the North-West followed by the South and the North. Expenditure shares on dairy and related products are lowest in the East. Focusing next on oils and sugars, the highest expenditure shares are in the Western states followed by states in the North. These estimates indicate that shares of total food expenditures on this category are lowest in the South. Finally, the highest rates of expenditures on processed food and eating out of the home are in the West, but the rates are not that much lower in the East and South.

Table 3.4 reveals that in terms of expenditures on "bad foods" that include dairy products, meats, oil and sugar, and expenditures on processed foods and eating out of the home, there is no consistent pattern in that some regions of India are better than others in some categories but worse in others. On average, the preponderance of excess weight in the South and North-West may be attributed to relatively high shares of spending on milk and milk products, eggs, meat and processed foods and spending at restaurants. But the manner in which the South and North-West dominate other regions when it comes to weight is not reflected in their emphasized presence across the "bad food" categories we consider.

However, this is not the case once consumption of rice and, in particular, consumption of PDS rice is taken into account. As we note above, it is the South that lies at the intersection of relatively high expenditures on rice and is marked by a large proportion of people who are overweight or obese. We explore the impact of

[3]The PDS is India's food security system which was established in 1965 to provide food items such as rice, wheat and sugar and non-food items such as kerosene to the poor at subsidized rates (Masiero 2015). The Food Corporation of India is the main government body that is in charge of procuring items from producers and then distributing it to the poor through fair price shops, also called ration shops, established throughout India (Mooij 1998).

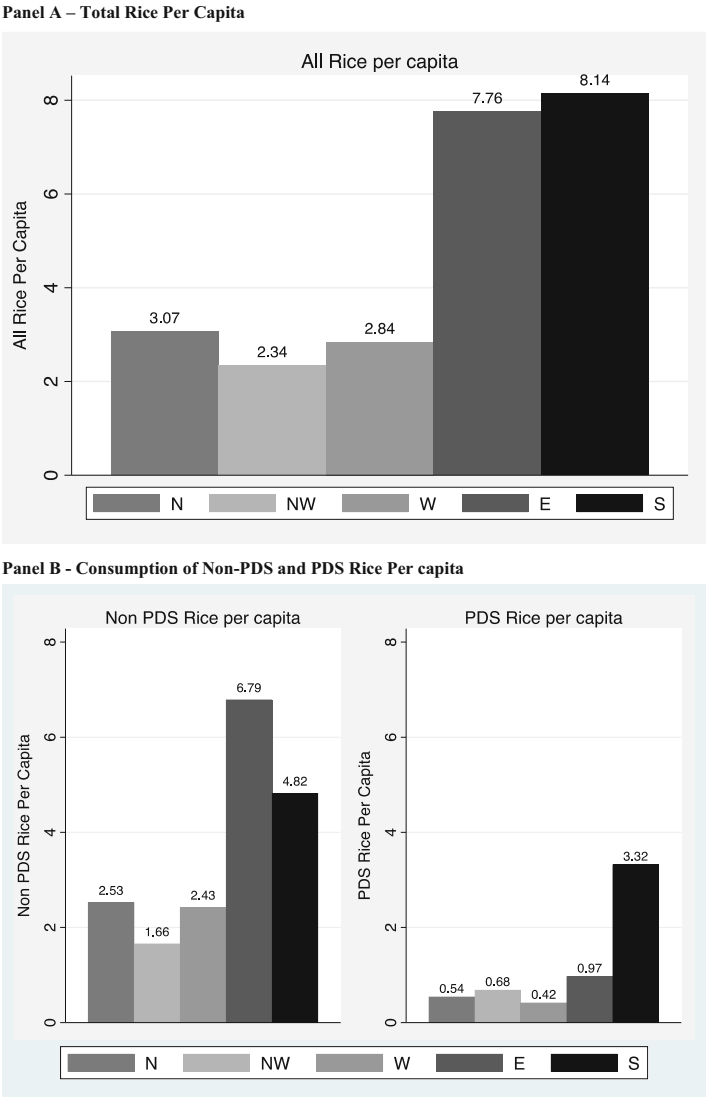


Fig. 3.4 Per capita consumption of rice in kilograms in the last month by region
Note: Authors' calculations using IHDS 2

rice consumption in greater detail in Fig. 3.4, which shows patterns of rice consumption per capita by region in the last 30 days. Panel A reports estimates for total rice consumed in the last month per capita. It is evident that the South has the highest per capita consumption followed closely by the East. In particular, the average person consumed a little over 8 and a little under 8 kilograms of rice in the South and East, respectively. The next highest level of rice consumption is in the North at a

very distant 3 kilograms per capita. The North-West has the lowest rice consumption per capita at 2 kilograms per capita in the last month. Hence, the "rice-consuming" regions of India are by far the South and the East.

Panel B is a closer snapshot of Panel A where we consider rice consumption separately from PDS and non-PDS sources. There is evidence from evaluation studies of the PDS that the system works more efficiently, in that there is less leakage, in the "functioning" states of the South (Khera 2011a). This is clear from the right-hand side of Panel B which reports estimates for per capita rice from the PDS source. On average, per capita consumption from this source in the Southern states is 3 kilograms per capita in the last month. This is head and shoulders above the next highest level of consumption from the PDS source which is in the East at 1 kilogram per capita. This is followed by the North-West, North and West, in declining order. Hence, PDS rice consumption is exceptionally high in the South. PDS rice is likely to be of inferior quality, both in terms of the actual grain and the overall quality of the rice (Khera 2011b). The nutritional quality and content of PDS rice is critical as well.[4] Most of PDS rice is polished white rice which does not have the nutritional content and other advantages of more expensive brands like Basmati (Little et al. 2017).[5] For these reasons, we hypothesize that unhealthy weight levels in the South are strongly correlated to the easy and abundant availability of rice from the PDS source. The left-hand side of Panel B shows that in terms of per capita consumption from non-PDS sources, the South, while still the second highest, now loses out to the East. Since the East does not depict as high rates of overweight or obese as the South, we conclude that PDS rice is an important factor that drives excess weight in states such as Tamil Nadu, Kerala, Karnataka and Andhra Pradesh.

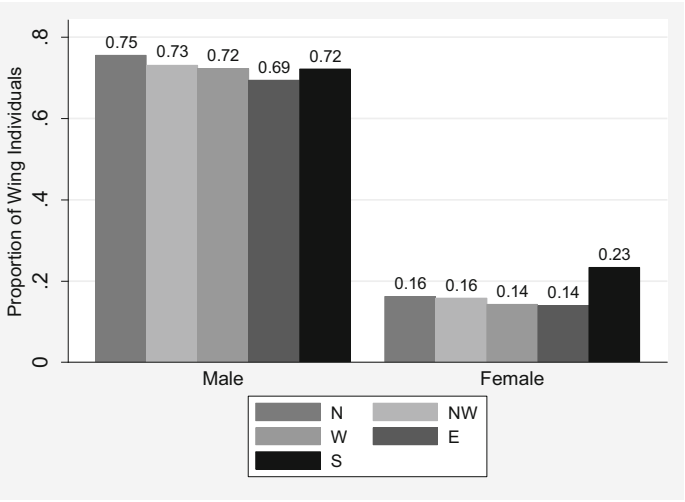
3.5.3 Differences in Labour Market Engagement

Evidence on India indicates that the average calories intakes have not witnessed significant increase over time; rather there has been a modest decline in average intakes (Deaton and Drèze 2009; Ramachandran 2014). Hence, reduction in physical activities might be one of the factors responsible for the increase in overnutrition.

[4]The nutritional content of rice is based on several measures including the glycaemic index (GI) and caloric content. The GI index measures how quickly food is converted into blood sugar in relation to either glucose or white bread which is normalized to 100 (Kennedy and Burlingame 2003). Low GI rice, like the Basmati and parboiled varieties, are usually preferred, especially in controlling diseases such as diabetes mellitus (Nisak et al. 2010). There is also evidence that Basmati rice has fewer calories than other rice varieties (https://www.livestrong.com/article/320971-basmati-rice-diet/. Accessed February 26, 2018). Given its nutritional and other advantages, Basmati rice is relatively more expensive on world markets (https://www.statista.com/statistics/255953/export-prices-for-selected-varieties-of-rice-since-2008/. Accessed February 26, 2018).

[5]Polished white rice has low fiber content, a high glycemic index and a poor micronutrient profile as compared to brown and other varieties of white rice (https://rayalseemadiaries.wordpress.com/2014/02/26/nutritional-insecurity-through-the-pds/).

Panel A: Proportion of Working Individuals by Gender and Region



Panel B: Proportion in White Collar Occupation (Conditional on Employment) by Gender and Region

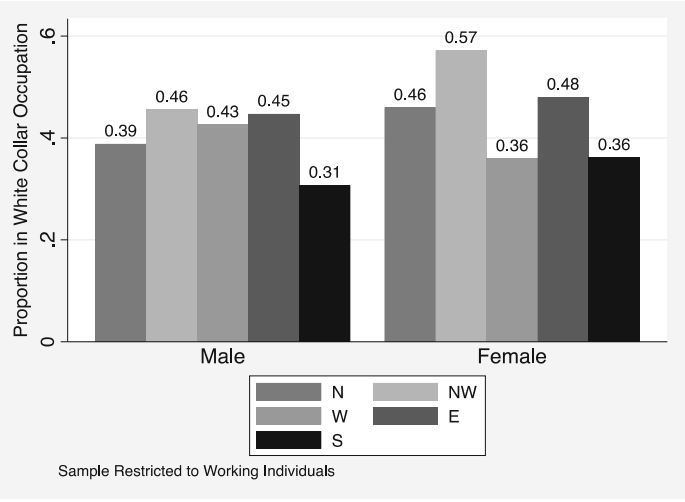


Fig. 3.5 Labour market engagement
Note: Authors' calculations using IHDS 2

Panel A of Fig. 3.5 shows that only 14%–23% of women aged 18–60 are engaged in the labour market (i.e. working); the corresponding figure for men as expected is much higher at 69–75%. Southern states have the highest proportion of working

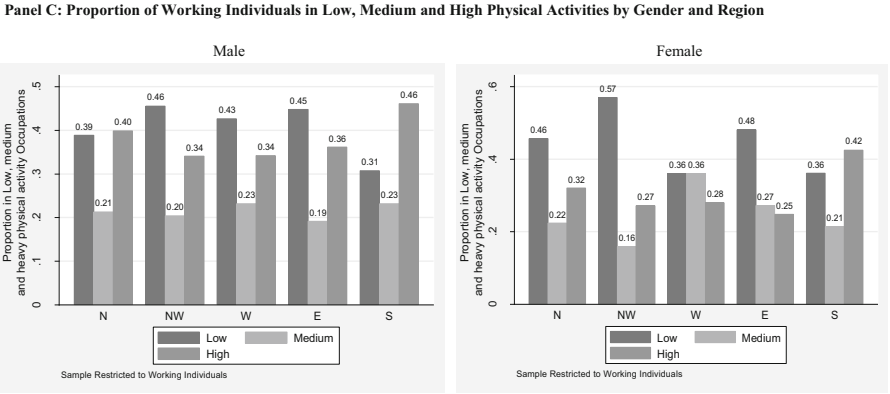


Fig. 3.5 (continued)

women followed by North-Western and Northern states.[6] For men, North followed by North-Western states have the highest rate of working men.

One of the possible factors promoting reduction in physical activities might include occupational activities. Activities at work are becoming more sedentary due to technological advancements in the work environment, as well as via changing labour opportunities, i.e. transition away from physically active jobs towards sedentary jobs. Panel B of Fig. 3.5 shows that conditional on working, the North-Western region which has the highest proportion of overweight or obese adults, also has the highest proportion of men and women engaged in white collar jobs, while southern region has the lowest. White-collar jobs are generally not physically strenuous and include professionals, technical or administrative workers, executives, managers and clerical workers. Blue-collar jobs are more physically demanding and include individuals working in agriculture, manufacturing, sales and those classified as service workers (such as maids, sweepers and protective service workers such as policemen or military personnel).[7]

We can alternatively consider a finer categorization of occupations in terms of intensity of activity associated with the relevant occupations: low, medium and heavy physical activities. All white-collar jobs are classified as low-activity

[6]The IHDS2 survey contains information on whether any household member worked on farms, worked for payment (wage/salary) or worked for a household business during the 12-month period preceding the survey. Also included are questions on the type of occupation/business, number of days worked in the preceding year and hours worked in a day in each occupation. Using this, we aggregate the number of days worked across all categories to get the total number of days worked in the preceding year. An individual is considered to be employed if he/she worked for at least 180 days in the preceding year.

[7]We use two-digit National Classification of Occupation (NCO) codes to identify the type of occupation associated with the primary activity, defined as one in which an individual spent maximum time in the preceding year. We then classify these occupations into white and blue-collar jobs.

occupations. Blue-collar jobs are further divided into medium-activity occupations (sales and service workers and those in transport and communications) or high-activity occupations (production workers, those in construction work). Panel C of Fig. 3.5 shows the distribution of working men and women in occupations involving low, medium and high physical activities. As clear, there is considerable variation across regions. Among working females, Eastern states followed by North-Western states have the lowest proportion of females employed in occupations involving high physical activity levels, and, among males, North-Western and Western regions have the lowest proportion of men working in occupations demanding high levels of physical work. The high proportion of males and females in the North-Western region working in sedentary occupations and the high incidence of overnourished adults in the same region suggests that the sedentary nature of jobs might be an important determinant in understanding rising weight levels. Further, in support of this observation, Dang et al. (2019) show that the less active nature of job is causally associated with elevated weight levels in India.

3.5.4 Differences in Reliance on Labour-Saving Devices

Reliance on labour-saving devices within the household may also explain patterns of excess weight given that four out of five women are not working. Labour-saving devices include washing machines; motorized vehicles such as cars, bikes and scooters; and the hiring of domestic help. Moreover, engagement in sedentary leisure activities such as watching television may be a contributory factor. Table 3.5 shows that the proportion of households possessing motor vehicles such as car, bike and scooter is highest in the North-West and lowest in the Eastern region at 59% and 29%, respectively. Similarly, about 50% of households in the North-West possess washing machines, the highest among all regions. In the North-West, 8% (second highest) of households hire servants for domestic work. These figures are suggestive of the fact that ownership of these assets and spending on domestic help can impact excessive weight by reducing time in physical exertive activities.

Table 3.6 reports the proportion of urban households watching television for more than an hour each day. Hours spent watching television and the accompanying

Table 3.5 Proportion of urban households possessing labour-saving devices, hiring domestic help by region

Region	Motor vehicle	Washing machine	Domestic help
North	41.12	23.27	5.2
North-West	58.77	49.56	7.84
West	55.53	6.58	6.01
East	29.18	10.4	17.02
South	42.48	16.12	4.69

Note: Authors' calculations using IHDS 2

Table 3.6 Proportion of urban households watching television for more than an hour each day by gender and region

Region	Female	Male
North	80.07	61.23
North-West	85.09	63.87
West	81.71	50.04
East	82.89	53.18
South	85.09	58.91

Note: Authors' calculations using IHDS 2

food advertisements could also drive obesity. Television not only contributes to physical inactivity, but commercials and other programs encourage individuals to consume more. Studies have shown that television viewing increases snacking, portion sizes and the percentage of calories from fat and overall calories (French et al. 2001). Table 3.6 shows that proportion of households with women watching television for more than an hour each day is the highest in the North-West and Southern region with 85% in each, while the Northern region with 80%, which is still substantial, has the lowest proportion. These patterns reflect those in overweight or obesity rates by region. The region with the highest proportion of households with men viewing television for more than an hour each day is the North-Western region (64%), again, resonating with weight trends in this region. Hence, it appears that sedentariness, whether at work or at home, is an important correlate of overnutrition, particularly in the North-West.

3.6 Health Impacts as Measured by NCDs

We focus on excess weight because the incidence of chronic health problems and NCDs like blood pressure, cardiovascular disease and diabetes is significantly higher for individuals with unhealthy BMI. The IHDS2 data contain health outcome variables that pertain to blood pressure and diabetes. However, information on cardiovascular disease is not collected directly in the survey, and so we use data on heart disease to examine this malady. While not exactly the same, cardiovascular disease is a subset of heart disease, and the latter is the closest proxy we have for the former in these data. We also note that these outcomes are self-reported and thus may suffer from the problem of misreporting. However, we examine them as they are illustrative of the negative consequences of excess weight.

Table 3.7 presents evidence on the incidence of these problems by gender and region: heart disease, high blood pressure and diabetes. It is clear that the likelihood of reporting heart disease and high blood pressure is the highest for residents in the North-Western states of India, and this is true for both males and females. Additionally, while the proportion of women reporting heart disease and high blood pressure is greater than the corresponding proportion of men in all regions, this is especially true in the North-Western states. Diabetes is however a different story, with the

Table 3.7 Likelihood of reporting non-communicable diseases by gender and region

	Male			Female		
Region	Heart disease	High blood pressure	Diabetes	Heart disease	High blood pressure	Diabetes
North	0.01	0.03	0.03	0.02	0.06	0.02
North-West	0.02	0.05	0.03	0.03	0.11	0.04
West	0.01	0.02	0.02	0.00	0.04	0.02
East	0.01	0.04	0.04	0.01	0.07	0.03
South	0.01	0.05	0.05	0.01	0.07	0.06

Note: Authors' calculations using IHDS 2

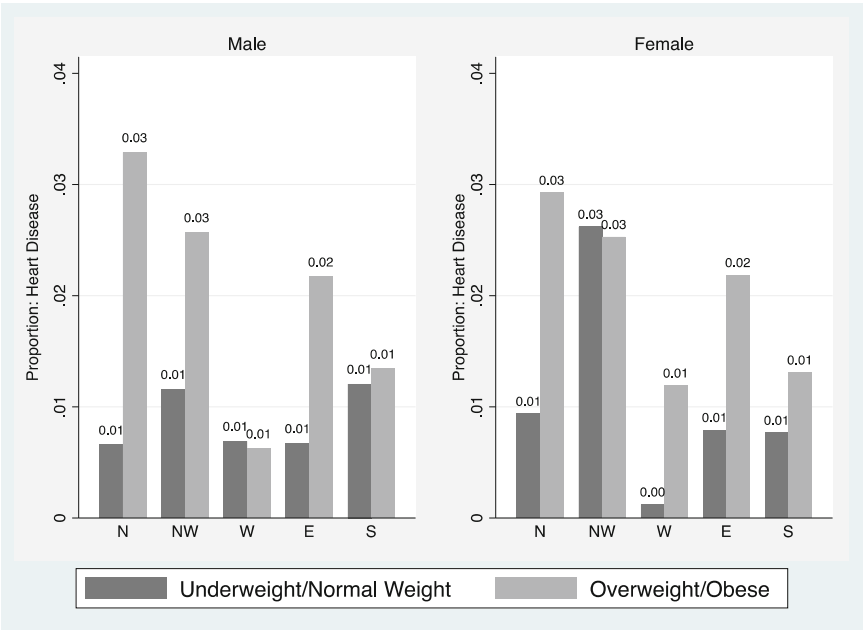
South dominating other regions for both males and females. This may be partly related to the patterns of rice consumption, which, as we noted above, is highest in the Southern states.

To examine how the incidence of NCDs varies by weight status, in Fig. 3.6, we present the likelihood of the individual reporting that he/she suffers from heart disease (Panel A), high blood pressure (Panel B) and diabetes (Panel C), by region, gender and weight status (whether the individual is overweight or obese or not). It is clear that the likelihood of reporting a NCD is an order of magnitude higher for those who are overweight or obese, and this holds for both males and females across most regions of residence. These relative differences by weight status provide compelling support to the argument that excess weight is a major correlate of NCDs.

3.7 Conclusion

This paper studies the increasing girth of adults in India by focusing on urban areas using a regional lens. We find that overweight or obese populations are in all regions of India but especially the North-West and the South. Although men are also impacted, the problem of excess weight is most clearly manifested among women. The factors that we examine to understand these regional weight patterns include variations in income, in diet, in labour market engagement and in reliance on labour-saving technologies. In general, income and concomitant expenditures on labour-saving technologies such as washing machines and transportation assets such as cars and bikes are strongly indicative of weight patterns in the North-West. On the other hand, diet, in particular, per capita consumption of PDS rice, appears to be a major driver of excess weight in the South. Labour market engagement as measured by the proportion of workers in white-collar jobs is also suggestive of weight status in the North-West. Hence various factors have contributed to the troubling phenomenon of overweight and obesity among adults in India, and the regional flavours of this epidemic may be attributed to some underlying characteristics over others, depending on the locale. We conclude by investigating the influence of excess

Panel A: Likelihood of Reporting Heart Disease



Panel B: Likelihood of Reporting High Blood Pressure

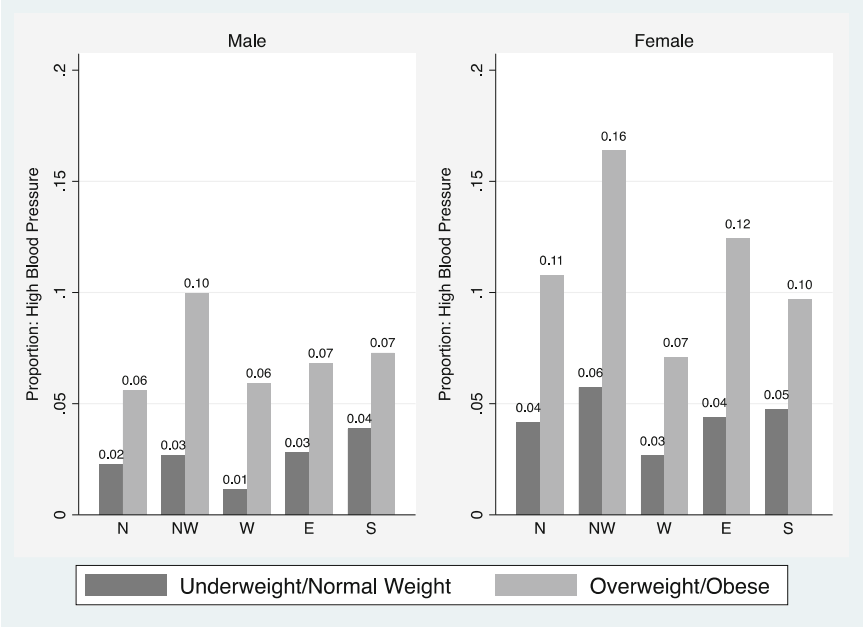


Fig. 3.6 Likelihood of reporting heart disease, high blood pressure and diabetes by region, gender and weight categories
Note: Authors' calculations using IHDS 2

Panel C: Likelihood of Reporting Diabetes

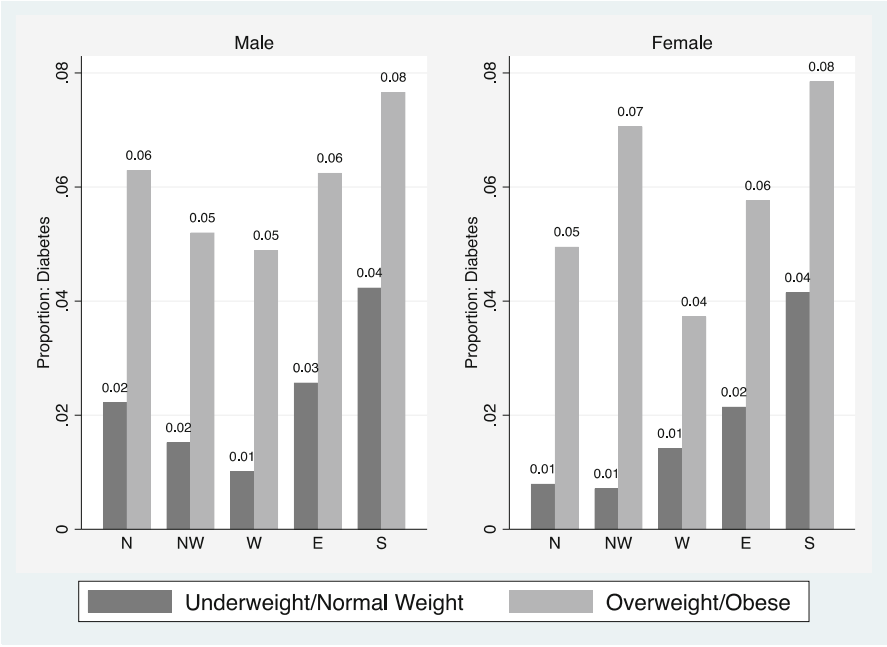


Fig. 3.6 (continued)

weight on NCDs including blood pressure, heart disease and diabetes. We find that being overnourished is positively associated with these diseases.

The policy implications of this study are substantial, and both the government and non-governmental bodies have important remedial roles to play. This includes spreading awareness regarding the problem, its causes and its consequences, especially in the health sphere. These agents also bear the responsibility for creating and encouraging the use of policies to mitigate the burden of excess weight. The 14.5% tax on unhealthy food that the government of Kerala state imposed is a step in the right direction; however regulatory measures of this nature alone may prove insufficient. Action is needed to make life-styles more active and exertive. Provision of tax concessions for gym memberships, incentives to schools to provide opportunities to children and young adults to engage in physical activity, policies that encourage more exercise among urban adult women such as group programs tailored to them and the importance of green spaces in construction plans of new office buildings and residential complexes are all important. A way to catch the attention of the audience that seems most impacted may be advertisement and information campaigns on television that emphasize the importance of more activity in daily life and the negative disease consequences that accompany a sedentary life profile. In the South, in particular, more awareness on the need to diversify diets away from reliance on rice would be invaluable. A concerted effort of this nature is essential to reverse the disturbing regional trends in weight that we document.

Appendix

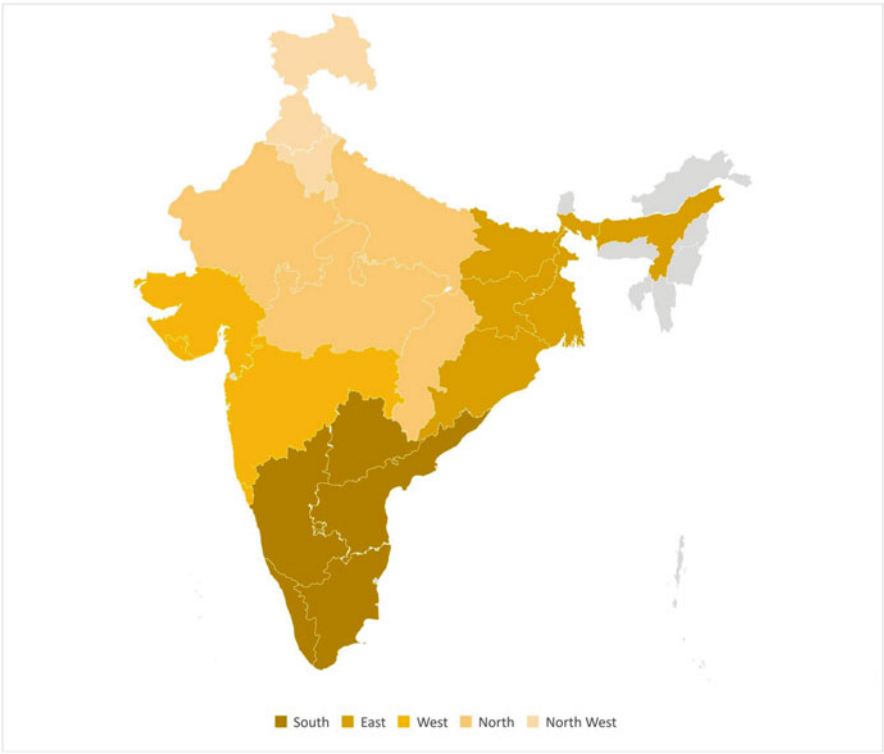


Fig. 3.7 Categorization of states of India into regions
Notes: Categorization of states is as follows:
South: Andhra Pradesh, Karnataka, Kerala, Tamil Nadu and Telangana
West: Goa, Gujarat and Maharashtra
East: Assam, Bihar, Jharkhand, Odisha, West Bengal
North: Chhattisgarh, Madhya Pradesh, Rajasthan, Uttarakhand and Uttar Pradesh
North-West: Haryana, Himachal Pradesh, Jammu and Kashmir and Punjab

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Chapter 4
Health System and Health Expenditure Productivity Changes in Indian States: Has It Changed for the Better in the Post-reform Period?

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Abstract In this chapter, we make an attempt to examine the health system productivity changes and health expenditure productivity changes for 17 major Indian states in the post-reform period. The time period of 2004–2005 to 2014–2015 is chosen owing to consistent availability of data. Further, an attempt is made to see if the states' income growth has any role in their behaviour of health system/expenditure productivity change. Both the productivity changes are calculated in per capita terms too. The selection of inputs and outputs for measuring productivity changes are guided by consistent availability of data across the states for our time period. The results of productivity changes are mixed in nature, though all the productivity changes are volatile as depicted by the coefficient of variation. Some of the measures witness higher fluctuation in the last 3 years of the study. Some of the possible reasons may be attributed to the nature of allocation of health expenditure in the revenue and capital accounts. Most of the states have legislated the Fiscal Responsibility and Budget Management Bill by now. This might have constrained the states to spend adequately on health. Moreover, health being primarily state subject governance in the sector in terms of proper allocation of budget and timely utilisation of the budget allocated matters a lot for the infrastructure to be in place.

Keywords Health system productivity change · Health expenditure productivity change · Indian states · Data envelopment analysis

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4.1 Introduction

The government of India has been making efforts to achieve equitable access to healthcare and improved health outcomes across states. Though the concept of primary healthcare goes back to the time of the popular Bhore committee's (the health survey and development committee) recommendations (1946), the government of India was fully committed to primary healthcare after the 1978 Alma-Ata Declaration of the World Health Assembly – Health for All by 2000 AD. This was reflected in the National Health Policy, 1982–1983. The Bhore committee envisaged development of primary health centres in the following two stages. First, as a short-term measure, one primary health centre was suggested for a population of 40,000, and each PHC was to be manned by 2 doctors, 1 nurse, 4 public health nurses, 4 midwives, 4 trained dais, 2 sanitary inspectors, 2 health assistants, 1 pharmacist, and 15 other class IV employees. A secondary health centre was also envisaged to provide support to PHC, to coordinate and supervise their functioning. Second, a long-term programme, called the three million plan, was also recommended for setting up primary health units with 75 bedded hospitals for each 10,000 to 20,000 population. Further, secondary units with 650-bedded hospital, again regionalised around district hospitals with 2500 beds, were also envisaged. The National Health Policy, 1983, aimed at *Health for All by 2000.* Accordingly the 1980s witnessed expansion in health infrastructure. For instance, in the plains, the norms included one primary health centre (PHC) for every 30,000 population and one subcentre for every 5000 population. Similarly, for the tribal and hilly areas, the norms were one PHC for every 20,000 population and one subcentre for every 3000 population. Thus, the policy was induced to increase public expenditure on health so that there is an improved equitable access to healthcare services. The increased public expenditure was also expected to reduce the financial burden on account of illness on the vulnerable segment of the population and the poor. However, the data obtained from different rounds of the National Health Accounts, Govt. of India, show mild increase in public spending on health in the last one decade. The government's share in total health expenditure (THE) increased from 22.5% in 2004–2005 to 29% in 2014–2015, whereas during the same period, the share of out-of-pocket expenditure (OOPE) declined from 69.4% of THE to 62.6% of THE.[1] There is an increase in the private health insurance expenditure from 1.6% of THE to 3.7% of THE during the said period (Table 4.1).

[1]As stated in the National Health Accounts, 2014–2015, THE constitutes current and capital expenditures incurred by government and private sources including external funds. THE as a percentage of GDP indicates health spending relative to the country's economic development. GHE constitutes spending under all schemes funded and managed by union, state and local governments including quasi-governmental organisations, and donors in case funds are channelled through government organisations. Out-of-pocket expenditures (OOPE) as per cent of THE: out-of-pocket expenditures are expenditures directly made by households at the point of receiving healthcare.

Table 4.1 Trends in health expenditure

Health expenditure indicator	2004–2005	2013–2014	2014–2015
Government health expenditure (GHE) as per cent of total health expenditure (THE)	22.5	28.6	29
Out-of-pocket expenditures (OOPE) as per cent of total health expenditure (THE)	69.4	64.2	62.6
Private health insurance expenditures as per cent of total health expenditure (THE)	1.6	3.40	3.7

Source: National Health Accounts

The increase in THE and decline in OOPE during 2013–2014 to 2014–2015 imply an increase in the financial protection available for households towards healthcare payments and relatively less dependence of the households on out-of-pocket expenditures. However, the question of productivity changes of public health expenditure still remains unanswered. The studies in the past have tried to measure efficiency of healthcare units, benefit incidence of health expenditure, health expenditure efficiency, etc., in the Indian context (Dash et al. 2007 and Acharya et al. 2011). A brief review of the select studies is presented below.

Dash et al. (2007) apply data envelopment analysis (DEA) to determine the efficiency of a set of district hospitals in Tamil Nadu. The study takes 29 district hospitals in the state, and the variables chosen are number of assistant surgeons, civil surgeons, staff nurses and beds as inputs and in-patient visits, outpatient visits, surgeries and deliveries performed as outputs. An input-oriented DEA model allowing for variable returns to scale ranks the hospitals based on the efficiency scores obtained. The results indicate that 8 of the 29 hospitals, about 27%, are efficient.

Acharya et al. (2011) employ the method of benefit incidence analysis to assess the extent to which public spending on healthcare has been pro-poor in two states of India, namely, Tamil Nadu and Orissa. Using data from the National Sample Survey Organisation (NSSO), the authors conclude that public spending on health has become more pro-poor by 2004–2005 in Tamil Nadu. For the state of Orissa, the results indicate that public spending on healthcare in Orissa has become pro-poor by 2004–2005 for outpatient services only.

In another study, Shetty and Pakkala (2010) rank 27 Indian states in terms of their technical efficiency by employing the Non-proportional Range Directional Model (NP-RDM) of data envelopment analysis (DEA). The results classify the states into two categories of states being responsible for poor health outcomes of the country. One category of states makes inefficient use of health inputs and the other suffers from the problem of inadequate healthcare resources.

Mohanty and Bhanumurthy (2018) attempt measuring efficiency of public expenditure in social sector, i.e. education and health, using data envelopment analysis for 27 Indian states for 3 different periods, i.e. 2002–2003, 2008–2009 and 2015–2016. The study considers infant survival rate and life expectancy at birth as two inputs. The health expenditure to GDP and non-health expenditure to GDP ratios are

considered as outputs. The DEA-based expenditure efficiency scores rank the western states higher than states in other regions. The states in eastern India are found to be inefficient. The empirical results yield good governance having a positive and significant impact on health expenditure efficiency. The study uses a public affairs index for the Indian states published by the Public Affairs Centre, India, as a proxy for governance.

Though health is primarily a state subject, the responsibility of healthcare has been mixed in the Indian scenario. Starting with the first 5-year plans, health policies have been formulated by the centre and implemented by the states. The preventive healthcare has been largely programme based and driven by the centre, whereas the curative part relating to hospitals and dispensaries has been under the states (Duggal 2001). The states have made their own efforts after liberalisation and economic reforms on health policy with support from international agencies such as the World Bank. In the last two and a half decades, the performance of the health system as a whole therefore has depended on the national policies, policies formulated and implemented by the states and finally the policy implementation by the local bodies. Hence, an assessment of productivity changes of public health expenditure as well as the health system as a whole assumes crucial importance in the Indian context. In particular, the post-reform changes in public health expenditure and changes in health policies in the states merit attention.

In view of the above, the present study attempts to fill a gap in health efficiency studies in India by studying the productivity changes in public health expenditure of major Indian states in the post-reform period. The productivity changes are also measured for the health system as a whole with select and limited input and output indicators.

The remainder of the chapter proceeds as follows. Section 4.2 presents the discussion on the scope of present study, nature of data and methodology developed. Section 4.3 deals with results and discussion followed by some concluding remarks in Sect. 4.4.

4.2 The Present Study, Data and Methodology

4.2.1 The Present Study

This study makes a modest attempt to study productivity changes in public health expenditure of major Indian states in the post reform period. The productivity changes are also measured for the health system as a whole with select and limited input and output indicators. The details of data and methodology are presented in Sects. 4.2.2 and 4.2.3.

4.2.2 The Data

The health system productivity change (HSPC) and health expenditure productivity change (HEPC) are measured for 17 major Indian states for the period 2004–2005 to 2015–2016. To measure these two productivity change measures, the inputs considered are health expenditure on revenue account, health expenditure on capital account, health system infrastructure measured as a simple sum of primary health centres (PHCs), community health centres (CHCs) and the subcentres (SCs). The outputs are two major health outcomes, i.e. crude death rate (CDR) and infant mortality rate (IFR).[2] CDR as an output is used instead of life expectancy at birth to have a longer time series for each state. The choice of inputs and outputs, though not exhaustive, is driven by the consistent availability of data for a set of major states, which is 17 in our case. The time period chosen falls under the post-economic reform era and is supposed to reflect changes initiated in 1991 in various sectors of the economy. The states also became competitive in undertaking reforms and investing in education and health out of their own resources supplementing the grant from centre under a plethora of welfare schemes floated by successive central government. All the data have been compiled from the sources such as NITI Aayog, Govt. of India, EPW Research Foundation, State Finances: A Study of Budgets published by the Reserve Bank of India, and the Sample Registration System Bulletins of the Census of India.

4.2.3 Methodology

4.2.3.1 Measuring Efficiency in the Health System

Using three inputs – health expenditure revenue (x_1), health expenditure capital (x_2) and total health infrastructure (x_3) – and two (undesirable) outputs, crude death rate (y_1) and infant mortality rate (y_2), we set up the following linear programming (LP) problem to compute the input efficiency of state h ($h = 1, 2, \ldots, 17$) at time t under the constant returns to scale (CRS) specification of Charnes et al. (1978):

$$E_{ic}^{t}\left(x_h^t, y_h^t\right) = \min_{\theta,\lambda} \theta \tag{4.1}$$

[2]Note that in our model setup, these two outputs are undesirable outputs by considering their additive inverses because the underlying objective is to minimise them for achieving higher productivity in any health system.

$$\text{s.t.} \sum_{j=1}^{17} x_{ij}^{t} \lambda_j \leq \theta x_{ih}^{t}, i = 1,2,3;$$

$$\sum_{j=1}^{17} y_{rj}^{t} \lambda_j \geq y_{rh}^{t}, r = 1,2;$$

$$\lambda_j \geq 0 \ (j = 1, 2, \ldots, 17); \theta : \text{free}$$

where λ_js, the intensity coefficients, are interpreted as the shadow prices. If $\theta = 1$, the state h operates on the health system production frontier at time t and, hence, is relatively efficient in the sample, and if $\theta < 1$, then the state h is relatively inefficient. The linear program (4.1) can be run for 17 times to compute the efficiency scores for 17 states for each time t.

4.2.3.2 Measuring Productivity Change in the Health System

We assess the *productivity change* (*PC*) in the healthcare systems of 17 Indian states over time. Here, productivity change for each state is disaggregated into two parts: (a) a part that is attributable to the state-specific better (worse) performance relative to the best practice benchmark in period t as compared to period $t - 1$ (called as *efficiency change* (EC) or *catching up* (CU)) and (b) a part that is attributable to overall better (worse) practice in period t as compared to period $t - 1$, including a better (worse) performance of the best practice benchmark itself (called as technical change (TC) or environmental change (EC)).

Following Caves et al. (1982), using the period $t - 1$'s technology as reference, the *PC* of state h ($h = 1, 2, \ldots, 17$) over the two time periods ($t - 1$ and t) can be defined as

$$PC_h^{t-1} = \frac{E_{ic}^{t-1}\left(x_h^t, y_h^t\right)}{E_{ic}^{t-1}\left(x_h^{t-1}, y_h^{t-1}\right)} \tag{4.2}$$

where $E_{ic}^{t-1}\left(x_h^{t-1}, y_h^{t-1}\right)$ measures the efficiency of period $t - 1$'s input vector using the period $t - 1$'s technology, and $E_{ic}^{t-1}\left(x_h^t, y_h^t\right)$ measures the efficiency of period t's input vector against the period $t - 1$'s technology. If $PC_h^{t-1} > 1$, state h exhibits *productivity growth*, over the two periods. If $PC_h^{t-1} < 1$, state h experiences *productivity decay*, and if $PC_h^{t-1} = 1$, there is neither productivity growth nor productivity decay.

Similarly, using the period t's technology as reference, the *PC* of state h ($h = 1, 2, \ldots, 17$) can be defined as

$$PC_h^t = \frac{E_{ic}^t\left(x_h^t, y_h^t\right)}{E_{ic}^t\left(x_h^{t-1}, y_h^{t-1}\right)} \tag{4.3}$$

where $E_{ic}^t\left(x_h^t, y_h^t\right)$ measures the efficiency of period t's input vector using the period t's technology, and $E_{ic}^t\left(x_h^{t-1}, y_h^{t-1}\right)$ measures the efficiency of period $t-1$'s input vector against the period t's technology. If $PC_h^t > 1$, state h exhibits *productivity growth*, over the two periods. If $PC_h^t < 1$, state h experiences *productivity decay*, and if$PC_h^t = 1$, there is neither productivity growth nor productivity decay.

Note that these two *PC* measures might give conflicting signal concerning productivity change since the aggregation weights used in these two measures are different. Therefore, to avoid an arbitrary base of comparison, Färe et al. (1994) suggested taking the geometric mean of these two *PC* measures:

$$PC_h^{t-1,t} = \left[\frac{E_{ic}^{t-1}\left(x_h^t, y_h^t\right)}{E_{ic}^{t-1}\left(x_h^{t-1}, y_h^{t-1}\right)} \times \frac{E_{ic}^t\left(x_h^t, y_h^t\right)}{E_{ic}^t\left(x_h^{t-1}, y_h^{t-1}\right)}\right]^{1/2} \tag{4.4}$$

To know if there is productivity growth/decay, whether it is due to *EC* or *TC* or both, the $PC_h^{t-1,t}$ expression in (4.4) can be decomposed as

$$PC_h^{t-1,t} = \frac{E_{ic}^t\left(x_h^t, y_h^t\right)}{E_{ic}^{t-1}\left(x_h^{t-1}, y_h^{t-1}\right)} \times \left[\frac{E_{ic}^{t-1}\left(x_h^t, y_h^t\right)}{E_{ic}^t\left(x_h^t, y_h^t\right)} \times \frac{E_{ic}^{t-1}\left(x_h^{t-1}, y_h^{t-1}\right)}{E_{ic}^t\left(x_h^{t-1}, y_h^{t-1}\right)}\right]^{1/2} \tag{4.5}$$

where the ratio outside the bracket measures the *EC* component and the geometric mean of two ratios inside the bracket captures the *TC* component. That is,

$$EC_h^{t-1,t} = \frac{E_{ic}^t\left(x_h^t, y_h^t\right)}{E_{ic}^{t-1}\left(x_h^{t-1}, y_h^{t-1}\right)} \tag{4.6}$$

$$TC_h^{t-1,t} = \left[\frac{E_{ic}^{t-1}\left(x_h^t, y_h^t\right)}{E_{ic}^t\left(x_h^t, y_h^t\right)} \times \frac{E_{ic}^{t-1}\left(x_h^{t-1}, y_h^{t-1}\right)}{E_{ic}^t\left(x_h^{t-1}, y_h^{t-1}\right)}\right]^{1/2} \tag{4.7}$$

If $PC_h^{t-1,t} > 1$, then there is productivity growth for state h, and if $PC_h^{t-1,t} < 1$, there is performance decay for state h. Similar interpretations hold for each of its components – *EC* and *TC*.

To compute $PC_h^{t-1,t}$ between period $t-1$ and t, four different efficiency indexes need to be computed – two own-period efficiency indexes, i.e. $E_{ic}^{t-1}\left(x_h^{t-1}, y_h^{t-1}\right)$ and $E_{ic}^t\left(x_h^t, y_h^t\right)$, and two cross-period efficiency indexes, i.e. $E_{ic}^{t-1}\left(x_h^t, y_h^t\right)$ and $E_{ic}^t\left(x_h^{t-1}, y_h^{t-1}\right)$, for each state h ($h = 1, 2, \ldots, 17$). So, we require to solve in total 68 ($=17 \times 4$) LP problems. To compute $E_{ic}^t\left(x_h^t, y_h^t\right)$, we solve the LP problem (4.1). $E_{ic}^{t-1}\left(x_h^{t-1}, y_h^{t-1}\right)$ can be computed by simply substituting the time period superscript $t-1$ for t in the LP problem (4.1).

The mix-period efficiency index $E_{ic}^{t-1}\left(x_h^t, y_h^t\right)$ can be computed by setting up the following LP problem:

$$E_{ic}^{t-1}\left(x_h^t, y_h^t\right) = \min_{\theta,\lambda} \theta \tag{4.8}$$

$$\text{s.t.} \sum_{j=1}^{17} x_{ij}^{t-1}\lambda_j \leq \theta x_{ih}^t, i = 1,2,3;$$

$$\sum_{j=1}^{17} y_{rj}^{t-1}\lambda_j \geq y_{rh}^t, r = 1,2;$$

$$\lambda_j \geq 0\ (j = 1, 2, \ldots, 17); \theta : \text{free}$$

Similarly, the mix-period efficiency index $E_{ic}^{t}\left(x_h^{t-1}, y_h^{t-1}\right)$ can be solved exactly like $E_{ic}^{t-1}\left(x_h^t, y_h^t\right)$ by interchanging time period superscript t with $t-1$ and $t-1$ with t in the LP problem model (4.8).

Note that the productivity change in the health expenditure and its drivers – EC and TC – can be computed from the same four LP problems but by removing the third input, i.e. total health infrastructure (x_3). Note that this method of productivity change was also earlier applied to compute dynamic macroeconomic performance change of Indian states (Sahoo and Acharya 2012; Acharya and Sahoo 2017).

4.3 Results and Discussion

In this section we discuss the results obtained from our DEA results on health system productivity change and health expenditure productivity change. The trends in HSPC of the 17 Indian states are presented in Table 4.2. The coefficient of variation presented in Table 4.3 and plotted in Fig. 4.1 shows the presence of interstate disparities in HSPC in the study period.

The interstate disparities are more visible after the year 2009. The HSPC is plotted for two different years, i.e. 2004–2005 and 2014–2015, for all the states in Fig. 4.2. It's evident that the disparity in health system productivity change has increased from the year 2004–2005 to the year 2014–2015.

In the year 2004–2005, only two states witnessed productivity growth in the health system, i.e. Andhra Pradesh and Punjab. The number of states witnessing productivity growth has varied between two to five over the period 2004–2005 to 2014–2015. All the other states have experienced productivity decay in the health system. No state was found with constant productivity during this period (Table 4.4).

An analysis of the HSPC ranks above shows that nine states have witnessed improvement in their ranks. Further, two states have retained their ranks, and the ranks of the rest of the states have fallen over 2004–2005 to 2014–2015. The

Table 4.2 Health system productivity change (2004–2005 to 2015–2016)

	Andhra Pradesh	Bihar	Chhattisgarh	Goa	Gujarat	Haryana	Jammu and Kashmir	Jharkhand	Karnataka	Kerala	Maharashtra	Odisha	Punjab	Rajasthan	Tamil Nadu	Uttar Pradesh	West Bengal
2004–2005	1.588	0.378	0.943	0.701	0.967	0.690	0.871	0.474	0.959	0.608	0.995	0.513	1.276	0.547	0.567	0.757	0.819
2005–2006	0.829	0.897	0.930	1.171	0.561	0.857	0.938	0.876	0.162	1.629	1.147	0.542	0.515	0.964	1.022	0.910	1.138
2006–2007	0.250	0.851	0.868	0.847	0.665	0.572	0.880	1.356	0.815	0.683	0.859	1.432	1.510	0.756	1.275	0.905	0.628
2007–2008	1.221	0.978	0.743	0.819	0.784	0.967	0.931	0.806	0.844	1.003	0.390	1.123	0.335	2.559	0.625	0.910	0.754
2008–2009	0.796	0.877	0.736	0.902	0.735	0.615	0.765	0.894	0.928	0.752	1.059	0.683	1.701	0.886	0.596	0.814	0.694
2009–2010	2.195	0.935	0.917	1.035	0.786	2.554	0.897	1.053	0.794	0.706	0.977	0.878	0.342	0.805	0.742	0.867	0.983
2010–2011	0.238	0.835	0.770	0.820	0.950	0.370	0.794	0.883	0.790	0.780	0.737	0.774	0.845	0.373	1.078	0.932	0.916
2011–2012	0.911	0.995	0.844	1.351	0.769	5.788	0.928	1.039	0.825	0.894	0.838	0.582	0.636	0.675	0.771	0.862	1.225
2012–2013	0.581	0.863	0.777	0.792	1.003	0.145	0.877	0.810	0.875	0.885	0.863	0.900	0.948	0.843	0.921	0.926	0.858
2013–2014	1.178	0.601	0.661	0.967	0.768	0.768	0.987	0.704	0.810	0.867	0.788	0.649	59.152	0.876	0.845	0.891	0.788
2014–2015	1.341	0.745	0.665	0.493	0.804	1.213	0.716	0.562	0.838	0.760	0.669	0.785	0.079	0.765	0.989	0.815	0.952

Table 4.3 Interstate disparities in HSPC

Year	CV
2004–2005	38.235
2005–2006	36.561
2006–2007	37.059
2007–2008	51.394
2008–2009	29.434
2009–2010	52.192
2010–2011	29.503
2011–2012	102.788
2012–2013	23.926
2013–2014	332.656
2014–2015	35.773

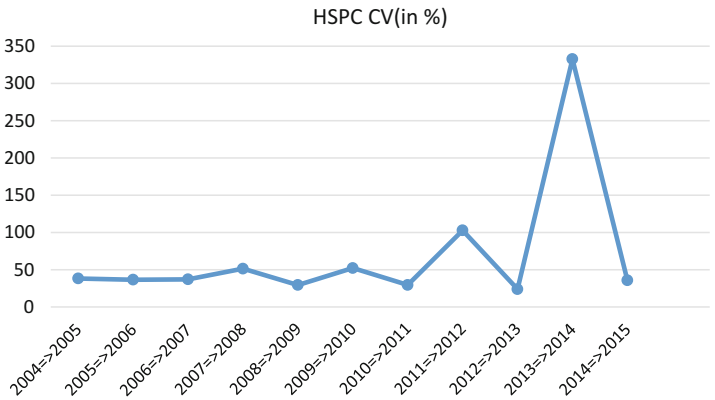

Fig. 4.1 Coefficient of variation (HSPC)

fluctuation in the ranks of states might be due to varying allocation of health expenditure (both revenue and capital) across levels of care, i.e. primary, secondary and tertiary care, and the timely completion of health infrastructure (Table 4.5).

As regards health expenditure productivity change (HEPC), we find that two to four states have experienced health expenditure productivity growth during the study period and the others' productivity has decayed. In the second half of the period under study, the number of states witnessing productivity decay has increased. The interstate disparity in HEPC as measured by the coefficient of variation is presented in Fig. 4.3. The disparity seems to be very high in the last 3 years (Table 4.6).

As evident in Table 4.7, about ten states have experienced improvement in their ranks in terms of health expenditure productivity. Andhra Pradesh is the only state to have retained its rank, whereas all the other states have fallen in their ranks. Further, productivity changes have been calculated using per capita inputs and per capita outputs. The results presented in Table 4.8 show that per capita HSPC (PCHSPC) ranks of nine states have improved from the year 2004–2005 to 2014–2015. It is also observed that the ranks of states change when seen in terms of their per capita HSPC.

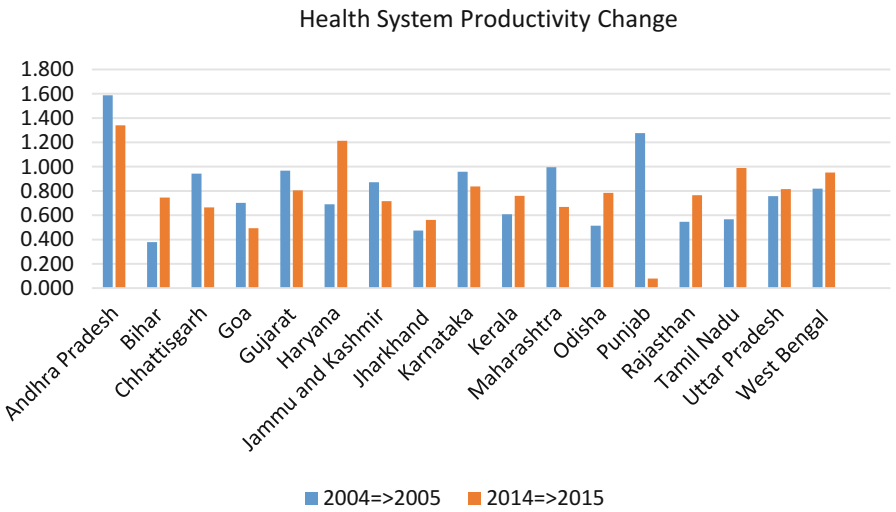

Fig. 4.2 Health system productivity change (2004–2005 and 2014–2015)

Table 4.4 Change in HSPC ranks of states

States	HSPC (2004–2005)	Rank	HSPC (2014–2015)	Rank
Andhra Pradesh	1.588	1	1.341	1
Bihar	0.378	17	0.745	11
Chhattisgarh	0.943	6	0.665	14
Goa	0.701	10	0.493	16
Gujarat	0.967	4	0.804	7
Haryana	0.69	11	1.213	2
Jammu and Kashmir	0.871	7	0.716	12
Jharkhand	0.474	16	0.562	15
Karnataka	0.959	5	0.838	5
Kerala	0.608	12	0.760	10
Maharashtra	0.995	3	0.669	13
Odisha	0.513	15	0.785	8
Punjab	1.276	2	0.079	17
Rajasthan	0.547	14	0.765	9
Tamil Nadu	0.567	13	0.989	3
Uttar Pradesh	0.757	9	0.815	6
West Bengal	0.819	8	0.952	4

However, there is an increase in number of states experiencing per capita health system productivity growth compared to the number of states experiencing per capita health expenditure growth till the year 2009–2010. Both the growth figures decline after the year 2010–2011. The productivity changes including health infrastructure inputs are better than the health expenditure productivity growth.

Table 4.5 Health expenditure productivity change (2004–2005 to 2015–2016)

Year	Andhra Pradesh	Bihar	Chhattisgarh	Goa	Gujarat	Haryana	Jammu and Kashmir	Jharkhand	Karnataka	Kerala	Maharashtra	Odisha	Punjab	Rajasthan	Tamil Nadu	Uttar Pradesh	West Bengal
2004–2005	1.600	0.378	0.943	0.698	0.967	0.690	0.871	0.474	0.920	0.608	0.995	0.513	1.249	0.547	0.567	0.757	0.819
2005–2006	0.829	0.897	0.930	1.126	0.561	0.857	0.938	0.876	0.162	1.627	1.147	0.542	0.544	0.964	1.022	0.910	1.138
2006–2007	0.249	0.851	0.868	0.822	0.665	0.572	0.880	1.356	0.815	0.683	0.857	1.432	1.455	0.756	1.275	0.905	0.628
2007–2008	1.246	0.978	0.743	0.678	0.784	0.967	0.931	0.806	0.844	0.979	0.399	1.123	0.323	2.542	0.625	0.910	0.754
2008–2009	0.770	0.877	0.736	0.884	0.735	0.615	0.765	0.894	0.928	0.760	1.056	0.674	1.661	0.872	0.596	0.814	0.694
2009–2010	2.195	0.935	0.917	0.990	0.786	2.496	0.897	1.053	0.794	0.706	0.977	0.878	0.342	0.805	0.742	0.867	0.983
2010–2011	0.238	0.835	0.770	0.773	0.950	0.370	0.794	0.883	0.790	0.780	0.737	0.774	0.845	0.373	1.078	0.932	0.916
2011–2012	0.911	0.995	0.844	1.388	0.769	5.788	0.928	1.039	0.825	0.894	0.838	0.582	0.636	0.675	0.771	0.862	1.225
2012–2013	0.581	0.863	0.777	0.768	1.003	0.145	0.877	0.810	0.875	0.885	0.863	0.900	0.948	0.843	0.921	0.926	0.858
2013–2014	1.178	0.601	0.661	0.967	0.768	0.768	0.987	0.704	0.810	0.867	0.788	0.649	59.152	0.876	0.845	0.891	0.788
2014–2015	1.341	0.745	0.665	0.486	0.804	1.212	0.716	0.562	0.838	0.760	0.669	0.785	0.073	0.765	0.989	0.815	0.952

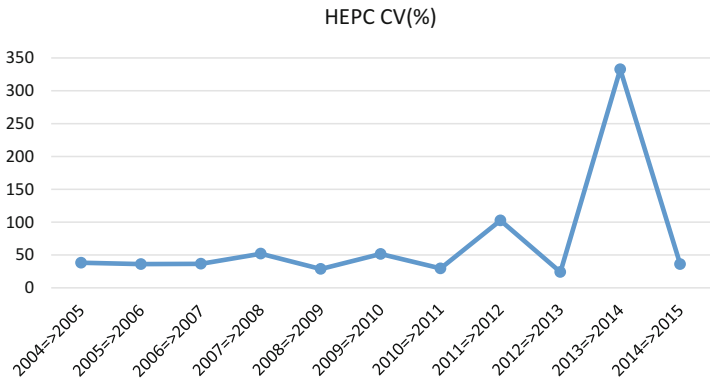

Fig. 4.3 Coefficient of variation (HEPC)

Table 4.6 Coefficient of variation (HEPC)

Year	CV
2004–2005	38.202
2005–2006	36.092
2006–2007	36.587
2007–2008	51.999
2008–2009	28.667
2009–2010	51.496
2010–2011	29.541
2011–2012	102.630
2012–2013	23.999
2013–2014	332.656
2014–2015	35.996

The reasons underlying wide variation in health system and health expenditure productivity changes may be complex. However, we attempt to relate both the productivity changes across the 17 states with net state domestic product of the states. A dynamic panel model consisting of an endogenous lagged dependent variable (productivity change variable) is estimated. It is widely accepted that the application of OLS on dynamic panel models may result in biased and inconsistent estimators. Therefore, to address this problem, generalised method of moments (GMM) proposed by Arellano and Bond (1991) is employed. Accordingly, to examine the determinants of productivity changes, we estimate a dynamic panel model with PCHSPC, PCHEPC and per capita NSDP growth. There is a negative relationship between both the per capita productivity change variables and NSDP growth. The impact of growth is higher on health expenditure productivity changes than health system productivity changes, the coefficient being −0.04 at 1% level of significance (Tables 4.9 and 4.10).

Further, the lagged productivity terms are negative and statistically significant implying the persistent effects of past productivity changes on the current period

Table 4.7 Change in HEPC ranks of states

States	HEPC (2004–2005)	Rank	HEPC (2014–2015)	Rank
Andhra Pradesh	1.600	1	1.341	1
Bihar	0.378	17	0.745	11
Chhattisgarh	0.943	5	0.665	14
Goa	0.698	10	0.486	16
Gujarat	0.967	4	0.804	7
Haryana	0.690	11	1.212	2
Jammu and Kashmir	0.871	7	0.716	12
Jharkhand	0.474	16	0.562	15
Karnataka	0.920	6	0.838	5
Kerala	0.608	12	0.760	10
Maharashtra	0.995	3	0.669	13
Odisha	0.513	15	0.785	8
Punjab	1.249	2	0.073	17
Rajasthan	0.547	14	0.765	9
Tamil Nadu	0.567	13	0.989	3
Uttar Pradesh	0.757	9	0.815	6
West Bengal	0.819	8	0.952	4

Table 4.8 Change in PCHSPC ranks of states

States	PCHSPC (2004–2005)	Rank	PCHSPC (2013–2014)	Rank
Andhra Pradesh	1.489	1	0.718	16
Bihar	0.797	16	0.838	13
Chhattisgarh	0.915	12	0.748	15
Goa	1.031	3	1	4
Gujarat	0.997	4	0.986	8
Haryana	0.925	11	0.994	6
Jammu and Kashmir	0.989	5	1.011	2
Jharkhand	0.953	9	0.897	12
Karnataka	0.954	8	0.972	10
Kerala	0.932	10	0.974	9
Maharashtra	0.963	6	1.010	3
Odisha	0.702	17	0.647	17
Punjab	1.120	2	29.582	1
Rajasthan	0.889	14	0.802	14
Tamil Nadu	0.907	13	0.990	7
Uttar Pradesh	0.877	15	0.957	11
West Bengal	0.961	7	0.995	5

change. This might be due to the fact that during the study period, there has been more productivity decays than productivity growth for most of the states. It's seen in Fig. 4.4 that the number of states witnessing productivity growth declined after the year 2010.

Table 4.9 NSDP growth and per capita health system productivity change: Arellano and Bund (1991) estimates.

Lagged PCHSPC	−0.87 (0.00)
NSDP growth (−1)	−0.02 (0.02)
Sargan test p-value	0.94

Dependent variable: per capita health system productivity change (PCHSPC)

Table 4.10 NSDP growth and per capita health expenditure productivity change (PCHEPC): Arellano and Bund (1991) estimates

Lagged PCHEPC	−0.69 (0.00)
NSDP growth (−1)	−0.04 (0.00)
Sargan test p-value	0.82

Dependent variable: per capita health expenditure productivity change

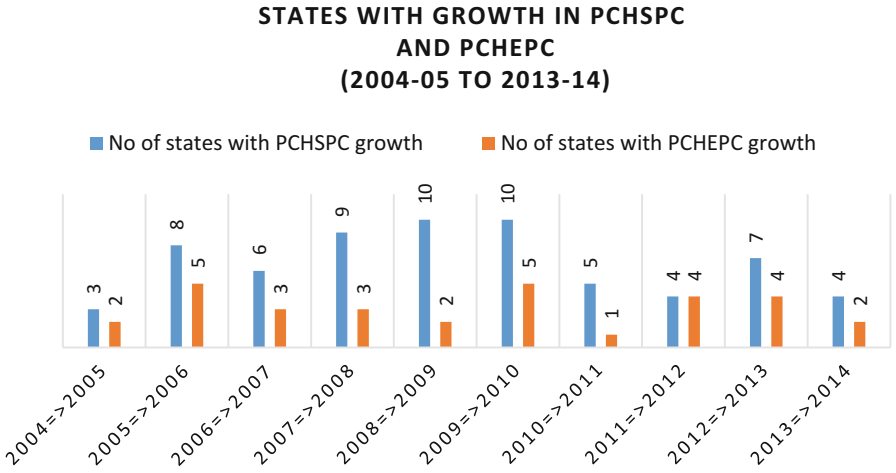

Fig. 4.4 Number of states with PCHSPC and PCHEPC growth

4.4 Conclusion

In this chapter we make an attempt to examine the health system productivity changes and health expenditure productivity changes for 17 major Indian states in the post-reform period. The time period of 2004–2005 to 2014–2015 is chosen owing to consistent availability of data. Further, an attempt is made to see if the states' income growth has any role in their behaviour of health system/expenditure productivity change. Both the productivity changes are calculated in per capita terms too. The selection of inputs and outputs for measuring productivity changes are guided by consistent availability of data across the states for our time period.

The results of productivity changes are mixed in nature, though all the productivity changes are volatile as depicted by the coefficient of variation. Some of the measures witness higher fluctuation in the last 3 years of the study. Some of the possible reasons may be attributed to the nature of allocation of health expenditure in the revenue and capital accounts. Most of the states have legislated the Fiscal Responsibility and Budget Management Bill by now. This might have constrained the states to spend adequately on health. Moreover, health being primarily state subject governance in the sector in terms of proper allocation of budget and timely utilisation of the budget allocated matters a lot for the infrastructure to be in place.

Our study has not been able to include the human resources as one of the inputs. Therefore, the results of productivity change need a cautious interpretation. We find a negative relationship between both the per capita productivity change variables and NSDP growth. The impact of growth is higher on health expenditure productivity changes than health system productivity changes. Our results also imply persistent effects of past productivity changes on the current period productivity change.

The limitation of the study lies in not being able to use relatively more disaggregated data which ignores the state-specific health outcomes in terms of productivity changes. The specific policy changes and efforts of the state largely contribute to the health outcomes. For instance, a recent study by Muraleedharan et al. (2011) points to several factors leading to success of Tamil Nadu's health system such as stable bureaucracy and effective managers ensuring continuity in policies and programmes. According to this study, innovations like a new drug system in Tamil Nadu also helped rationalising both purchase and distribution of medicines to public hospitals and PHCs. The study also emphasises the role of enabling factors such as improved gender equality, higher literacy rate and economic growth. Therefore, studies in the future may incorporate these specific factors into the productivity change analysis done in this chapter. The determinants of technical change and efficiency change could also be studied to examine the policy efforts of different states. Some control variables such as enrolment ratios in education, literacy rate, human development index, etc. could also be considered in the dynamic panel models.

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Chapter 5
Gender Perspectives in Health-Related Situation in Rural Bangladesh: A Microlevel Study

Wardatul Akmam

Abstract Bangladesh has a success story in achieving the Millennium Development Goals, especially those related to women's development. Women's participation in income-generating activities, education, and politics has also increased significantly in the recent years. Under the circumstances, the proposed study endeavors to discover the gender perspectives in health-related situation in a village named Kathalbari situated in northern Bangladesh. Using social survey method, heads of household and their spouses were interviewed using structured questionnaires to know about their health-related situation and practices. Data have been processed and analyzed using SPSS software. Factors that affect health condition of men and women have been identified using binomial logistic regression. The findings suggest that disparity between men and women regarding getting nutritious food, maintenance of necessary hygiene, and seeking medical care is not very conspicuous. Among many variables, ownership of land and age affect men's health condition, while women's health condition was significantly affected by age and use of contraceptives (significance level 0.05).

Keywords Gender · Health-related situation · Kathalbari village · Bangladesh

5.1 Introduction

Article 25 (1) of the Universal Declaration of Human Rights states, "[e]veryone has the right to a standard of living adequate for the health and well-being of himself and of his family, including food, clothing, housing and medical care and necessary social services, and the right to security in the event of unemployment, sickness, disability, widowhood, old age or other lack of livelihood in circumstances beyond his control" (United Nations 2015). Article 2 of the same document declares "[e]

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veryone is entitled to all the rights and freedoms set forth in this Declaration, without distinction of any kind, such as race, colour, sex, language, religion, political or other opinion, national or social origin, property, birth or other status. . . .” Therefore, as human beings, all men and women have equal right to get ample opportunity to remain healthy and to get access to health care. As Bangladesh has endorsed this document, the people of this country also deserve the same.

The World Health Organization (1946) defines “health” as “a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.” Sociologists contend that the concepts of “health” and “illness” are social constructs. Rather than having a universal meaning, connotation of such concepts is influenced by culture, experience, time, place, etc. (Conrad and Barker 2010).

There are several models that explain issues relating to health and illness in sociology, e.g., biomedical model, social model, etc. According to the biomedical model, illness—either mental or physical—occurs when some measurable physiological departure takes place from what is recognized as “normal” or “healthy” (Strickland and Patrick 2015). This model does not take into account socioeconomic, cultural, and environmental variables, which are emphasized by the social model. The author of this chapter underscores the need to consider factors that help people to remain healthy as well as those that help one to get well when they are sick. For this reason, instead of using the concept of “health,” the author uses the term “health-related situation” in which culture and socioeconomic-demographic aspects, time, and space as well as people’s access to health-care system have been brought under consideration.

Bangladesh is a country where inequity is high with a Gini coefficient of 0.32. Health-related situations vary in this country with changes in various factors such as geographic region, rural-urban location, wealth, gender, etc. (UNICEF 2015). According to Britt et al. (2010), “gender equity and positive health outcomes are mutually reinforcing.” In order to address this issue in a patriarchal society like Bangladesh, this paper endeavors to study the health-related situations from a gender perspective in a rural setting of northern Bangladesh.

At a certain point in time, baby boys naturally outnumber baby girls by a ratio of 105:100 (WHO 2018). However, according to Amartya Sen (1990), this usual trend found in developed countries was not observed in India or North Africa, owing to gender disparity in the distribution of food, access to medical care and social services, etc. Similar was the situation of women in Bangladesh until the recent past. During the second half of the twentieth century, women’s life expectancy at birth in Bangladesh was 49 years or below. During the first few years of this millennium, service of a trained doctor was not available to about 30% of the dying patients, and prenatal checkups were not done by 60% of the expectant mothers. People in the rural areas in particular enjoyed very little access to health-care facilities. The poor were also deprived of such services (Rahman et al. 2005).

At present average life expectancy at birth in Bangladesh has risen up to 72 years (UNDP, Bangladesh 2017). The Human Development Index reveals that an improvement by 46% had taken place in between 1990 and 2013 (UNICEF 2015). Findings of a study carried out in 2009 showed that female under-five mortality rate

(U5MR) was 20% lower than that of boys (UNICEF 2011). Maternal mortality rate reduced from 4.5/1000 live births in 1998 (Ahmed et al. 1998) to 1.7/1000 live births in 2014 (The Daily Star 2014). Similarly, many significant visible changes have occurred in women's socioeconomic position, lifestyle, and empowerment. Bangladesh has a success story in achieving the Millennium Development Goals, especially in reducing head-count poverty, primary school enrollments, gender parity in primary and secondary education, improved immunization coverage, and under-5 mortality rates (UNICEF 2015). Women's participation in income-generating activities, education, and politics has also increased significantly. A finding of a research conducted by Asaduzzaman et al. (2015) was that 88% of the respondent women contributed to increase their household income. Gender Gap Report, 2017 shows that the position of Bangladesh is 47th among 144 countries (placing the country with the least gap on top), based on the criteria of "political empowerment, economic participation and opportunity, educational attainment and health and survival," leading the list of South Asian countries (Rezvi 2017).

Nevertheless a study conducted in a remote village of Chandpur district found a "very poor" condition of women's health. Women aged between 15 and 49 suffered from various diseases, including fever, diarrhea, skin diseases, asthma, reproductive tract infection, and gynecological diseases (Paul et al. 2014). According to a report of 2015, only 40% of the population enjoys government medical facilities, and malnutrition is persistent in all age groups. Poverty prevents the poor from getting minimum access to secondary−/tertiary-level medical care, although the government tries to provide primary health-care services through union-level health centers and upazila (thana) health complex hospitals (Prince 2015). The major public health concerns in Bangladesh according to Mohammad et al. (2016) are childhood malnutrition; unsanitary living conditions; food contaminated by toxins, microbial pathogens, and chemical substances; TB; pneumonia; cancer; diabetes; chronic cardiovascular disease; chronic respiratory disease; etc. Under the circumstances, this study endeavors to discover the gender perspectives in health-related situation in a village named Kathalbari situated in northern Bangladesh. More specific objectives of the study and its methodology are given below.

5.2 Objectives of the Study

The specific objectives of this study are as follows:

1. To examine the socioeconomic and demographic conditions of the people of the study village;
2. To study the health-related situation for men and women in the village;
3. To depict the differences in the health-related situation for men and women in the village (if any).

5.3 Methods

Social survey method has been used for this study. The study locale was a village named Kathalbari, located in Katabari Union of Gobindaganj Thana within Gaibandha District under Rangpur Division. The area is situated in northern Bangladesh. There were 303 households in the village at the time of data collection (January to March, 2018). To get actual information, the head (usually a male) and his wife of each household were interviewed (using structured schedules) by some interviewers appointed by the researcher. Attempts have been made to include all the households. However, as the questionnaires included some personal questions, some residents in the village declined to participate as a respondent. At the end of the survey, the number of respondents stood at 199. Even among these 199 respondents, not all the questions were answered by all respondents. The data were processed and analyzed using SPSS software. Statistical procedure of binomial logistic regression has been applied to show the socioeconomic and demographic factors that can predict the health condition of men and women.

5.4 Socioeconomic and Demographic Condition of the Respondents

Socioeconomic conditions make up a significant share of the health-related situation in any area. Having information on age, occupation, income, etc. helps us to understand the extent to which these factors affect people's awareness on health issues and also determine whether they would or would not avail medical services (Khanum et al. 2003). Hossen (2014: 109) is of the opinion that socioeconomic factors rather than medical care influence "the most important antecedents of human health." Owing to its prime importance, information on various socioeconomic factors is presented in this section before delving into more particular health-related aspects.

Table 5.1 portrays that more than 91.4% of the households under study earned less than 15,000 taka (183 US$) per month. With such an income, it is difficult to maintain a healthy lifestyle. However, most of the respondents opined that they were feeling healthy at the time of data collection.

Table 5.1 Family income

Amount of income per month (taka)[a]	No. of respondents	Percent
<5000	89	44.7
5000–15,000	93	46.7
15,000–30,000	13	6.5
30,000–50,000	4	2.0
Total	199	100.0 (Approx.)

[a]1 US$ = 82 taka

Table 5.2 Occupation of the heads of household

Occupation	No. of respondents	Percent
Service	15	7.9
Business	1	0.5
Farmer	164	86.8
Others	9	4.8
Total	189	100.0

Table 5.3 Amount of cultivable land owned by the respondents

Social status	No. of respondents	Percent
No cultivable land	81	40.7
Less than one bigha[a]	15	7.6
1–3 bighas	46	23.1
3–9 bighas	41	20.6
More than 9 bighas	16	8.0
Total	199	100.0

[a]1 bigha = 0.33 acres

A village or a rural area is often characterized by the occupation of its residents. It is expected that most of the residents of a village would earn their living through agriculture—be it as a land owner or a tenant. Table 5.2 shows occupation of the heads of households who are usually male in Bangladesh. Accordingly, in this study, all the heads of households were men. Among the respondents, only 1 was a businessman, and 15 (7.9%) were service holders. Nine of them earned their living by engaging in other occupations, including teaching in a school or a *madrasa* (a school that emphasizes Islamic teachings). However, almost 87% of the respondent heads of household in Kathalbari village earned their living through agriculture proving it as a typical rural area.

In rural areas, ownership of land is sometimes more important than pecuniary income. Table 5.3 presents the amount of cultivable land owned by the respondents. It shows that more than 71% of the respondents owned less than one acre of land. Only about 30% of the households owned more than three *bighas* (1 acre) of land. We observe that marginalization regarding ownership of cultivable land has already occurred in Kathalbari.

Level of education achieved by the respondents is an indicator of their income, lifestyle, and well-being. In developing countries, mother's education is said to be an important indicator of children's survival and health as well as their education (see Akmam 1997, 2001). Women's education is also related to reduction of fertility rate (Akmam 2002). Table 5.4 reveals that a higher proportion of men (18.7%) were illiterate than women (12.4%) in the study village. This could be due to the fact that the government and NGOs have undertaken various types of initiatives for girls' education in particular since the 1990s. Besides, husbands are usually 5–10 years older than wives meaning that the wives might have received better educational opportunities than their husbands. A higher percent of women have been

Table 5.4 Level of education of the male and female respondents

	Male		Female	
Level of education	No. of respondents	Percent	No. of respondents	Percent
Illiterate	37	18.7	24	12.4
Literate	49	24.7	52	26.8
Primary	41	20.7	49	25.3
Secondary	53	26.8	68	35.0
Tertiary	18	9.1	1	0.5
Total	198	100.0	194	100.0

Table 5.5 Religion of the respondents

Religion	No. of respondents	Percent
Islam	173	86.9
Hinduism	26	13.1
Total	199	100.0

Table 5.6 Age of male and female respondents

	Male		Female	
Age (in years)	No. of respondents	Percent	No. of respondents	Percent
15–25	3	1.5	18	9.3
26–40	98	49.2	103	53.1
41–50	48	24.1	45	23.2
51–60	37	18.6	26	13.4
More than 60	13	6.5	2	1.0
Total	199	100.0 (Approx.)	194	100.0

educated up to the secondary level (35%) than men (26.8%). However, much greater proportion of men ($n = 18$, 9.1%) achieved tertiary-level education than women ($n = 1$, 0.5%).

Table 5.5 portrays religion of the respondents. Often religions prescribe or prohibit certain acts that are likely to affect one's health. Among the 199 households of Kathalbari under this study, 86.9% ($n = 173$) were Muslim, and 13.1% ($n = 26$) were Hindu.

Age of an individual naturally affects one's health condition. Usually people suffer less from diseases in between 15 and 45 years of age, the working age. As people grow older, their morbidity rate increases. Thus age is an important demographic factor to consider while studying health condition. Among the respondents of this study, heads of households (males) are relatively older than their wives. It is more or less a cultural norm in patriarchal societies like Bangladesh that wives would be younger to their husbands. Table 5.6 shows that 73% of the men and 76% of the women belonged to the age group of 26–50 years. More than 25% of the men were aged more than 50 years while only 14% of the women belonged to that age category.

Table 5.7 Number of members in household

No. of members	No. of respondents	Percent
Three	2	1
Four	149	74.9
More than four	48	24.1
Total	199	100.0

Table 5.8 Type of house

Type of house	No. of respondents	Percent
Kacha	135	70.7
Semipaka	16	8.4
Pakka	40	20.9
Total	191	100.0

Table 5.9 Number of rooms in the house

No. of rooms in the house	No. of respondents	Percent
One	3	1.5
Two	132	67.7
Three	41	21.0
Four	17	8.7
More than four	2	1.0
Total	195	100.0 (Approx.)

Joint families are now breaking up into nuclear families that comprise of husband, wife, and their unmarried children. Hence, the average number of members in family (family size) is naturally decreasing. Moreover, birth control practices are keeping family size small. In the study area, more than 75% of the households had only four members or less in their families (Table 5.7).

The type of house one lives in negatively affects his/her health if it is not congenial to good health. As portrayed in Table 5.8, more than 70% of the respondents of this study lived in *Kacha* houses (wall and floor made of mud with a roof made of bamboo and straw or corrugated iron sheets). Almost 21% lived in *Pakka* houses (concrete roof and floor, wall of bricks) and 8% lived in Semi*paka* houses (concrete floor, brick walls, and roofs made of corrugated iron sheets).

Number of rooms of a house usually represents the size of the house as well as the extent of privacy maintained. Most of the respondents (67.7%) lived in two-room houses while 21% lived in houses with three rooms (Table 5.9).

Nowadays, a house without electricity is unthinkable. Although electricity connection is still not available in all parts of Bangladesh, 98% of the respondents in Kathalbari enjoyed electricity connection (Tables 5.10).

The main source of safe drinking water in the study village was tube well. Access to safe water is essential for healthy living. Table 5.11 confirms that 99% of the respondents had a tube well within their home compound. Although tube wells of some areas of Bangladesh are badly contaminated by arsenic, the study village Kathalbari is free of such menace.

Table 5.10 Whether residence has electricity connection

Whether residence has electricity connection	No. of respondents	Percent
Yes	192	98.0
No	4	2.0
Total	196	100.0

Table 5.11 Whether the house has a tube well

Whether the house has a tube well	No. of respondents	Percent
Yes	189	99.0
No	2	1.0
Total	191	100.0

Table 5.12 Type of toilet

Type of toilet	No. of respondents	Percent
Sanitary	102	51.3
Non-sanitary	97	48.7
Total	199	100.0

To maintain hygiene, a sanitary latrine/toilet is a must. In Kathalbari, it is observed that only 51.3% of the respondents had sanitary toilets in their houses. This shortcoming has to be overcome to ensure health for all in the village (Table 5.12).

5.5 Health-Related Situation in Kathalbari: Gender Perspectives

All the social, economic, demographic, and environmental factors along with access to health care comprise the health situation of a particular area. Health situation involves consumption of a balanced diet, maintenance of hygiene, and access to health care. Health situation in Kathalbari is described below on the basis of these three conditions mentioned above.

As we have seen in Table 5.1, monthly income of the villagers was quite low. With such an income, it is difficult to manage protein-rich food items like meat and fish everyday for everyone in the house. Eggs are also a good source of protein. In Kathalbari, women of many households kept chickens to get eggs and to have meat when necessary. At the time of their need, they also sold those chickens and eggs to get hard cash. Table 5.13 shows that 34.2% of the women respondents never ate meat/fish/eggs. However, all of the male respondents consumed these protein items at least once a week. Surprisingly, however, we observe that while only 22.1% of the male respondents consumed protein items everyday, 48.7% of the women enjoyed the same.

Table 5.13 Consumption of meat/fish/egg by the male and female respondents

Consumption of meat/fish/egg per week	Male		Female	
	No. of respondents	Percent	No. of respondents	Percent
Never	0	0	68	34.2
1–2 days	5	2.5	0	0
3–4 days	113	56.8	6	3.0
5–6 days	37	18.6	28	14.1
Everyday	44	22.1	97	48.7
Total	199	100.0	199	100.0

Table 5.14 Consumption of dal by the male and female respondents

Consumption of dal per week	Male		Female	
	No. of respondents	Percent	No. of respondents	Percent
Never	0	0	6	3
1–2 days	57	28.9	0	0
3–4 days	120	60.9	35	17.7
5–6 days	18	9.1	129	65.2
Everyday	2	1.0	28	14.1
Total	197	100.0 (Approx.)	198	100.0

Table 5.15 Consumption of milk by the male and female respondents

Consumption of milk per week	Male		Female	
	No. of respondents	Percent	No. of respondents	Percent
Never	2	1	0	0
1–2 days	45	22.6	70	35.2
3–4 days	84	42.2	30	15.1
5–6 days	16	8.1	73	36.7
Everyday	52	26.1	26	13
Total	199	100.0	199	100.0

Dal (split pulses) is a kind of bean-like crop, rich in protein consumed by almost all people in Bangladesh. There are many types of *dal* including lentils, chickpeas, *mung*, etc. *Dal* is a source of vegetable protein, which doctors recommend to those who cannot afford to eat animal protein. Table 5.14 shows consumption of *dal* by the male and female respondents. The table clearly shows that women consume dal more often than men—whereas 14.1% of the female respondents consumed *dal* everyday, and only 1% of the male respondents did the same.

Milk is a good source of protein, carbohydrate, vitamins, and minerals. Women usually suffer from calcium and iron deficiency and doctors advise them to take milk and milk products (e.g., yogurt) as a remedy. Consumption of milk is therefore taken in this research as a criterion of being in good health. According to Table 5.15, on an

Table 5.16 Consumption of vegetables by male and female respondents

Consumption of vegetables per week	Male		Female	
	No. of respondents	Percent	No. of respondents	Percent
Never	0	0	3	1.5
1–2 days	44	22.1	28	14.1
3–4 days	151	75.9	3	1.5
5–6 days	2	1.0	0	0
Everyday	2	1.0	165	82.9
Total	199	100.0	199	100.0

average, consumption of milk is similar for men and women. Even though 13.1% of the female respondents took milk everyday, 26.1% of the males consumed milk everyday.

Consumption of vegetables is necessary for a balanced diet. Vegetables provide us with necessary vitamins and minerals. Among the respondents we find that women by far consumed more vegetables than men. In rural areas of Bangladesh, women usually keep kitchen gardens in which they grow vegetables. Thus vegetables are more easily available to them than meat and fish (Table 5.16).

5.6 Maintenance of Hygiene

Like eating a balanced diet, it is also important to maintain personal hygiene as well as hygiene of the household as a whole. In rural Bangladesh sexual division of labor imposes the duty of cooking food and keeping the house clean on women. They also are in the charge of doing the laundry. It is to be mentioned that all these works are done manually that require a lot of physical labor.

To do their laundry, the women used both detergent powder (92.6%) and laundry soap (16.6%) depending on the type of clothes they washed. Most frequently they used tube well site (77%) and local pond site (15%). Apart from cleaning the rooms, it is necessary to clean the toilet as well. Contagious and communicable diseases for the most part spread through the toilet. So it is important to clean the toilet regularly. More than half of the respondents (52.8%) cleaned the toilet once a week and 7.5% cleaned the toilet everyday. Most of the respondents used toilet cleaning detergent to clean their toilets.

The usual place to wash dishes for a huge majority of the female respondents was the tube well site (93.5%). However, to clean the dishes, most of them (57.3%) used ash (burnt fuel wood/fodder). Almost 41% used dishwashing detergent. Many rural women think cleaning dishes (especially those made of aluminum) with ash makes them shinier. Moreover, it saves them the extra expenditure for dish cleaning detergent.

Table 5.17 Substance used by respondents to wash their hands after using toilet

	Male		Female	
Substance	No. of respondents	Percent	No. of respondents	Percent
Soap	104	52.5	98	50.0
Ash	49	24.7	89	45.4
Soil	45	22.7	9	4.6
Total	198	100.0 (Approx.)	196	100.0

Table 5.18 Whether wears sandals while using toilet

	Male		Female	
Whether wears sandals while using toilet	No. of respondents	Percent	No. of respondents	Percent
Yes	197	99.5	195	99.5
No	1	0.5	1	0.5
Total	198	100.0	196	100.0

It is necessary to maintain hygiene and be cautious while preparing food. In order to retain vitamin A of vegetables, it is suggested by doctors to wash vegetables before cutting and not vice versa. Among the respondents of Kathalbari, 93.5% washed the vegetables after cutting them. Washing the vegetables after cutting them drained away the vitamins that were soluble in water (e.g., Vitamin A). It is also important to keep food covered to keep it safe from flies and other insects. Among the respondents 74% said that they were not able to keep their food covered all the time. Naturally it is expected that many people would suffer from stomach disorders. The villagers did, however, put their garbage in one specific place, to keep germs from spreading (97%). Maintenance of hygiene requires cutting one's nails regularly. Among the respondents 92% cut their nails every week. To cut their nails, they mostly use razor blades (60.8%) and nail cutters (35.2%). A huge majority of the women (96%) took their bath at the site of tube wells, and 76% used bathing soap everyday while taking their bath. It is to be mentioned that the tube well sites in most cases were fenced on four sides without a roof.

People all over Bangladesh are now aware of the importance of washing their hands after using the toilet. Washing hands with only water is not sufficient. So, respondents used soap, ash (of fodder/fuel wood, etc.), and even soil to clean their hands. Table 5.17 shows that larger number of women used ash (45.4%) as compared to soil, which tends to be more often used by men (22.7%) in Kathalbari.

Wearing sandals while using the toilet is very important to be safe from various germs that cause diseases. Table 5.18 shows that this practice is equally prevalent among males and females.

The most important question this paper aims to answer is whether male and female respondents of Kathalbari felt completely healthy or not. Almost 73% of the men and 76% of women said they felt completely healthy at the time of the interview (Table 5.19).

Table 5.19 Whether feels completely healthy or not

Whether feels completely healthy or not	Male		Female	
	No. of respondents	Percent	No. of respondents	Percent
Yes	145	72.9	152	76.4
No	54	27.1	47	23.6
Total	199	100.0	199	100.0

Table 5.20 Common diseases the respondents suffered from

Most common diseases the respondents suffered from	Male		Female	
	No. of respondents	Percent	No. of respondents	Percent
Cold/flu	27	13.6	5	2.5
Fever	108	54.3	11	5.5
Headache	120	60.3	6	3
Toothache	45	22.6	7	3.5
Stomach problems	42	21.1	47	23.6
Diabetes	0	0	15	7.5
Female disease	0	0	139	69.8
Others	9	4.5	3	1.5

Multiple response accepted

Table 5.20 depicts the common health problems the respondents suffered from. Among men, fever, headache, toothache, and stomach problems were common. Among women, female diseases occupied the most common health problems. Diabetes was observed among 7.5% of the women.

5.7 Access to Health Care

In order to understand the situation regarding the respondents' access to health care, a short description of the types of treatment available to them is necessary. There is a union health center at 2 km distance and an upazila health complex hospital run by the government at 7 km distance from Kathalbari. Union health center provided some primary treatment, while upazila health complex hospitals provided relatively more specialized facilities. If a patient needs better treatment, they are referred to Shaheed Ziaur Rahman Medical College Hospital, Bogra, Rangpur Medical College Hospital, or even to hospitals situated in Dhaka, the capital.

Under private management some qualified MBBS (Bachelor of Medicine and Bachelor of Surgery) doctors treated patients at a place known as Bagda about 1.5 km from Kathalbari. There was also a treatment provider known as *Kaviraj* who provided herbal treatment. Usually women sought this kind of treatment. Moreover, there was a homeopath doctor to whom people went for treating specific

Table 5.21 Type of treatment availed by the respondents

Type of treatment used by respondents	Male		Female	
	No. of respondents	Percent	No. of respondents	Percent
Kaviraj (herbal)	0	0	14	7
Govt. health center/complex	60	30.2	192	96.4
MBBS doctor (private)	23	11.6	106	53.3
Village doctor	166	83.4	155	77.9

Multiple response accepted

types of disease, like female diseases. Further more, there were some "village doctors" who prescribed and provided medicine to the villagers just on the basis of their experiences of selling medicines at drug stores. They did not have any specific degree or training.

Table 5.21 shows the type of treatment the male and female respondents availed when they were sick. According to Hossen and Westhues (2011), location, monetary requirements, "bureaucratic responses to the patient," sex of the health worker and social distance between service seeker and provider, and sex of providers create barriers to women's accessibility to medical care.

It is evident from Table 5.21 that women of Kathalbari sought medical care from various types of health-care providers, even from those that were situated at a distance. Village doctors provided treatment at a low cost. Although they did not have any medical degree, the medicines they prescribed and provided relieved the patients of their sufferings. That is why more people preferred to go to them for treatment.

Doctors who served at the government health centers and health complex hospitals were mostly male. However, they (women) could (83.4%) talk to them about their health problems without hesitation. Thus the barriers mentioned by Hossen and Westhues (2011) do not appear to be functioning in this village. The respondents were asked whether they provided same types of treatment for male and female members of their families. To this question only 67 women respondents responded. Among them, 92.5% have said that they took similar types of initiatives for the treatment of the female and male members of their families.

Table 5.22 depicts the amount of money spent per month by the male and female respondents. All the women respondents were informed that they had to spend some money for treatment purposes, be it a small amount. Three (1.5%) of the male respondents did not spend any money for treatment. The table reveals that on an average, women spent more money for medical purposes than men. More than 88% of the women spent 200–1000 taka, while that amount of money was spent for medicine by 66% of the male respondents. Ninety eight percent of the male respondents themselves paid for their treatment, while spouse/daughter of the remaining male respondents paid for their treatment. Among the respondents 86% women and 78% men were content with the health services they received. Those

Table 5.22 Amount of money spent per month on medicine

Amount of money spent per month on medicine	Male		Female	
	No. of respondents	Percent	No. of respondents	Percent
Do not spend any money	3	1.5	0	0
100–200	60	30.3	21	10.7
200–500	99	50.0	112	57.1
500–1000	32	16.2	62	31.6
More than 1000	4	2.0	1	0.5
Total	198	100.0	196	100.0 (Approx.)

who were not content complained about the high cost, low standard of treatment, and the distance of the health complex.

Among the respondents, 97.5% of the male and 96% of the female took vaccines to prevent five common diseases—diphtheria, measles, polio, tetanus, and whooping cough. Almost all of the women took necessary vaccines during pregnancy. A higher percent (96.5%) of the females visited government health center/complex than the males (30.2%). Only about 40% of the female respondents and 33% of the male respondents received necessary medicine at the government health center. Eighty two percent of the male and 96% of the female respondents reported that the behavior of the health workers at the health center/complex was neither good nor bad. Only 28% of the males but 90% of the females have opined that the doctors at the health complex considered their problems seriously, with care. Fifteen percent of the male respondents and only 0.5% of the female respondents have been informed that the doctors came to their houses for treatment upon request.

5.8 Reproductive Health of Women

Factors related to the reproductive health of women significantly affect their health condition as a whole. Although 76.4% of the female respondents of this study have expressed that they felt "completely healthy," while responding to another question, 132 out of 192 women (69.3%) have reported that they suffered from one or more female diseases. Only 131 women have given information on the type of problems they suffered from—126 (63.3%) said they suffered from leucorrhoea and 5 (2.5%) from irregular menstruation. Only 63 of them have informed the type of treatment they sought to treat these diseases. Among them 20 (31.7%) availed kaviraji (herbal) medicine, 30 (47.6%) sought advice of homeopath doctors, and 13 (20.6%) used other forms of treatment including allopathic medicine. All of those who suffered from female diseases informed about these problems to their family members—mostly to their husbands (99.3%). Only one woman shared about her female disease with her mother-in-law. This information shows a sharp variation with the finding of Khanum (2002) that rural women tried to conceal information regarding their female

diseases from their husbands and mothers-in-law. It also proves that the relationship between husband and wife is becoming easy, which allows them to share all types of information with each other, without a sense of vulnerability of being deserted because of his/her illness.

Women respondents' experiences of childbirth help to better understand the scenario regarding their reproductive health. Among the 199 respondent women, only one had given birth to their youngest child 1–3 years ago. Most of them (92%) had given birth at least 6 years back. This information indicates a low fertility rate in the village.

In a study by Roy and Shengelia (2016), it was found that traditional birth attendants conducted three fourths of all deliveries at home. Such unskilled deliveries were directly related to rural residence and lower level of education. Similar were the findings of Walton and Schbley (2013)—the risk of postpartum morbidity increased at the hands of unskilled birth attendants in rural areas who were not able to follow the proper birth practices. Among the respondent women in Kathalbari, 43.2% had given birth to their youngest child at home, 27.1% had given birth at government union/upazila health center, and 26.6% had their babies delivered at hospitals/clinics situated in district towns.

During their pregnancy, 95% of the respondent women sought medical advice—97% went to union-level health centers, 26% went to upazila health complex, and almost 50% sought advice at doctors' private chambers. It is to be noted that respondents sought advice from more than one place. However, at the time of delivery, only 2.5% got help of a doctor, 40.7% took assistance of a trained midwife, and 44.2% had their babies delivered by a nurse. Only one respondent spoke of complication during their last pregnancy. She had developed diabetes during that period. Among the 199 respondents, only 5 (2.5%) said that they took increased amount of food during pregnancy and 2 (1%) avoided consumption of *dal* as a precaution.

Male and female respondents were asked about the use of contraceptives. All the female respondents responded to this question, but the answer was received from only 156 male respondents. Almost all the women (96%) and men (98.1%) who answered the question used contraceptives either at the time of the interview or previously for birth control. Majority of the women took pills (63.8%), while others took injections (37.2%) as means of birth control. Condom was the only means used by men.

Maintenance of hygiene during menstrual period is a part of reproductive health of women. Of the 199 respondents, 94 (47.2%) used sanitary napkins, and 90 (45.2%) used old cloth during this period. Fifteen respondents abstained from answering this question. Those who used cloth reused them by washing. They used tube well water and soap to wash the cloth. Most of them (60%) dried the cloth in sunlight, but the rest dried the cloth at a corner of a room, so that people cannot see it. However, this practice opens possibility of infection and female diseases in the long run.

5.9 Impact of Socioeconomic and Demographic Factors on Health of Respondents

Binomial logistic regression analysis was carried out for men and women respondents separately to ascertain the gender-segregated effects of some socioeconomic and demographic variables thought to be associated with a respondent's being healthy. In the logistic regression analysis on the basis of data for men, religion, whether satisfied with food intake or not, type of toilet, family size, whether satisfied with treatment received, family income, education level, age, protein intake, milk intake, type of house, occupation, and amount of land were the independent variables, and the dependent variable was whether a male respondent felt completely healthy or not. The logistic model was statistically significant, $\chi^2(13) = 27.402$, $p < 0.010$. The model explained 23.8% (Nagelkerke R^2) of the variance in remaining healthy and correctly classified 75.3% of cases. Increasing age was negatively associated with a man being healthy, and amount of land was positively associated with men being healthy at the significance level of 0.05 (Table 5.23).

In the logistic regression analysis on the basis of data of women, religion, type of toilet, whether satisfied with treatment received, family income, education level, age, protein intake, milk intake, type of house, and whether uses contraceptives or not were the independent variables, and the dependent variable was whether a female respondent felt completely healthy or not. The logistic model was statistically significant, $\chi^2(10) = 25.389$, $p < 0.005$. The model explained 18.9% (Nagelkerke R^2) of the variance in remaining healthy and correctly classified 77.2% of cases. Increasing age and use of contraceptives were negatively associated with a woman being healthy at the significance level of 0.05. Protein intake was positively associated at the 0.10 significance level, and living in a kacha house was negatively associated with women being healthy at significance level 0.10 (Table 5.24).

5.10 Conclusions

From the findings of the research, it can be said that despite having low income, the health-related situation in Kathalbari was not very bad for its inhabitants. A positive sign was that almost all the men and women respondents were vaccinated. However, almost half of the households did not use sanitary toilets. This is an issue that needs due attention. The gap between men's and women's level of education was not very wide. Overall differences between men's and women's health-related situations did not appear to be conspicuous. Women's access to different types of health-care providers was not restricted. Rather, women availed more options of health care than men. More women visited the upazila health complex than men to get health care, although it was situated at a distance from the village. Nevertheless, we observe some differences in consumption of food among men and women—relatively low-cost food (*dal* and vegetables) were consumed by women in greater amounts.

Table 5.23 Results of binary logistic regression analysis (men)

Independent variables	B	SE	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B)	
							Lower	Upper
Religion_	0.029	0.585	0.003	1	0.960	1.030	0.327	3.243
Whether satisfied with food intake	−20.793	27777.778	0.000	1	0.999	0.000	0.000	.
Type of toilet	−0.652	0.573	1.295	1	0.255	0.521	0.170	1.601
Family size	−0.288	0.516	0.312	1	0.576	0.750	0.273	2.061
Whether satisfied with treatment received	−0.662	0.482	1.883	1	0.170	0.516	0.200	1.328
Family income	−0.496	0.493	1.013	1	0.314	0.609	0.232	1.601
Education level	0.153	0.502	0.093	1	0.761	1.165	0.436	3.114
Age	−1.097	0.476	5.313	1	0.021	0.334	0.131	0.849
Protein intake	0.485	0.471	1.058	1	0.304	1.623	0.645	4.086
Milk intake	0.016	0.593	0.001	1	0.979	1.016	0.318	3.244
Type of house	−0.793	0.543	2.128	1	0.145	0.453	0.156	1.313
Occupation	−0.193	0.528	0.134	1	0.714	0.824	0.293	2.318
Amount of land	0.960	0.487	3.891	1	0.049	2.612	1.006	6.783
Constant	21.481	27777.778	0.000	1	0.999	2133435618.284		

Table 5.24 Results of binary logistic regression analysis (women)

Independent variables	B	SE	Wald	df	Sig.	Exp (B)	95% C.I. for EXP(B)	
							Lower	Upper
Type of toilet	−0.582	0.523	1.241	1	0.265	0.559	0.200	1.556
Family income	−0.619	0.427	2.101	1	0.147	0.539	0.233	1.244
Type of house	**−0.973**	0.510	3.645	1	**0.056**	0.378	0.139	1.026
Education level	0.188	0.424	0.197	1	0.657	1.207	0.526	2.768
Age	**−1.053**	0.408	6.666	1	**0.010**	0.349	0.157	0.776
Milk intake	0.557	0.480	1.350	1	0.245	1.746	0.682	4.470
Protein intake	**0.870**	0.474	3.360	1	**0.067**	2.386	0.942	6.045
Religion	0.861	0.600	2.058	1	0.151	2.365	0.730	7.667
Whether uses contraceptives	**−1.914**	0.960	3.972	1	**0.046**	0.148	0.022	0.969
Satisfaction with treatment received	1.262	0.888	2.020	1	0.155	3.534	0.620	20.144
Constant	−0.140	1.468	0.009	1	0.924	0.869		

Apart from the natural factor of age, the variables that were found significantly associated with men's and women's health condition were different. While men's health condition depended on their ownership of land, women's health tended to be dependent on consumption of protein, type of house, and whether they used contraceptives or not. A huge number of women (almost 70%) suffered from female diseases. More research needs to be carried out on the effects of contraceptives, as its negative effect has been observed on women's health. This issue must be addressed immediately by the government and the policy planners. Many men and women were observed availing treatment of village doctors, who did not have any professional training. Although the symptoms suffered by the villagers may subdue to some extent by the medicines prescribed by these doctors, the side effects of such medicines can be dangerous, even fatal, as these doctors often fail to prescribe the correct doses. Women have to be more careful in covering food and washing vegetables before cutting them into pieces. Awareness level must be raised in these aspects of health.

Amount of land has appeared as the social class related factor that significantly affected men's health condition. As women did not have direct access to the income received from landed property, their health situation depended more on direct consumption of protein (meat/fish/egg) and living in *pakka* house, which the poor can seldom afford. Therefore, as Islam and Biswas have suggested, "[e]quity must be the guiding principle in developing the health policy in Bangladesh. Under stewardship of the government there must be determination and a strategic vision to improve and strengthen both public and private sectors" (Islam and Biswas 2014).

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Chapter 6
Assessing Health-Related Situation of the Rural Elderly in Bangladesh: A Microlevel Study

Md. Fakrul Islam and Wardatul Akmam

Abstract Quality of life is a concept that has gained significant importance in the sociocultural, political, and medical vocabulary. With the emergence of free market economy and pro-globalization policies, Bangladesh has paved the way for the developed to be more developed and rich to be richer. There is a section of privileged citizens who are endowed with money, education, medical facilities, name, fame, and social status, enjoying modern amenities of life, and living in urban areas. The comparatively poor and underprivileged sections are more often living in the rural areas being deprived of even the basic needs and amenities of life. Usually, the rural elderly live with their families in Bangladesh. Their family members take care of them. It is an expectation of traditional society and of the elderly themselves that all their needs will be met by their offspring and other relatives living nearby. But with the passage of time, this tradition is breaking down. Therefore, it is very likely that the quality of life of the elderly in Bangladesh has currently gained a downward motion. The objective of this study is to discover the health-related situation of the elderly at some remote villages in a northern district of Bangladesh. It also delves into the gender-based differences among the elderly in their health-seeking behaviors. The principal method used for the study was a social survey. Face-to-face interview has been conducted with a structured questionnaire among the rural men and women aged 56 years and above to draw empirical data. Descriptive analyses of data using various statistical tools have been made to trace out the prevailing situation.

Keywords Health related situation · Rural elderly · Quality of life · Old age allowance

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6.1 Introduction

The number of aged people in Bangladesh as well as in all over the world is increasing rapidly. With increased life expectancy caused by improved medical facilities, the problem of elderly persons has become an increasing concern for all countries, and particularly it has emerged as a serious problem for developing countries like Bangladesh. This is because the traditional support for the elderly in these countries, the family and related institutions, has become unable to look after the elderly caused by poverty, industrialization, urbanization, and other reasons. Societal and/or state initiatives to fulfill this gap are almost absent or extremely limited in these countries because of scarcity of resources. As a result, millions of elderly are passing a miserable life in and outside the family. Bangladesh is not an exception to that. At present, there are about eight million elderly in the country. Most of them are destitute. Destitute elderly can be seen moving helplessly everywhere in the country. But a major portion of them are living in rural areas with unthinkable sufferings and miseries. They are living without minimum standards and quality of life. But they are our senior citizens and a principal part and parcel of our civil society! They can easily contribute a lot of good things to the society through guidance and advice if proper dignity and care is given to them.

This study has focused on this untouched issue and hope to explore some experiences for the welfare of the rural elderly in the near future. Through an exploratory social survey method, this research has been carried out with the help of an interview guide as the tool of data collection. The study has been conducted in some villages situated in a northern district of Bangladesh named Lalmonirhat.

6.2 Statement of the Problem

Bangladesh is a developing, largely rural, country with a population of more than 150 million (Nicola Cherry et al. 2012). Although health services remain limited, much has been achieved among the young, but with little care from outside the family for the growing population of the rural elderly. The present study was designed to identify the quality of life of the rural people of Bangladesh.

As a result of the decrease in child death and the improvement in medical science, the life expectancy of people is increasing day by day. According to the UNFPA report in 1950, "there were 200 million elderly people in the world and this is increased to 350 million in 1975. The UNO projection suggests that elderly number has reached to 600 million in 2000. If this trend continues, the elderly population by 2025 will be 1.2 billion. After that the growth of elderly population will be even higher and by 2025 it will be about 2 billion" (Abedin 1996) (Table 6.1).

The SAARC countries bear 18.1% of the total elderly population of the world and 31.6% of the elderly population of Asia. The percentage of aged population of the SAARC countries was 6.9 compared to 6.5% in Asia and 9.5% in the world during

Table 6.1 Trends of the elderly population in the SAARC countries (percentage of total population aged 60 years or older)

Country	1995	2000	2005	2010	2015
Bangladesh	4.7	4.9	5.2	5.5	6.2
Bhutan	5.5	5.7	5.8	5.9	6.0
India	7.6	8.0	8.4	9.0	9.9
Maldives	5.5	5.3	5.2	5.2	6.0
Nepal	5.2	5.4	5.7	6.0	6.4
Pakistan	4.6	4.7	4.8	5.1	5.9
Sri Lanka	8.7	9.4	10.3	11.8	13.3

Source: Proceedings of the International Seminar on Aging in SAARC Countries (18–19 October 1996), Department of Statistics, University of Rajshahi, Bangladesh

Table 6.2 Feature of the aged people in Bangladesh, 2001

	Rural			Urban		
Age limits	Both (%)	Male (%)	Female (%)	Both (%)	Male (%)	Female (%)
60–64	2.42	2.53	2.29	1.85	1.95	1.72
65–69	1.24	1.36	1.11	0.92	1.01	0.83
70+	2.89	3.19	2.57	1.99	2.07	1.90
Total	6.55	7.08	5.97	4.76	5.03	4.45

Source: Population Census 2001, National Report (Provisional), July 2003, Bangladesh Bureau of Statistics, Planning Division, Ministry of Planning, pp 134–135

the year 1995 (Abedin 1996). "In the period between 1911 and 2000, there has almost been a fourfold increase in the number of the elderly. Within these 89 years, the old people (60+) of Bangladesh have gone up from 1.38 to 7.2 million and they formed 5.67% of total population in 2000" (Kabir 2003). This indicates that the percentage of the elderly people is increasing gradually in Bangladesh.

Table 6.2 shows that the number of rural aged people is higher than that of urban aged. But in both cases, age group 65–69 years is small in number as compared to age groups 60–64 and 70+. In 2001 population census, age group 70+ in rural area is the highest number. They suffer much more from insecurity than those living in urban areas. "From the study of 141 aged people, it is clear that 45.39% of elderly people are suffering from insecurity. Out of them 27.66% are male and 17.73% are female" (Roy 2000).

"The absolute number of the elderly population is expected to be 17.78 million and at that time, they will form about 10.09% of the total population" (Kabir 2003). The statistics given above show that the elderly people in Bangladesh are increasing rapidly in keeping with the similarity of the world. "In Bangladesh, the life expectancy of the people has been increased from 56.1 years in 1991 to 68.2 years in 2000" (GOB 2004). The number and amount of the problems of aged people in Bangladesh is increasing and keeping pace with the demographic figure of aged people. At this age of industrialization and urbanization, the problems faced by the aged people seem to be more complicated. The physical problems faced by the aged

people include heart disease, diabetes mellitus, respiratory disease, hypertension, arthritis, bronchogenic carcinoma, cataract, cancer, anemia, asthma, urinary, TB, flatulence, constipation, diarrhea, insomnia, and hiccups. On the other hand, mental problems faced by the aged people include mental depression, Alzheimer's disease, paranoid, negligence, mental stress, loneliness, feelings of insecurity, and Parkinson's disease.

Nowadays aged people are suffering from both of physical and mental problems. That means physical problems being combined with the mental problems or mental problems being combined with physical problems are making the life of aged people more complicated. In both cases, a common factor plays a negative role, and the factor is "poverty." That means that the factor "poverty" fuels both physical and mental problems. In some cases aged people can expose their problems to which they depend upon and some cases they cannot. But in both cases, aged people require some financial support to track down the problem.

6.3 Research Questions

Based on the personal experience and through reviewing existing literatures mentioned in the earlier section, the following research questions have been identified:

- What are the main problems of rural elderly in Bangladesh?
- What kind of quality of life (QOL) are the elderly enjoying in Bangladesh?
- How much care and respect the elderly are getting from their family members in rural Bangladesh?
- What kinds of programs are being implemented by the government and nongovernment organizations for improving the quality of life of rural elderly in Bangladesh?
- How did you manage to lead life prior to getting allowance and who took care of you and now who does so?
- Is there any role of elderly in decision-making of their family and society?
- What should be the role of government, nongovernmental agency, and members of society to serve the elderly?

6.4 Definition of Key Concepts

6.4.1 Rural Elderly

Older persons living in rural areas are called rural elderly. According to Kabir (2003), "The term elderly is applied to those aged 60 and over in conformity with the International Plan of Action on Aging adopted by the World Assembly of Aging, held in Vienna in 1982." According to the Retirement Act 1974, the retirement age

from government service is 57 years. In Bangladesh, people over 60 years of age are generally considered as elderly. We generally use the term for those people who are selected for getting the old age allowance by the government and already have got the allowances for 2 years.

6.4.2 Quality of Life

Quality of life means the general well-being of a person or society, defined in terms of health and happiness, rather than wealth. "Quality of life" has quickly become a catchall term, but confusion over what it actually means could have serious negative consequences according to some recent research.

"Quality of life" is subjective and multidimensional, encompassing positive and negative features of life. It's a dynamic condition that responds to life events: A job loss, illness, or other upheavals can change one's definition of "quality of life" rather quickly and dramatically.

6.4.3 Old Age Allowance (OAA)

The measures of financial grant taken by the government of Bangladesh like other countries of the world for poor and disabled aged, with a view to intensify the mental strength, upgrade social status, and restore feelings of security is called old age allowance program. In this study, old age allowance means the "Baisko Bhata" which has been given to the rural elderly people. For the first time in 1997, the amount of Bhata was only taka 100. But it has been increased to 420 Tk. in 2017.

6.4.4 Elderly Welfare

According to the *Encyclopedic Dictionary of Sociology*, "the term geriatric is often applied to patients, hospitals, nurses and so on. The medical specialist helps to ensure that the illness complaints of the old are investigated and treated (rather than dismissed as inevitable consequences of an intractable old age)" (Sharma 1999). In this study, elderly welfare or in other words geriatric welfare means the service or work for the elderly people in society. As elderly people have particular psychosocial and economic problems, they need specific services. The services rendered for the elderly people whether it may be in the family or by the organized institution have been used as elderly welfare or geriatric welfare in this study.

6.4.5 *Rural Bangladesh*

Rural Bangladesh means the village area of Bangladesh. In this study, the term rural goes to the meaning that, the area, where metropolitan or town facilities are not available, the economy is agro-based and the most common occupation is farming.

6.5 Objectives of the Study

To mitigate the research questions, the researcher have selected and fixed some specific objectives to carry out the study. These are as follows:

1. To know the demographic, socioeconomic condition of the study people.
2. To identify the health problems of rural elderly in Bangladesh.
3. To know how the old age allowance provided by the government is being spent by the beneficiaries and to assess how far this allowance has been promoted their quality of life.
4. To examine the appropriateness of methods for assessing the *quality of life* (QOL) situation in this group.

6.6 Ethical Considerations

This section describes the ethical processes that the researcher followed for data collection and how he followed ethical guidelines when conducting the research. Before starting to distribute questionnaires and conduct face-to-face interviews with the respondents, the researcher assured them that the information were going to be kept in a secure and private place. The information would be reported anonymously, and there were no risks, or harms, in their active participation. Respondents were well informed that data collected from them would be considered as very confidential and use only for academic research. It was also informed to the respondents that their name and address will not be used or attached in any form of data they provide, nor reveal any information for their personal identity.

However, the questions that have been set for the interview may arouse a feeling of guilt among the respondents for possessing different attitudes about their living standard and quality of lives. Here the respondents were free to refuse to answer any of the questions they found objectionable and to withdraw from the study without any points or reasons.

6.7 Review of Literature

This chapter shows a literature review of selected books and articles which are relevant to this research work and which were useful in the development of the research questions and interview instruments. There are many works, which are closely or distantly related to the particular area of this study. These literatures have been presented here under several subheadings. These are (a) Overall Scenario of Ageism and Elderly, (b) Overall Scenario of Quality of Life of the Elderly, (c) Related Literature on Old Age Allowance (OAA) Services, and (d) Summary of the Related Literature.

(a) **Overall Scenario of Ageism and Elderly in Bangladesh**

There are many books and research reports that have been published on ageism and geriatric welfare which are mostly related to urban areas. Comparatively, rural aged population and their quality of life are new areas of conducting research work in Bangladesh.

Georgia M. Barrow and Patricia A. Smith (1979) have published a book on *Aging, Ageism, and Society*. The chapters in this book from which I benefited are "Health," "Social Bonds: Family and Friends," "Work and Leisure: The Right to Choose," and "Living Environments" which are very much consistent with my study. Other areas of concern were life cycle, theories, death, dying, etc. Although the book reflects totally the American culture of aged people, nevertheless this book has made me conceptually strong from an overall point of view.

Wilson (2000**)** wrote a book entitled *Understanding Old Age: Critical and Global Perspective*, where she highlighted on the world aging problem. In the global perspectives, the writer discussed on aging world, aging across the world, rising tides: demography and old age, globalization, migration and aging, material resources in later life, and so on. But she skipped what services are available for the aged people that means sort of services are available for the aged people in the developing countries like Bangladesh, she overlooked.

Marshall (1983), a Professor of Social Work, University of Liverpool, in his famous book *Social work with Old People*, traced out the elderly situation and social work intervention to the aged people and ageism. The book is not designed to Bangladeshi society, but it throws some insight which suits my research topic. This book focuses on how social work practice deals with the aged people. However this book reflects the experience of the author gathered from the British society. Elderly population situation, social work intervention to aged people, and the dealing with ageism are discussed in this book.

Phillipson (2002) published an article entitled "The Frailty of Old Age" where he highlighted on the demographic condition of old age, nature of aged problem, and the role of family members in later life. This article has provided me with techniques of analysis.

Nasir and Fatema (1986**)** have presented an article entitled "Aged Male and Female: A Sociological Analysis" in journal of *Social Science Review* vol: 13 where

they attempted to examine the comparative nature of problems – economic, health, and sociocultural problems of aged male and female in our society. More specifically they highlighted on the psychological aspect, decision-making process, and the daily activities of aged people.

Ahmmed (2006**)** has carried out his Ph.D. thesis on "Aging Situation in Some Selected Tribal Communities in Bangladesh" from the Institute Social Welfare and Research, University of Dhaka. This research work has been carried out with a view to trace out the socioeconomic situation, to explore the indigenous system of caregiving, and to understand the degree of participation aged people.

Hossain (2010**)** a Professor, Department of Statistics, University of Rajshahi, Bangladesh, has carried out his Ph.D. research entitled "Demography of Aging: Lessons from Bangladesh." Here the researcher focuses on trends in the rapid increase in the number of aged people in Bangladesh. This research work has been accomplished based on secondary data, which are backdated but analytical in nature. He too focuses on the trends in vital rates as reflected by the changing age-sex composition as well as recent family trends in view of contraceptive use and late marriage. But the author has not included experience in regard to the problems faced by the aged people and their care arrangement.

Kabir (2003**)** in Bangladesh edited a book named *The Elderly: Contemporary Issues* with guidance of Bangladesh Association of Gerontology. Actually the book contains several articles on elderly written by renowned scholars of our country who produced a mentionable data on socioeconomic, culture, health, physical, and psychological problems of aged people in our country. The matter of great concern in this book is that the book contains a lot of contemporary data and reflects the true depiction of elderly situation mainly in context of Bangladesh.

(b) **Overall Scenario of Quality of Life of the Elderly and Situation in Bangladesh**

Anderson R.L. And Lewis D.A. (2001) wrote an article in the journal of clinical psychology in 2000 titled "Quality of life of persons with severe mental illness living in an intermediate care facility." They examined the association between resident characteristics, clinical factors, mental health service utilization, and QOL for people living in an intermediate care facility (IFC) and compare outcomes with QOL reported by people with psychiatric disorders living in other residential settings. Data and information were collected from 100 people diagnosed with schizophrenia, nurse, patient's diary, etc. The study suggested that IFC residents reported significantly higher QOL scores than state hospital patients and lower scores than community samples. But the authors have not included experience in regard to the problems faced by the aged people and their care arrangement.

Young (1995) who is a lecturer by profession in Social Policy at Colchester Institute, London published a book titled *Mastering Social Welfare* where she produced massive discussion on trends on old age population, attitudes to old age, elderly people and poverty housing, health facilities, and security services for the elderly of the British community, in Chap. 13. Having gone throw this book, I have become able to establish a comparison between the British and our society, and I

have too drowned some relevant insights from this book. Here she too highlighted on the insufficient care arrangement for the elderly. This book also reflected the culture of British society.

Goldberg and Naomi Connelly (1996) published a book entitled *The Effectiveness of Social Care for the Elderly: An overview of recent and current evaluative research* where she massively discussed on service programs for the aged people. This book has been written based on evaluative research focusing on community care for the elderly people.

Nilsson et al. (2007**)** studied the role and functional aspects of quality of life of older people in rural Bangladesh. The aim of the study is to explore the meaning of quality of life (QOL) for elderly in rural community in Bangladesh. Data were obtained through interview with 11 senior persons aged 63–86 years. It was a case study research. Two major themes emerged from the data; those were (a) having a role in the family and the community and (b) being functional both physically and economically. The results of the study showed that the elderly people of Bangladesh expect and prioritize a good health, very good social network, good and secure financial condition, social security, and good life. This study can provide the researcher a good understanding about the situation of rural elderly in Bangladesh.

Rahman (2002) wrote a book titled *Samajik Jara Bigganer Vumika (Role of Social Gerontology)* where he has become able to trace out a true depiction of aged people totally in context of Bangladesh focusing on the health (mental and physical), family, services, demography, etc. He produced a massive discussion on the every aspect of the aged people of Bangladesh. In this book the author used a wide range references. The author has made here a future trend in regard to health, life expectancy, economy, power, education, governmental services, etc. of aged people of Bangladesh.

Roy (2000**)** carried out her Ph.D. thesis from the Institute of Bangladesh Studies (IBS), on *Jautho Paribarer Aasthitishelata Abong Bangladesher Gramanchale Bridhader Nirapattar Upar er Provab: Ekti Thanavittik Shamikkha* (Instability of Joint Family and its Impact on Security of Aged in Rural Bangladesh). This research work focuses mainly on socioeconomic situation, interaction pattern, and the security programs at both governmental and nongovernmental levels, which are related to my work. But the study excludes specific services for the people in or outside the family.

(c) **Related Literature on Old Age Allowance (OAA) Services**

Ahmed and Choudhury (2007**)** published an article titled (in Bangla) "Probinder Nirapotta Bidhane Boyyoshka Vater Pravab (The Impact of Old Age Allowance in the Security of Aged People)" in the "Bangladesh Journal of Geriatrics" vol: 42, where they produced discussion and data on impact of old age allowance in upgrading the status of aged people, appropriate use of allowance, and satisfaction over the amount of money which are very much related to my study.

The books and the articles mentioned above have helped to great extent to make myself conceptually and theoretically strong and enriched and filled up the gap of my knowledge in this regard.

6.7.1 Summary of the Related Literature

The literatures reviewed above are very important to develop conceptual understanding, theoretical base and evaluate the services of the elderly in our society and also in other societies. However, these works did not study the effectiveness of the existing programs and care arrangements and *quality of life* (QOL) of the elderly living in rural Bangladesh.

The elderly population in Bangladesh is increasing in an alarming scale, and most of them are living in villages. It is necessary to look at how we can provide effective services for these huge and growing population groups particularly that are helpless. Traditionally, responsibility of the elderly people in Bangladesh lies with the family. However, nowadays, due to various reasons, families are no longer being able to look after the elderly people. In this context institutions may fulfill the gap and ensure effective service for the elderly. But as mentioned earlier, institutions in Bangladesh have not been flourished according to need. Only a few are working with lot of difficulties. Moreover it is not an easy task to bring all the elderly people of the country under institutional service. So, we can't ignore the role of family in taking care of the elderly yet. In fact the majority, if not all elderly in Bangladesh, are living in their families somehow.

With increasing inability to serve the elderly, more and more elderly find themselves in helpless situation. Hence the question arises to develop and ensure the QOL of rural elderly. So it is a big question for us how we should ensure better QOL services for the rural elderly? Which policy settings better meets the needs of the rural aged poor people? Who are responsible for that at this prevailing situation? None of the studies discussed above looked into the matter deeply. So this study is an empirical attempt to fill up this research gap.

After reviewing the literature, the researcher observed that a large number of studies both qualitative and quantitative tried to explore the influential factors that elderly in developing countries usually face in order to survive with a minimum standard life. A meaningful and high quality of life can't be maintained by them. Anyway, the researcher found only three studies Nilsson et al. (2007), Ahmed and Choudhury (2007), and Kabir (2003), which explored the problems and standard of life as well as QOL of the elderly living in rural Bangladesh.

6.8 Methodology of the Study

6.8.1 The Research Design

Based on the research questions and the objectives, the researcher has used a mixed (descriptive and explorative) social research design. The researcher has described the socioeconomic situations of rural elderly and domains of their *quality of life* and depicted the findings in a descriptive statistical form.

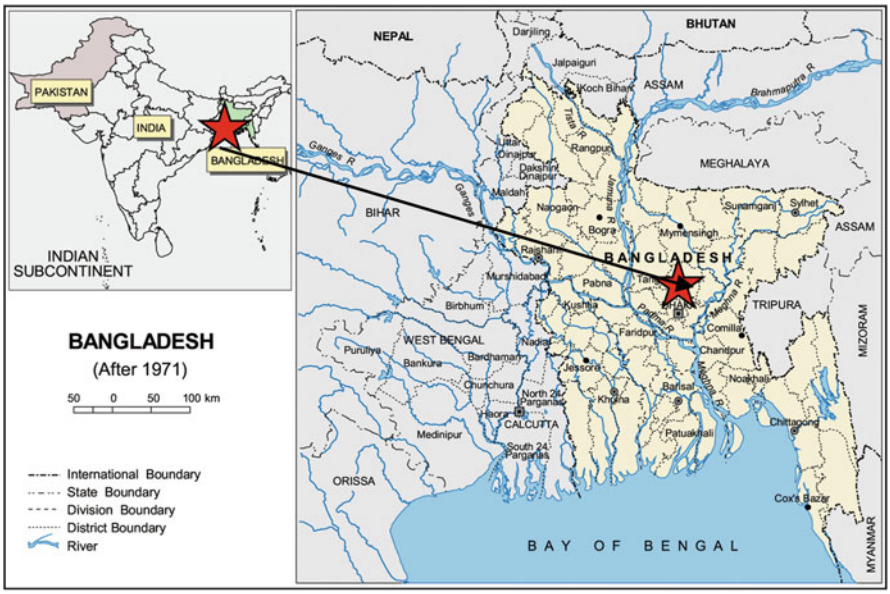

Fig. 6.1 Map of the Indian subcontinent and the map of Bangladesh

6.8.2 Selection of Study Area, Sample Size, and Sampling Techniques

Study Area The research was carried out in five villages Hiramanik, Atbil, Dhaknai, Fakirtari, and Haribhanga; upazila, Sadar Lalmonirhat; and district, Lalmonirhat, Bangladesh. See Fig. 6.1 map of the Indian subcontinent and map of Bangladesh and the study area at Lalmonirhat District (red star marked) (Fig. 6.2).

Study Method This research was an exploratory social survey in nature. The study area was selected purposively which is located in the northern Lalmonirhat District of Bangladesh. The study was of a mixed method, involving quantitative and qualitative analysis.

Factors and Hypothesis of Study (Variables) Indicators of Quality of Life (QOL) along with health, income, expenditure, gender, housing, education level, participation in income-generating activities, income level, OAA, social values and perceptions, social policy, disease, environment, and satisfaction levels with various sub-indicators like food, medicine, transports, care, overall happiness, etc. have been considered. Basically, the age-class quality (AQOL) and monthly income-class quality (MIQOL) have been measure with various dependent variables. Besides, some paired variables have been considered.

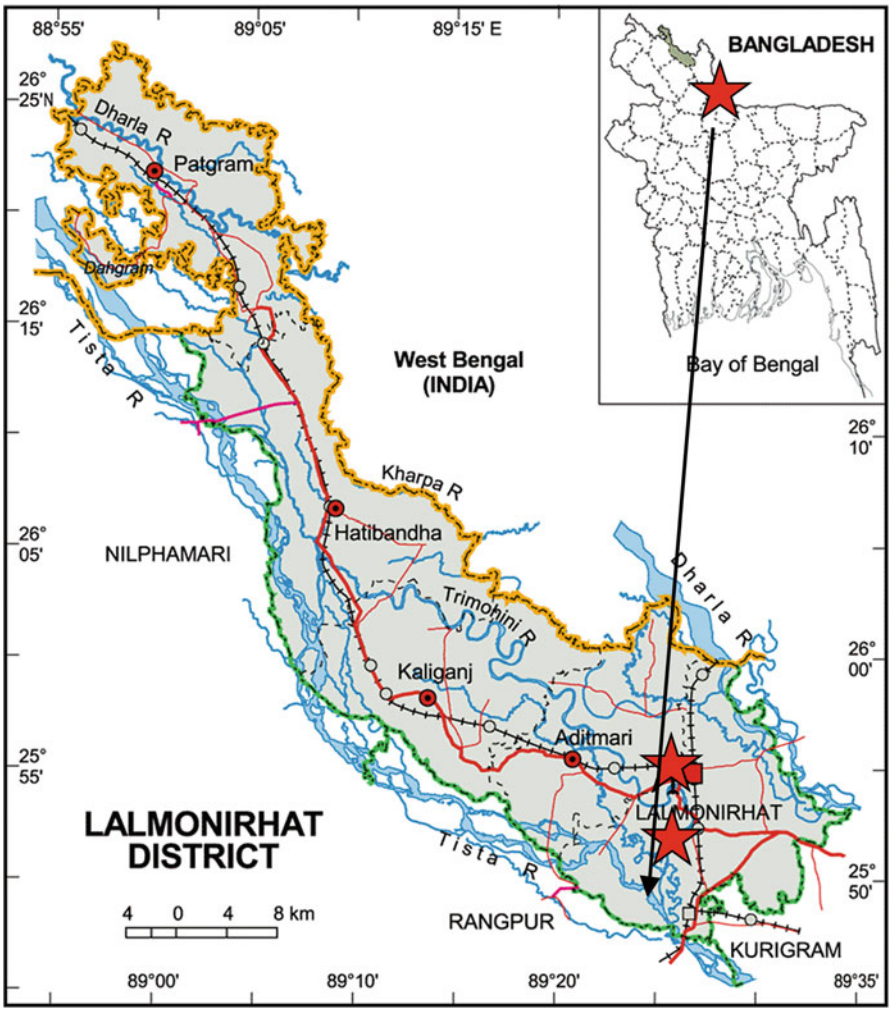

Fig. 6.2 Map of Bangladesh and map of Lalmonirhat District

6.8.3 Testing Hypotheses

1. *__Hypothesis__ *(H_1)*: Rural elderly irrespective of the categories (gender, age class, income class) **differ** with the six satisfaction levels of their life.
2. **Hypothesis** (H_2)**:** The **higher the** monthly income (including OAA), the **higher the** quality of life.

6.8.4 Study Population and Sampling

The total study population size (approximately) was 8756 (according to voter lists and 50+ aged men and women), and the sample size is (267 + 17) =284 calculated through using the following formula. Multistage sampling (purposive and simple random) methods were followed to select the samples.

Sampling is the procedure of selecting a representative portion from a study population. In this study, multistage sampling method were be used to select the study villages and the sample size. The study area (district and upazila) was selected purposively. Researcher did not know the actual number of the study population. Even in the union or upazila health office, there was no such information about the rural elderly.

In that case, usually, selecting sample size from an unknown population, the popular formula is $n_0 = \frac{Z^2pq}{e^2}$

This is called Cochran's formula to yield a representative sample for proportions.

$$n_0 = \frac{Z^2pq}{e^2}$$

$$n_0 = \frac{(1.96)^2(0.5)(0.5)}{(0.05)^2} = 384$$

Where:

n_0 = sample size
Z = 1.96(confidence level of 95%)
P = 0.5(estimated population proportion)
q = (1-p) =0.5
e = 0.05(error limit)

If the population is small, then the sample size can be reduced slightly.[1] This is because a given sample size provides proportionately more information for a small population than for a large population.

As the study population was unknown, the sample size (n_0) was be adjusted using the following formula:

$$n = \frac{n_0}{1 + \frac{(n_0 - 1)}{N}} = \frac{384}{1 + \frac{384-1}{875}} = 267$$

Where:

N = size of population = 875; n= sample size
n = adjusted sample size

[1] http://www.edis.ifas.ufl.edu/pd006 [accessed December 10, 2010]

Table 6.3 Sample frame and sample size

Category of respondents	Number of respondents included in the sample	Sampling procedure
Male elderly	153	Multistage sampling
Female elderly	114	Multistage sampling
Total sample size (directly involved)	**267**	
General doctor/village doctor/health worker	7	All
GO-NGO personnel and local leaders	10	Purposive
Grand total	**284**	

Moreover, 17 persons were interviewed as the key informants from the local leaders, union health workers/medical officers, village doctors, NGO personnel, and local people's view. The sample frame is presented below through a table (Table 6.3).

6.8.5 Methods of Data Collection

Primary data for the study were collected through interviewing respondents face to face using an interview schedule.

6.8.6 Pretesting

A pretest was carried out with a draft of questionnaire schedule before the final data collection process begun.

6.8.7 Data Processing, Data Interpretation, and Statistical Analysis

The SPSS (Statistical Packages for Social Science) version 20 software has been used for data processing and interpretation and for statistical analysis. Data have been tested using chi-square test, correlation coefficient, etc.

6.8.8 Validity and Reliability of Data

The researcher believes that all sorts of data, which have been collected for this study, are reliable, true, and unbiased. Various strategies were used with utmost care as much as possible during data collection. The researcher tried to ensure the quality of data during collection and processing stage. To ensure validity and reliability of data, the questionnaire had been pretested three times before finalization. Observation was also made to ensure the validity and reliability of data. The researcher used to maintain a notebook to record his personal observations about the respondents.

6.9 Results and Discussions

The selected variables are analyzed using SPSS 20th version. It gives meaning and life to the study. Apart from descriptive analysis, correlations, paired sample tests, one-way ANOVA, and chi-square were also done to reach at a logical conclusion. Besides, summary table of personal profile, socioeconomic profile, and physical quality of life of respondents have been clubbed into three separate roofs and discussed. The level of satisfaction and score of QOL with the total and the average value have been measured.

6.9.1 Respondents in the Study Villages

Table 6.4 shows the name of 5 villages and their 12 sections with number of respondents and percentages.

6.9.2 Different Profiles of the Respondents

In this section, data of personal, socioeconomic, and physical quality of life (PQL) of the respondents have been shown.

6.9.2.1 Personal Profile of the Respondents

Table 6.5 shows personal profile of the respondents and percentages through gender, age, religion, types of family, marital status, who is the family guardian, etc. with total number, average, and standard deviations. It shows that among the respondents, 57% was male, and 43% was female with their average age 69 years. Among them, 93% are Muslim, and 7% are Hindu, and 45% live in joint family and 55% in single

Table 6.4 Respondent in the study villages

Respondents in the study villages		
Village name and sections	Frequency	Percentage
1. Atbil	17	6.4
Atbil (dorponashkor)	5	1.9
Atbil (dorponoshkor)	10	3.7
Atbil (khamar)	1	0.4
2. Dhaknai	14	5.2
East dhaknai	12	4.5
North dhaknai	8	3.0
South dhaknai	4	1.5
West dhaknai	7	2.6
3. Hiramanik	10	3.7
East hiramanik	26	9.7
Middle hiramanik	2	0.7
North hiramanik	6	2.2
4. Fakirtari	72	27.0
Fakirtari namatari	1	0.4
5. Harivanga	71	26.6
Harivanga south	1	0.4
Total	267	100.0

family. Among them, 71% are married, 21% are widow, and others are divorced or living singles. Son 49%, father 26%, brother 15%, and mother 6% are the guardians of the respondent's families.

6.9.2.2 Socioeconomic Profile of the Respondents

Table 6.6 shows socioeconomic profile of the respondents and percentages through education, occupation, monthly income, monthly expenditure, savings, and loan in BDT. The literacy rate is 98.5%, among them can sign only 38%, passed SSC 3%, HSC 1.5%, and bachelor 0.7% only. They are 28% farmer, 17% day laborer, 40% housewives, 8% employee, and 7.5% small businessmen. Their average monthly income is BDT 2037.00, monthly expenditure BDT 7558.00, and savings BDT 0.00. Among the respondents, 88 (33%) have loan, and per capita loan was BDT 35,922.00. They have opined that this amount of loan is a burden for them and barrier to lead a good quality of life.

6.9.2.3 Physical Quality of Life (PQL) of the Respondents

Table 6.7 shows physical quality of life profile of the respondents and percentages through ownership and type of housing, source of drinking water, type of toilet, access to modern facilities of life, etc. The data show that 94% respondents own

Table 6.5 Personal profile of the respondents

Personal profile of the respondents				
Gender	**Frequency**	**Percentage (%)**	**Mean**	**Std. deviation**
Female	114	42.7		
Male	153	57.3		
Total	**267**	**100.00**	**68.76**	**9.85**
Age in years	**Frequency**	**Percentage (%)**	**Mean**	**Std. deviation**
56–60	**126**	**47.2**		
61–65	**53**	**19.8**		
66–70	**28**	**10.5**		
71–75	**27**	**10.1**		
76–80	**28**	**10.5**		
81–85+	**5**	**1.9**		
Total	**267**	**100**	**69 (2.22)**	**1.47**
Religion				
Islam	248	92.88		
Hindu	19	7.12		
Total	**267**	**100.00**		
Type of Family	**Frequency**	**Percentage (%)**	**Mean**	**Std. deviation**
Single family	147	55.1		
Joint family	120	44.9		
Average family member	–	–	**6.16**	
Total	**267**	**100**	**–**	
Marital status				
Married	189	70.8		
Divorced/separated	2	0.8		
Widow	74	27.7		
Single	2	0.7		
Total	**267**	**100.00**	**–**	**–**
Who is the family guardian?				
Son	131	49.1		
Daughter	9	3.4		
Father (self)	69	25.8		
Mother	16	6.0		
Brother	39	14.6		
Uncle	3	1.1		
Total	**267**	**100.0**	**–**	**–**

homestead and 6% are homeless, taking free shelter living in other's house. The 89% houses were katcha-tin made (self house), 5% were pucca half wall (self house), and others were made of bamboo and straw. The 97% respondents drink tube well water, 67% had sanitary toiles, 29% use katcha toilets, and about 5% still use bamboo garden, open field, etc. for toilet. The 10.5% said they got access to modern facilities of life, 68% said sometimes, and 29% said they never got. In replying if never why,

Table 6.6 Socioeconomic profile of the respondents

Socioeconomic profile of the respondents				
Educational status	**Frequency**	**Percentage (%)**	**Mean**	**Std. deviation**
0 (illiterate)	4	1.5		
Can sign	101	37.8		
Class 1–5	34	12.7		
Class 6–10	21	7.9		
SSC	8	3.0		
HSC	4	1.5		
Bachelor/honors	2	0.7		
Did not go school	93	34.8		
Total	**267**	**100**	**98.5%** (literacy rate)	**–**
Occupation	**Frequency**	**Percentage (%)**	**Mean**	**Std. deviation**
Day labor	42	15.7		
Farmer (agriculture)	75	28.1		
Business	20	7.5		
Employee	21	7.9		
Housewife	106	39.7		
Others	3	1.1		
Total	**267**	**100**	**–**	**–**
Monthly income (in BDT)	**Frequency**	**Percentage (%)**	**Mean**	**Std. deviation**
5000–10,000	185	69.3		
10,001–15,000	43	16.1		
15,001–20,000	30	11.2		
20,001–25,000	6	2.2		
25,000+	3	1.1		
Total	**267**	**100.0**	**BDT. 2037/–**	**1.39**
Monthly expenditure (in BDT)	**Frequency**	**Percentage (%)**	**Mean**	**Std. deviation**
1000–5000	102	38.2		
5001–10,000	88	33.0		
10,001+	77	28.8		
Total	**267**	**100.0**	**BDT. 7558/–**	
Monthly savings (in BDT)				
0.00–100	0.00	1		
101–200	1.00	163		
201–500	2.00	44		
501–1000	3.00	38		
1001–2000	4.00	12		
2001–5000	5.00	6		

(continued)

Table 6.6 (continued)

Socioeconomic profile of the respondents				
5001–10,000	6.00	3		
Total	**267**	**100.0**	**–**	**–**
Monthly loan (in BDT)	**Frequency**	**Percentage (%)**	**Mean**	**Std. deviation**
2000–10,000	26	29.54		
100,001–20,000	36	40.90		
20,001–30,000	22	25.02		
30,001–40,000	4	4.54		
Total	**88**	**100.00**	**35922.693**	**38232.289**

36% respondents said because they were old; 3.5% said nobody took care of them; 13% said no electricity at house; 14.3% said they don't have any TV, fridge, computer, and mobile phone; and 14% said he was a poor person.

6.9.3 Paired Samples Tests of Age Category and Various Socioeconomic Statuses of the Respondents

Table 6.8 shows paired samples tests of age category and various socioeconomic statuses of the respondents. It shows that there are no significant relationships among age category and education, occupation, land ownerships, income, expenditure, religion, food insufficiency, family size, etc. but have significant relationships with marital status (0.54), sleeping (0.30), and social contact (0.71) of the respondents. It can be said that maximum pair differences do not make influence on the quality of life of the rural aged people in the study area.

6.9.4 Level of Satisfaction Between Age-Category Quality of Life (AQOL) and Various Determinants of the Respondents (Six (6) Selected Indicators)

In this section the level of satisfaction between AQOL and occupational satisfaction, housing condition, sanitation, personal hygiene, transportation facilities, old age allowance (OAA), and social policy services have been analyzed.

Table 6.7 Physical Quality of Life (PQL) of the respondents

Physical quality of life (PQL) of the respondents				
Ownership of housing	Frequency	Percentage (%)	Mean	Std. deviation
Yes (self house)	250	93.6	97.8	0.028
No (other's house)	17	6.4		
Type of housing	**Frequency**	**Percentage (%)**		
Rent house (other's house)	3	1.1		
With father (other's house)	9	3.4		
With mother (other's house)	1	0.4		
With brother (other's house)	4	1.5		
Pucca half wall (self house)	13	4.9		
Katcha-Tin made (self house)	237	88.8		
Total	**267**	**100.0**	**–**	**–**
Source of drinking water	**Frequency**	**Percentage (%)**		
Tube well	242	90.6		
Pond and tube well	15	5.6		
Taped water	10	3.7		
River	0	0		
Total	**267**	**100.0**	**–**	**–**
Types of toilet	**Frequency**	**Percentage (%)**		
Sanitary (common)	179	67.0		
Katcha (common)	77	28.8		
Hanging	2	0.7		
Others (bamboo garden, open field)	9	3.4		
Total	**267**	**100.0**	**–**	**–**
Get access to modern facilities of life?	**Frequency**	**Percentage (%)**		
Yes I get it	28	10.5		
Never get	57	21.3		
Sometimes get	182	68.2		
Total	**267**	**100.0**	**–**	**–**
Get access to modern facilities of life? If never why?	**Frequency**	**Percentage (%)**		
Because I am old	20	35.8		
No electricity connection at house	7	12.8		
I am poor person	8	14.03		
No one take care	4	7.15		
Social problem	4	7.15		
No TV, fridge, computer, mobile phone	8	14.3		
I don't know	4	7.15		
No one take care	2	3.5		
Psychosocial problem	1	1.25		
Total	**57**	**100.0**	**–**	**–**

Table 6.8 Paired sample tests of age category and various socioeconomic statuses of the respondents

Paired samples test									
		Paired differences							
					95% confidence interval of the difference				
		Mean	Std. deviation	Std. error mean	Lower	Upper	t	df	Sig. (2-tailed)
Pair 1	Age category – education qualification	−1.32210	2.90210	0.17761	−1.67179	−0.97241	−7.444	266	0.000
Pair 2	Age category – occupation	−1.08614	2.19964	0.13462	−1.35119	−0.82109	−8.068	266	0.000
Pair 3	Monthly income – expenditure	−9100.080	6334.928	389.888	−9867.778	−8332.381	−23.340	263	0.000
Pair 4	Savings – amount of loan	−35922.693	38232.289	4075.576	−44023.341	−27822.045	−8.814	87	0.000
Pair 5	Source of loan – landless	3.122	0.674	0.074	2.974	3.270	41.953	81	0.000
Pair 6	Household land – number of meal	−14.99184	0.18089	0.01156	−15.01460	−14.96907	−1297.273	244	0.000
Pair 7	Food availability – diseases	−2.36704	1.97734	0.12101	−2.60530	−2.12878	−19.560	266	0.000
Pair 8	Marital status – age category	0.05618	1.52443	0.09329	−0.12751	0.23987	0.602	266	0.548
Pair 9	Ag category – religion	−3.84586	1.60033	0.09812	−4.03906	−3.65267	−39.194	265	0.000

(continued)

Table 6.8 (continued)

Paired samples test									
		Paired differences					t	df	Sig. (2-tailed)
		Mean	Std. deviation	Std. error mean	95% confidence interval of the difference				
					Lower	Upper			
Pair 10	Age category – family size	−3.93609	3.18719	0.19542	−4.32086	−3.55132	−20.142	265	0.000
Pair 11	Food insufficiency – age category	−1.53543	1.71160	0.10740	−1.74694	−1.32393	−14.297	253	0.000
Pair 12	Diseases - cooperation	2.24345	2.00861	0.12292	2.00142	2.48547	18.251	266	0.000
Pair 13	Where you sleep at night? – age category	−0.27626	1.48085	0.09237	−0.45817	−0.09436	−2.991	256	0.003
Pair 14	Social contact – age category	−0.03968	1.71425	0.10799	−0.25236	0.17299	−0.367	251	0.714
Pair 15	Age category – social security	−2.35955	1.65829	0.10149	−2.55937	−2.15973	−23.250	266	0.000

Table 6.9 Clubbed table with levels 1–6 of satisfaction between AQOL and six selected indicators

Age category * satisfaction with occupation level cross-tabulation						
Level-Level of satisfaction		**with occupation**				Total
		Very dissatisfied	Dissatisfied	Satisfied	Very satisfied	
Age category/ level of satisfaction with occupation	56–60	53	32	32	9	126
	61–65	24	14	13	2	53
	66–70	10	11	7	0	28
	71–75	10	5	10	2	27
	76–80	14	9	4	1	28
Total		**113**	**72**	**68**	**14**	**267**
Chi-square (χ^2)==10.1 at 15 d.f., Asymp. Sig. (2-sided) = 0.001 significant						
Level 2		**Level of satisfaction with housing**				Total
		Very dissatisfied	Dissatisfied	Satisfied	Very satisfied	
Monthly income/level of satisfaction with housing	56–60	6	18	84	18	126
	61–65	2	7	39	5	53
	66–70	1	3	18	6	28
	71–75	1	4	21	1	27
	76–80	3	1	21	3	28
Total		**13**	**34**	**185**	**35**	**267**
Chi-square (χ^2) = 13.25 at 15 d.f., Asymp. Sig. (2-sided) = 0.001 significant						
Level 3		**Level of satisfaction with sanitation and personal hygiene**				Total
		Very dissatisfied	Dissatisfied	Satisfied	Very satisfied	
Monthly income/level of satisfaction with sanitation and personal hygiene	56–60	28	29	58	11	126
	61–65	11	14	26	2	53
	66–70	5	8	15	0	28
	71–75	5	5	12	5	27
	76–80	8	8	11	1	28
Total		**58**	**66**	**124**	**19**	**267**
Chi-square (χ^2) = 12.24 at 15 d.f., Asymp. Sig. (2-sided) = 0.005 significant						
Level 4		**Level of satisfaction with transport facilities**				Total
		Very poor	Poor	Good	Very Good	
Monthly income/level of satisfaction with transport facilities	56–60	0	9	97	20	126
	61–65	0	6	42	5	53
	66–70	0	8	18	2	28
	71–75	1	6	18	2	27
	76–80	1	5	16	6	28
Total		**2**	**35**	**194**	**36**	**267**
Chi-square (χ^2) = 23.33 at 18 d.f., Asymp. Sig. (2-sided) = 0.005 significant						

(continued)

Table 6.9 (continued)

Age category * satisfaction with occupation level cross-tabulation						
Level 5		**Level of Satisfaction with old age allowance (OAA)**				Total
		Very dissatisfied	Dissatisfied	Satisfied	Very satisfied	
Monthly income/level of satisfaction with old age allowance (OAA)	56–60	23	72	31	0	126
	61–65	10	30	12	1	53
	66–70	4	20	4	0	28
	71–75	2	17	8	0	27
	76–80	5	14	8	1	28
Total		**45**	**156**	**64**	**2**	**267**
Chi-square (χ^2) = 10.25 at 15 d.f., Asymp. Sig. (2-sided) = 0.005 significant						
Level 6		**Level of State facility of social policy services**				Total
		Very dissatisfied	Dissatisfied	Satisfied	Very satisfied	
Monthly income/state facility of social policy services	56–60	4	32	142	7	185
	61–65	1	15	25	2	43
	66–70	1	8	21	0	30
	71–75	0	2	3	1	6
	76–80	0	1	2	0	3
Total		**6**	**58**	**193**	**10**	**267**
Chi-square (χ^2) = 10.25 at 15 d.f., Asymp. Sig. (2-sided) = 0.005 significant						

6.9.4.1 Levels 1–6 of Satisfaction Between AQOL and Six (6) Selected Indicators

The clubbed Table 6.9 shows the 1–6 levels of satisfaction between AQOL and six (6) selected indicators. Levels of satisfactions have been measured between age-category quality of life (AQOL) and various determinants of the respondents (**with six (6)** selected indicators. Each level showed lowest score one to highest score four ($4 \times 6 = 24$) regarding:

Occupation *chi-square* (χ^2) =10.1 at 15 d.f., Asymp. Sig. (2-sided) = 0.001 significant

Housing (χ^2) =13.25 at 15 d.f., Asymp. Sig. (2-sided) = 0.001 significant

Sanitation and personal hygiene (χ^2) =12.24 at 15 d.f., Asymp. Sig. (2-sided) = 0.005 significant

Transportation facilities (χ^2) =23.33 at 18 d.f. Asymp. Sig. (2-sided) = 0.005 significant

OAA (χ^2) = 10.25 at 15 d.f., Asymp. Sig. (2-sided) = 0.005 significant

Social policy and services (χ^2) = 10.25 at 15 d.f., Asymp. Sig. (2-sided) = 0.005 significant

Table 6.10 Intercorrelation matrix among perceived level of satisfaction (six variables)

Intercorrelation matrix among perceived level of satisfaction (six variables)							
		Satisfaction with main earning	**Satisfaction with transport**	**Satisfaction with marital life**	**Satisfaction with buying daily necessities**	**Satisfaction with having loan as burdens**	**Satisfaction with overall condition and QOL**
Satisfaction with main earning	Pearson correlation	1.00	−0.023	0.082	0.082	0.082	−0.013
	sig. (2-tailed)		0.704	0.182	0.182	0.182	0.838
	N		267	267	267	267	267
Satisfaction with transport	Pearson correlation		1.00	0.012	0.012	0.012	0.671[a]
	sig. (2-tailed)			0.844	0.844	0.844	0.000
	N			267	267	267	267
Satisfaction with marital life	Pearson correlation			1.00	1.000[a]	1.000[a]	0.166[a]
	sig. (2-tailed)				0.000	0.000	0.007
	N				267	267	267
Satisfaction with buying daily necessities	Pearson correlation				1.00	1.000[a]	0.166[a]
	sig. (2-tailed)					0.000	0.007
	N					267	267

(continued)

Table 6.10 (continued)

Intercorrelation matrix among perceived level of satisfaction (six variables)							
		Satisfaction with main earning	**Satisfaction with transport**	**Satisfaction with marital life**	**Satisfaction with buying daily necessities**	**Satisfaction with having loan as burdens**	**Satisfaction with overall condition and QOL**
Satisfaction with having loan as burdens	Pearson correlation					1.00	0.166[a]
	sig. (2-tailed)						0.007
	N						267
Satisfaction with overall condition and QOL	Pearson correlation						1.00
	sig. (2-tailed)						
	N						267

[a]Correlation is significant at 0.01 level (2-tailed)

6.9.4.2 Intercorrelation Matrix Among Perceived Level of Satisfaction (Six Variables)

Table 6.10 shows intercorrelation matrix among perceived level of satisfaction (six variables). It shows that there is significant positive correlation between high monthly income and quality of life irrespective of the gender and age class.

6.9.4.3 Testing Hypothesis

Hypotheses: The study tested proposed hypotheses and the results are:

1. *__Hypothesis__ *(H_1)*: Rural elderly irrespective of the categories (gender, age class, income class) **differ** with the six satisfaction level of their life.

   ***Null Hypothesis* *(H_0)*:** Rural elderly irrespective of the categories (gender, age class, income class) **do not differ** with the six satisfaction levels of their life.

   ****Result:*** With regard to the total quality of life score, there is a difference in the mean values and the correlations. The chi-square (χ^2) value shows that there is a significant difference in overall QOL among the respondents at 0.05 levels. Hence, the null hypothesis is rejected, and the research hypothesis is accepted. It is concluded that there exists a significant difference in overall QOL among the respondents.
2. **Hypothesis** (H_2)**:** The higher the monthly income (including OAA), the **higher the** quality of life.

   ***Null Hypothesis* (H_0)*:** The higher the monthly income (including OAA), the **lower the** quality of life.

   ****Result:*** There is significant positive correlation between high monthly income and quality of life irrespective of the gender and age class. The chi-square (χ^2) value shows that there is a significant difference in overall QOL among the respondents at 0.05 levels. Hence, the null hypothesis is rejected and the research hypothesis is accepted. The mean value shows that high land owner, service holder, and OAA receiver were leading more comfortable life than the nonowners and non-receivers.

6.10 Summary, Recommendation, and Conclusion

6.10.1 Summary of the Survey

The survey was carried out on five villages named *Hiramanik*, *Atbil*, *Dhaknai*, *Fakirtari*, and *Haribhanga* at Lalmonirhat District of Bangladesh. Elderly aged between 56 and 100 years of old took part in the research as respondents.

Table 6.5 revealed personal profile of the respondents and percentages through gender, age, religion, types of family, marital status, who is the family guardian, etc. with total number, average, and standard deviations. It shows that among the respondents, 57% was male, and 43% was female with their average age 69 years. Among them, 93% are Muslim and 7% are Hindu and 45% live in joint family and 55% in single family. Among them, 71% are married, 21% widow, and others are divorced or living singles. Son 49%, father 26%, brother 15%, and mother 6% are the guardians of the respondent's families.

Table 6.6 showed socioeconomic profile of the respondents and percentages through education, occupation, monthly income, monthly expenditure, savings, and loan in BDT. The literacy rate is 98.5%, among them can sign only 38%, passed SSC 3%, HSC 1.5%, and bachelor 0.7% only. They are 28% farmer, 17% day laborer, 40% housewives, 8% employee, and 7.5% small businessmen. Their average monthly income is BDT 2037.00, monthly expenditure BDT 7558.00, and savings BDT 0.00. Among the respondents, 88 (33%) have loan, and per capita loan was BDT 35,922.00. They have opined that this amount of loan is a burden for them and barrier to lead a good quality of life.

Table 6.7 showed physical quality of life profile of the respondents and percentages through ownership and type of housing, source of drinking water, type of toilet, access to modern facilities of life, etc. The data show that 94% respondents own homestead and 6% are homeless, taking free shelter living in other's house. The 89% houses were katcha-tin made (self house), 5% were pucca half wall (self house), and others were made of bamboo and straw. The 97% respondents drink tube well water, 67% had sanitary toiles, 29% use katcha toilets, and about 5% still use bamboo garden, open field, etc. for toilet. The 10.5% said they got access to modern facilities of life, 68% said sometimes, and 29% said they never got. In replying if never why, 36% respondents said because they were old; 3.5% said nobody took care of them; 13% said no electricity at house; 14.3% said they don't have any TV, fridge, computer, and mobile phone; and 14% said he was a poor person.

The results reveal that the mean age of the respondents is 69, average family member per family is 06, and literacy rate is 96%. Average monthly income was BDT 2037.00, monthly expenditure is BDT 7558.00, and savings is BDT 478.00. Interestingly, among the respondents, 88 (32.95%) have loans, and their per capita amount of loan is BDT 35,923.00 as overlapping of microcredit functions is seen disbursed by various government and NGOs. The 95 percent respondents have their own homesteads, and 89 percent houses are *katcha* (bamboo tin-roofed), and 4.9 percent houses are *pucca* (made by brick cement).

Ninety-one percent respondents drink tube well water, others drink tap or dug well water, and about 6 percent use pond water for bath and dishwashing. Sixty-seven (67%) percent respondents use common sanitary toilets, 29% use common, ill healthy and 4% use open fields or bamboo gardens as toilets. Among the respondents, 10.5% get, 68.2% sometimes get, and 21.3% never and get access to modern facilities of life. Those who never get (21%) such modern facilities replied on I am not getting it because I am old, sick, and poor and have no electricity connection in my house, no one takes care of me, etc. About OAA and widow benefits among the

OAA receivers, the 76% respondents opined that the amount is insufficient, and they are not fully satisfied with this amount and the system.

Some paired samples tests (Table 6.8) on age category and various socioeconomic statuses of the respondents showed that there are no significant relationships among age category and education, occupation, land ownerships, income, expenditure, religion, food insufficiency, family size, etc. but have significant relationships with marital status (0.54), sleeping (0.30), and social contact (0.71) of the respondents.

The other paired samples tests (due to page constrains, no table is given) on monthly income and physical quality of life (PQL) of the respondents showed that there are no significant relationships among the amount of monthly income and drinking water, toilet, food disease, care, etc. but have significant relationships with state facilities (0.75), entertainments, social security, and utility services (0.48).

Table 6.10 showed intercorrelation matrix among perceived level of satisfaction (six variables). It shows that there is significant positive correlation between high monthly income and quality of life irrespective of the gender and age class.

Levels of satisfactions have been measured (Table 6.9) between age-category quality of life (AQOL) and various determinants of the respondents (**with six (6)** selected indicators each level lowest one to highest four $4 \times 6 = 24$) regarding:

Occupation *chi-square* (χ^2) =10.1 at 15 d.f., Asymp. Sig. (2-sided) = 0.001 significant
Housing (χ^2) =13.25 at 15 d.f., Asymp. Sig. (2-sided) = 0.001 significant
Sanitation and personal hygiene (χ^2) =12.24 at 15 d.f., Asymp. Sig. (2-sided) = 0.005 significant)
Transportation facilities (χ^2) =23.33 at 18 d.f. Asymp. Sig. (2-sided) = 0.005 significant
OAA (χ^2) = 10.25 at 15 d.f., Asymp. Sig. (2-sided) = 0.005 significant)
Social policy and services (χ^2) = 10.25 at 15 d.f., Asymp. Sig. (2-sided) = 0.005 significant)

Again, the levels of satisfaction (due to page constrains no table is given) have been measured between monthly income based quality of life (MIQOL) and various determinants of the respondents (**with separate six (6)** selected indicators each level minimum one to maximum four $4 \times 6 = 24$) regarding:

Marital life *chi-square* (χ^2) = 12.8 at 6 d.f., Asymp. Sig. (2-sided) = 0.005 significant
Food satisfaction (χ^2) =8.24 at 13 d.f., Asymp. Sig. (2-sided) = 0.005 significant
Types of diseases (χ^2) =8.24 at 6 d.f., Asymp. Sig. (2-sided) = 0.005 significant)
Medical treatment (χ^2) = 6.95 at 15 d.f., Asymp. Sig. (2-sided) = 0.005 significant)
Loan (χ^2) =2.28 at 6 d.f., Asymp. Sig. (2-sided) = 0.005 significant)
Overall happiness (χ^2) =23.85 at 9 d.f. Asymp. Sig. (2-sided) = 0.005 significant

The mean level QOL score (due to page constrains, no table is given) of the respondents with total 12 ($12 \times 8 = 48$ maximum score) selected criterions has been measured separately, which have showed separate score of QOL of the respondents

on occupation (1.28), housing (2.56), sanitation and personal hygiene (1.89), transportation facilities (2.28), OAA (1.93), social policy and services (1.28), marital status (1.13), food satisfaction (2.98), types of diseases (2.10), medical treatment (1.86), loan receiving (2.40), and overall happiness about quality of life (2.98). The lowest average score was found as 1.136, and the highest score was observed as 1.988 within these 12 selected categories.

Finally, the total score of above 12 selected criterions has been measured. The total QOL score of the respondents was found 23.68 (49.33%), which is out of the total 48, and the average QOL of the respondents is 1.97. It obviously indicates the very low quality of life comparing the international standard (76%).

6.10.2 Recommendations

Though the rural elderly are experienced, respected, and thought to be knowledge and advice tank of the society, in most cases, they do not get proper respect and attention. Sometimes they are neglected by the family members and deprived from the opportunities provided by the government. They are not safe and secured in the transitional period of family pattern since the functions of family as a social institution are gradually getting changed. In fact they are treated as the "senior citizens" of the society. In spite of taking many positive measures for the all elderly, situation of rural aged people is getting from bad to worse. On the basis of the findings, the following suggestions are being recommended.

There is no specific elderly policy in Bangladesh. As a result, program regarding elderly welfare does not continue due to political reason (it may be mentioned the *"Shantee Nibash"* project as an example which stopped functioning). The government of Bangladesh may establish "An Ageing Welfare Ministry," which can formulate elderly policy, and it should include the following:

(a) To reduce poverty of rural elderly through increasing state facilities like OAA and widow benefits (76% respondents opined that the amount is insufficient and they are not fully satisfied with this and as the QOL score is 1.97 due to lack of money).
(b) To introduce nonformal aged education.
(c) To provide health cards, free health service in nearby government hospitals (as 68% of the elderly suffer from various diseases), nutritious foods, recreations, transportations, and communication facilities.
(d) To establish old home for the destitute, family care deprived, and disabled aged. For this government can introduce surcharge like *Jamuna Bridge*, lottery should create "Aging Welfare Fund."
(e) To arrange seminar workshop, meeting, FGD, etc. for creating awareness for taking care and giving recognition and respect to the rural aged people living in Bangladesh.

Finally, it can be said that the study may give some necessary directions for both academic- and policy-related benefits by drawing attention to the government as well as the policy-makers related to the rural aged people in Bangladesh. Therefore, the study suggests that social policy regarding the improvement of QOL of rural aged people should be formulated and enhanced soon.

6.10.3 Conclusion

The problem of the old age has become more pronounced now than before. Though the western countries discussed the quality of life for the welfare of the people for long years, it is apt time to realize the quality of elderly living in remote rural Bangladesh. As Bangladesh is the home of 160 million people and about 82% people live in the rural areas. As recently our average life expectancy rate has increased (from 56 years to 71 years of age), the rural elderly should be prioritized and become a national issue. The findings are relevant to understand the condition and to raise the demand for a better social welfare policy for the rural aged. As a part of vulnerable section of people, rural elderly have tremendous sufferings in the society. They want to get rid of these painful experiences. They deserve help from the nation to enjoy the rest of their life. So it is considered as a major concern to the social policy-makers and planners. As per the findings, the researchers hope that the present study will be able to identify the effective service and formulate a better policy and plan from the viewpoint of professional social work and sustainable social development in Bangladesh.

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Part III
Southeast Asia

Chapter 7
Do Trade Reforms Promote Nutritional Status? Evidence from Indonesia

Ari Kuncoro, Yuri Mansury, Arianto A. Patunru, and Budy P. Resosudarmo

Abstract There is a long tradition in economic development that highlights the role of nourishment in the transition from a subsistence into a mature economy. The purpose of this chapter is to provide an empirical basis for the relationship between trade reforms and population nutritional status using Indonesia as a case study. The analysis employs a panel data of Indonesian districts from four waves of the National Socioeconomic Survey in 1993, 1999, 2005, and 2011 to estimate the degree to which exogenous variations in tariff barriers affect endogenous variations in nutrient consumption. Simultaneous equation estimation results show that lower tariff barriers are expected to lead to a positive and significant impact on nutritional status.

Keywords Trade reforms · Nutrition · Indonesia · Structural equation modeling

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7.1 Introduction

Economic development seeks to improve the well-being of the majority of people. Lower child morbidity and higher life expectancy are examples of quality of life achievements attributable to lower poverty, economic growth, and generally higher levels of development (Subramanian et al. 2002). The prerequisites for improvements include social infrastructure such as public medical services, access to sanitation facilities and safe water, and healthy living condition. When the facilities are in place, improved prospects associated with being healthy contribute to lower mortality rates and a higher life expectancy. Being able to access healthy food in particular is an important vehicle to pursue productivity and distributional goals (Smith 1999). The extent of nutrient intakes is therefore a reasonable indicator of health intertwined with society's level of development (Behrman and Deolalikar 1988). This chapter addresses challenges to the attainment of a better life that exist in the relationship between structural change and nutritional intakes.

A study of such relationship must recognize the distinction between health outcomes, including biological functioning, physical stature, or morbidity rates, and health inputs, such as access to medical or recreational activities. This chapter highlights nutritional intakes, a vital input that purportedly contributes to health improvements if consumed above the thresholds that remain relevant for many developing economies. Biomedical evidence indeed confirms a significant link between calorie intakes and health through oxygen uptake (Strauss and Thomas 1998). Protein is another critical macronutrient needed for a wide range of biological functions and processes. Chronic protein deficiency can cause irreversible damages to the immune system, while a rising share of protein intake indicates an improvement in diet quality (Thomas and Strauss 1997).

There is a long tradition in economic development that highlights the role of nourishment in the transition from a subsistence into a mature economy. The efficiency wage theories (Leibenstein 1957; Stiglitz 1976; Pitt et al. 1990) in particular argue that workers' productivity depends on their nutritional status, itself is related to food consumption out of wages. An increase in labor market returns therefore is expected to reduce malnourishment, which in turn leads to a rise in aggregate output.

Whereas there are multiple pathways through which nutritional intake can contribute to labor market outcomes, a multitude of economic factors can also affect food choices. It is well known, for example, that lower-income classes spend a greater proportion of their income on food than do higher-income ones (Hymans and Shapiro 1976) and that the former has a greater tendency to consume diets rich in carbohydrates. We focus here on the role of policies that can directly or indirectly influence nutritional intakes.

Specifically, this chapter looks at an important policy instrument that to date has received relatively little attention in the discourse of nutritional intake: trade policy. The changing international economy is arguably the most important structural transformation that takes place during the development process. An increased

integration into the global economy is indeed often described as an engine of sustained growth (see, e.g., the International Monetary Fund 2017). As the globalization tidal wave continues to sweep over the developing world, the implications for the general health of the population and more specifically for nutritional status deserve more attention.

Substantial attention has been paid to measuring the contribution of trade policy to economic growth (e.g., Rodriguez and Rodrik 2001), productivity impact (Amiti and Konings 2007), child labor employment (Kis-Katos and Sparrow 2011), wage skill premium (Amiti and Cameron 2012; Paz 2014), and poverty (Kis-Katos and Sparrow 2015), as well as to the distributional consequences of such policy (Grossman and Helpman 2002; Basri and Patunru 2012). This chapter sought to engage in the debates at the nexus between trade reforms and household nutritional intake.

While at first glance the connection between trade policies and nutritional intake appears to be tenuous, there are several channels through which trade barriers can directly affect the home food economy and, by extension, health outcomes. A policy that bans the import of staple food, for instance, will end up raising domestic prices when production capacity is limited. This then hurts especially the poor, who are likely to reduce their consumption or switch to low-cost foods with lower nutrient content, thus increasing the likelihood of nutrition deficiencies. In contrast, the lowering of trade barriers is expected to promote diversification by facilitating the imports of a wider range of food products (Thow and Hawkes 2009; Hawkes et al. 2015). Trade liberalization can also affect human nutrition and health indirectly via its effect on household incomes.

It is possible, however, for substitution effects to dominate, thus inducing price-sensitive households to consume more of the low-cost but less-nutritious varieties. Hence, while development scholars readily acknowledge the potential of trade liberalization to significantly influence food security, they also recognize the positive and negative effects on different segments of the population (Pinstrup-Andersen and Rosegrant 2001). Whether the opening up of the domestic market has a net positive impact is, therefore, an empirical question that this chapter seeks to investigate.

We focus here on Indonesia, the largest country in Southeast Asia. With a population of over 260 million, Indonesia is the fourth most populous country and, despite a per capita income of US$ 4000 in 2016, is among the 20 largest economies in the world. For the last five decades, Indonesia has maintained solid macroeconomic performance, commitment to fiscal responsibility, moderate inflation, and strong export growth (World Bank 2018). These accomplishments position the emerging country to be on a par with Brazil, India, and China.

The rationale for choosing the emerging nation as a case study, however, is driven by pressing practical concerns in the area of public health. The World Economic Forum estimated that the cost of diet-related noncommunicable diseases from 2012 to 2030 will amount to US$ 4.5 trillion, or more than five times the 2012 GDP (Bloom et al. 2015). Poor hygiene practices, inadequate sanitation, and food insecurity have all contributed to malnutrition in Indonesia. As a result, malnutrition levels in all forms have persisted, showing no discernible improvement since 2007 (ASEAN/UNICEF/WHO 2016).

A sea change transforming the policy landscape in this country is the state decentralization that the country has experienced in the past 20 years. With the enactment of the 1999 Governance and Fiscal Balance Law, regional governments now have greater control over resources and discretion in meeting the needs of their constituents. Whether the devolution of powers has succeeded in addressing the challenge of widening regional disparities in Indonesia is debatable (Hill et al. 2008; Mansury and Sohn 2015). Nonetheless, decentralization means that the impact of trade reforms is expected to be even more place-based in much of its character. Accordingly, this chapter makes use of district-level data to examine the causal relationship between trade exposure and nutritional consumption.

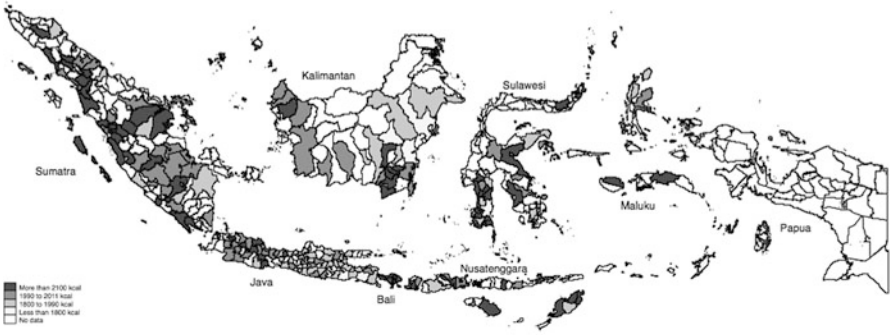
The chapter is in seven parts. The next part reviews the current state of nutritional intakes across Indonesian regions. Section 7.3 presents an overview of the changing trade regimes in Indonesia and the evolving policy instruments. Section 7.4 discusses the data and measurement issues. Section 7.5 is on the structural equation model that we utilize to explore the link between trade and nutrition. We then turn to Sect. 7.6 for a numerical assessment of the impact of trade barriers on nutritional status. Section 7.7 concludes.

7.2 Current State of Population Nutritional Intake

Nutrition deficiencies remain a formidable public health challenge in many parts of Asia despite stellar macroeconomic performance. In Association of Southeast Asian Nations (ASEAN) member countries, millions still suffer from chronic undernutrition, which in turn leads to maternal illness, youth morbidity, disability, and death. Health achievements, however, vary greatly across member states. While Thailand and Malaysia appear on track in terms of achieving Millennium Development Goals, more than a quarter of children under 5 in Laos remain underweight (ASEAN/UNICEF/WHO 2016). Differences in access to food are staggering, especially between states with the highest prevalence of undernourishment (the Philippines, Cambodia, Myanmar, and Laos) and those with the lowest prevalence (Brunei Darussalam and Malaysia).

Indonesia, the focus of this chapter, has achieved several nutritional milestones. Per capita food energy supply has increased by 50% between 1961 and 2013.[1] Similarly, per capita protein availability is today 75% higher than it was in the 1960s. As a result, the prevalence of undernourishment has fallen from about a fifth of the population in the 1990s to less than a tenth in 2017. At the same time, the depth of food deficit—defined as the mean difference between the average daily dietary energy intake of an undernourished population and its average minimum energy requirement—has fallen from the high of per capita 135 kcal in 2004 to 47 kcal in

[1] Data from FAOSTAT statistics database. Retrieved March 26, 2018 from the Food and Agriculture Organization of the United Nations website http://www.fao.org/faostat/en/#data



Source: Authors' calculation based on Susenas data.

Fig. 7.1 Daily per capita calorie intake, 2011. (Source: Authors' calculation based on Susenas data)

2016. Thus, compared to Mainland China, India, and Thailand, for example, Indonesia is lowest in terms of both the prevalence of undernourishment and the depth of food deficit.

Malnutrition nevertheless remains the principal threat to food security in Indonesia. By 2016, about 18 million Indonesians still have dietary energy consumption below the minimum required for maintaining a healthy life. Per capita protein availability is only 76% of the world average in 2013, and a fifth of the preschoolers still suffer from severe vitamin A deficiency. Indeed, Indonesia has struggled to combat stunting and wasting among preschool children, performing at a level that lags far behind Mainland China and Thailand.

Nationwide, calorie and protein consumption experienced a significant drop in 1999, presumably affected by the Asian economic crises in the late 1990s, but has since recovered. The national trend, however, conceals the wide variations across regions in Indonesia. Figure 7.1 maps the calorie and protein consumption at district levels—for this illustrative purpose, we only use 2011. While a number of districts were excluded due to crosswalking and to non-surveys, the figure nevertheless shows the tendency for districts in Java, the western part of Sumatra, and the southern parts of Sulawesi and Kalimantan to have higher levels of calorie consumption. Protein consumption on the other hand exhibits a very similar albeit relatively less concentrated spatial pattern.

7.3 Current State of Trade Reform and Policy

Trade policies in Indonesia have gone through a number of regime changes (Pangestu et al. 2015). Political pressures, macroeconomic adjustments, and external shocks have all motivated phase transitions at one time or another. An inward

orientation that focuses on import substitution was the strategy adopted during the oil boom of the 1970s. The global decline in oil prices, however, was the impetus of the comprehensive trade liberalization undertaken in the mid-1980s (Feridhanusetyawan and Pangestu 2003).

Reform slowed down in the early 1990s as heavily protected producers of agriculture and basic manufacturing mounted a pushback. The 1998 Asian financial crisis, however, was instrumental in the return to the regime that drastically reduced barriers to trade. The fluid positions notwithstanding, it is safe to say that, overall, the economy has sustained the transformation from a closed regime early on to one of Asia's most liberal trade regime in the new millennium (Resosudarmo and Kuncoro 2006).

The increased openness is evident from import barriers that have stabilized at a level that is significantly lower than it was in the 1990s. Figure 7.2 shows Indonesia's "most-favored nation" tariffs, defined as is the tariff charged on imports of a good applied in nondiscriminatory manner to all trade partners without exception. As shown, mean tariff rates currently hover at about 7.2% compared to over 15% in 1995, while the weighted average that takes trade volumes into account has dropped from about 11% in 1999 to less than 5% in 2013. At the same time, Patunru and Rahardja (2015) noted that despite the substantially lower tariff rates, trade protection nevertheless has re-emerged with a new form, namely nontariff barriers. These include quota restrictions, local content requirements, and labeling. Ideally, therefore, trade reform analysis should take into account not just tariffs but also nontariff barriers into considerations. Quantifying the latter, however, can be a daunting task. While the numbers of such barriers can be recorded, to date, measuring their intensities remains challenging. This chapter therefore focuses on the repercussions of measureable tariff barriers.

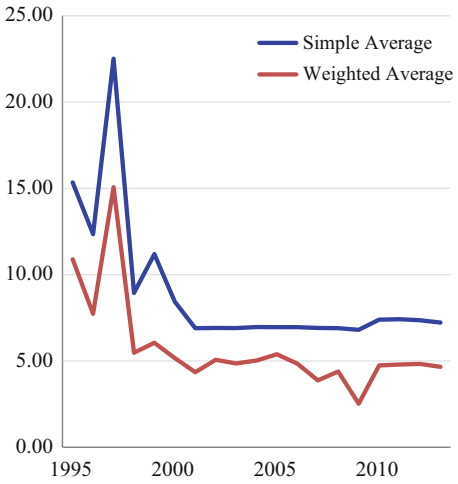


Fig. 7.2 Indonesia's most favored nation (MFN) tariffs (%) on imports from the rest of the world, 1995–2013. (Source: World Bank's World Integrated Trade Solution (WITS) database)

Source: World Bank's World Integrated Trade Solution (WITS) database.

Another challenge is the variability of the tariffs at the regional level. As previously noted, tariffs are imposed at the national level. Our study therefore requires a measure of trade impediments at the subnational, district level. Accordingly, we use the labor market share of the sector where imports are subject to tariffs or, alternatively, the output share of manufacturing sector in that district's economy, to calculate district tariff exposures. The formula for district output tariff exposure ($to_{d,\,t}$) is as follows (see Amiti and Cameron 2012; Kis-Katos and Sparrow 2015):

$$to_{d,t} = \sum_{s=1}^{20} \left[\frac{L_{s,d}}{L_d} ts_{s,t} \right], \tag{7.1}$$

where $L_{s,\,d}$ is the number of workers in sector s in district d, L_d is total workers in district d, and $ts_{s,\,t}$ is the level of tariff that exists in sector s at time t. The information on the number of sectoral workers per district is taken from the 1990 Indonesian census, following the standard practice of using pre-reform time invariant weights that is common in many empirical micro studies (Lemieux 2002; Bernard and Jensen 2004; McCaig 2011). Henceforth, we will use the shorthand TLO for labor-weighted output tariff.

Similarly, the formula for district input tariff exposure ($ti_{d,\,t}$) is as follows:

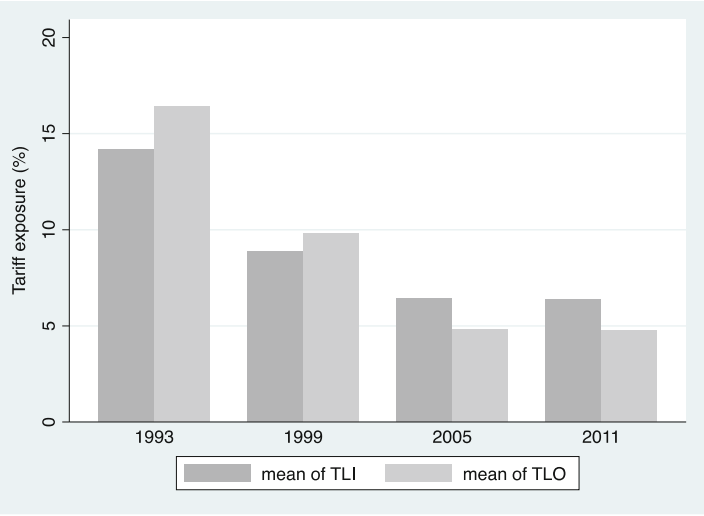
$$ti_{d,t} = \sum_{s=1}^{20} \left[\frac{L_{s,d}}{L_d} \left(\sum_{j=1}^{20} \frac{M_{j,s}}{M_s} ts_{j,t} \right) \right], \tag{7.2}$$

where $M_{j,\,s}$ is the value of input j in sector s and M_s is the total value of inputs in sector s. We use the 1990 national input-output (IO) table[2] to derive the input-output structure at the sectoral level. Henceforth, we will use the shorthand TLI to denote labor-weighted input tariff.

Figure 7.3 shows the evolution of mean district labor-weighted tariff exposures from 1993 to 2011. Both average district input and output tariff exposures have clearly been on a downward trajectory during the period. As shown, labor-weighted output tariff exposures are lower than input tariff exposures in 2005 and 2011 while noticeably higher in the first two periods.

For measures that use output share of manufacturing as weights, we will refer to district-level output tariff exposures as TMO and input tariff exposures as TMI. In contrast to the labor-weighted measures, the manufacturing-weighted measures (not shown here) reveal that the degree of exposures to output tariffs is consistently higher than that to input tariffs.

[2]We use IO table with 66 sectors based on the 1990 economic census published by Statistics Indonesia (BPS).



Source: Authors' calculation based on TRAINS database and Sakernas data

Fig. 7.3 Labor-weighted tariff exposure. (Source: Authors' calculation based on TRAINS database and Sakernas data)

7.4 Data

There are two sets of measures necessary for this study, namely, for nutritional intake and for trade reform. The use of calorie and protein consumption as indicators of the former poses a significant challenge, as a wide variety of foods must be reduced to a weighted average using standard calorie/food or protein/food conversion factors. Nevertheless, these indicators should yield some clues concerrning the degree of nutritional status. The main source of data for the two nutrient indicators is the Indonesian National Socioeconomic Survey (*Survei Sosial Ekonomi Nasional,* henceforth Susenas). We employ the data from four waves of Susenas, namely, in 1993, 1999, 2005, and 2011, for two reasons. First, these particular survey years have additional modules specific for consumption. Second, we want to see how the consumption of calorie and protein has evolved over time in Indonesia.

The government office of Statistics Indonesia (*Badan Pusat Statistik*, BPS) includes calorie and protein consumption in its 2011 survey. The 1999 and 2005, however, do not have such information. The 1993 survey includes calorie and protein intake questions, but with numerous anomalies in the results. In fact, BPS itself in a 2011 report acknowledged that their measures of nutrition consumption before 1996 needs to be significantly adjusted (BPS 2011). We assume that the calorie and protein consumption data in the 2011 Susenas are valid. We then use it to calculate a "conversion factor" defined as the reported quantity of food consumed divided by the corresponding calorie or protein content. We next apply the

conversion factors backward to the 1993, 1999, and 2005 series to estimate the equivalent calorie and protein content for each year.[3]

Tariff reductions are arguably the most important aspect of trade reforms. One immediate problem is that virtually all tariff data are available only at the national level, whereas our intended unit of observation is the representative household at the district level. Measurement operationalization therefore entails converting the tariff variable into one that changes over time and over districts. We therefore use "tariff exposure" instead of tariff itself (e.g., Kis-Katos and Sparrow 2015). This "regional exposure to tariff" employs as weights either the ratio of the number of workers in the affected sector to the total size of the labor force in the economy or, alternatively, manufacturing share in the region. We extracted the tariff information from TRAINS (Trade Analysis Information System) database provided by the United Nations Conference on Trade and Development (UNCTAD). To convert it into exposure variables, we use the national survey of the labor force (*Survei Angkatan Kerja Nasional*, Sakernas) and the survey of manufacturing firms (*Survei Industri*, SI).

A third key challenge in the data construction is to "crosswalk" the changing universe of Indonesian districts. The number has grown significantly due to the proliferation of new districts in response to the 1999 decentralization policy. We would like to track a fixed set of districts over time in our longitudinal study, and since the observations span the period from 1993 to 2011, dropping a number of districts from the sample becomes inevitable.[4]

Despite the measurement challenges, this study—in addition to the analysis of trade-health nexus via nutritional consumption—also contributes to the development of a database tracking calorie and protein consumption in Indonesia for the years 1993, 1999, 2005, and 2011. Our approach moreover is a general one that can be applied to other Susenas years for which consumption modules are available.

Table 7.1 describes the observed variables used in this study and their measurement units**.** Table 7.2 records the correlation matrix for the observed indicator

Table 7.1 List of variables

Variable name	Description	Unit
Calorie	Dietary energy consumption per person	Kcal/day/person
Protein	Dietary protein consumption per person	Grams/day/person
TLO	Labor-weighted output tariff exposure	%
TLI	Labor-weighted input tariff exposure	%
TMO	Manufacturing-weighted output tariff exposure	%
TMI	Manufacturing-weighted input tariff exposure	%
Urban	Percent urban in the total population	%
Pce_exp	Monthly per capita expenditures	Indonesian rupiah

[3]The technical exposition of the methods used in this study is available upon request.

[4]Another complication is that Aceh was not surveyed by BPS in 2005.

Table 7.2 Correlations and descriptive statistics

	Calorie	Protein	TLO	TLI	TMO	TMI	Urban	Pce_exp
Calorie	1							
Protein	0.8010	1						
TLO	−0.0051	−0.2502	1					
TLI	0.1392	−0.1527	0.9102	1				
TMO	0.0361	−0.1835	0.6158	0.5675	1			
TMI	0.1102	−0.1328	0.682	0.6804	0.7842	1		
Urban	−0.1312	0.1179	0.1037	−0.1165	−0.0382	−0.0529	1	
Pce_exp	0.0461	0.3538	−0.5689	−0.602	−0.5803	−0.6085	0.3891	1
Mean	1971.22	53.44	9.01	8.99	11.86	8.32	0.39	262967.00
Std. Dev.	397.40	10.92	5.07	3.35	6.29	4.12	0.33	247365.10
Min.	631.64	16.13	2.23	3.02	0.00	0.56	0.00	21761.16
Max.	3707.09	91.26	20.64	17.12	21.72	14.78	1.00	1563503.00

Note: N is 962
Source: Authors' calculation

variables in our data and summarizes the descriptive statistics. Also featured are two additional control variables, namely, percent of urban areas in the district and monthly per capita expenditures.

7.5 The Method: Structural Equation Model

Our model brings to focus the causal pathway linking international trade to population nutritional status. Causal thinking in the presence of unobserved latent variables is central to structural equation modeling (SEM). What distinguishes SEM from, say, OLS, is the integration of latent variables into a simultaneous equation framework where causal relations are explicitly considered. Such a framework consists of two parts. The first part, called the measurement sub-model, specifies the indicators used to measure the latent constructs since the latter are not directly observable. The causal links from independent latent variables to the dependent ones are then formalized in the second part, referred to as the structural sub-model.

We begin with the concept of trade barriers—the degree to which domestic markets are protected by government regulatory measures. The four indicators of trade barriers we have for this study are TLI, TLO, TMI, and TMO (see Sect. 7.3). In the measurement portion of the model, the observed indicators are hypothesized to arise from the underlying latent construct as follows:

$$T_{ik,t} = \alpha_k + \eta_k TradeBarriers_{i,t} + \xi_{ik,t}, \tag{7.3}$$

where $k = \{\text{TLI, TLO, TMI, TMO}\}$, $T_{ik,t}$ is the value of indicator k for district i observed at time t, and ξ_{ik} is the measurement error in the kth equation. The interpretation is straight forward. Each of the indicator variables responds only to the single underlying concept, *TradeBarriers*, which represents the shared meaning of the set of indicators on a single dimension. At the same time, each indicator is allowed to have its own unique error term, ξ_{ik}. Since the latent construct and the measurement errors are unobservable, they are estimated using a confirmatory factor analysis approach.

We turn next to the measurement of nutritional status, which in this study has two indicators, namely, daily intakes of calorie and protein, for nutritional status. Assuming that the state of nourishment is reflected by the observed intakes of calories and protein, the latent variable *NutritionStatus* can be modeled as follows:

$$N_{il,t} = \delta_l + \gamma_l NutritionStatus_{i,t} + \upsilon_{il,t}, \tag{7.4}$$

where $l = \{\text{calorie, protein}\}$, $N_{il,t}$ is the value of indicator l for district i observed at time t, and υ_{il} is the measurement error in the lth equation.

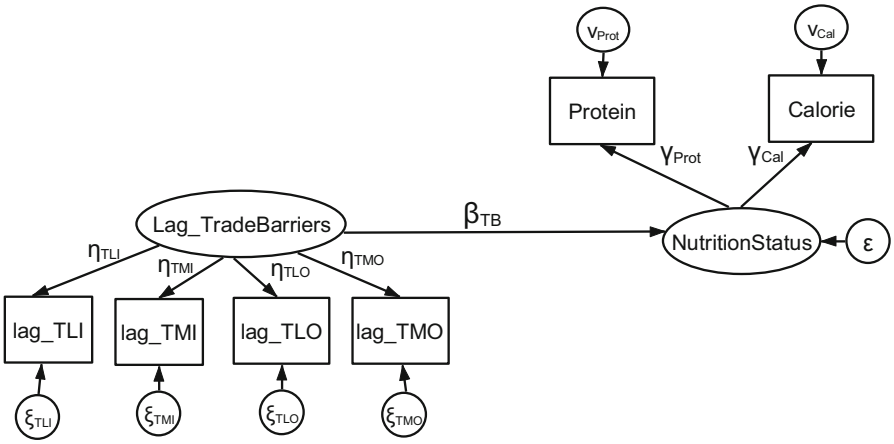


Fig. 7.4 Measurement and structural portions of the structural equation model

The main specification of interest corresponds to the structural sub-model describing how variations in the independent variables affect changes in the dependent variables. We postulate for the full SEM a single latent exogenous variable, *TradeBarriers*, influencing a single latent endogenous variable, *NutritionStatus*. This is accomplished through a recursive model describing a direct pathway from trade impediments to nutrition intake shown in Fig. 7.4.

Three features of Fig. 7.4 are worth highlighting. First, with two indicators, the measurement model for nutrition is underidentified, an issue which we address below in our analysis. Second, lagged tariff exposures are used as indicators of trade barriers to ensure temporal ordering and thus the direction of causality—if it exists—from trade barriers to nutritional status. Third and perhaps most importantly for this study, we expect trade barriers to exert a negative impact on nutritional status. The central hypothesis to be tested is therefore a negative $\beta_{TB} = \frac{\partial NutritionStatus}{\partial Lag\_TradeBarriers}$, i.e., the claim that lower barriers to trade would lead to higher nutritional levels, in the following structural model:

$$NutritionStatus_{il,t} = \beta_0 + \beta_{TB} TradeBarriers_{i,t-1} + \epsilon_{il,t}, \tag{7.5}$$

We turn now to the estimation procedure. The above description identifies the model's structural coefficients: γ_l's, η_k's, and β_{TB}. SEM makes use of the observed variance-covariance matrix to estimate these coefficients. Several methods are available. We use the iterative method of maximum likelihood estimation (MLE) to reproduce the observed variance-covariance matrix. Assuming multivariate normality, this approach solves the equations simultaneously to identify the parameters that best fit the data.

Formally, MLE searches for the set of estimates to produce a model-implied covariance matrix $\boldsymbol{\Sigma}$ that is as similar as possible to the observed covariance matrix

S. Hayduk (1987) shows that this is equivalent to minimizing the following log-likelihood ratio function:

$$F = \log|\boldsymbol{\Sigma}| - \log|\mathbf{S}| + \text{trace}\left(\mathbf{S}\boldsymbol{\Sigma}^{-1}\right) - k, \tag{7.6}$$

where k is the total number of indicator variables. Since MLE quantifies the magnitude of the departures between what is observed and the coefficient estimates, comparison of the model-implied variances and covariances among the indicators with the one observed from the data provides the fundamental basis for testing the model's fit. The ensuing analysis takes advantage of the fact that F follows a chi-square distribution.

7.6 Results

Figure 7.5 plots the sample distribution of per capita calorie intake (left panel) and per capita protein intake (right panel). Both panels indicate that the normal distribution provides a good theoretical approximation. The symmetric bell shape rules out the presence of outliers that could otherwise distort the analysis in a significant way, and it also paves the way for the maximum-likelihood estimation method that assumes an underlying normal distribution.

We analyze all the models presented here using the Stata/IC 14.2 statistical package and estimate the structural coefficients using maximum likelihood with missing values technique. In all the estimates reported here, both daily intakes of calorie and protein are standardized to have mean zero and unit standard deviation. Stata's maximum likelihood estimator converges quickly across all models in four to six iterations.

Table 7.3 reports the fit statistics for the different models estimated. TLI, TLO, TMI, and TMO all load with the expected sign and the coefficients are statistically

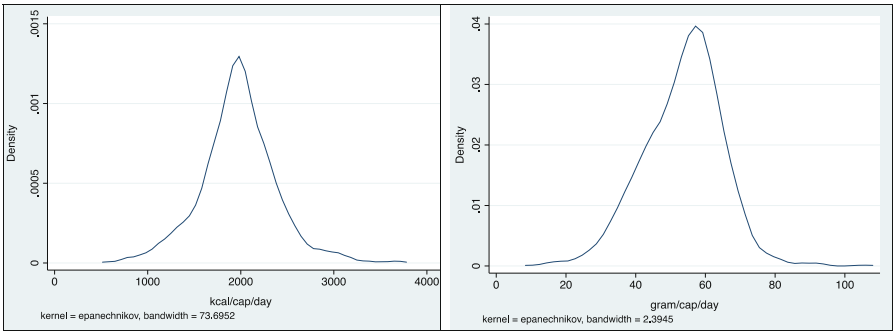


Fig. 7.5 Empirical distribution of per capita calorie intake (left) and per capita protein intake (right). (Source: Authors' calculation based on Susenas data)

Table 7.3 Comparison of models

Model	Chi-squared	df	RMSEA	CFI
Base	571.33	8	0.250	0.885
Modified	71.45	7	0.090	0.987
Identified	571.33	9	0.236	0.885
Identified_mod	71.59	8	0.084	0.987
Overidentified	571.33	10	0.223	0.885
Overidentified_mod	71.67	9	0.079	0.987

Note: df stands for degrees of freedom, RMSEA for root mean square error of approximation, and CFI for comparative fit index

significant, lending credence to the hypothesis that the observed indicators are suitable measures of *TradeBarriers*. Specifically for the base model visualized in Fig. 7.4, the model explains at least 49% of the variations in each of the tariff indicators. Similarly, while the measurement portion of *NutritionStatus* is underidentified, both daily intakes of calorie and protein load with a positive sign and the coefficients are significant.

Of primary interest is the structural model, which does confirm the causal impact of trade barriers on nutrition status, while showing a path coefficient that is significant at the 0.01%. The negative coefficient reveals that a higher value of the latent independent variable is associated with a lower value of the latent dependent variable. Since the former is a weighted average of the four tariff indicators, the standardized solutions for the base model coefficient suggest that one standard deviation *decrease* in mean tariff rates is expected to lead to 0.59 standard deviations *increase* in *NutritionStatus*.

The chi-square of 571.3, however, indicates a poor global fit. Since the goal is to reproduce the empirical covariances embedded in the data, a *p*-value lower than the probability thresholds suggests the failure to do so. In other words, we reject that the differences between the model-implied covariance matrix $\boldsymbol{\Sigma}$ and the observed $\mathbf{S}$ (see Eq. (7.6)) are due to random chance. The poor fit is also evident from the root mean square error of approximation (RMSEA) of 0.250, much higher than the standard of 0.05, and from the comparative fit index (CFI) of 0.885, below the ideal standard of 0.950.

Lagrange multiplier test indices subsequently reveal that allowing correlated error terms for TMI and TMO would significantly improve global fit. Accordingly, Table 7.3 reports the fit of the modified model where the residuals e.TMI and e.TMO are correlated. The estimated impact of *TradeBarriers* on *NutritionStatus* again has the expected negative sign and is highly significant statistically, while chi-square is now reduced to 71.45, RMSEA fell to 0.09, and the CFI rose to 0.987. Since the two models are nested, the chi-square difference with one df shows a significant improvement in fit at the 1% level. We could improve the fit further by correlating e.TLO and e.TMO in yet another round of modifications. At this point, however, we are inclined to save the degrees of freedom for future alterations and avoid what amounted to be an exclusively data-driven exploratory analysis (MacCallum 1986).

Addressing next the underidentification of *NutritionStatus* measurement, we fix the variance of daily protein intake at the level estimated for the base model. As it turns out, both the statistical significance and magnitude of the coefficients for the now exactly identified model are not materially affected, while the chi-squared statistic, RMSEA, and CFI are indistinguishable from the base model's, albeit with an additional degree of freedom, calculated as the difference between the total number of unique entries in the covariance matrix **S** and the total number of estimated coefficients. Just like for the base model, however, allowing the error terms for TMI and TMO to correlate improves global fit substantially, as shown in the row for the Identified_mod model.

The Overidentified model adds an overidentifying restriction by fixing the variance of daily calorie intake (as well as the variance of daily protein intake) and generates results virtually identical to the base model's. The final model, labeled Overidentified_mod, preserves the base model's causal structure while allowing for correlated error terms to strike the balance between global fit and parsimony. Table 7.4 reports the estimated structural equation for the final model.

Figure 7.6 pulls together the causal and measurement parts of the final model. The causal sub-model in particular highlights the main result, namely, that one standard

Table 7.4 Estimated structural equation, Overidentified_mod

NutritionStatus $(t) = -0.6043$ * *TradeBarriers* $(t-1)$
(-25.67)
Errorvar. $= 0.6349$ (22.32), $R^2 = 0.365$
Chi-Square $= 71.67$ $(p = 0.0000)$
Root Mean Square of Approximation $(RMSEA) = 0.079$
Goodness of Fit Index $(CFI) = 0.987$

Note: *t*-values are presented in parenthesis

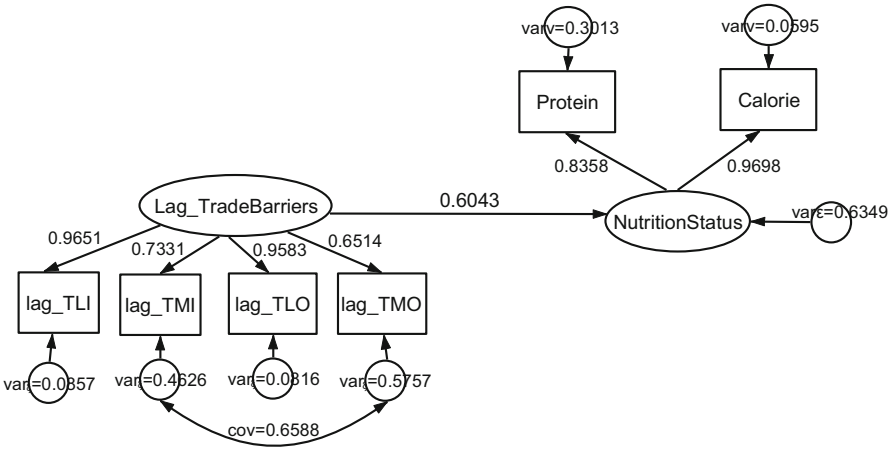


Fig. 7.6 Estimated coefficients and variances from the SEM with overidentifying restrictions

Table 7.5 Estimated measurement equations, Overidentified_mod

Protein =	0.8358 * *NutritionStatus* (113.99)	*Errorvar.* = 0.3013 (24.59)	$R^2 = 0.699$
Calorie =	0.9698 * *NutritionStatus* (750.37)	*Errorvar.* = 0 0.0595 (23.72)	$R^2 = 0.941$
TLI =	0.9561 * *TradeBarriers* (155.78)	*Errorvar* = 0.0857 (7.31)	$R^2 = 0.914$
TMI =	0.7331 * *TradeBarriers* (44.17)	*Errorvar* = 0.4626 (19.01)	$R^2 = 0.537$
TLO =	0.9583 * *TradeBarriers* (157.36)	*Errorvar* = 0.0816 (6.99)	$R^2 = 0.918$
TMO =	0.6514 * *TradeBarriers* (31.86)	*Errorvar* = 0.5757 (21.62)	$R^2 = 0.424$

Error Covariance between TMI and TMO = 0.6588 (33.98)
Note: *t*-values are presented in parenthesis

deviation decrease in *TradeBarriers* is expected to bring about 0.62 standard deviation increase in *NutritionStatus*.

Table 7.5 reports the estimated measurement equations. As specified by the model, every observed indicator is associated with an error variance, labeled *Errorvar*, which can be interpreted as measurement or observational errors. All the estimated error variances are significant at the 0.001%. The covariance between TMI and TMO is presented at the bottom and is also statistically significant. The coefficient of determination, R^2, in the context of SEM can be interpreted as the degree to which an indicator is a reliable measure of the underlying construct. As Table 7.5 shows, *Calorie* is the most reliable indicator of *NutritionStatus*, while TLI and TLO have high reliability as *TradeBarriers* indicators.

We conducted two additional robustness checks. First, we introduced two controls to the final model, namely, per capita expenditures and the share of urban population in the total population. Neither is statistically significant. More importantly, the various estimates for both the causal and measurement models remain robust in specifications with additional control variables. We therefore retain Overidentified_mod as the final model to preserve parsimony. Second, we re-estimated all the models reported here under different assumptions regarding joint normality. Specifically, we use the robust standard error estimator that relaxes the normality assumption when estimating the standard errors. As it turns out, the adjusted chi-square statistics (Satorra and Bentler 1994) remain consistent with the various inferences presented above. Likewise, we estimated the models using the asymptotic distribution-free method, which yields results that again are consistent with those drawn from the MLE results.

7.7 Conclusions

The debate continues on the nature of the relationship between trade policy and economic development. This chapter presents new evidence showing the impact of trade liberalization on nutritional achievements. Using a SEM for the largest country in Southeast Asia, we found empirical support for the view that, in general, lower trade barriers promote better nutrition status.

The estimated influence can be viewed as the total impact of trade openness on nutritional status. Trade can indeed affect nutrition through several indirect channels. Downstream businesses that make use of previously protected inputs can generate more profits, which provide the incentive to hire more workers. The rise in employment and wages then gives households the spending power to purchase nutrient-rich food. But even the most direct mechanism we can think of is likely mediated by market forces. The chief benefit of reduced tariffs is the lower prices of imports and importables, which again render wider food options more affordable. Here the markets for food are the intermediate channels that transmit the influences of liberalized trade. The decomposition of the total impact, however, requires indicators of the different mediators that we currently do not have. A follow-up study can pursue a multi-market model that speaks to the general equilibrium nature of economic interdependencies.

Such a model would enable the positive and negative impact of trade reforms to be considered simultaneously in a unified framework. Indeed, it can be argued that a more open trade renders import-competing sectors more vulnerable to globalization forces. Even enthusiastic advocates of trade liberalization acknowledge the adverse impact of import competition on low-skill jobs (World Bank 2017) and the ostensible polarization that results from the growing disparities between those benefitting and those suffering from greater openness. While linking health outcomes to tradable sectors, the labor market, and income distribution is beyond the scope of this chapter, it can be pursued in a subsequent study that employs a general equilibrium approach.

The multiregional dimension of trade reforms is another area of interests. There is a considerable spatial inequality between districts, especially in terms of sociodemographic characteristics and the degree of external dependence. As economic processes tend to cluster geographically, indicators of what many would consider progress, including tradable sector employment, educational attainment, and nutritional status, are also likely to be spatially concentrated. But a focus on the correlates of outcomes would relegate the change mechanisms and dynamic processes to a black box, all while exposing the analysis to the risk of spurious associations. Instead, what the future explanatory research needs is a theoretical framework that spells out the economic processes that account for the spatial effects. Pursuing this line of inquiry therefore requires a set of indicators for the preferences, resource constraints, and behavioral rules that reflect the hypothesized mechanisms.

Our final note highlights the need for a more comprehensive set of indicators for trade barriers to capture more fully the construct's meaning. As Krugman et al. (1995) points out, measuring protectionism is not trivial. While tariff rates can be measured, there are substantial nontariff barriers, such as various import licensing schemes, which are not easily quantified. In addition, economic historians have argued that removing formal barriers to trade is not necessarily a prerequisite to global integration (see, e.g., O'Rourke and Williamson 2002). For an archipelago nation like Indonesia, it is not difficult to imagine that poor transportation infrastructure and weak supply chains present equally daunting challenges.

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Chapter 8
Health Inequity in the Philippines

Miann S. Banaag, Manuel M. Dayrit, and Ronald U. Mendoza

Abstract Health is an important component of human development. A healthy and well-trained workforce attracts investments and spurs economic progress. For this reason, countries need to ensure that its health system provides adequate services to its population. Where the system relies on public and private providers, there must be effective synergy between the two sectors. In the case of the Philippines where inequity has been a major concern in health outcomes and service provision, policy makers face the following challenges: (1) reduce the discrepancy in the access to healthcare services among its socioeconomic classes; (2) reduce the discrepancy in the quality of health services between the public and private sectors; (3) increase the availability of services to geographically isolated and depressed areas; and (4) reduce out-of-pocket expenditures as a percentage of total health expenditure.

Keywords Health inequity · Health outcomes · Out-of-pocket expenditures

Health is an essential component of human development. As Sen (2002) described it, "Health is among the most important conditions of human life and a critically significant constituent of human capabilities." Using a wider lens, better health conditions could lead to a more capable and effective workforce in an economy that would stimulate investments and economic progress. For this reason, it is essential for countries to strike a good balance between public and private provision of health services. Health systems must ensure that every citizen is given fair and

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equal access to healthcare services that could improve their health welfare and protect them from dire financial consequences of ill health.

Nevertheless, inequality in healthcare access and health outcomes between poor and rich households continues to persist in many countries. Often, the poor are caught in a paradox—they typically have higher healthcare needs yet suffer from lower levels of health service utilization. Out-of-pocket spending in health places a huge burden not just on the poor but even among some in the middle class when a household experiences a spike in health expenses due to sickness. Therefore, the aspiration of universal healthcare coverage is to provide access to quality healthcare without causing financial hardship. As a country's resources expand, primary and preventive health services should at least be included—but more advanced treatments could also be covered (Kim and Loayza 2018).

In the Philippines, to align with the global agenda of the United Nation's Sustainable Development Goals (SDG), the National Objectives for Health (NOH) was instituted to guide policy makers and researchers in planning, policy formulation, and program development. One key component of NOH is to ensure that health equity will be upheld by setting equity targets along with the national targets for each critical health indicator. It placed emphasis in ensuring that everyone regardless of race, gender, ethnicity, income, or other social condition has a fair opportunity to live a long and healthy life, which is a fundamental human right.[1]

Health inequity, on the other hand, persists when inequality in health and health outcomes are avoidable and unnecessary and are rooted in social injustice. Consider, for instance, babies born in the Philippines' Autonomous Region of Muslim Mindanao (ARMM) region who are twice more likely to die in their first 5 years of life than babies born from the country's National Capital Region (NCR). Disparities can be attributed to poverty and vulnerabilities due to environment. ARMM has a poverty incidence almost 14 times that of NCR; and the former has been known for its conflict stricken areas and bad governance. These are among the factors that conspire toward the relatively higher mortality rate among children under 5 years old—along with many other issues such as the scarcity of available health service facilities and personnel in the region.

This essay outlines and illustrates some of the key issues around health inequity in the Philippines. Section 8.1 reviews some of the data on health inequity, providing concise descriptions of the disparities in some measures of health outcomes and illustrations of its extent in the country. Section 8.2 expounds on inequities in health spending by describing the risks and burdens caused by catastrophic health expenditures among poor and middle-income households. A brief synthesis outlines some of the possible policy interventions to reduce the disparities among social groups by linking the results to previously done studies.

[1] See http://www.doh.gov.ph/national-objectives-health

8.1 Health Inequity

Health inequities exist when there are disparities in health and healthcare and their determinants that are deemed to be avoidable, unfair, and unjust. Hence not all disparities in health between population groups are regarded as inequities (Son 2009). In particular, inequities are often influenced by variables such as income, wealth, educational level, occupation, gender, geographical location, and ethnicity.[2]

In fact, in the Philippines, consistent improvement in national life expectancy is evident in the last decades. Women continue to live longer than men. Behavioral, social, and biological factors contribute to this gap in life expectancy between men and women. However, a more intriguing picture shows a widening gap in life expectancy between women and men over the years (Fig. 8.1). In 1960, life expectancy of women was at 59.08 years, while those of men was 56.6 years, posting a difference of 2.5 years. By 2015, the gap widened to about 6.8 years, i.e., the life expectancy of women is at 72.5 and 65.7 for men.

The disparity in life expectancy is much more pronounced when one examines the data across developed and underdeveloped areas in the Philippines (Fig. 8.2). A child may expect to live for only about 54 years in the province of Tawi-Tawi (a conflict-affected and underdeveloped province in the Southern Mindanao region); and this is 19 years shorter than the national average and even lower by around 24 years compared to children living in La Union province (a far more developed province compared to Tawi-Tawi and situated in the northern island of Luzon).

In general, most provinces in Mindanao have relatively lower life expectancy at birth than the national average. Armed conflicts, war, and bad governance in Mindanao have been among the underlying reasons for underdevelopment, as well as lower access to healthcare facilities and services.

For the nation as a whole, infant, child, and maternal mortality rates have also significantly decreased during recent years due mainly to improved technology and delivery of health services (Fig. 8.3). The infant mortality rate has declined gradually from 38 deaths per thousand in 1993 to 25 deaths per thousand in 2008. Meanwhile the under-5 mortality rate has almost halved during 1993–2008, falling from 64 to 34 deaths per thousand.

Likewise, maternal mortality rates have decreased from 209 to 162 deaths per thousand from 1998 to 2006 (Fig. 8.4). Such improvements in aggregate health status have come about with improvements in medical technology, specifically the treatment of communicable diseases, as well as policy efforts that have focused on disease prevention such as programs to increase access to basic sanitation and water facilities and expansion of immunization and vaccine programs against preventable diseases.

Nevertheless, much disparity is hidden by these national averages. Infant mortality substantially varies across income groups in the Philippines. Gaps in mortality

[2]The focus is on differences that can be addressed using policy action. Disparities in biological and genetic conditions cannot be considered as inequities.

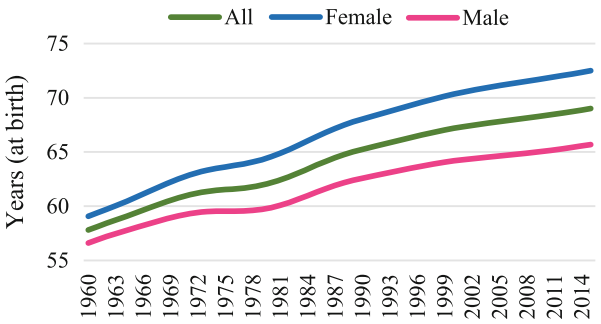

Fig. 8.1 Life expectancy at birth in the Philippines, 1960–2015. (*Source:* World Bank World Development Indicators)

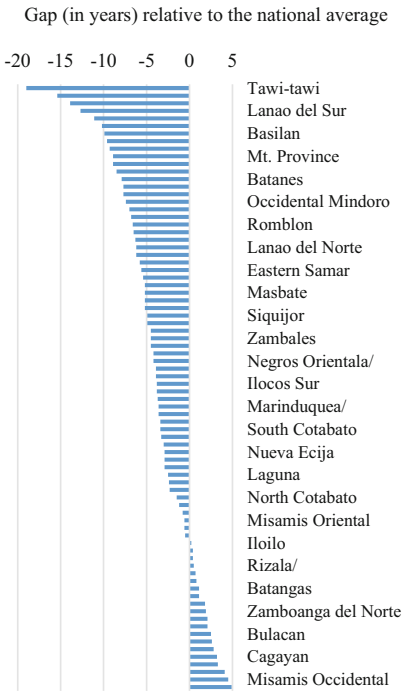

Fig. 8.2 Differences in life expectancy among provinces relative to the national average, 2012. (*Source:* Ateneo Policy Center staff calculations based on data from Human Development Network)

rate between the highest and lowest quintile have slightly narrowed down over time, but these still remain considerable. Children from the lowest socioeconomic status are less likely to survive childhood by up to three times when compared to children from the highest-income households (Fig. 8.5).

Income and development disparities shape and influence health disparities (and vice versa). A study by Strina et al. (2003) showed that there is a high degree of association between prevalence of diarrhea and hygienic conditions and sanitary facilities of households. Children from poor households are often deprived of better sanitation facilities such as access to safe drinking water and clean cooking environment compared to wealthier households. Poor and low-income households are

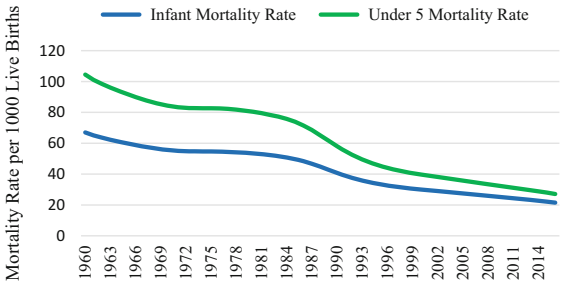

Fig. 8.3 Child mortality rates, 1960–2016. (*Source:* Estimates developed by the UN Inter-Agency Group for "Child Mortality Estimation")

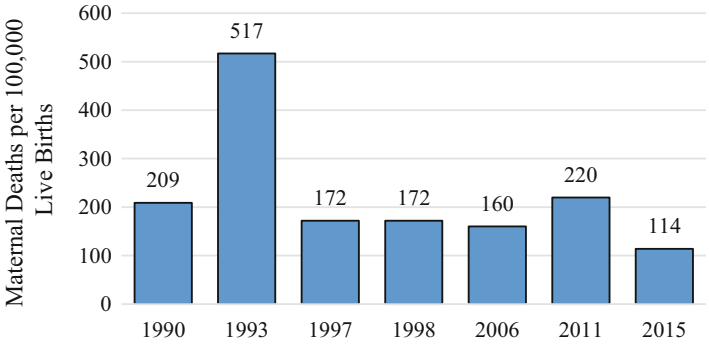

Fig. 8.4 Maternal mortality ratio. (*Source:* World Bank World Development Indicators)

also often subjected to poor hygienic practices, which in turn make them more vulnerable to bacterial and parasitic diseases like diarrhea. Over the years, prevalence of diarrhea has been declining, as cited earlier mainly due to the improvement in medical technology. But the risk is still higher among households in the lowest-income quintile compared to children under 5 years old in the richest quintile (see Fig. 8.6).

8.2 Catastrophic Health Spending

The out-of-pocket share of health expenses is typically larger for less developed countries, compared to richer ones (see Fig. 8.7).

While there are many factors that influence health outcomes, in the Philippine context which offers a mix of public and private healthcare providers, prohibitive health expenses are clearly a variable to consider.[3] When faced with a health emergency, and the critical need for health services and medicines, the typical Filipino household often has no choice but to undertake a variety of coping

[3]This section draws on earlier work by the author. See Mendoza (2008).

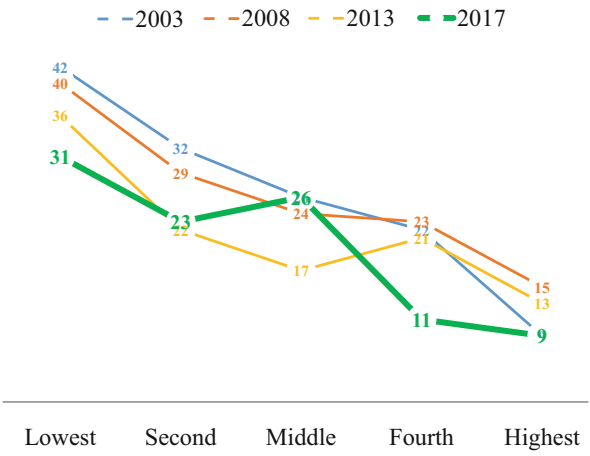

Fig. 8.5 Infant mortality rate by wealth quintile, 2003–2017. (*Source:* National Demographic and Health Survey, Philippines)

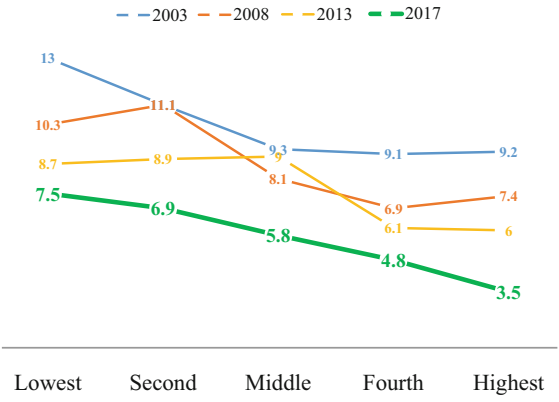

Fig. 8.6 Prevalence of diarrhea among children under 5 years old by wealth quintile, 2003–2017. (*Source:* National Demographic and Health Survey, Philippines. *Note:* Prevalence of diarrhea pertains to percentage of children under age 5 who had diarrhea in the 2 weeks preceding the survey)

strategies. Studies on healthcare spending in the developing world have shown rather consistently that the poor have a higher spending burden when compared to the rich (see Fig. 8.8).

The main focus here is in those instances wherein household spending could be so high that they could be catastrophic for low-income households: the vulnerable non-poor could be pushed into poverty, and the already poor could be pushed deeper into poverty. In the health literature, one definition suggests that health spending could be deemed catastrophic when a household must "reduce its basic expenditure over a period of time to cope with health costs" (Xu et al. 2003).

There are a number of ways to try and develop indicators for catastrophic health spending, depending largely on the threshold of spending (expressed as a share of household income) which could be deemed "catastrophic." Studies have used thresholds ranging from 5% to 20% (of total household or non-food expenditures), and some scholars refer to 10% as a common choice, with the rationale that this best

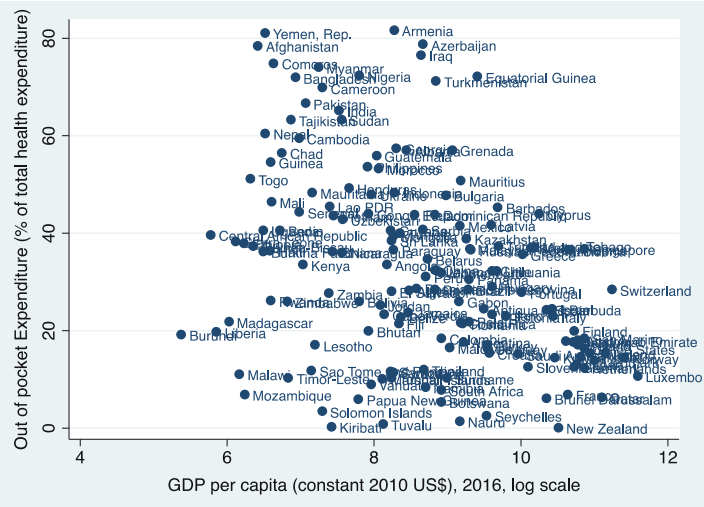

Fig. 8.7 GDP per capita plotted against out-of-pocket expenditure in 161 countries. (*Source:* WHO, Global Health Expenditure, 2016. World Bank Development Indicators)

approximates the threshold which implies giving up other basic needs, disposing of productive assets, incurring debt, or becoming (more) impoverished (see Shrime et al. 2015; Van Doorslaer and others 2007; Xu et al. 2003).[4]

Figure 8.9 illustrates the proportion of the population in a sample of 14 countries and territories in Asia (including the Philippines) that might be vulnerable to incurring catastrophic payments for healthcare. The share of the population that is vulnerable to making catastrophic payments will clearly vary with the threshold chosen, though as Fig. 8.7 shows, even relatively conservative threshold levels still indicate large numbers of these countries' populations that remain vulnerable to catastrophic health spending. Taking 10% of total household expenditures as the threshold, up to 16% of households in Bangladesh, 15% of households in Vietnam, and 13% of households in China are vulnerable to catastrophic health spending. The corresponding share for the Philippines is smaller; but the final numbers still affect a large number of families (i.e., well over one million households based on these estimates).

Catastrophic health spending could lead to many other outcomes that could "trap" the household not just in poor health but also in general poverty and low income over time. As regards coping behavior, in order to avoid catastrophic health spending, households may choose to minimize healthcare seeking behavior, in turn leading to undiagnosed sickness and perhaps even more health risks later down the road. For critically important healthcare, some households may resort to selling assets,

[4]Recent empirical analysis of catastrophic health spending in India by Bonu et al. (2009) suggest that the poverty headcount in that country may have increased by as much as 28–31 percent due to health payments—translating to about 40 million people falling below the poverty line.

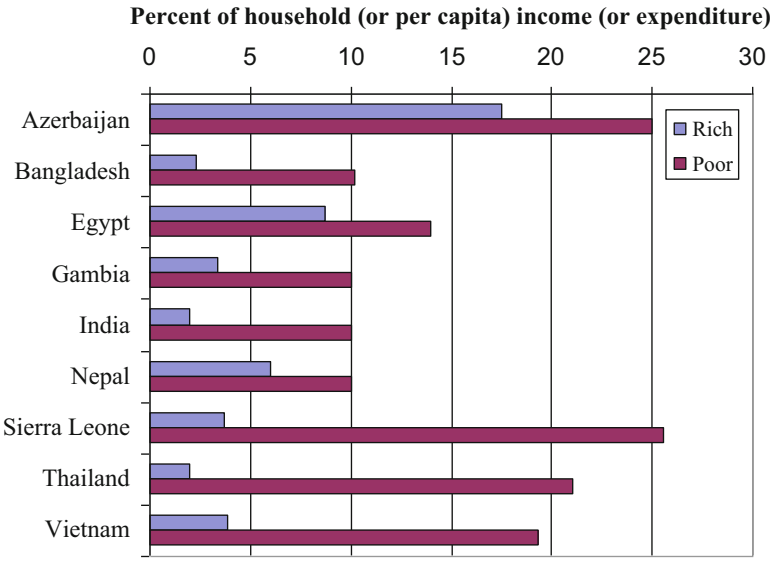

Fig. 8.8 Comparative health expenditures for rich and poor households in selected developing countries. (*Note*: Definitions of poverty may differ across the studies from which the data for this figure is drawn from. *Source:* Fabricant, Kamara and Mills (1999,181–184))

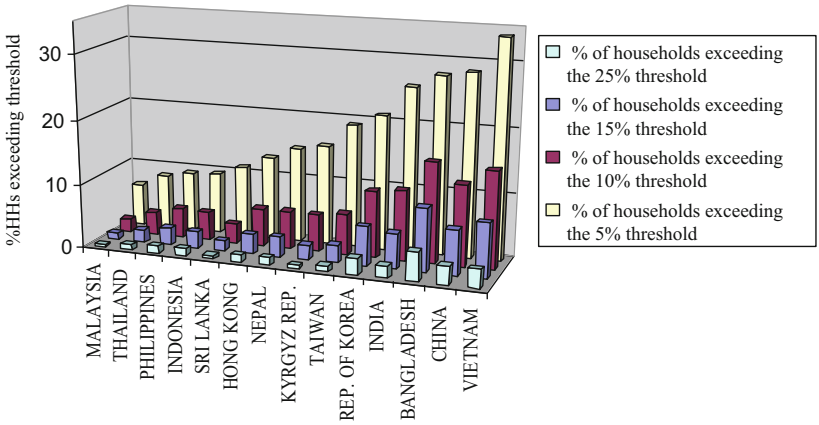

Fig. 8.9 Percentage of households incurring catastrophic healthcare payments. (*Note:* Threshold levels for out-of-pocket spending as a percent of total expenditure range from 5% to 25%. Figures reported refer to the percent of households whose spending exceeds the specified thresholds. *Source:* Van Doorslaer and others (2007, 38–39))

including those that represent hard-earned savings or those that contribute to income (e.g., livestock, vehicles, or land). Children can also be pulled out of school and/or sent to work in order to make up for the additional financial burden faced by the family. These types of coping behavior signal how a dramatic increase in health

spending could further debilitate a poor household's ability to earn income and frustrate their escape from poverty. It also potentially illustrates how future generations could be trapped in both low income and also poor health, given human capital investments could also suffer due to catastrophic health shocks.

8.3 Synthesis and Recommendations

As regards Philippine health outcomes, the gaps between the best and worst performing subpopulations persist and, in some cases, are found to be increasing over time. As has been seen in other countries where health services have been devolved to local authorities, the observed disparities in health outcomes at the provincial level (i.e., variation in life expectancy) may also point to variations in the performance of local governments.

Devolution is one component of the Philippines' Local Government Code of 1991 where the country's healthcare system is decentralized from the central government to the local government units. It essentially aims to improve service provisions by bringing it closer to people. Key public health services, together with all related assets, liabilities, equipment, personnel, and records, were devolved by the Department of Health (DOH) to the local government units (LGUs). However, as has been shown by previous studies (Furtado 2001; Lakshminarayanan 2003), decentralization does not always result in better equity, efficiency and effectiveness in health service provisions. In fact, devolution has led to deterioration in quality health service delivery in some of the poorer LGUs in the Philippines. This entails policy interventions from the central government agency that is targeted toward worst-performing provinces. Further studies that would evaluate and identify the most effective health service delivery mechanism in the context of the Philippines would also be necessary. Ideally, devolution of health services should be accompanied by increased capacity and/or accountability on the part of health units in the rural sector and the LGUs responsible for them.

Furthermore, lack of health professionals and their unequal distribution, low investments in health sector infrastructure, and geographical inaccessibility to health facilities in remote locations seem to be some of the underlying factors that contribute to widening disparities among health outcomes in Philippine LGUs. However, it should also be noted that extreme poverty and persistent armed conflict may also be important factors. Focusing on these areas and deliberate efforts in fighting challenges arising from these issues could help improve health service delivery that would eventually minimize the disparities.

While it is evident that the Philippines, like many other middle-income countries, has achieved some progress toward the Millennium Development Goals, as revealed by the improvement in aggregate health status over the years, persistent inequity in health outcomes across socioeconomic status is still evident. The burden of financial consequences and higher mortality risks are mostly borne by poor households. Wealth-related inequity remains pervasive and appears to be strongly associated

with important health services and socioeconomic determinants. The unequal distribution of health interventions, particularly facility-based delivery, is found to contribute to the huge disparities in infant mortality between the poorest and richest households (Kraft et al. 2013). Strong pro-poor policy interventions that focus on facility-based delivery could be crucial to further reduce infant mortality among poor households.

In the Philippine context, more effective and inclusive social health insurance—notably through PhilHealth, the country's primary social insurance platform, and private insurance providers—reflects a continuing challenge which is also mirrored in other developing countries (Carrin and James 2005).

The Philippines has made significant strides toward universal health coverage in the past few years.

Recent policy reform expanding social health insurance (PhilHealth) coverage relied heavily on the incremental revenue brought by the passage of the Sin Tax Reform Law in December 2012. The law increased taxes on tobacco and liquor products (Congress of the Philippines 2012). According to the World Health Organization (WHO), within the first year of the law's implementation, the government was able to collect more than Php 500 million, which were allocated to PhilHealth coverage (85%) and to subsidies for displaced tobacco farmers (15%). In 2016, DOH reported a substantial increase in PhilHealth coverage to about 90% of the entire population (a modelled estimate of 93.4 million Filipinos). This is remarkably higher than the 74% figure in 2009. However, the increase in PhilHealth coverage is only half the picture; the other half has to do with benefit utilization which has remained low. In 2011, the Annual Poverty Indicator Survey (APIS) showed that PhilHealth utilization rate was only 4%. There are several explanations for the low PhilHealth utilization rates. One is that the poor generally avoid seeking care in hospitals because of the burdensome expenses that hospitalization entails, PhilHealth coverage notwithstanding. Another is that health personnel and health facilities which provide quality care may be scarce or absent in remote and geographically isolated areas making access to healthcare unattainable in these communities.

PhilHealth provides healthcare coverage through so-called benefit packages which are reimbursed based on stipulated case rates. For in-patients, this case rate payment system has led to lower average cost per case and shorter length of hospital stay. Specifically, an in-patient hospitalization package includes hospital room/ward; services of healthcare professionals; diagnostic, laboratory, and other medical examination services; and prescription drugs which are subject to specific limitations. There are also outpatient packages usually targeted at chronic diseases including tuberculosis, diabetes, and hypertension. At the present time, these outpatient benefit packages are not universally available; they are mainly targeted at indigents whose premiums are shouldered by the government (through the Sin Tax Law) (Dayrit et al. 2018). Lack of knowledge of these benefit package especially among lower-income groups remains pervasive and is being addressed by the government through better health promotion at the local government level.

PhilHealth is generally unable to pay for the total cost of a hospitalization. Thus a hospitalized patient makes out-of-pocket payments (OOP) for the balance not

covered by PhilHealth. To protect indigents from OOP, a No Balance Billing Policy has been instituted in government hospitals where the poor and the indigent would usually go. For paying clientele on the other hand, OOP could constitute as much as 70% of the total hospital bill. These paying clientele would generally go to private hospitals where the quality of services is considered better but where the costs of these services are higher than their public counterparts. This situation exposes many citizens to catastrophic health expenditures. To address this, PhilHealth has come up with the z-package to address catastrophic conditions like cancer, kidney transplantation, and heart surgery (Dayrit et al. 2018).

Private health insurance (voluntary health insurance) plays a supplemental role to PhilHealth. Coverage is provided by health maintenance organizations (HMOs) and private insurance companies. The Philippine National Demographic Survey 2013 showed that 1.9% of households (or roughly 1.9 million population) had purchased private health insurance (Philippine Statistics Authority and ICF International 2014). Buying private insurance is one way to increase protection against catastrophic health expenditure but because of coverage ceilings, a person is not necessarily safe from OOP. HMOs provide group insurance for large companies and seek to enroll large numbers of young workers who have a low-risk health profile. By creating an extensive network of accredited physicians who are compensated on a discounted-fee-for-service basis or retainer basis, the HMOs are able to lower costs for servicing their clients.

Analyzing total health expenditures in 2014, out-of-pocket expenditures accounted for 53.7%, public expenditure accounted for 34.3% of which PhilHealth contributed 16.1%, and voluntary health insurance accounted for 13.5% (Dayrit et al. 2018).

From a standpoint of equity therefore, the Philippines has to address a number of challenges: (1) reduce the discrepancy in the access to healthcare services among its socioeconomic classes, (2) reduce the discrepancy in the quality of health services between the public and private sectors, (3) increase the availability of services to geographically isolated and depressed areas, and (4) reduce out-of-pocket expenditures as a percentage of total health expenditure.

A Universal Health Care Bill is about to be passed by the Philippine Congress that seeks to address the aforementioned challenges. The UHC Bill seeks to restructure the Philippine health system and looks to pool various public funds to make the social insurance system more effective and inclusive. Improving health equity in the country will depend greatly on how the Philippines is able to make the vision and mandate of the UHC Bill a reality (Senate 2018).

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Part IV
East Asia

Chapter 9
An Investigation of Medical Expenditures in Hospitals and Clinics Using Propensity Scores

Noriko Ishikawa and Mototsugu Fukushige

Abstract This study identifies the factors affecting people's attitudes toward hospital use and measures the impact of people's attitudes toward healthcare services on out-of-pocket healthcare expenditures using the data from an original questionnaire survey in Japan. We regard the probability of hospital use as a propensity score in order to remove other impacts on the expenditure except the differences between hospital and clinic users. Our empirical results reveal that the accessibility of healthcare facilities is one of the most important factors affecting people's behaviors in choosing their primary care provider and that out-of-pocket medical expenditures are irrelevant to whether people choose a hospital or a clinic in Japan.

Keywords Out-of-pocket medical expenditure · Accessibility of healthcare facilities · Probit model · Propensity score estimation

9.1 Introduction

As of 2015, the national medical care expenditure in Japan was estimated to be 42.3644 trillion yen (about 380 billion US dollars) and has been rising steadily over the past 60 years, according to the empirical results of the Estimates of National Medical Care Expenditure (MHLW 2015). Furthermore, the healthcare spending is expected to increase significantly because of the rapid growth in the aging population. To overcome the continuing financial difficulties, the Japanese government has been promoting clinical specialization and collaboration: in other words, the

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government has been looking for the best way to prevent rapid increase in healthcare costs by the radical reform of the medical and healthcare system.

Because most specialists (regardless of whether they work in a small clinic or a large hospital) offer primary care services,[1] people have the freedom to visit any clinics or hospitals without any reservations in Japan. They may also seek second or third opinions from other specialists until they are satisfied with the empirical results. Some patients with symptoms of mild severity, such as sore throat, mild fever, stiff neck, or headache, are willing to visit a large hospital with some specialized clinical departments. Although the government has introduced a system under which patients without a referral letter are required to pay an extra fee when visiting a large hospital, the system does not seem to work well. To offer more incentives for appropriate use of medical resources—e.g., trying to convince people with mild symptoms to visit a clinic rather than a hospital—is expected not only to secure more opportunities for people in need of more advanced and acute treatments but also to stop providing excessive or unnecessary treatments and thereby reducing both monetary costs and the time involved.

Do patients who choose a hospital really pay more compared with those who choose a clinic? To our knowledge, no studies exist that answer this question. We thus explore the impact of hospital use on out-of-pocket medical expenditures using the results of an original questionnaire survey conducted on subjects living in the Kanto region in Japan. In this paper, we first clarify the factors affecting people's attitudes toward healthcare facilities and estimate the probability of choosing a hospital as a primary care provider by using a probit model. When discussing the relationship between out-of-pocket medical expenditures and people's choice of healthcare services, it is preferable to compare expenditures among people who have the same probability of hospital use. We thus estimate the medical expenditure as a function of the probability by applying an ordered probit model and compare the estimated differences for each group with the same probability. This procedure follows the convention of propensity score estimation, defined by Rosenbaum and Rubin (1983).

Some interesting and important results can be obtained. People' attitudes toward healthcare services seem to depend on region-specific characteristics rather than individual-related factors: people are more likely to visit a hospital if they are living far from a clinic or a railway station or are living close to a hospital. This indicates that accessibility to healthcare facilities is one of the important factors affecting people's choice of healthcare services. On the other hand, a clear and radical difference in out-of-pocket medical expenditures between hospital and clinic users cannot be found, with very few exceptions. This implies that hospital use itself is not

[1] As Takamura (2015) indicates, the definition of *primary care* seems to be ambiguous in Japan compared with other countries. On the other hand, the concern for primary care services has been increasing; e.g., the training program for primary care physicians led by the Japanese Medical Association was launched in 2016.

a critical issue in terms of the reduction in medical expenditures. People in Japan seem to use healthcare services appropriately without any restrictions.

The remainder of the paper is organized as follows. Section 9.2 surveys the healthcare system in Japan. Section 9.3 reviews previous studies addressing healthcare services, and Sect. 9.4 provides a detailed description of the data that we used. Section 9.5 indicates the model for estimation of propensity scores and the empirical results of estimating factors determining the attitudes toward hospital use. In Sect. 9.6, we discuss the model for measuring the differences in out-of-pocket expenditures. The paper ends with some concluding remarks.

9.2 Overview of the Healthcare System in Japan

In Japan, all people are covered under the public insurance system so that they receive appropriate medical treatment and care with a low cost.[2] Basically, the self-pay ratio of medical expenditures depends on the patient's age[3]: children under 6 years of age and people over 70 years of age pay 20% of actual medical expenses, and people over 75 years of age only pay 10% of the medical costs. Among OECD countries, out-of-pocket medical spending in Japan is relatively low (see Fig. 9.1).

In addition, people are free to choose medical care services offered by clinics or hospitals unlike in the UK and the USA.[4] According to the Medical Care Law in Japan, a *hospital* is defined as a medical institution with 20 or more beds providing "truly scientific and appropriate treatment" to the injured or the sick. A *clinic* is a healthcare facility with 19 or less beds without strict regulation compared with a hospital. As of 2017, the number of hospitals was 8439, and over 10,000 clinics are located all over Japan (see Table 9.1). Although the number of practicing physicians per 1000 population in Japan is below the average of 35 OECD countries,[5] the numbers of hospitals and clinics seem to be sufficient for people to ensure access to healthcare services.

Previous papers show that a mismatch between patients' preferences and medical care supply exists in Japan. For instance, Moriwaki et al. (2016) indicated that the proportion of outpatients with mild symptoms of diseases or sicknesses is estimated to be about 35–40% in hospitals with over 200 beds. Tsukahara et al. (2016)

[2]If people receive advanced healthcare services using any drugs or treatments, which are not approved by the Ministry of Health, Labour and Welfare, they should pay all medical costs.

[3]If people over 70 years of age earn over a certain level, they should pay 30% of medical expenses. On the other hand, all welfare payment recipients can access healthcare services free of charge.

[4]In the UK, people are required to register with their local general practitioner (GP) practice for primary medical care. In the USA, previous studies indicated that access to medical care seems to be limited for most people (Guagliardo et al. 2004; Ross and Detsky 2009; Larson and Halfon 2010; Woolf and Aron 2013).

[5]The numbers of practicing physicians per 1000 population in Japan, the UK, and the USA are 2.4, 2.8, and 2.6, respectively. The average of 35 OECD countries is 3.4 (OECD 2017).

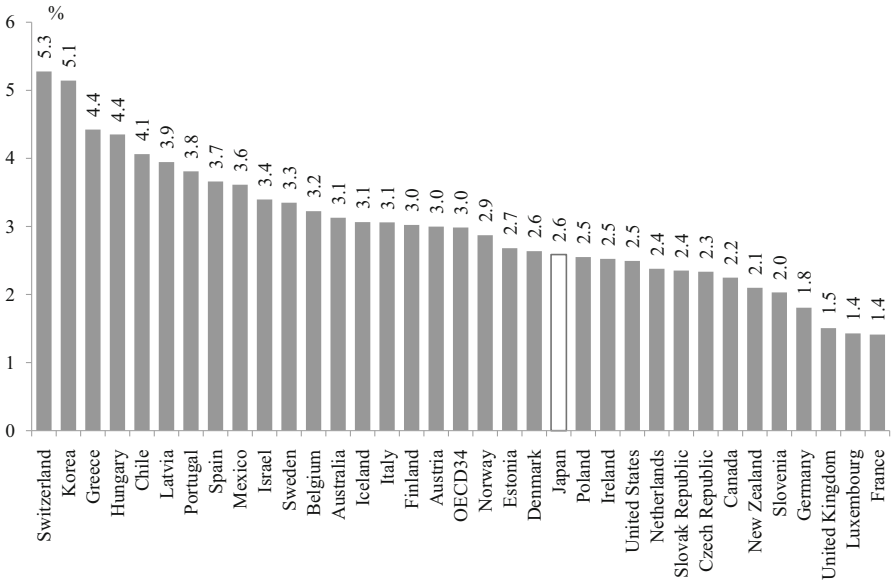

Fig. 9.1 Out-of-pocket medical spending as a share of final household consumption among OECD countries, 2015 (or nearest year). (*Source*: OECD 2017)

Table 9.1 International comparison of access to healthcare facilities

		Number of facilities	Number of facilities per 100,000 people
USA	Retail health clinic[a]	2400	0.73
	Hospital[b]	5534	1.69
UK	GP practice[c]	7454	13.49
	NHS trust[d]	251	0.45
Japan	Clinic	101,505	80.08
	Hospital	8439	6.66

Source: The data for the USA are from AHA (2018) and Accenture (2015), the data for the UK are from NHS (2017), and the data of Japan are from MHLW (2017). The number of facilities per 100,000 people is calculated using data from US Census Bureau (2017), ONS (2017), and STAT JAPAN (2017)

[a]Retail health clinics, located mostly in drugstores or supermarkets, offer various kinds of health services performed by a nurse practitioner or a physician assistant

[b]Total number of all US registered hospitals that meet the American Hospital Association's criteria for registration as a hospital facility

[c]A general practitioner (GP) is a medical doctor who offers primary care services.

[d]The National Health Service (NHS) trust is an organization that manages the most hospitals providing secondary care in the UK

demonstrated that one-fourth of outpatients of large hospitals should go to a clinic because of their mild-to-moderate symptoms. People are more likely to visit a hospital rather than a clinic because they might believe that physicians in large hospitals are highly trained and have more specialized knowledge compared with

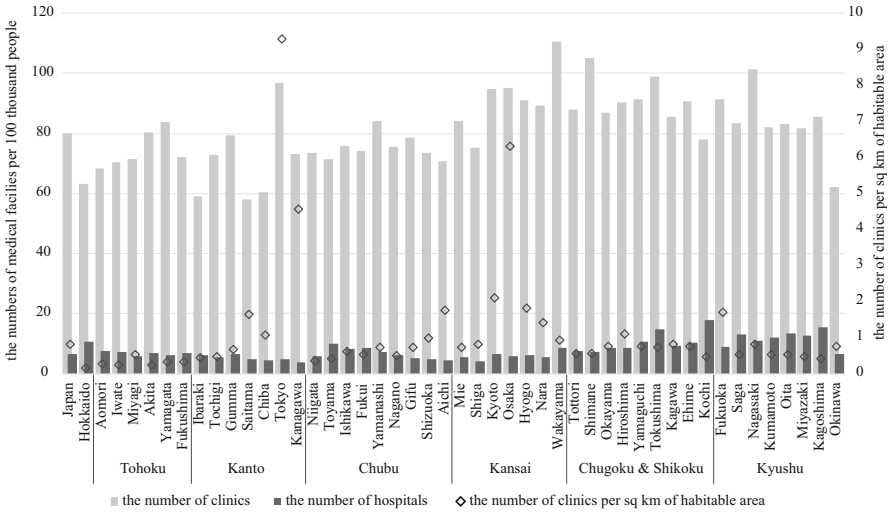

Fig. 9.2 Numbers of clinics and hospitals per 100,000 people and numbers of clinics per km^2 of habitable area by prefecture in Japan in 2017. (*Source*: The numbers are calculated using data from MHLW (2017) and STAT JAPAN (2016, 2017))

those in small clinics. Although the Japanese Ministry of Health, Labour and Welfare has instituted a system under which patients are required to pay an extra fee in addition to the standard initial consultation fee when visiting a hospital with 200 or more beds without a referral letter of introduction, the mismatch between patients and medical facilities has not yet been totally resolved.

Before discussing the regional allocation of healthcare facilities, we make reference to the definition of availability and accessibility, which are well known as important concepts when considering healthcare systems.[6] We consider the availability of healthcare services as the supply of healthcare providers and facilities—i.e., the number of physicians, clinics, or hospitals per person—and the accessibility of healthcare as the spatial distribution of healthcare providers, i.e., the density of healthcare facilities or the distance between patients and their closest healthcare facility.

Now, we show the regional differences in the availability of healthcare services, i.e., the number of healthcare facilities among prefectures, which are the first administrative divisions in Japan (see Fig. 9.2). There exist some regional differences in numbers of both clinics and hospitals, as well as in the number of clinics per km^2 of habitable area. The density of clinics, considered as a proxy of the accessibility of primary care services, is estimated to be relatively high in Tokyo, Osaka, and Kanagawa prefectures, which have highly populated cities and districts such as

[6]Penchansky and Thomas (1981) indicated that the five dimensions of access (availability, accessibility, accommodation, affordability, and acceptability) are the important aspects when examining healthcare services.

Table 9.2 Regional differences in accessibility of healthcare services in Japan

	Population (thousand people)	Number of clinics per 100,000 people	Number of clinics per km^2 of habitable area
Japan	126,933	79.97	0.828
Hokkaido	5352	63.30	0.151
Tohoku	8915	73.51	0.321
Kanto	43,132	75.57	1.785
Chubu	21,415	73.61	0.751
Kansai	22,489	92.20	1.952
Chugoku	7406	90.87	0.798
Shikoku	3818	88.63	0.697
Kyushu	14,405	85.78	0.740

Source: The numbers are calculated using data from MHLW (2017) and STAT JAPAN (2016, 2017)

Tokyo Metropolis, Osaka, and Yokohama, respectively. The Kanto region, where the people surveyed in this study reside, has one-third of the population of Japan, and the accessibility of clinics is relatively high compared with other regions, although the availability of clinics is rather low (see Table 9.2).

9.3 Literature Survey

In this paper, we are interested in both factors affecting people's choice of healthcare facilities and causes that make a difference in out-of-pocket expenditures on healthcare services. The goal of our study is to reveal the impact of "hospital use" on out-of-pocket expenditures. Although there exist a large number of studies on healthcare services, most of which focus on the relationship between the utilization of healthcare services and population health (Shi and Starfield 2001; Guagliardo 2004; Padilla et al. 2016), we know of no studies dealing with our concerns.

Several studies deal with the utilization of healthcare services. Van Doorslaer et al. (2006) found out the pro-rich inequality in health service use by using the data of 21 OECD countries: people with higher incomes are more likely to visit a specialist compared with people with low incomes, although the utilization of primary care services seems to be equal. Chan et al. (2006) discovered that rurality is one of the factors preventing Medicare beneficiaries from visiting specialists in the USA, and Hiscock et al. (2008) indicated that the travel time to access GP services in New Zealand is negatively associated with GP utilization. Some studies focus on the relationship between patient choice and the quality of healthcare services. Beckert et al. (2012) and Varkevisser et al. (2012) clarified that patients seem to take quality into account when they choose their hospital. Gaynor et al. (2016) found that the removal of constraints on patient choice makes patients more responsive to the clinical quality of care at hospitals, by using data from the UK. Moreover, Brekke

et al. (2007) emphasized that a strict gatekeeping role of GPs may reduce social welfare.

On the other hand, with respect to out-of-pocket expenditures, a number of studies have dealt with the effectiveness of health insurance: the disparity between the insured and the uninsured. Finkelstein and McKnight (2008) found out that the Medicare system, the public health insurance program for old people or the disabled in the USA, has a significant effect on protecting the elderly from financial risk. Anderson et al. (2012) clarified that having health insurance would reduce the utilization of emergency departments and inpatient services. Both Gross et al. (1999) and Shen and McFeeters (2006) concluded that the effect of the public insurance system in the USA seems to be too limited for the burden of out-of-pocket expenses for people to be eased. Moreover, Ziller et al. (2006) shed light on the regional differences of the insurance rate by using data on US residents: rural residents are more likely not to receive appropriate healthcare compared with urban residents. Some studies indicate that the risk of out-of-pocket healthcare expenditures is higher as age increases or at the end of life (Marshall et al. 2011; Kelley et al. 2015; Fahle et al. 2016).

Accumulated studies have revealed that (1) the utilization of healthcare services is related to both individual and regional characteristics, (2) the quality of hospitals is also an important factor affecting patients' choice of hospital, and (3) out-of-pocket healthcare expenditures depend significantly on the age of the users. We also note that people with chronic conditions have a higher financial burden compared with others without chronic conditions (Hwang et al. 2001; Anderson and Horvath 2004; Paez et al. 2009).

9.4 Data

In this study, we use the data from an original questionnaire survey on residential environment conducted in February 2009. The subjects were randomly selected from the population in the Kanto region based on the Basic Resident Register (conducted by the Ministry of Internal Affairs and Communications) using a two-step random sampling procedure. As noted in Sect. 9.2, the Kanto region, which comprises the Tokyo Metropolis and six other prefectures (Ibaraki, Tochigi, Gunma, Saitama, Chiba, and Kanagawa), is estimated to have relatively high accessibility of primary care services so that people residing in the region may have a lot of variety from which to choose. We sent 2000 people the questionnaires by mail and received 1118 responses.

First, we classify the data from the respondents in terms of respondents' attitudes toward health services and accessibility of healthcare facilities (see Table 9.3). We examine the accessibility of healthcare facilities from the responses to Q7 (see Appendix for details); that is, if one responds that there are one or more healthcare facilities with walking distance (about a 10–15-min walk) from home, we assume that the area has a high accessibility of healthcare facilities.

Table 9.3 Peoples' choice and accessibility of medical facilities

	Respondents' attitudes toward healthcare services[a]		
Accessibility of healthcare facilities	Using a clinic as a primary care provider	Using a hospital as a primary care provider	Total
Area close to clinic and hospital	371	189	560 (59.9%)
Area close to clinic but not hospital	238	54	292 (31.2%)
Area close to hospital but not clinic	2	8	10 (1.1%)
Area far from clinic and hospital	40	33	73 (7.8%)
Total	651 (69.6%)	284 (30.4%)	935 (100%)

[a]Unknown data are excluded

In terms of people's attitudes toward healthcare services, we found that almost 70% of all respondents chose a clinic as a primary care provider, whereas 30% of respondents were more likely to visit a hospital. With respect to accessibility of healthcare facilities, almost 60% of respondents resided in an area close to both a clinic and a hospital. Although 7.8% of respondents did not live close to either a clinic or a hospital, we concluded that the accessibility of healthcare facilities was relatively high.

9.5 Estimation of Propensity Scores

9.5.1 Model

Our goal for this analysis is to clarify the relationship between the amount of out-of-pocket expenditure on healthcare services and the choice of healthcare facilities. The empirical results, however, might be misleading if we apply a regression model estimating factors affecting out-of-pocket expenditure directly: people with higher needs in healthcare services (such as people with chronic conditions) tend to visit hospitals more frequently and to have more out-of-pocket expenses. Given this, it is more appropriate to compare out-of-pocket expenditures by people with the same probability of hospital use. This procedure comes from the concept of propensity score, defined by Rosenbaum and Rubin (1983). We can regard the probability of hospital use as a propensity score, and matching on propensity scores removes other impacts on the expenditure except the differences between hospital and clinic users.

First, we investigate the factors affecting people in choosing healthcare facilities. We assume the following probit model:

$$y_i^* = \beta_0 + \sum_{j=1}^{k} \beta_j x_{ij} + \epsilon_i \qquad \epsilon_i \tilde{} N(0,1) \tag{9.1}$$

where y_i^* is a latent variable, which is not observed. This unobservable variable is related to the individual i's actual decision of choosing a hospital as a primary care provider, which is observed as y_i. In other words, the binary variable y_i can be assumed to have values as follows.

$$y_i = \begin{cases} 1 \quad \text{(a person chooses a hospital)} & \text{if} \quad y_i^* > 0 \\ 0 \quad \text{(a person does not choose a hospital)} & \text{if} \quad y_i^* \leq 0 \end{cases}$$

The independent variable x_{ij} is the jth variable of individual i that relates to y_i^*. We also note that β_0 and β_j are unknown coefficients and ϵ_i is an error term that is assumed to have standard normal distribution. In this analysis, we employ the dummy variable, y_i, DVHOSP, which takes the value one if the respondent chooses a hospital as a primary care provider, and zero otherwise.

We collect variables that involve both individual and regional characteristics as independent variables (see Table 9.4). For individual-related variables, we employ variables representing individual characteristics such as respondent's age (AGE), number of family members (NFM), whether or not living with children under 10 years of age (NCHILD), whether or not living with people over 70 years of age (NOLD), main source of income (denoted by three dummy variables, PAID1 for salary, PAID2 for business/profession, and PAID6 for pension), and household income level (INC),[7] which are thought to be largely affected by the choices of the respondents. Because some data, such as AGE and INC, are only collected in bands, these variables are represented by the midpoints of each band. For each open-ended top band, we add a dummy variable (DAGE70, DINC1, DINC6, DYEAR1, DYEAR6, DWTSTA1, and DWTSTA5) to eliminate bias from applying representatives of the open-ended top band.

We also apply home ownership (OWNH) and length of residence (RYEAR) variables which proxy for satisfaction within the regions. As we noted above, previous studies make a point that the quality of the hospitals is also one of the important factors affecting the patients' choices of hospitals. Hence, we add a dummy variable (RES57) that represents people's awareness and attitudes toward "quality" estimated by the questionnaire. We asked people the important reasons for choosing a primary care provider by offering some alternatives and collected data from the following three alternatives: "having good medical specialists," "having a variety of clinical departments," and "having advanced medical equipment" (see Appendix, for details). If RES57 has a value of 1, it can be assumed that respondents have a higher propensity to choose healthcare services with good quality.

[7]With respect to AGE, NFM, and INC, we add each of the squared terms, which denote AGE2, NFM2, and INC2, respectively.

Table 9.4 Explained and explanatory variables

Variables	Description
Dependent variable (probit model)	
DVHOSP	1 goes to a hospital & = 0 otherwise
Dependent variable (ordered probit model)	
MEDEXP	Total annual household out-of-pocket medical expenses (ordered score) takes values 1, 2, 3, 4, 5, and 6
	1: less than 10 thousand yen 2: 10–30 thousand yen 3: 30–50 thousand yen
	4: 50–100 thousand yen 5: 100–150 thousand yen 6: over 150 thousand yen
Independent variables (probit model)	
<Individual-related variables>	
AGE	Age of respondent (midpoint of each cell) takes values 25, 35, 45, 55, 65, and 75
AGE2	AGE squared
DAGE70	1 for over 70 years of age; 0 otherwise
NFM	Number of family members
NFM2	NFM squared
NCHILD	1 if a household has one or more family members under 10 years of age; 0 otherwise
NOLD70	1 if a household has one or more family members over 70 years of age; 0 otherwise
PAID1	1 if main source of income is from salary; 0 otherwise
PAID2	1 if main source of income is from business/profession; 0 otherwise
PAID6	1 for main source of income is from pension; 0 otherwise
INC	Total annual household income (ten thousand yen, midpoint of the cells) takes values 100, 300, 500, 700, 900, and 1200
INC2	INC squared
DINC1	1 if total annual household income is less than 2 million yen; 0 otherwise
DINC6	1 if total annual household income is over 10 million yen; 0 otherwise
OWNH	1 if a person owns a house (or flat); 0 otherwise
RYEAR	Length of residence (year, midpoint of each cell) takes values 0.5, 2, 4, 7.5, 15, and 25
DYEAR1	1 for resident less than one year; 0 otherwise
DYEAR6	1 for resident over 20 years; 0 otherwise
RES57	1 if choose the clinic having a good doctor, a variety of clinical departments, or advanced medical equipment; 0 otherwise
<Region-specific variables>	
DCLINIC	1 living area close to clinic; 0 otherwise
DHOSP	1 living area close to hospital; 0 otherwise
WTSTA	walking time to the nearest railway station (minute, midpoint of each cell) takes values 3, 7.5, 15, 25, and 45
DWTSTA1	1 for less than a 5-min walk to the nearest railway station; 0 otherwise
DWTSTA5	1 for more than a 30-min walk to the nearest railway station; 0 otherwise

For region-specific variables, we use two dummy variables, DCLINIC and DHOSP, to represent the proximity to a clinic and a hospital, respectively. We also employ the variables that denote walking time to the nearest railway station (WTSTA) not only for estimating the transportation advantages of the area but also for representing the accessibility to a range of services. In Japan, there are shopping streets or commercial complexes packed with a variety of retail stores, restaurants, offices, and clinics in the area close to every railway station. We present descriptive statistics of these variables in Table 9.5. We use 813 observations in the analysis after excluding questionnaires with missing data and identify the optimal model based on the minimum value of Akaike's Information Criteria (AIC).

9.5.2 *Empirical Results*

We show the empirical results of estimation of the probit model in Tables 9.6 and 9.7. With regard to individual-related variables, respondent's age, home ownership, the number of families, household income, and length of residence are significantly associated with the probability of choosing a hospital as a primary care provider, although the latter three variables have little impact on the probability. We see that people over 70 years of age are more likely to visit a clinic rather than a hospital and people owning their own home are more likely to visit a hospital. Interestingly, stronger attitudes toward quality would significantly increase the probability of visiting a hospital. We understand that people might believe that a hospital would be preferable because it offers higher-quality services compared with a clinic.

Region-specific variables are found highly to affect people's hospital choices rather than individual-related variables. The proximity to healthcare facilities is the important factor: people are likely to choose a hospital if they live close to a hospital. Proximity to a clinic would greatly reduce the probability of choosing a hospital. On the other hand, lower accessibility to a railway station would boost the probability of choosing a hospital. Generally, most hospitals are located in the suburbs rather than in the center of the city because of their volume. Our empirical results indicate that people living close to a railway station find it easier to access and choose a clinic.

The Eq. (9.1) and estimators of the parameters give us the ith individual probability of choosing a hospital, which is denoted as $P_{\mathrm{h}i} = P(y_i = 1|x_i)$. It is calculated by the following equation:

$$P_{\mathrm{h}i} = F\left(\boldsymbol{x}_i\hat{\boldsymbol{\beta}}\right) \tag{9.2}$$

where $F(\cdot)$ is the cumulative distribution function of the error term ϵ_i, $\boldsymbol{x}_i$ is a vector of ith independent variables, and $\hat{\boldsymbol{\beta}}$ is the vector of maximum likelihood estimates. We use the estimated $P_{\mathrm{h}i}$ as a propensity score in the next model.

Table 9.5 Descriptive statistics of the explained and explanatory variables[a]

	Mean	Standard deviation	Minimum	Maximum
DVHOSP	0.2509	0.4338	0	1
MEDEXP	3.5252	1.5356	1	6
AGE	54.1636	14.3510	25	75
AGE70	0.1710	0.3767	0	1
NFM	3.3604	1.3840	1	9
NCHILD	0.1857	0.3891	0	1
NOLD70	0.3370	0.4730	0	1
PAID1	0.6199	0.4857	0	1
PAID2	0.0873	0.2825	0	1
PAID6	0.2534	0.4352	0	1
INC	622.2632	319.1874	100	1200
DINC1	0.0467	0.2112	0	1
DINC6	0.1427	0.3500	0	1
OWNH	0.8696	0.3369	0	1
RYEAR	16.7792	8.2069	0.5	25
DYEAR1	0.0197	0.1390	0	1
DYEAR6	0.4403	0.4967	0	1
RES57	0.2792	0.4489	0	1
WTSTA	17.2540	12.8575	3	45
DCLINIC	0.9176	0.2752	0	1
DHOSP	0.5843	0.4932	0	1
DWTSTA1	0.1107	0.3140	0	1
DWTSTA5	0.1390	0.3462	0	1

[a]The total number of observations involved is 813

Table 9.6 Empirical results of estimation of the probit model

Dependent variable	DVHOSP		
Constant	−0.32051	+	(0.23573)
DAGE70	−0.27467	*	(0.15159)
NFM2	−0.01465	**	(0.00562)
INC2	−1.875E–07	+	(1.252E–07)
RES57	1.21163	**	(1.11177)
OWNH	0.39775	*	(0.17794)
RYEAR	−0.01209	*	(0.00698)
DCLINIC	−0.94834	**	(0.18575)
DHOSP	0.36629	**	(0.11680)
DWTSTA5	0.22231	+	(0.15238)
Fraction of correct predictions	0.776138		
AIC (Akaike's Information Criteria)	382.62661		
Log likelihood	−372.627		

The values in the brackets denote the standard errors (SEs)
The superscripts **, *, and + indicate statistical significance at the 1%, 5% and 10% levels, respectively

Table 9.7 Prediction of effects of changes in the explanatory variables

	$\frac{\partial P_i}{\partial x_{ij}}$	
	0	1
Constant	0.08196	−0.08196
DAGE70	0.07024	−0.07024
NFM2	0.00375	−0.00375
INC2	4.79464D–08	−4.79464D–08
RES57	−0.30983	0.30983
OWNH	−0.10171	0.10171
RYEAR	0.00309	−0.00309
DCLINIC	0.24251	−0.24251
DHOSP	−0.09367	0.09367
DWTSTA5	−0.05685	0.05685

9.6 Analysis of Medical Expenditures

9.6.1 Model

Now we analyze the impact of hospital use on out-of-pocket medical expenditures. We first show Fig. 9.3, in which the level of medical expenditure is plotted on the vertical axis and the probability of hospital use is plotted along the horizontal axis: circles in Fig. 9.3 indicate those who actually use hospitals as primary care providers; and crosses indicate those who visit clinics. The dependent variable is the total annual household out-of-pocket medical expenditure, which is denoted as MEDEXP (see Tables 9.4 and 9.5). Because the variable MEDEXP_i is obtained as interval-coded data, which take integer values in the range from 1 to 6, we assume the following ordered probit model:

$$\begin{aligned} Z_i^* = \quad & f_0(P_{\text{hi}}) + \text{DVHOSP}_i * f_1(P_{\text{hi}}) + (1 - \text{DHOSP}_i) * [f_2(P_{\text{hi}}) + \text{DVHOSP}_i * f_3(P_{\text{hi}})] \\ & + (1 - \text{DHOSP}_i) * (1 - \text{DCLINIC}_i) * [f_4(P_{\text{hi}}) + \text{DVHOSP}_i * f_5(P_{\text{hi}})] + \upsilon \quad \upsilon \tilde{} N(0, 1) \end{aligned} \tag{9.3}$$

where Z_i^* is a latent variable, which is not observed but is related to the observed variable MEDEXP_i. We assume that the error term υ has standard normal distribution. The functions $f_k(\cdot)$, $k = 0, 1, 2, 3, 4, 5$, are assumed to be cubic functions with respect to P_{hi}. The observed variable is assumed to be generated from Z_i^* as follows:

$$\begin{aligned} &\text{MEDEXP}_i = 1 \quad \text{if} \ \ Z_i^* < \mu_1 \\ &\text{MEDEXP}_i = j + 1 \quad \text{if} \ \ \mu_j \le Z_i^* < \mu_{j+1} \\ &\text{MEDEXP}_i = 6 \quad \text{if} \ \ \mu_5 \le Z_i^* \end{aligned}$$

where $j = 1, 2, 3, 4$, and $\mu_1 = 0$.

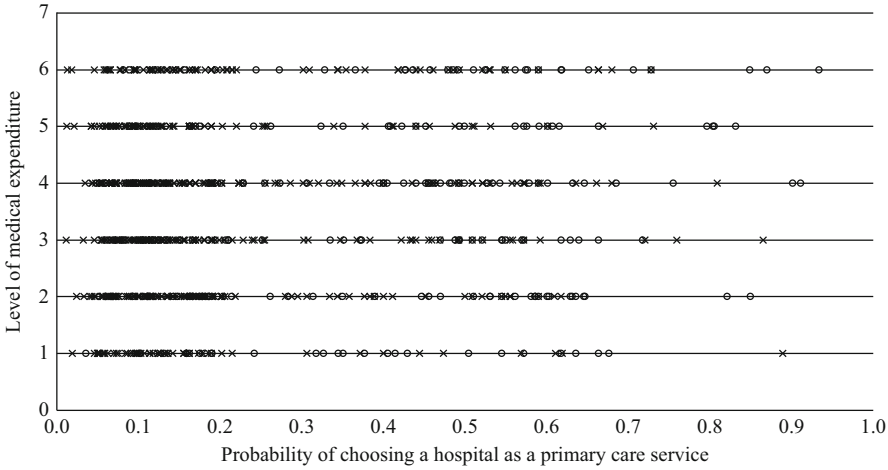

Fig. 9.3 Probability of choosing a hospital and the level of medical expenditure

The differences depending on whether or not the respondents use a hospital can be estimated by the dummy variable DVHOSP_i. We also add the third and fourth terms in the right-hand side of (3) to distinguish the impact by characteristics of the residential area. These terms enable us to estimate the difference in the impact of the accessibility of a hospital on expenditures.

Now, we first examine the impact of hospital use on out-of-pocket medical expenditures in the case of people living close to both clinics and hospitals (Case A). Substituting $\mathrm{DHOSP} = 1$ and $\mathrm{DCLINIC} = 1$ into the Eq. (9.3), we have the following.

$$Z_i^* = f_0(P_{\mathrm{h}i}) + \mathrm{DVHOSP}_i * f_1(P_{\mathrm{h}i}) + \upsilon \tag{9.4}$$

The differences between expenditures among people choosing a clinic or hospital are obtained by $\mathrm{DVHOSP}_i * f_1(P_{\mathrm{h}i})$. We also have the equation for the case of $\mathrm{DHOSP} = 0$ and $\mathrm{DCLINIC} = 1$, when people live close to clinics but not hospitals (Case B), as follows.

$$\begin{aligned} Z_i^* = {} & f_0(P_{\mathrm{h}i}) + \mathrm{DVHOSP}_i * f_1(P_{\mathrm{h}i}) \\ & + (1 - \mathrm{DHOSP}_i) * [f_2(P_{\mathrm{h}i}) + \mathrm{DVHOSP}_i * f_3(P_{\mathrm{h}i})] + \upsilon \end{aligned} \tag{9.5}$$

The impacts of people's attitudes toward hospitals are estimated by the magnitude of $\mathrm{DVHOSP}_i * f_1(P_{\mathrm{h}i}) + (1 - \mathrm{DHOSP}_i) * \mathrm{DVHOSP}_i * f_3(P_{\mathrm{h}i})$.

Because the probabilities of hospital use ($P_{\mathrm{h}i}$) of most observations are in the range from 0 to 0.7 in Case A (from 0 to 0.6 in Case B) (see Table 9.8), the reliable domain of the estimated function is thought to be limited to $0 < P_{\mathrm{h}i} < 0.7$ in Case A ($0 < P_{\mathrm{h}i} < 0.6$, in Case B).

Table 9.8 Distribution of observations by probability of hospital use

	Case A		Case B	
	DHOSP = 1 and DCLINIC = 1		DHOSP = 0 and DCLINIC = 1	
	DVHOSP = 1	DVHOSP = 0	DVHOSP = 1	DVHOSP = 0
ALL	121	346	50	229
$P_h < 0.1$	5	62	9	123
$0.1 \leq P_h < 0.2$	31	195	7	66
$0.2 \leq P_h < 0.3$	12	29	3	4
$0.3 \leq P_h < 0.4$	1	3	10	14
$0.4 \leq P_h < 0.5$	18	13	15	18
$0.5 \leq P_h < 0.6$	29	30	5	4
$0.6 \leq P_h < 0.7$	23	12	1	0
$P_h < 0.7$	2	2	0	0

9.6.2 Empirical Results

The empirical results are shown in Table 9.9. The optimal model is selected by the minimum value of the AIC criteria. Some terms of $f_k(P_{hi})$ are omitted as insignificant variables from the model. Using the empirical results (see Table 9.8), we obtain MEDEXP_i as the following function of P_{hi}.

$$\begin{aligned}\text{MEDEXP}_i = \quad & 1.2392 + 5.6968\text{P}_{hi}^2 - 8.2321\text{P}_{hi}^3 \\ & +\text{DVHOSP}_i * \left(-8.1867\text{P}_{hi}^2 + 13.3196\,\text{P}_{hi}^3\right) \\ & +(1 - \text{DHOSP}_i) * \left[-0.1661 + \text{DVHOSP}_i * \left(14.7005\text{P}_{hi}^2 - 28.6624\text{P}_{hi}^3\right)\right] \\ & +(1 - \text{DHOSP}_i) * (1 - \text{DCLINIC}_i) * \left[\left(-54.0019P_{hi} + 102.4490\text{P}_{hi}^2 - 57.6933\text{P}_{hi}^3\right)\right. \\ & \times +\text{DVHOSP}_i * \left.\left(-10.2978\text{P}_{hi}^2 + 20.6021\,\text{P}_{hi}^3\right)\right]\end{aligned}$$

The categorized values μ_2, μ_3, μ_4, μ_5 are also estimated. We graph the functions of (4) and (5) (Cases A and B) by people's attitudes toward hospital use ($\text{DVHOSP}_i = 0$ and 1), respectively (see Fig. 9.4). There seems to be a difference in medical expenditure among people who choose a hospital or a clinic as a primary care provider.

To examine the differences more precisely, we check the means and standard deviations of the estimates, which imply differences due to differences in people's choice by each probability of choosing a hospital from 0.1 to 0.6 at an interval of 0.1. The results show the existence of a significant difference between groups with the same probability (see Table 9.10). On the other hand, we classify observations into two groups by the probability of hospital use in Cases A and B and perform a two-sample t-test to examine the difference between these groups (see Table 9.11). These empirical results indicate a clear difference between hospital and clinic users at the interval of $0.1 \leq P_h < 0.2$. Generally speaking, however, we do not have evidence for the robustness of the difference from these empirical results.

In terms of Case A, contrary to our expectations (or to the government's expectations), users of primary care at a hospital tend to pay less out-of-pocket expenses

Table 9.9 Empirical results of estimation of the ordered probit model

Dependent variable	MEDEXP		
C	1.2392	**	(0.0821)
$P_{hi}2$ (P_{hi} squared)	5.6968	**	(2.0407)
$P_h^i 3$ (P_{hi} cubed)	−8.2321	**	(3.2683)
DVHOSP $*$ $P_{hi}2$	−8.1867	**	(2.6518)
DVHOSP $*$ $P_{hi}3$	13.3196	**	(4.3380)
1 – DHOSP	−0.1661	*	(0.0862)
(1 − DHOSP) $*$ DVHOSP $*$ $P_{hi}2$	14.7005	**	(5.6803)
(1 − DHOSP) $*$ DVHOSP $*$ $P_{hi}3$	−28.6624	**	(11.0512)
(1 − DHOSP) $*$ (1 − DCLINIC)	8.4534	**	(2.6856)
(1 − DHOSP) $*$ (1 − DCLINIC) $*$ P_{hi}	−54.0019	**	(17.1077)
(1 − DHOSP) $*$ (1 − DCLINIC) $*$ $P_{hi}2$	102.4490	**	(34.8611)
(1 − DHOSP) $*$ (1 − DCLINIC) $*$ $P_{hi}3$	−57.6933	**	(22.5514)
(1 − DHOSP) $*$ (1 − DCLINIC) $*$ VHOSP $*$ $P_{hi}2$	−10.2978	+	(7.1619)
(1 − DHOSP) $*$ (1 − DCLINIC) $*$ VHOSP $*$ $P_{hi}3$	20.6021	*	(12.3878)
μ_2	0.7724	**	(0.0549)
μ_3	1.2468	**	(0.0618)
μ_4	1.9138	**	(0.0694)
μ_5	2.4191	**	(0.0773)
AIC (Akaike's Information Criteria)	1423.30761		
Log likelihood	−1405.31		

The values in the brackets denote standard errors (SEs)
The superscripts **, *, and + indicate statistical significance at the 1%, 5%, and 10% levels, respectively

compared with their counterparts in areas having high accessibility of clinics and hospitals. Although we did not ask respondents about the frequency of visiting a doctor, this result may imply that people using a clinic as a primary care provider see a physician more regularly than their counterparts. Taking into account that people with chronic diseases can receive appropriate medical services at a small clinic, this result indicates that the efficient use of healthcare resources might be achieved without any strict regulations in Japan.

In Case B, opposite from Case A, people visiting a hospital tend to pay more out-of-pocket expenses compared with those visiting a clinic. Because people use a hospital far from their home in this case, two possible interpretations for the result can be made: it may be because (a) people with more acute conditions visit a hospital to receive special medical care services that they need or (b) people are just willing to consume higher-quality medical services offered by a larger hospital rather than a small clinic. Although we unfortunately examine these two factors separately, inducing people to use a small clinic close to their home might be a way for the reduction of health expenditures.

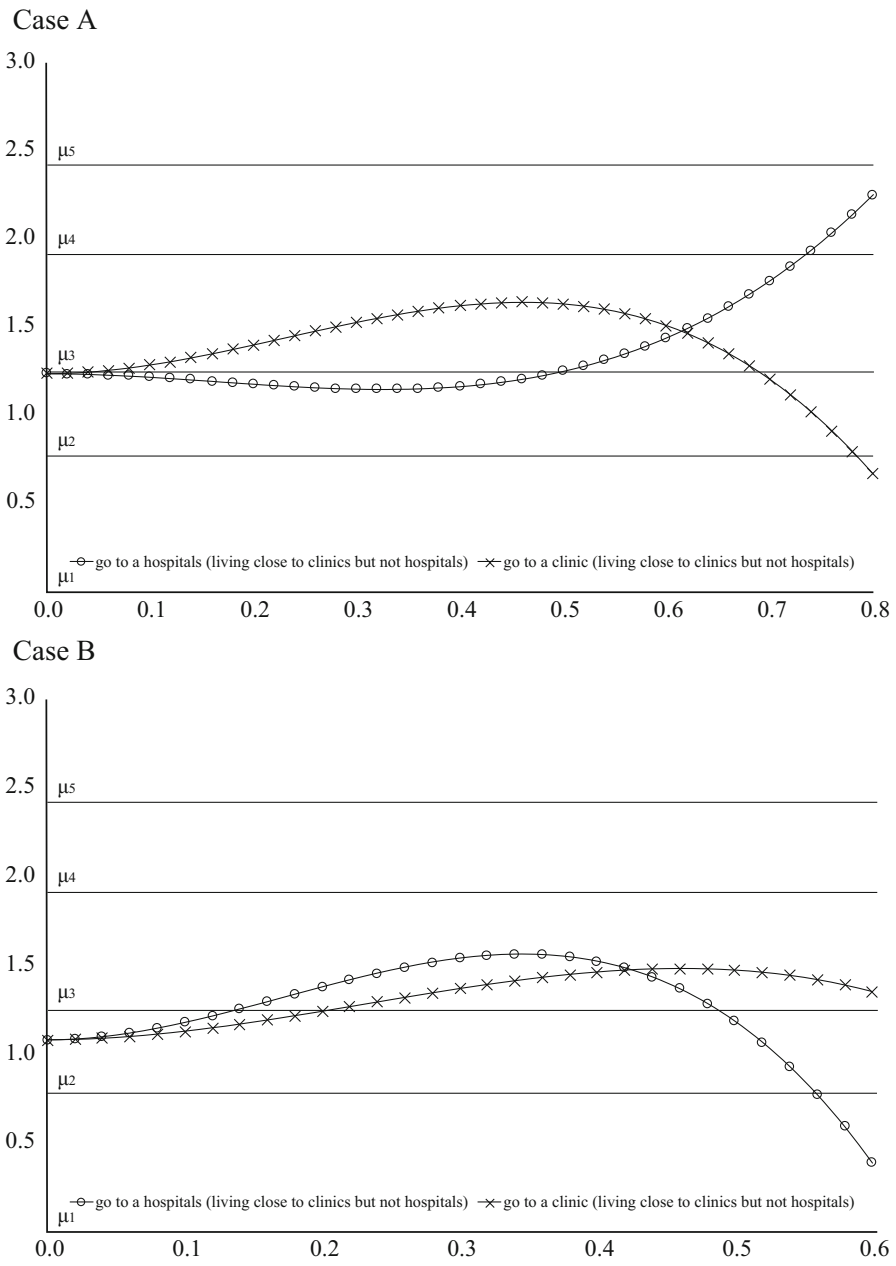

Fig. 9.4 Medical expenditure as a function of the probability of choosing a hospital

Table 9.10 Differences between the functions between DVHOSP = 0 and 1

	Case A		Case B	
	$\text{DVHOSP}_i * f_1(P_{\text{h}i})$		$\text{DVHOSP}_i * f_1(P_{\text{h}i}) + (1 - \text{DHOSP}_i) * \text{DVHOSP}_i * f_3(P_{\text{h}i})$	
	Estimates		Estimates	
$P = 0.1$	−0.0685	(0.0297)	0.04980	(0.0306)
$P = 0.2$	−0.2209	(0.0958)	0.13781	(0.0947)
$P = 0.3$	−0.3772	(0.1636)	0.17199	(0.1524)
$P = 0.4$	−0.4574	(0.1984)	0.06027	(0.1695)
$P = 0.5$	−0.3817	(0.1656)	−0.28940	(0.1521)
$P = 0.6$	−0.0702	(0.0304)	−0.96908	(0.2815)

The number in the brackets denotes standard error, and all estimates are statistically significant at the 1% level

Table 9.11 Results of two-sample t test (t statistics)

	Case A	Case B
$P_{\text{h}} < 0.1$	0.97033	0.95622
$0.1 \leq P_{\text{h}} < 0.2$	-2.05919^{*}	-1.80783^{+}
$0.2 \leq P_{\text{h}} < 0.6$	−0.66076	−0.76203
$0.6 \leq P_{\text{h}}$	−0.67003	–

The superscript * and $^{+}$ indicate statistical significance at the 5% and 10% levels, respectively

9.7 Concluding Remarks

The goal of this study is to identify the factors affecting people's attitudes toward hospital use and to measure the impact of people's attitudes toward healthcare services on out-of-pocket healthcare expenditures. To explore the impact of hospital use on out-of-pocket expenditures more precisely, we estimate medical expenditures as a function of the probability of choosing a hospital and verify the differences for each group with the same probability. Although we do not have enough data to compare matched one-to-one pairs between hospital use and clinic use groups, we can measure the differences between them.

The Japanese government has been promoting appropriate use of medical resources by reforming the healthcare system to confront financial issues in healthcare in Japan. Our empirical results reveal that people's choices of healthcare facilities are strongly related to where they live rather than who they are: the accessibility of healthcare facilities is one of the most important factors affecting people's behaviors in choosing their primary care providers. The empirical results, however, also demonstrate that out-of-pocket medical expenditures are irrelevant to whether people choose a hospital or a clinic, although some clinic users living close to healthcare facilities are likely to pay more, and hospital users living far from hospitals have reduced medical costs. This implies that hospital use is not such a critical issue in terms of reduction of medical expenditure, and people's choice of healthcare services in Japan might be pertinent and appropriate without any

gatekeeping regulations, although it is necessary to attract people to clinics to reduce time costs associated with acute and critical care patients.

Appendix: Residential Environment Survey (Including Pension Income)? (Conducted in 2009): Summary

Q1. What type of house do you reside in?

1) Detached house 2) Tenement house 3) Rental apartment (wooden)
4) Apartment or condominium

<Additional question for respondents who answer (1) or (2) in Q1>
AQ1-1. What type of ownership applies to your residential land and housing?

1) Renting land and house 2) Owning a house on leased land
3) Owning land and house

<Additional question for respondents who answer (4) in Q1>
AQ1-2. What type of ownership applies to your residence?

1) Renting 2) Owning

(Omitted)

Q3. How long have you lived in your current house?

1) Less than one year 2) 1–3 years 3) 3–5 years
4) 5–10 years 5) 10–20 years 6) More than 20 years

(Omitted)

Q6. How long does it take from your house to the nearest railway station on foot?

1) Less than 5 min 2) 5–10 min 3) 10–20 min
4) 20–30 min 5) More than 30 min

Q7. Are there any medical/healthcare facilities within walking distance (about 10–15 minutes' walk) from home? If there are any, please fill in the number of facilities.

Are there any clinics (without beds) near your house?

1) Yes (number of facilities:) 2) No

Are there any medical/healthcare facilities (with beds) near your house?

1) Yes (number of facilities:) 2) No

Q8. If you feel sick, what type of medical/healthcare facility (your primary care physician office) do you usually go to?

1) A clinic without beds
2) A small hospital with 20–100 beds and 1–5 clinical departments
3) A medium-sized hospital with 100–500 beds and 5–10 clinical departments
4) A large hospital with over 500 beds and 10–20 clinical departments

Q9. What transport do you use to get to your primary care. physician office? Please select those that apply in the list below.

1) Walking 2) Bicycle 3) Motorbike/motor scooter
4) Car 5) Taxi 6) Bus 7) Train

Q10. How long does it take from your house to your primary care physician office?

1) Less than 5 min 2) 5–10 min 3) 10–30 min
4) 30–60 min 5) More than 60 min

Q11. What are important reasons for choosing a primary care physician office? Please select those that apply in the list below.

1) Proximity to home
2) Proximity to workplace
3) Having good access to transportation
4) Having a kind doctor
5) Having good medical specialists
6) Having a variety of clinical departments
7) Having advanced medical equipment
8) Available within short waiting times

9) Being referred by my GP
10) Having a good reputation
11) Recommended by my friends/acquaintances
12) Other ( )

(Omitted)

SQ1. Please identify the characteristics of the respondent.

Gender: 1) Male 2) Female
Age: 1) 20s 2) 30s 3) 40s 4) 50s 5) 60s 7) 70 or over

SQ2. How many family members do you live with (excluding yourself)? Please fill in the number of members by age.

1) Under 10 years of age (number of members:)
2) 10–19 years of age (number of members:)
3) 20–29 years of age (number of members:)
4) 30–39 years of age (number of members:)
5) 40–49 years of age (number of members:)
6) 50–59 years of age (number of members:)
7) 60–69 years of age (number of members:)
8) Over 70 years of age (number of members:)

SQ3. What is the main income source of your household?

1) Wages/salaries (paid to a parson for regular work or services)
2) Income from business/profession
3) Income from immovable property (income received from rental properties)
4) Interest income (earned on public and corporation bonds and/or saving accounts)
5) Dividend income (distribution of earnings to shareholders)
6) Pension income
7) Other ( )

SQ4. How much is the total annual household income (including pension income)?

1) Less than 2 million yen 2) 2–4 million yen 3) 4–6 million yen
4) 6–8 million yen 5) 8–10 million yen 6) More than 10 million yen

(Omitted)

SQ8. How much is the total annual household out-of-pocket medical expenses (excluding orthodontic expenses)?

1) Less than 10 thousand yen	2) 10–30 thousand yen	3) 30–50 thousand yen
4) 50–100 thousand yen	5) 100–150 thousand yen	6) More than 150 thousand yen

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Part V
Oceania

Chapter 10
Health and Distance to Healthcare in Papua New Guinea

Alice Louise Kassens and Yana van der Meulen Rodgers

Abstract This study uses household survey data from 2009 to 2010 merged together with geospatial data from the United Nations on health facilities to examine the association between distance to healthcare facilities, health, and healthcare usage in Papua New Guinea, one of the most isolated and rural countries in the world. Greater distance from healthcare facilities reduces access to healthcare by presenting transportation challenges and is expected to reduce both healthcare usage and individual health. Results from multivariate regression analysis suggest distance is a detracting factor, although other factors such as education, socioeconomic status, and access to resources matter more.

Keywords Health · Development · Spatial analysis · Papua New Guinea

10.1 Introduction

Many individuals in developing countries go without the healthcare that could increase their life expectancy and quality of life. In these countries, the greatest rates of underutilization are among those in the bottom income quintiles (O'Donnell 2007). Many of the communicable diseases pervasive in Papua New Guinea, including malaria, have effective treatments available. Availability and access to healthcare are impacted by the supply and quality of healthcare workers and medical provisions, quality of roads, number of healthcare facilities and beds in those facilities, transportation, distance, and income. There is significant variation in access and availability across Papua New Guinea. For some residents, access to a healthcare facility requires a several-hour trip by boat or foot.

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One of the causes of the underutilization of healthcare by the poor in developing countries is the distance to facilities with needed healthcare goods and services (O'Donnell 2007). Global positioning systems (GPS) and mapping software can be used to adequately assess the distance to healthcare facilities by community (Baker et al. 2008). When paired with healthcare facility usage data, policymakers can estimate the effect of distance on access to and demand for healthcare in rural areas, crucial information to the development of effective policy. Distance to facility with adequate resources would be less of an issue, however, if roads were improved.

This analysis utilizes data from Papua New Guinea's 2009–2010 Household Income and Expenditure Survey (HIES), a rich household-level data set that has detailed information on human capital indicators, socioeconomic status, health, and individual-specific information on health facility usage, health outcomes, and access to transportation. These data are merged with geographical data on health facilities to determine how distance from health facilities and the quality of transportation services and infrastructure affect health facility usage. We are also interested in how access to and usage of health facilities differ by gender and by urban/rural status. Our analysis is based on a GIS modeling approach as well as ordinary least squares regressions that control for a complete set of individual and household characteristics.

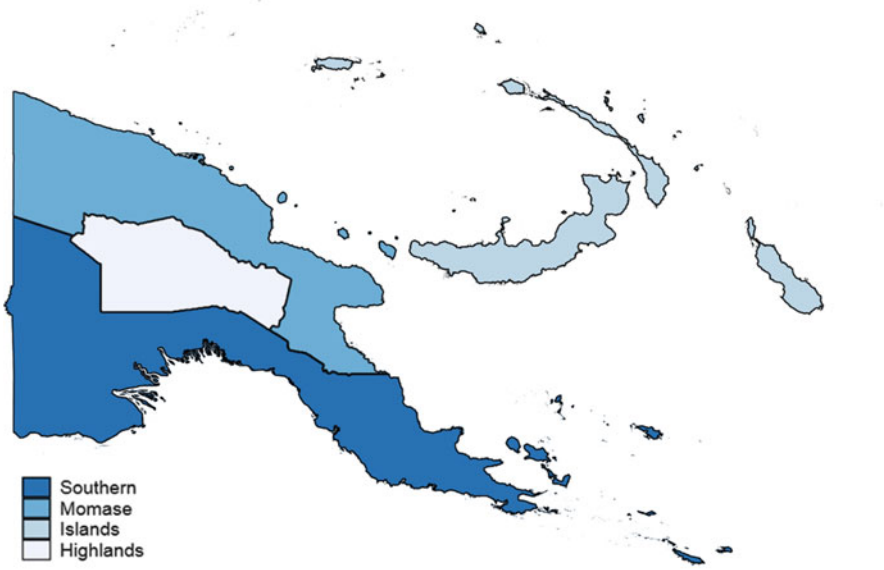
10.2 Country Background

Papua New Guinea is one of the world's most rural countries. The majority (86%) of Papua New Guinea's households still live in the rural sector, with more than one third of the population residing in the Highlands region and more than a quarter residing in the Momase region (Fig. 10.1).[1] Moreover, Papua New Guinea's rural sector has a relatively high dependency ratio compared to other Asian countries. Like other tropical and subtropical countries, communicable diseases, particularly malaria and tuberculosis, are the major cause of morbidity and mortality in Papua New Guinea. The highest incidence of malaria is reported in the Southern, Island, and Momase regions, and the lowest incidence is reported in the Highlands. The low incidence in the Highlands is likely due to the altitude; the malaria parasite and its mosquito carrier do not thrive at high altitudes and lower temperatures. Warmer temperatures and lower altitude likely contribute to the higher incidence in the Southern, Island, and Momase regions. Among children in Papua New Guinea, mortality rates for children under the age of 5 have been declining, largely due to reductions in death from malaria and pneumonia. Malnutrition is thought to be the leading cause of death among children and has been perhaps overlooked in the fight to control other causes of death (Aipit et al. 2014).

[1]These percentages are tabulated by the authors using the full sample of 22,718 individuals in the 2009–2010 HIES.

Panel A: Geographical Location in Asia

Panel B: Papua New Guinea by Regions



Sources: Panel A is from the Wikimedia Commons. Panel B is generated by the authors using GIS data from OCHA.

Fig. 10.1 Papua New Guinea: geographical location and regions. (**Panel A**): Geographical location in Asia. (**Panel B**): Papua New Guinea by regions. (*Sources*: Panel A is from the Wikimedia Commons. Panel B is generated by the authors using GIS data from OCHA)

Table 10.1 Mode of transportation for most recent visit to health facility (%)

	Urban	Rural
Male		
Walk	42.5	73.9
Vehicle, private	18.8	2.5
Canoe	0.0	1.3
Boat	0.0	0.2
Bus	34.1	18.7
Other	4.6	3.4
No. observations	426	554
Female		
Walk	42.0	73.9
Vehicle, private	16.5	2.6
Canoe	0.0	1.1
Boat	0.0	1.1
Bus	37.2	19.0
Other	4.3	2.5
No. observations	498	631

Note: Percentages are weighted and sample sizes are unweighted. Data represent mode of transportation for most recent visit to a health facility among individuals ages 15 and above. Based on the 2009–2010 Papua New Guinea HIES

Not only is Papua New Guinea one of the most rural countries in the world, it also has one of the most isolated populations, with four out of five people living in rugged or coastal terrain without access to roads and public transportation (World Bank 2013). Poor infrastructure potentially deters the use of healthcare facilities, and the primary mode of transportation to medical facilities in all but metropolitan areas is walking. Coupled with higher income and accessible roads, vehicular transportation is a more common mode of transportation to healthcare facilities in metro areas. Restricted or poor access to roads and public services in rural areas has been documented as a major obstacle to accessing healthcare in Papua New Guinea's rural areas, especially for women and children (Bauze et al. 2012). Women are more likely to walk to receive health services, suggesting that those women too sick to walk or are unable to carry a sick child may not be seeking needed care. The costs of other modes of transportation have increased 40–60% in rural areas since the early 2000s, thus exacerbating healthcare access issues (World Bank 2013).

Table 10.1 illustrates mode of transportation to healthcare facility by gender and urban status for HIES respondents' most recent visit to a facility. Note that the data include all individuals aged 15 and over. The primary mode of transportation to healthcare facilities in rural areas is walking. Almost three quarters of people residing in rural areas walk to a healthcare facility, with no discrepancy by gender. Coupled with higher income and accessible roads, vehicular transportation, both public and private, are more common modes of transportation to healthcare facilities in urban areas. Again, the gender differences are quite small, with a slightly higher

Table 10.2 Type of health facility used (past 30 days) by gender and urban status (%)

	Male		Female	
	Urban	Rural	Urban	Rural
Government hospital/clinic	49.8	24.3	52.4	25.0
Government health center	10.8	19.3	11.7	20.5
Government aid post	1.7	21.1	2.2	19.4
Mobile clinic	0.6	0.0	0.5	0.5
Community health worker	0.2	0.7	0.2	1.5
Church hospital	2.5	3.3	2.7	2.4
Church health center	5.0	21.5	5.8	20.7
Church aid post	3.5	6.9	3.0	7.3
Private hospital	9.9	0.5	11.1	0.8
Chemist/drug store	3.2	1.1	3.2	0.6
Public health post	0.3	0.9	0.0	1.2
Private clinic/NGO	12.2	4.7	11.8	3.6
Traditional practitioner	0.6	0.9	1.0	0.4
Other	3.8	1.4	1.3	1.5
No. observations	375	470	382	535

Note: Percentages are weighted and sample sizes are unweighted. Percentages can add up to more than 100 since respondents can use more than one facility in the time period. Based on the 2009–2010 Papua New Guinea HIES. Responses are conditional on seeking treatment for a health problem

percentage of men than women using private vehicles, while a slightly higher percentage of women than men use public buses.

Table 10.2 shows the type of healthcare facility that is used in urban and rural areas by men and women who sought treatment for a health problem in the past 30 days and attended at least one facility. Public hospitals and clinics are the most frequently used type of healthcare facility, particularly in urban areas. About half of all men and women sought treatment for a health problem in a public hospital or clinic, with very little difference between men and women. Another 11% of men and women sought treatment in a private hospital in urban areas. In contrast, church-run facilities and other public facilities, including government health centers and aid posts, are more commonly used in rural areas. Facility use is driven by facility location, thus explaining the greater use of health centers and aid posts in rural areas of Papua New Guinea. Substantial gender differentials are not apparent.

Table 10.3 illustrates healthcare facility use by expenditure quintile and urban status for those who sought treatment for a health problem in the past 30 days. When the facility use responses are cut across expenditure quintile, the sample sizes get quite small; caution should be used when evaluating the distribution, particularly for those infrequently used healthcare facilities. In rural areas, all groups use public facilities, although the poor are more likely to use a government aid post, while the relatively wealthy are more likely to use public hospitals and health centers. Church health centers are also utilized in rural areas across the expenditure quintiles, though more frequently by the upper tail of the expenditure distribution. Church facilities

Table 10.3 Healthcare facility use (past 30 days) by urban status and expenditure quintile (%)

	Expenditure quintile (last 12 months)				
	1st (poorest)	2nd	3rd	4th	5th (richest)
Urban					
Government hospital/clinic	1.8	3.7	4.5	8.7	32.5
Government health center	0.6	0.8	0.9	2.1	6.9
Government aid post	0.0	1.2	0.3	0.1	1.4
Mobile clinic	0.0	0.0	0.0	0.0	0.5
Community health worker	0.0	0.0	0.0	0.0	0.2
Church hospital	0.0	0.1	0.1	0.6	1.7
Church health center	0.3	0.1	0.3	1.2	3.6
Church aid post	0.0	0.0	0.7	0.9	1.7
Private hospital	0.6	0.2	0.3	0.8	8.7
Chemist/drug store	0.0	0.1	0.1	0.1	2.8
Public health post	0.0	0.0	0.0	0.1	0.0
Private clinic/NGO	0.0	0.0	0.6	0.5	10.9
Traditional practitioner	0.0	0.1	0.0	0.0	0.6
Other	0.1	0.1	0.0	0.1	1.8
No. observations	24	43	56	118	516
Rural					
Government hospital/clinic	3.9	5.1	5.6	5.5	4.3
Government health center	3.3	4.5	3.9	5.1	3.1
Government aid post	6.4	4.0	4.2	2.3	3.2
Mobile clinic	0.1	0.0	0.0	0.0	0.1
Community health worker	0.2	0.4	0.2	0.3	0.0
Church hospital	0.3	0.6	0.7	0.6	0.7
Church health center	2.9	4.5	4.7	4.7	4.4
Church aid post	0.7	0.8	1.5	2.3	1.9
Private hospital	0.0	0.2	0.0	0.2	0.2
Chemist/drug store	0.0	0.1	0.0	0.2	0.6
Public health post	0.0	0.3	0.7	0.0	0.0
Private clinic/NGO	0.2	0.9	0.5	1.5	1.1
Traditional practitioner	0.2	0.1	0.1	0.2	0.0
Other	0.1	0.2	0.0	0.7	0.4
No. observations	185	209	204	224	183

Note: Percentages are weighted and sample sizes are unweighted. Percentages can add up to more than 100 since respondents can use more than one facility in the time period. Based on the 2009–2010 Papua New Guinea HIES. Responses are conditional on seeking treatment for a health problem

are highly subsidized by the government. When coupled with government health centers and subcenters, they provide a variety of services for rural areas and serve as intermediary points of care for higher-level facilities and hospitals (World Health Organization 2013). Church groups commonly run smaller subcenters for healthcare in rural areas, which offer the same services as their larger counterparts. The urban

Table 10.4 Illness (past 30 days) among individuals seeking healthcare by urban status (%)

	Urban	Rural
Stomach disorder	2.9	3.1
Cough	16.6	22.0
Cold	8.5	5.8
Back pain	10.2	21.2
Asthma	2.2	3.6
Stomach ache	4.1	6.2
Headache	12.3	24.0
Toothache	2.4	1.7
Ear pain	0.6	0.6
Diarrhea	2.9	2.6
Skin problem	2.2	2.7
Accident	1.1	0.5
Malaria	36.1	24.6
Pneumonia	1.6	1.3
Tuberculosis	1.8	0.7
Joint pain	7.2	16.3
Fever	5.1	10.6
Other	14.8	5.8
No. observations	757	1005

Note: Percentages are weighted and sample sizes are unweighted. Percentages can add up to more than 100 since respondents can have more than one illness in the time period. Based on the 2009–2010 Papua New Guinea HIES. Responses are conditional on seeking treatment for a health problem

poor almost exclusively use public facilities, particularly hospitals and health centers. Comparatively, their wealthier peers most intensely use public hospitals and health centers but also visit a wide range of church and private facilities.

Table 10.4 shows the types of illnesses for which respondents seek treatment at health facilities by urban status. Malaria and coughs are the most common ailment in urban and rural areas, although visits for coughs are more common in rural areas and visits for malaria in urban areas. Several other ailments that could be related to malaria and coughs are also common reasons to seek treatment, especially fever and headache. A sick person may not to go to a health facility for many reasons including distance, cost, and quality of care. Some illnesses may weaken a person such that traveling to a health facility is not feasible, particularly if walking is the only mode of transportation. Table 10.5 shows the reported reasons for not going to a health facility for individuals who were sick in the last 30 days. In urban areas, 90% of respondents did not go to a health facility because either their illness was not serious enough or they treated it at home, compared to 60% in rural areas. Distance to a health facility is only an issue for those in rural areas. About 19% of respondents in rural areas state that they did not get treatment at a health facility because the distance was too great.

Table 10.5 Reason for not seeking treatment at a health facility for a health problem (past 30 days) by urban status (%)

	Urban	Rural
Not serious enough	31.6	27.2
Treated at home	58.3	33.0
Health facility too far	1.4	18.6
No transportation	0.3	0.7
Healthcare too expensive	3.2	7.5
Transport too expensive	0.3	1.7
Health workers unfriendly	0.1	0.4
Health workers not present	0.3	5.0
Healthcare not good quality	1.6	1.1
Other	4.2	4.9
No. observations	796	969

Note: Percentages are weighted and sample sizes are unweighted. Based on the 2009–2010 Papua New Guinea HIES

10.3 Conceptual Framework and Previous Evidence

This study's estimation model is based on a health production model originally developed in Grossman (1972a, b) which explains how various inputs impact the production of health through the demand for health capital. Health is considered a durable capital good from which individuals gain utility not from the health itself, but from the use of time for which they are healthy. Individuals want good health, but cannot purchase it directly in the marketplace. Instead, health is produced by combining time and medical inputs. Health is both a consumption and investment good. Consumption of health makes people feel better and is utility generating. As an investment good, health increases the number of days available to work and earn income. It is assumed that an individual is endowed with an initial stock of health at birth that depreciates over time until death. Individuals can modify the rate of depreciation of their health through various activities. Some activities, like exercise, slow the rate of depreciation while others, like smoking, increase it. Individuals can increase their time spent in the labor market and their productivity by increasing their stock of health, which makes health investments a form of human capital investment.

In the basic Grossman model, an individual's intertemporal utility function depends on their health endowment, their stock of health across time, and their consumption of other commodities as follows:

$$U = U(\alpha_0 H_0, \alpha_1 H_1, \ldots, \alpha_n H_n, Z_0, \ldots, Z_n).$$

The notation H_0 denotes an individual's initial stock of health with which they are endowed at time 0, H_t is the person's endogenous stock of health at time t, α_t represents the service flow per unit of health stock that an individual enjoys in period t, and Z_t represents the aggregate consumption of all non-health goods in period t, and n represents the period for which the individual plans in the future.

Total length of life is assumed to be endogenous, and death takes place when a person's health stock falls below a minimum threshold $H_{\min}$.

In the model, the net amount of investment in an individual's health stock over time depends both on that person's gross investment in and the depreciation of their health stock. The rate of health depreciation is assumed exogenous and varies with age. An individual's gross investment (I_t) and aggregate consumption (Z_t) are defined according to two household production functions:

$$I_t = I_t(M_t, TH_t; K)$$
$$Z_t = Z_t(X_t, T_t; K)$$

I_t denotes an individual's gross investment in health; M_t represents a vector of commodities purchased in the marketplace that contribute to gross investment in health, including medical care; TH_t and T_t signify the time that individuals invest in their health and in the aggregate consumption good Z_t, respectively; K represents an individual's exogenously determined stock of knowledge that helps to improve the efficiency of household production; and X_t denotes the individual commodities purchased in the marketplace used in the household production of the aggregate consumption good Z_t. Both production functions are linear and homogeneous in their respective marketplace good (M_t and X_t) and time inputs (TH_t and T_t). The marketplace goods and time inputs are each assumed endogenous, in limited supply, and subject to constraints. The time budget constraint allows for time lost from market and household activities due to illness and injury which is inversely related to the stock of health.

Individuals are assumed to choose the utility maximizing level of health stock H_t and aggregate consumption Z_t in each period, subject to the net amount invested over time in health (including depreciation), and their production, resource, and total budget constraints. In equilibrium, the optimal quantity of investment in each period determines the ideal quantity of health capital (Grossman 1972a, b). One implication of this model is that, since travel time to health facilities is part of the cost of medical care, distance and travel time to health facilities reduce the demand for medical care. Medical care is rationed by its market price and indirect costs such as access, including travel time and distance. Hence, travel to a medical facility enters the health production function.

A growing number of empirical studies use geospatial measures of healthcare access combined with multivariable regression analysis to examine how distance to health facilities affects health outcomes and medical care usage. Travel to a healthcare facility is a spatial dimension of healthcare access that can be measured in terms of distance or time. Geographical access to healthcare, in turn, refers to the spatial relationship between someone who demands healthcare and someone who supplies it; this concept differs from the availability of healthcare which refers to whether there is an adequate supply of healthcare providers relative to demand (Nesbitt et al. 2014). The spatial dimension of healthcare access also contrasts with other features of healthcare access, including affordability, social acceptability, red tape, perceptions of poor quality, and poor information about services (Rosero-

Bixby 2004). Studies indicate that households in rural areas of developing countries tend to use the nearest health facility in terms of geographical distance (see, e.g., Tanser et al. 2001). Moreover, straight line distance between the household and the health facility is often correlated with road distance and travel time, a finding that is helpful in modeling healthcare access when data on roads and travel time are not readily available or reliable (Al-Taiar et al. 2010).

Most findings point to an inverse relationship between distance to a healthcare facility and health outcomes, where health outcomes are often measured by utilization of a facility. For example, a strong association between distance and healthcare access is found in Niger, where 90% of roads are unpaved (Blanford et al. 2012). In this case, children who live within an hour's walk from the nearest health center have almost twice the odds of getting their complete vaccinations by the age of one compared to children living farther away. An inverse relationship between distance to the nearest health facility and children's vaccination rates is also found in Yemen (Al-Taiar et al. 2010). Early neonatal mortality is also associated with distance to health facilities. In Ethiopia, early neonatal deaths increase by 14.4 deaths per 1000 live births among those living more than 80 km from a comprehensive emergency obstetric and newborn care facility compared to those living within 10 km of such a facility (McKinnon et al. 2014). Efforts by the Ethiopian government to improve access to obstetric and newborn care facilities will potentially reduce early neonatal mortality rates.

Spatial disparities are often confounded by racial differences in access to healthcare. For instance, in South Africa, there are marked differentials by race and income in distance from the nearest public clinic, with 14% of black South Africans living more than 5 km from the closest clinic as compared to just 4% of whites (McLaren et al. 2014). Accordingly, black adults are less likely than white adults to have a health consultation in the past year. Similarly, black children below the age of 5 are less likely to have a skilled attendant present at their birth compared to their white counterparts. In Ghana, women's odds of giving birth in the presence of a skilled health professional are also inversely related to distance to the nearest health facility (Nesbitt et al. 2014).

10.4 Data and Methodology

Several data sets contribute to the sample used to estimate the determinants of health facility usage and health in Papua New Guinea. We use Papua New Guinea's 2009–2010 Household Income and Expenditure Survey (HIES) for spatial and nonspatial data pertaining to households. Latitude and longitude measures are provided by HIES supervisors and noted by interviewers for each household prior the interview, although not all information is complete. Additionally, some latitude and longitude values are switched and need adjustment prior analysis, while others are outside of the possible coordinates for Papua New Guinea (0° to −12° latitude, 140° to 154° longitude) and are set to missing. The final analytic sample of adults

aged 15 and over who have geospatial data pertaining to the nearest health provider includes 13,193 individuals and 3904 households.

Spatial data for healthcare facilities are provided by the United Nations Office for the Coordination of Humanitarian Affairs (OCHA). Collected in 2000, the data set includes 705 locations ranging from district hospitals to aid posts. It is a uniquely available data set that contains spatial coordinates for many health facilities, permitting the estimation of the nearest neighboring health facility for each household. Because the HIES data contain spatial coordinates for all respondent's household location, we merged these two data sets and have information for each household and their nearest health facility.

Unfortunately, the HIES only provides data on distance to the nearest health facility for households with a member who visited a health provider in the past 30 days or 12 months, depending on survey question. Thus, if a respondent visited no providers, then we have no information within the HIES about distance to a health facility for that respondent, and we must obtain this information from an outside source. The self-reported distance data from the HIES cannot be used for our regression analysis as the survey questions on distance are only answered for household members who visited a health facility. An additional issue with the distance measures in the HIES data set is that they are self-reported by the head of household, subjecting the measure to reporting error. The main drawbacks for the OCHA data set are as follows: (1) it was collected several years before the HIES was conducted, and therefore some facilities may have opened or closed in the intervening period, and (2) it represents only a portion of the actual number of health facilities reported in some government documents.[2] Despite these disadvantages, we rely on the OCHA spatial data for health facilities to overcome the larger constraints imposed by the HIES distance and travel time information.

Figure 10.2 shows each household and healthcare facility in Papua New Guinea layered with the national road network, also from OCHA. Households and health facilities are clustered together and fall along roads. Given the nature of the supply and demand for infrastructure (roads) and services (health facilities), the clustering and tracking with households is not surprising and reflects the precision of the GPS data in both the HIES and OCHA data sets.

Two distance measures are generated using Stata functions. First, *geonear* (Picard 2012), which estimates the geodetic distance between each household and healthcare facility (the length of the shortest curve between two points on a sphere), generates a variable measuring the distance of the nearest neighboring health facility for each household measured in kilometers. This variable minimizes the Euclidean distance, $d_E(i,j) = [\sum(x_{ik}, x_{jk})^2]^{1/2}$, between household i, with coordinates (x_{i1}, x_{i2}), and the j health facilities, with coordinates (x_{j1}, x_{j2}), available to it. Given Euclidean distance

[2]We conducted an extensive search for spatial data encompassing most if not all of the reported health facilities in Papua New Guinea but were unsuccessful. Additionally, outreach to the national statistics office in Papua New Guinea for spatial coordinates of the health facilities reported in (National Department of Health 2011) was unsuccessful. The OCHA data set is the best data currently available.

Note: The map depicts regional borders and roadways as dark lines. Households and health facilities are clustered together and are represented as dark and light gray circles. Map generated by authors using HIES and OCHA data.

Fig. 10.2 Households, health facilities, and road network in Papua New Guinea. Note: The map depicts regional borders and roadways as dark lines. Households and health facilities are clustered together and are represented as dark and light gray circles. (Map generated by authors using HIES and OCHA data)

is often not the route taken by individuals from one location to another, we also employed the *georoute* (Weber and Peclat 2016) function which estimates the distance between two points using available road network data through the HERE API. The function generates the distance most likely traveled in kilometers for each household and nearest neighboring health facility pair. *Georoute* also estimates the travel time in minutes between two locations. In total, the GIS data yield two distance and one travel time measures.

Table 10.6 presents sample means for all the dependent and independent variables, including the travel distance and time measures, at the individual level. Most striking is the differential in average educational attainment between urban and rural areas. In urban areas, 65% of individuals have secondary or tertiary education compared to 26% of individuals in rural areas. The opposite is true of people with less than primary schooling, where the percentage of people with very little to no education in rural areas is about triple that of urban areas. Households are larger in urban areas by an average of 1.5 persons per household. Although families in urban

Table 10.6 Sample means, 2009–2010 HIES (% unless otherwise indicated)

	Total	Urban	Rural
Male	51.2	51.6	50.8
	(50.0)	(50.0)	(50.0)
Age	34.0	33.0	35.1
	(14.7)	(13.8)	(15.5)
Currently smokes	33.8	30.5	37.6
	(47.3)	(46.1)	(48.4)
Household expenditure quintiles			
Bottom	10.8	2.3	20.5
	(31.1)	(15.0)	(40.4)
2nd	12.3	4.8	20.9
	(32.9)	(21.4)	(40.6)
3rd	14.7	8.6	21.6
	(35.4)	(28.0)	(41.2)
4th	18.3	16.2	20.7
	(38.7)	(36.8)	(40.5)
Top	43.8	68.1	16.3
	(49.6)	(46.6)	(36.9)
Dwelling owned by hh	73.7	58.1	91.4
	(44.0)	(49.3)	(28.1)
Educational attainment			
Less than primary school	24.3	12.7	37.4
	(42.9)	(33.2)	(48.4)
Primary school	29.4	22.8	36.9
	(45.6)	(42.0)	(48.2)
Secondary school	31.1	41.6	19.3
	(46.3)	(49.3)	(39.5)
Tertiary school	15.2	23.0	6.4
	(35.9)	(42.1)	(24.4)
# Working-age adults in hh	4.3	4.9	3.5
	(2.2)	(2.4)	(1.7)
# Children in hh	2.4	2.5	2.3
	(1.8)	(1.9)	(1.7)
# Elderly in hh	0.1	0.1	0.2
	(0.4)	(0.4)	(0.5)
Female-headed hh	4.3	4.0	4.7
	(20.3)	(19.6)	(21.1)
HH has tap water	46.1	72.4	16.2
	(49.9)	(44.7)	(36.9)
HH has improved toilet	32.7	56.9	5.2
	(46.9)	(49.5)	(22.2)
Geographical region			
Southern	36.0	49.8	20.3
	(48.0)	(50.0)	(40.2)

(continued)

Table 10.6 (continued)

	Total	Urban	Rural
Highland	22.5	9.9	36.8
	(41.8)	(29.9)	(48.2)
Momase	27.6	29.2	25.7
	(44.7)	(45.5)	(43.7)
Islands	13.9	11.1	17.2
	(34.6)	(31.4)	(37.7)
Urban	53.2	–	–
	(49.9)	–	–
Health and health facility usage			
Health complaint, past 30 days	28.0	23.5	33.1
	(44.9)	(42.4)	(47.0)
Visited health facility, past 30 days	51.8	51.3	52.2
	(50.0)	(50.0)	(50.0)
Hospitalized, past 12 months	4.5	4.3	4.7
	(20.7)	(20.3)	(21.1)
Distance and time to closest health facility			
# km (Euclidean)	19.3	16.3	22.7
	(21.6)	(16.3)	(26.0)
# km (roads)	18.7	16.5	21.8
	(22.5)	(15.6)	(29.3)
# Minutes (roads, by vehicle)	25.1	23.5	27.2
	(38.8)	(28.4)	(49.7)
Sample size	13,193	7025	6168

Note: Weighted values. Based on the 2009–2010 Papua New Guinea HIES. Sample size for *georoute* distance measures is 8626 (5022 in urban and 3604 in rural areas). Standard deviations in parentheses

areas are less likely to claim ownership of their dwellings than their rural counterparts, they are far more likely to have access to tap water and improved toilets. About half of the urban sample is concentrated in the Southern region of the country (home to the nation's capital city Port Moresby), while rural individuals are more evenly distributed across regions. Also of note, one third of the sample in rural areas reported having a health complaint in the past 30 days compared to 24% in urban areas. However, the average likelihood of visiting a facility in the past month (51–52%) or being hospitalized in the past year (4–5%) is about the same across urban and rural areas. As expected, the Euclidean travel distance to the closest health facility is greater in rural areas (23 km) than in urban areas (16 km). It also takes individuals more time to reach health facilities in rural areas (27 min) than urban areas (24 min). That said, 16 km between the average individual and the closest health facility in an urban area is still surprisingly far given the population densities of urban areas. Interestingly, the average Euclidean distance is quite close to the

Table 10.7 Summary of Key Dependent and Independent Variables

Variable	Survey question	Condition	Definition
Dependent			
Health complaints	Did you have any health complaints in the last 30 days?	None, asked of everyone in household	Yes = 1, no = 0
Health provider, past 30 days	In the past 30 days, did you seek treatment at a health facility or provider for your health problems?	Asked of all household members conditional on reporting at least one health complaint in the past 30 days	Yes = 1, no = 0
Hospitalized, past 12 months	Have you been hospitalized, that is, stayed one or more nights in a healthcare facility during the past 12 months?	None, asked of everyone in household	Yes = 1, no = 0
Independent			
Distance, Euclidean	NA	HIES household matched to nearest neighboring health facility in OCHA data set using Euclidean distance (*geodist*)	Kilometers
Distance, Stata-generated	NA	HIES household matched to nearest neighboring health facility in OCHA data set using shortest route (*georoute*)	Kilometers
Time, Stata-generated	NA	HIES household matched to nearest neighboring health facility in OCHA data set using shortest route, estimated travel time based on route (*georoute*)	Minutes

distance by roads in both urban and rural areas. Data sources and construction for the key dependent and independent variables are described in more detail in Table 10.7.

The empirical analysis continues with a logistic regression analysis of the determinants of health status and health facility usage. The estimation equation is specified as follows:

The notation Y_i denotes one of the three variables: (1) if individual i experienced a health complaint in the last 30 days, (2) if individual i used a health facility in the past 30 days for a health issue, or (3) if individual i was hospitalized in the past 12 months. The variable A is the distance to health facility in kilometers or time travel to facility in minutes, and the matrix X represents individual and household-level controls in$Y_i = \beta_0 + \beta_1 A_i + \beta_2 X_i + \varepsilon_i$cluding gender, age, smoking status, illness (in the case of the two utilization dependent variables), household expenditure quintile, marital status, access to clean water, and an improved toilet. All statistical analyses are weighted to the national population using the sampling weights provided with the HIES. Because the survey records multiple individuals per household as separate observations, for analysis at the individual level, we correct the standard errors for clustering at the level of the household.

10.5 Regression Results

The logistic regression results for reporting a health complaint in the past 30 days are reported as odds ratios in Table 10.8. The odds ratio reflects how the likelihood of an event changes as a particular variable changes. When the odds ratio equals 1, the likelihood of the event occurring does not change; when it is greater than one, the likelihood of the event happening increases; and when it is less than one, the likelihood of the event happening decreases. Odds ratios are always positive numbers. Table 10.8 shows that for the entire sample, a one kilometer increase in the distance to the closest health facility increases the odds of reporting a health complaint by 0.4%. Similar results are found for those residing in rural areas. The largest distance effect is in the urban areas, where a one kilometer increase in the distance to the nearest health provider increases the odds of reporting a health complaint by 1.1%.

Several factors matter more to individuals' health status than distance and travel time. Men are considerably less likely than women to report a health complaint, ceteris paribus, and this result holds in both urban and rural areas. Not surprisingly, smoking raises the odds of reporting a health complaint, as does getting older. In keeping with health production theory, those with greater education and assets are healthier. The odds of individuals with tertiary degrees reporting a health complaint are about 25% lower than individuals with no schooling, and most of this effect is in rural areas. Individuals living in dwellings owned by the household are also less likely to have health complaints. Additionally, the odds of reporting a health complaint are lower for individuals living in households with more children and working-age adults in the household. This result suggests a joint production of health across individuals within the household. Living in urban areas reduces the odds of reporting a health issue by about half. More perplexing is the difference between urban and rural areas in the effect of having improved toilet facilities. Individuals in households with improved toilets are less likely to report a health concern in urban areas, while having an improved toilet facility in rural areas raises the odds of reporting a health issue by more than 50%.

Table 10.9 shows the odds ratios for visiting a health facility in the past 30 days conditional on reporting a recent health complaint. Based on that condition, the subsample is less healthy and smaller than the overall sample. Distance and time traveled appear to play little role in usage of a health facility for an illness. Although the odds ratios for distance and travel time by road to the nearest health facility are statistically significant, the magnitudes are very close to 1.0, suggesting the odds of visiting a health facility are virtually the same with each additional kilometer or minute of travel. The odds of men using a health facility when ill are lower than women in rural areas but greater in urban areas. The poorest individuals, relative to the wealthiest, exhibit lower odds of visiting a health facility when ill in rural areas but considerably greater odds in urban areas. One possible explanation is that the poorest households have greater access to financial resources to fund visits to health providers in urban areas relative to their rural peers. There are no other significant

Table 10.8 Logit estimates for whether individual reported a health complaint in the past 30 days

	Total			Urban			Rural		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Male	0.807***	0.770***	0.770***	0.854***	0.872*	0.873*	0.797***	0.748***	0.748***
	(0.042)	(0.051)	(0.051)	(0.051)	(0.061)	(0.061)	(0.048)	(0.059)	(0.059)
Age	1.028***	1.028***	1.028***	1.026***	1.026***	1.026***	1.028***	1.028***	1.028***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.002)	(0.003)	(0.003)
Currently smokes	1.110*	1.259***	1.259***	0.992	0.998	0.995	1.123*	1.302***	1.302***
	(0.066)	(0.096)	(0.096)	(0.071)	(0.084)	(0.084)	(0.076)	(0.116)	(0.116)
Household expenditure quintiles (ref: top quintile)									
Bottom	0.871	0.996	0.996	0.712	0.611	0.602	0.870	1.013	1.016
	(0.117)	(0.181)	(0.181)	(0.209)	(0.229)	(0.228)	(0.130)	(0.202)	(0.203)
2nd	0.877	0.881	0.880	0.940	1.013	1.017	0.876	0.882	0.885
	(0.106)	(0.133)	(0.133)	(0.176)	(0.244)	(0.245)	(0.120)	(0.150)	(0.151)
3rd	0.803*	0.733**	0.731**	0.852	0.851	0.847	0.800*	0.725*	0.728*
	(0.094)	(0.106)	(0.106)	(0.121)	(0.140)	(0.139)	(0.107)	(0.120)	(0.121)
4th	0.963	0.839	0.837	0.938	1.015	1.015	0.969	0.815	0.816
	(0.107)	(0.113)	(0.113)	(0.107)	(0.136)	(0.135)	(0.128)	(0.132)	(0.132)
Dwelling owned by hh	0.855	0.771**	0.772**	0.791**	0.848	0.846	0.895	0.729*	0.721*
	(0.086)	(0.095)	(0.095)	(0.073)	(0.089)	(0.089)	(0.129)	(0.140)	(0.138)
Educational attainment (ref: less than primary)									
Primary school	0.919	0.871	0.872	0.992	0.926	0.923	0.911	0.862	0.864
	(0.064)	(0.081)	(0.081)	(0.104)	(0.121)	(0.120)	(0.068)	(0.089)	(0.089)
Secondary school	0.899	0.981	0.983	0.911	0.904	0.902	0.902	0.995	0.995
	(0.077)	(0.106)	(0.106)	(0.096)	(0.119)	(0.118)	(0.089)	(0.125)	(0.125)
Tertiary school	0.753***	0.859	0.859	0.914	0.926	0.921	0.717**	0.854	0.851
	(0.081)	(0.114)	(0.114)	(0.108)	(0.133)	(0.132)	(0.102)	(0.156)	(0.155)

(continued)

Table 10.8 (continued)

	Total			Urban			Rural		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
# Working-age adults in hh	0.925***	0.924***	0.923***	0.974	0.965	0.965	0.909***	0.912***	0.912***
	(0.019)	(0.024)	(0.024)	(0.018)	(0.022)	(0.022)	(0.024)	(0.031)	(0.031)
# Children in hh	0.958**	0.952**	0.952**	0.979	0.973	0.972	0.954**	0.949*	0.949*
	(0.019)	(0.023)	(0.023)	(0.025)	(0.029)	(0.029)	(0.022)	(0.027)	(0.027)
# Elderly in hh	0.883	0.893	0.893	0.826*	0.824	0.824	0.881	0.892	0.891
	(0.070)	(0.085)	(0.086)	(0.096)	(0.111)	(0.111)	(0.077)	(0.094)	(0.094)
Female-headed hh	1.011	1.136	1.137	1.130	1.085	1.081	0.973	1.113	1.113
	(0.123)	(0.171)	(0.171)	(0.162)	(0.182)	(0.182)	(0.134)	(0.193)	(0.193)
HH has tap water	1.128	1.020	1.013	1.104	1.312**	1.312**	1.130	0.972	0.969
	(0.105)	(0.125)	(0.123)	(0.116)	(0.178)	(0.178)	(0.125)	(0.142)	(0.142)
HH has improved toilet	1.284**	1.241	1.229	0.832*	0.806*	0.803*	1.719***	1.615**	1.606**
	(0.157)	(0.179)	(0.176)	(0.090)	(0.100)	(0.099)	(0.324)	(0.366)	(0.360)
Geographical region (ref = Southern)									
Highlands	0.844*	0.865	0.877	0.758*	0.766*	0.807	0.851	0.877	0.866
	(0.086)	(0.124)	(0.129)	(0.112)	(0.118)	(0.125)	(0.105)	(0.180)	(0.186)
Momase	1.159	0.964	0.986	1.175	1.472***	1.571***	1.182	0.942	0.937
	(0.112)	(0.152)	(0.160)	(0.116)	(0.199)	(0.217)	(0.150)	(0.215)	(0.225)
Islands	1.070	1.099	1.103	1.177	1.041	1.134	1.076	1.110	1.079
	(0.118)	(0.182)	(0.187)	(0.150)	(0.153)	(0.167)	(0.142)	(0.262)	(0.264)
Urban	0.540***	0.589***	0.594***	–	–	–	–	–	–
	(0.055)	(0.078)	(0.078)	–	–	–	–	–	–

Distance and time to closest health facility									
# km (Euclidean)	1.004**			1.001			1.004**		
	(0.002)			(0.003)			(0.002)		
# km (roads)		1.002			1.011***			1.002	
		(0.002)			(0.003)			(0.002)	
# Minutes (roads)			1.001			1.006***			1.001
			(0.001)			(0.001)			(0.001)
Sample size	13,071	8548	8548	6948	4976	4976	6123	3572	3572

Note: Standard errors, in parentheses, are clustered at the household level
The notation *** is $p < 0.01$, ** is $p < 0.05$, and * is $p < 0.10$
Sample is all individuals in the HIES aged 15 and up with observed values for distance and time to health facility

Table 10.9 Logit estimates for whether individual with a health complaint visited health facility in the past 30 days

	Total			Urban			Rural		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Male	0.894	0.904	0.911	1.155	1.274*	1.276**	0.854*	0.833	0.841
	(0.075)	(0.101)	(0.101)	(0.122)	(0.158)	(0.158)	(0.081)	(0.109)	(0.110)
Age	1.004	1.004	1.004	0.998	0.998	0.998	1.005	1.004	1.004
	(0.003)	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)	(0.003)	(0.005)	(0.005)
Currently smokes	0.857*	0.980	0.975	0.873	0.808	0.811	0.866	1.029	1.025
	(0.079)	(0.120)	(0.119)	(0.109)	(0.121)	(0.121)	(0.089)	(0.147)	(0.145)
Household expenditure quintiles (ref: top quintile)									
Bottom	0.522***	0.365***	0.366***	1.952	5.532*	5.505*	0.517***	0.367***	0.372***
	(0.110)	(0.105)	(0.104)	(1.260)	(5.511)	(5.475)	(0.121)	(0.116)	(0.117)
2nd	0.876	0.873	0.882	1.065	1.085	1.073	0.872	0.905	0.925
	(0.170)	(0.205)	(0.206)	(0.327)	(0.401)	(0.395)	(0.189)	(0.241)	(0.244)
3rd	0.858	1.040	1.047	0.664	0.841	0.844	0.856	1.078	1.101
	(0.169)	(0.256)	(0.255)	(0.165)	(0.246)	(0.247)	(0.190)	(0.304)	(0.306)
4th	0.876	1.138	1.148	0.817	0.766	0.767	0.876	1.206	1.230
	(0.155)	(0.240)	(0.242)	(0.160)	(0.167)	(0.168)	(0.183)	(0.308)	(0.314)
Dwelling owned by hh	0.908	0.884	0.875	1.017	0.895	0.893	0.965	1.053	1.030
	(0.149)	(0.177)	(0.174)	(0.145)	(0.150)	(0.149)	(0.225)	(0.332)	(0.323)
Educational attainment (ref: less than primary)									
Primary school	1.215*	1.264	1.257	0.785	0.817	0.821	1.255*	1.322	1.313
	(0.136)	(0.205)	(0.203)	(0.137)	(0.176)	(0.177)	(0.150)	(0.237)	(0.234)
Secondary school	1.181	1.087	1.075	0.812	0.750	0.749	1.208	1.103	1.081
	(0.165)	(0.201)	(0.197)	(0.150)	(0.168)	(0.167)	(0.191)	(0.235)	(0.230)
Tertiary school	1.158	1.095	1.087	0.863	0.716	0.719	1.170	1.161	1.136
	(0.201)	(0.249)	(0.247)	(0.166)	(0.164)	(0.165)	(0.267)	(0.361)	(0.355)
# Working-age adults in hh	0.964	0.934	0.935	0.982	0.951	0.952	0.956	0.921	0.924
	(0.033)	(0.040)	(0.040)	(0.028)	(0.031)	(0.031)	(0.041)	(0.051)	(0.051)

# Children in hh	1.008	1.059	1.057	1.101***	1.178***	1.178***	0.996	1.037	1.032
	(0.032)	(0.043)	(0.043)	(0.036)	(0.047)	(0.047)	(0.037)	(0.051)	(0.051)
# Elderly in hh	1.064	1.090	1.087	0.960	0.962	0.960	1.066	1.105	1.099
	(0.137)	(0.174)	(0.173)	(0.194)	(0.225)	(0.225)	(0.148)	(0.198)	(0.196)
Female-headed hh	0.875	0.918	0.916	0.868	0.716	0.715	0.858	0.924	0.919
	(0.159)	(0.212)	(0.212)	(0.207)	(0.215)	(0.215)	(0.174)	(0.244)	(0.242)
HH has tap water	1.023	0.980	0.995	1.187	0.982	0.969	1.033	1.019	1.050
	(0.144)	(0.183)	(0.186)	(0.194)	(0.218)	(0.214)	(0.170)	(0.228)	(0.237)
HH has improved toilet	1.053	1.292	1.314	0.757*	0.823	0.828	1.367	1.753	1.870
	(0.201)	(0.298)	(0.301)	(0.124)	(0.157)	(0.157)	(0.412)	(0.713)	(0.771)
Geographical region (ref = Southern)									
Highlands	0.766*	0.713	0.676*	1.685**	1.752**	1.698**	0.692**	0.532**	0.476**
	(0.119)	(0.151)	(0.146)	(0.378)	(0.419)	(0.410)	(0.128)	(0.171)	(0.159)
Momase	0.828	0.602**	0.543**	1.253	1.128	1.082	0.765	0.446**	0.375***
	(0.125)	(0.148)	(0.134)	(0.195)	(0.255)	(0.250)	(0.146)	(0.165)	(0.142)
Islands	0.675**	0.561**	0.542**	1.206	1.052	1.000	0.612**	0.412**	0.375***
	(0.110)	(0.139)	(0.136)	(0.246)	(0.261)	(0.256)	(0.118)	(0.148)	(0.139)
Urban	0.708**	0.610**	0.599***	–	–	–	–	–	–
	(0.107)	(0.121)	(0.119)	–	–	–	–	–	–
Distance and time to closest health facility									
# km (Euclidean)	1.001			1.002			1.000		
	(0.002)			(0.004)			(0.002)		
# km (roads)		0.993**			0.995			0.992**	
		(0.003)			(0.004)			(0.003)	
# Minutes (roads)			0.997**			0.997			0.995**
			(0.002)			(0.002)			(0.002)
Sample size	3655	2276	2276	1631	1163	1163	2024	1113	1113

Note: Standard errors, in parentheses, are clustered at the household level
The notation *** is $p < 0.01$, ** is $p < 0.05$, and * is $p < 0.10$
Sample is all individuals in the HIES aged 15 and up with observed values for distance and time to health facility

differences across expenditure quintiles. In urban areas, for each additional child in the household, the odds of visiting a health facility increases between 10 and 18%, indicating health maintenance is a greater priority in households where children are present. Health facility usage depends significantly on urban status and region of residence. Overall, urban residents are considerably less likely than rural residents to visit a health provider when sick or injured. Looking at the disaggregated results by urban and rural status, relative to individuals in the Southern region, individuals in Papua New Guinea's other regions (especially the Highlands) are generally more likely to visit health centers if they live in urban areas, but less likely to visit health centers if they live in rural areas. It is not clear why these regional results change by urban and rural status.

Table 10.10 reports the odds ratios for hospitalization in the past 12 months, which by survey design are not conditional on having a health complaint. However, it is likely that a hospital admission requires a higher level of illness than simply visiting a health facility. Increasing the distance to the nearest health facility including hospitals, measured by Euclidean distance, reduces the odds of a hospital admission in urban areas by 0.7%. When measured by road route, the odds are reduced by 0.8–1.0% overall and in rural areas, respectively, but are greater by 1.0% in urban areas. Road routes through the *georoute* command are more accurate in urban areas, and the increase in odds is likely capturing the greater access to public transportation.

Regardless of urban status, the odds of a male hospital admission are about 60% less than a female one. Individuals in the poorest quintile are 60% less likely to be admitted to a hospital relative to those in the top quintile, particularly in rural areas. Each adult in the household decreases the odds of a hospital admission in rural and urban areas, again suggesting more efficient household production of health in households with more adults. The marginal child increases the odds of an admission in urban areas. Relative to a male-headed household, the odds of a hospital admission for those residing in a female-headed household is between 40 and 85% greater. This result may stem from female decision-makers investing more in healthcare for everyone under their roof, including children. Access to clean drinking water dramatically reduces the odds of a hospital admission, while having an improved toilet has no effect.

10.6 Conclusion

This study has examined the determinants of health status and healthcare utilization with an empirical model grounded in a theoretical health production model and estimated with nationally representative household survey data. Our key question is whether distance from health providers can explain the underutilization of health facilities in Papua New Guinea as is often the case in other developing countries. Our results indicate that in most cases, individuals are less likely to seek healthcare with each additional kilometer or minute that they must travel. However, the magnitude

Table 10.10 Logit estimates for whether individual was hospitalized in the past year

	Total			Urban			Rural		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Male	0.475***	0.402***	0.402***	0.373***	0.385***	0.385***	0.495***	0.404***	0.404***
	(0.058)	(0.065)	(0.065)	(0.053)	(0.061)	(0.061)	(0.070)	(0.078)	(0.078)
Age	1.002	1.002	1.002	1.006	1.007	1.007	1.001	1.001	1.001
	(0.004)	(0.005)	(0.005)	(0.005)	(0.006)	(0.006)	(0.005)	(0.006)	(0.006)
Currently smokes	1.105	1.170	1.170	1.116	0.982	0.982	1.097	1.210	1.210
	(0.133)	(0.180)	(0.180)	(0.164)	(0.166)	(0.166)	(0.151)	(0.217)	(0.217)
Household expenditure quintiles (ref: top quintile)									
Bottom	0.424***	0.421***	0.419***	0.811	1.112	1.100	0.410***	0.403***	0.400***
	(0.094)	(0.130)	(0.129)	(0.365)	(0.544)	(0.535)	(0.098)	(0.134)	(0.133)
2nd	0.640**	0.723	0.719	0.867	0.734	0.739	0.617**	0.711	0.708
	(0.125)	(0.175)	(0.174)	(0.273)	(0.268)	(0.269)	(0.131)	(0.186)	(0.185)
3rd	0.722*	0.680*	0.675*	0.828	0.634	0.629	0.694*	0.672	0.667
	(0.135)	(0.158)	(0.158)	(0.201)	(0.194)	(0.192)	(0.143)	(0.171)	(0.169)
4th	0.675**	0.534***	0.533***	0.850	0.974	0.977	0.641**	0.477***	0.477***
	(0.118)	(0.116)	(0.116)	(0.159)	(0.200)	(0.200)	(0.129)	(0.123)	(0.123)
Dwelling owned by hh	1.090	0.981	0.989	1.038	0.981	0.979	1.129	0.991	0.997
	(0.183)	(0.180)	(0.180)	(0.157)	(0.161)	(0.160)	(0.273)	(0.288)	(0.285)
Educational attainment (ref: less than primary)									
Primary school	1.047	1.143	1.138	0.995	0.965	0.965	1.029	1.144	1.138
	(0.158)	(0.221)	(0.221)	(0.210)	(0.239)	(0.239)	(0.169)	(0.245)	(0.244)
Secondary school	1.158	1.275	1.269	1.140	1.065	1.062	1.137	1.286	1.273
	(0.202)	(0.281)	(0.279)	(0.244)	(0.268)	(0.267)	(0.225)	(0.329)	(0.326)
Tertiary school	0.779	0.962	0.963	0.987	0.996	0.989	0.692	0.893	0.893
	(0.170)	(0.265)	(0.266)	(0.226)	(0.263)	(0.262)	(0.209)	(0.355)	(0.356)

(continued)

Table 10.10 (continued)

	Total			Urban			Rural		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
# Working-age adults in hh	0.868***	0.910**	0.912**	0.891***	0.910**	0.909**	0.860***	0.910	0.914
	(0.033)	(0.042)	(0.043)	(0.030)	(0.035)	(0.035)	(0.042)	(0.058)	(0.058)
# Children in hh	1.001	1.012	1.011	1.098***	1.101**	1.099**	0.981	0.990	0.988
	(0.033)	(0.041)	(0.041)	(0.036)	(0.044)	(0.043)	(0.039)	(0.051)	(0.051)
# Elderly in hh	0.894	0.765	0.764	0.988	0.740	0.741	0.873	0.765	0.765
	(0.136)	(0.139)	(0.139)	(0.181)	(0.152)	(0.152)	(0.148)	(0.154)	(0.155)
Female-headed hh	1.473*	1.815**	1.812**	1.299	1.453	1.449	1.472*	1.859**	1.854**
	(0.303)	(0.437)	(0.436)	(0.313)	(0.390)	(0.390)	(0.345)	(0.520)	(0.518)
HH has tap water	0.881	0.605**	0.611**	0.963	0.914	0.903	0.879	0.594**	0.602**
	(0.139)	(0.125)	(0.126)	(0.166)	(0.207)	(0.199)	(0.167)	(0.154)	(0.154)
HH has improved toilet	1.197	1.282	1.302	0.936	0.972	0.970	1.464	1.411	1.459
	(0.248)	(0.307)	(0.314)	(0.158)	(0.192)	(0.191)	(0.409)	(0.477)	(0.491)
Geographical region (ref = Southern)									
Highlands	0.697**	0.755	0.737	0.856	0.844	0.887	0.660**	0.659	0.636
	(0.120)	(0.162)	(0.158)	(0.213)	(0.222)	(0.238)	(0.133)	(0.185)	(0.177)
Momase	0.652**	0.682	0.654*	1.125	1.175	1.239	0.580**	0.561	0.532*
	(0.110)	(0.174)	(0.168)	(0.174)	(0.257)	(0.280)	(0.130)	(0.198)	(0.187)
Islands	1.435**	1.228	1.237	1.448*	1.606**	1.740**	1.403*	1.032	1.035
	(0.247)	(0.293)	(0.294)	(0.293)	(0.360)	(0.386)	(0.289)	(0.328)	(0.325)
Urban	0.830	0.870	0.863	–	–	–	–	–	–
	(0.137)	(0.182)	(0.180)	–	–	–	–	–	–

Distance and time to closest health facility									
# km (Euclidean)	1.001			0.993*			1.002		
	(0.003)			(0.004)			(0.003)		
# km (roads)		0.992**			1.010**			0.990**	
		(0.004)			(0.005)			(0.005)	
# Minutes (roads)			0.996			1.005**			0.994
			(0.003)			(0.002)			(0.004)
Sample size	13,098	8566	8566	6956	4981	4981	6142	3585	3585

Note: Standard errors, in parentheses, are clustered at the household level
The notation *** is $p < 0.01$, ** is $p < 0.05$, and * is $p < 0.10$
Sample is all individuals in the HIES aged 15 and up with observed values for distance and time to health facility

of these effects are rather small, suggesting that investment in more public health facilities may be less of a priority than other public investments as the government seeks to improve access to healthcare services (National Department of Health, 2011). The National Health Service Standards, approved by Papua New Guinea's government in 2011, were designed in part to ensure that the country's health services provide quality healthcare and are closely integrated with other government functions, including infrastructure planning and investment. We find that education, other indicators of socioeconomic status, and access to resources such as clean water and sanitation services matter more in health status and decisions to seek healthcare. These findings suggest that government efforts to invest in education, poverty reduction, and public infrastructure may do more to improve healthcare utilization than building new healthcare facilities.

In interesting question for future research is how these findings differ for young children and whether parents are more or less deterred by distance from healthcare facilities in seeking treatment for their children. Addressing this question requires both a different conceptual framework and a new estimation model since young children by and large depend on their parents for making their healthcare decisions, and a number of household dynamics can enter into these kinds of decisions.

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