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## **Impact of Health on Earnings: Individual and District Level Analysis for Pakistan**

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**IMPACT OF HEALTH ON EARNINGS:  
INDIVIDUAL AND DISTRICT LEVEL ANALYSIS FOR PAKISTAN**

## **ABSTRACT**

The present study aims to explore the impact of health on productivity, measured through earnings at both individual level and district level of Pakistan. For individual analysis health is measured by various nutrition intakes (calories, protein and vitamin A) and for district analysis health is measured by nutrition intake as well as through regional health facilities (number of beds per earners and basic health units per earners) by obtaining the data from *Household Integrated Economic Survey 2010-2011* and from various *Provisional Development of Statistics*. The study concludes that health is foremost element to enhance the productivity level. The unequal distribution of nutrition intake and health facilities causes the earnings inequality, to narrow down this earning inequality there is a need for fair distribution of nutrition intake and health facilities.

## I. INTRODUCTION

Health is one of the foremost factors determining the productivity of an individual. Healthy individuals are in general more productive than non-healthy individuals. Productivity of an individual can be measured through his earnings. A productive person earns more as compared to less productive person. The same argument holds at aggregate level, the nations with relatively more healthy people grow faster. As Lucas (1988) rightly defined human capital as the engine of economic growth.

The relationship between health and earnings can be examined with two-ways; there exist bi-directional relationship between health and earnings. First health and other forms of capital increase the productivity measured through earnings. Second there exist reverse causation health expenditure is the function of earnings or wealth.

World Bank in (2005) showed that the fifty percent economic growth differential between developed and developing country is due to ill-health and low life expectancy[see detail in study Renny (2012)].

It has been seen that people living in poor countries are less healthy than the people living in rich countries. Table 1.1 reports the GDP per capita, life expectancy at birth, infant mortality rate per 1000 live births and physician per 1000 habitants, of few developed and developing countries. The following table shows that physician for 1000 habitants and life expectancy are very high and infant mortality rate is low for those countries that have high per capita GDP. On the other hand, if we analyze the developing their health conditions such as life expectancy and physician for 1000 habitants are far below with high infant mortality rate.

**Table1.1. Health Indicators and GDP Per Capita of Selected Countries**

Country	GDP per capita (constant 2000US \$)	Life Expectancy at birth	Infant Mortality rate (per 1000 live births)	Physician (per 1000 Habitant)
Japan	39971	82.8	2.4	2.14
USA	37329	78.4	6.5	2.40
UK	28230	80.4	4.5	2.70
Canada	25575	81.0	5.0	2.10
France	22758	81.3	3.5	3.44
Bhutan	1393	66.9	43.6	0.02
India	804	65.0	48.6	0.65
Pakistan	664	61.0	61.4	0.81
Bangladesh	558	68.3	38.6	0.30
Nepal	269	68.4	40.6	
Ethiopia	219	58.7	54.6	0.22

*Source; World Development Indicators (2013)*

The statistics show that countries with better health condition are more prosperous in terms of per capita GDP. A similar conclusion was given by Hasan (1999). He mentioned that the South Asian developing countries (India and Pakistan) are still far below in GNP per capita as compared to East Asian developing countries (Malaysia, Republic of Korea and Thailand) during the last three decades. He concluded that this low GNP per capita is due to only that these countries are far behind in healthy human capital, there is still very low level of investment in both health and education sectors. He mentioned in their study that in (2000), health expenditure in East Asian developing counties was 33 percent times higher than South Asian developing Countries.

A common empirical approach to study the effect of health on productivity is to focus to analyze the impact of health (typically measured by nutrition intake) on earnings of an

individual. One of the pioneering studies in this regard is of Leibenstein (1957) who attempted to analyze the relationship between nutrition intake and productivity of labor by giving the Efficiency Wage Hypothesis Theory. Since then a large number of studies analyzed the impact of health on earnings. In this regard studies by [Arcand (2001), Weinberger (2003) and Traore (2007)] are important.

In Pakistan a limited work has been done in the area. Moreover the studies are restricted to some regions of Pakistan. There is hardly any comprehensive national level study. No study has given the regional comparison. The present study is an attempt to bridge the gap by conducting a comprehensive individual level analysis of the impact of health on earnings. The analysis will be extended to study the role of district level differences in health status and health facilities on earnings.

## **II. LITERATURE REVIEW**

Growth theories emphasize that human capital has important role for economic growth. Human capital is stock of competences, skill knowledge, education, training and health. However, the earlier literature took education as the proxy of human capital to analyze its impact on economic growth and not addressed the health as human capital.<sup>1</sup>

In mid-1970 the studies started looking at health human capital as another indicator and focus on the relationship between health and economic growth. One of the earlier studies in this regard is of Preston (1975) who explored the relation by taking per capita income and life expectancy for 57 countries. He found that there is concave relationship between health and economic growth and with time relationship become stronger. Since then a large literature is

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<sup>1</sup> In this regard studies [Mincer (1981), Becker (1990), Ellis and Wang (1994) and Abbas (2000)] are important

available on impact of health on economic growth. The earlier literature can broadly be classified in two groups; studies focused on health inputs and studies focused on health outputs.

### **Review of Studies Based on Health Input**

Health inputs include physical factors as well as financial resources since both influence the individual's health. Physical factor include the nutrition intake at different stages of life. Whereas financial resources include the access of medical care services, health expenditure/investment and health incentives etc.

There are number of studies that examined the impact of health input indicators on economic growth. The researchers have analyzed the varying health inputs which contribute to worker productivity measured by earnings and number of hour to work. Malnutrition remains a serious problem in many parts of the world, about 800 million people (17% of the world's population) remain malnourished, reported by United Nations Food and Agriculture Organization FAO (2003). There are several studies who conclude that calorie intake is also one of the major factors to affect the labor productivity or wages which leads to economic growth. Stauss (1986) taking calories intake as health indicator and examine its impact on earnings by applying two stage least square for 1974 to 1975 for a cross section household data in rural Sierra Leone. The result shows that by increasing 1 percent calories intake raises the earnings 13.5 percent significantly. Similarly Aziz (1995) has taken the 40 households of Indian economy and analyze for two periods for 1976-77 and 1977-78. He included both male and female and investigate the impact of calories intake on their earning profile. His results are very interesting that calories are significant for female rather than male.

Height and weight are also considered as health input indicators, it has been assumed that taller persons are more productive and have more capacity to work hard especially for labor work. There are different ways that are used to express weight for height; one that is often used is body mass index. Many researchers used the height and body mass index to analyze its impact on the productivity of labor such as Haddad and Bouis (1991) explore the determinants of the earning function for the agriculture sector of the Philippines economy. He has taken the health indicators such as Height, body mass index and calories intake per adult equivalent with other socio and demographic variables to analyze its impact on daily log earnings. The result indicates that with more investment on health and nutrition improves the adult height, these effects are permanent and result in incremental income flows over a number of years. On the same fashion Thomas and Strauss (1997) analyzed the impact of height, body mass index and calories and protein intake on wages for men and women in urban Brazil for the period of 1974-1975 on household data. The result indicates for both men and women who participate in the market wage sector, all three health indicators significantly affect wages.

Weinberger, (2003) analyzed the impact of micronutrient intake, under investigation is iron, on the productivity of Indian rural households by applying two-stage least square technique. The study concluded that productivity measure in wages would be 5 to 17.5 percent higher if households would increase their nutrition intake. There are other studies, who conclude that different health indicators (calories, height, BMI) of [Deolalikar (1988), Kedir (2008) and Traore(2007)] are important determinants to increase the earning per capita.

Many researchers used dietary energy supply (DES) and prevalence of food inadequacy (PFI) as health indicators. DES is calories intake per day, it is recorded in terms of national average from food consumption and PFI is the fraction of population whose calories intake is



below from certain level. Arcand (2001) examines the effect of two measures of nutritional status of DES and PFI – on the growth rate of real GDP per capita for 129 countries from the 1960s to the 1980s. The result shows that nutrition intake has been an important determinant of economic growth and concludes that inadequate nutrition is causing losses of 0.23 to 4.7 percentage points in the annual growth rates of per capita GDP worldwide

Gyimah-Brempong (2004) explores that and stock (child mortality rate) and investment in (health expenditure) of health have important for raising the economic growth or GDP of country. Results of study suggest that relationship is quadratic and health in least developed countries will enhance the economic growth in the short run and raises the level of GDP in the long run because investment in health become a part of stock of human capital. Similarly Ogundipe and Lawal (2011) found that health expenditure has strong and substantial effect on economic growth.

Health facilities are also one of the most important factors to determine the health of worker. Aguayo-Rico *et.al.* (2005) estimated the Solow growth model with human capital through panel data approach which includes the health indices .The index has four components consisted on life style, environment and health services and health index. They suggested that if funds are expended to the right channels, the effects of this expenditure on the economic growth will be strong.

### **Review of Studies Based on Health Output**

Health outcomes are results of health inputs and genetic endowment that affect quality or health status of individuals. This indicator includes life expectancy, mortality indicators, ability to work, height and specific disease such as malaria, diarrhea, HIV/AIDS etc.

Bloom *et.al.* (2000) used the production function model for economic growth as a factor of physical capital, labor force and human capital which consists of three components, average year of schooling, average work experience of the work force and health (proxy with life expectancy). There results show that good health has positive and significant effect on economic growth. Across studies mention [Barro and Lee (1994), Bloom and Williamson (1998), Ranis *et. al.* (2000), Arora (2001) and Bloom *et. al.* (2004), Browser (2010)] life expectancy has positive and significant impact on economic growth.

One of the interesting findings by Acemoglu and Johnson (2006) that also used the life expectancy and predicted mortality as health indicator and exploits the international epidemiological transition period the wave of period in which new innovation and improvement in health was began in 1940. The result shows with the interventions in health care system and due to predicted mortality helps to increase the life expectancy that leads to economic growth.

Adult survival rate is also used as proxy of health that also influences the productivity of labor that enhances the economic growth. Bhargava, *et al.* (2001) found positive relationship between adult survival rate and economic growth in the period 1965 to 1990 in developed and developing countries.

Taking Daily Adjusted Life years (DALY) as health indicator proposed by WHO (2008) Audibert and Pascale (2010) analyzed the impact of DALY on economic growth for 159 countries by taking annual averages over 1999-2004's period. The result suggests that DALY and communicable diseases and malaria are important contributing factors for economic development.

The sense of common purpose in the worldwide struggle against HIV/AIDS has increased in last two decades. There are several of studies that examine the impact of specific diseases such as HIV/ AIDS and Malaria on economic growth. [Cuddington and Hancock (1994), Rene (2000), Scott and Jennifer (2006)] found that there is negative impact of HIV/AIDS on economic growth. Some researchers have focused on the effect of malaria on economic growth such as [Gallup et al (1999), Sachs (2003) and Carstensen and Gundlach (2006)].

### **Empirical Evidence from Pakistan**

Up till now the discussion about the importance of health and its link with income distribution was revolving around different developed and developing countries excluding Pakistan. There is very little work has been done for Pakistan for both time series and cross section data.

On time series data only two studies are found on the related issue. Akram *et. al.* (2008) analyzed the short run and long run dynamic of health human capital on economic growth. His health indicators are life expectancy, infant mortality rate, health expenditure and population per bed to see its impact on GDP per capita for period 1972-2006. The result shows that life expectancy, infant mortality rate and population per bed have significant impact on economic growth. The second study is analyzed on the impact of health status and education on the employment of Pakistan such as Bashir et al (2012) examined the impact of health and education for employment status of Pakistan for 1970 to 2010. The result indicates that health and education play significant role to determine the employment of Pakistan.

By using micro data Nasir and Iqbal (2009) explored the factors of wage differential at individual level in Pakistan by using the data of Labor Force Survey (2007-08). He had taken

sick leave of individual as proxy of health indicator with other explanatory variables to analyze its impact on wage differentials. The result indicates that health is also important factor to determine the wages.

Similarly, Chaudhry et al (2010) examined the impact of health and education of female earnings for the district Vahari. Similarly, Faridi et al (2010) have studied the contribution of health and education on employment status for district Bahawalpur by taking cross section data from 2008 to 2009. They apply logit model and its result indicates that health and education are the most important factors for determining the employment status.

A lot of work has been done to analyze the relationship between health and productivity and result probably vary depending on the health indicator used and the countries included in the analysis. A very little work has been done for developing countries, especially for Pakistan. No study has been found that capture the role of health on earning dispersion of Pakistan at individual level. Our aim is to analyze the impact of health on productivity and incorporate those problems which are mentioned in above studies at both individual and aggregate level. We are taking nutrition intake as personal health indicator and analyze its impact on earnings of individuals. For aggregate level we will examine the impact of personal health indicator as various nutrition intakes and as well as public provision of health facility as regional health indicator on earnings for districts analysis of Pakistan.

### **III. METHODOLOGY**

The present study discusses one of possible deterrents of growth, the differences in socio economic status among individuals and on across districts in a country, as derived by differences in human capital specially emphasize the health embodied in them. A rich debate has been

provided in literature that health has the major contribution on earnings but the question is what are the channels through which health and other indicators get transformed into disparities.

### 1. Individual Level Econometric Model

We have evaluated the impact of human capital and other indicators on earning potential. Standard earning equation is estimated while acknowledging that earnings are determined by number of factors like human capital which has two components health and education. For the health we have taken the various nutrition intakes. Following fruitful learning from literature some exogenous variables are included in our model for empirical investigation i.e. age of earner, square of age and dependency ratio. In this way we developed the following models that fulfill the determinants of earnings of individual. In the first model we are taking the absolute amount of nutrition intakes which the individual has consumed per day to analyze the impact of health on earnings.

$$LE_i = \partial_0 + \partial_1 CL_i + \partial_2 PR_i + \partial_3 VT_i + \partial_4 EDU_i + \partial_5 DR_i + \partial_6 AG_i + \partial_7 SAG_i + \mu_i \quad (3.1)$$

Where,

LE = Log of monthly earnings of  $i^{\text{th}}$  individual.

CL = Calories consumed per day by  $i^{\text{th}}$  individual.

PR = Protein consumed per day by  $i^{\text{th}}$  individual.

VT = Vitamin A consumed per day by  $i^{\text{th}}$  individual.

EDU = Successful year of schooling of  $i^{\text{th}}$  individual.

DR= Dependency Ratio on  $i^{\text{th}}$  individual.

AG = Age of  $i^{\text{th}}$  individual.

SAG = Square of age of  $i^{\text{th}}$  individual.

$\mu_i$ = Random error term.

In second model we take the dummies of various nutrition intakes such as dummy for calories, dummy for protein and dummy for Vitamin A as proxy of health. While other explanatory variables are education, age, square of age and dependency ratio on the earnings function (3.2).

$$\begin{aligned} LE_i = & \beta_0 + \beta_1 DCL_i + \beta_2 DPR_i + \beta_3 DVT_i + \beta_4 EDU_i + \beta_5 DR_i \\ & + \beta_6 AG_i + \beta_7 SAG_i + \mu_i \end{aligned} \tag{3.2}$$

Where,

DCL = A dummy variable for calories of  $i^{\text{th}}$  individual; =1 if it consumed calories equal or greater than recommended daily allowance, =0 otherwise.

DPR = A dummy variable for protein of  $i^{\text{th}}$  individual; =1 if it consumed protein equal or greater than recommended daily allowance, =0 otherwise.

DVT = A dummy variable for vitamin A of  $i^{\text{th}}$  individual; =1 if it consumed vitamin A equal or greater than recommended daily allowance, =0 otherwise.

In the third model we are taking the dummy of all nutrition intakes. The individual who's all nutrition intakes (calories, protein and vitamin A) are equal or above their requirement with other variables education, age, square of age and dependency ratio on earnings function (3.3).

$$LE_i = \gamma_0 + \gamma_1 DNUT_i + \gamma_2 EDU_i + \gamma_3 DR_i + \gamma_4 AG_i + \beta_5 SAG_i + \mu_i \quad (3.3)$$

Where,

DNUT= A dummy variable for all nutrition intakes of  $i^{th}$  individual; =1 if individual consumed calories, protein and vitamin A are equal or greater than recommended daily allowance, 0= otherwise.

To check that either pooling is viable in Pakistan with respect to gender and region we apply the Chow test. The Chow test itself is testing against the pooled and is based on the assumption of equal variance and coefficients between groups. Applying the test in case of Pakistan is insignificant; output indicating that pooling is not viable. Therefore we estimate the impact of health indicators on earning function for male and female with rural and urban segments.

## **2. Aggregate Level Econometric Model**

After estimating the individual log earning regression models, now we came up to analyze at aggregate level for this we are taking the health (personal health indicator and regional health indicator) with other variables are proportion of higher education, average age, dependency ratio and proportion of males of a district on earning disparities at district level. The study considered the log linear econometric model to evaluate the effect of health and other indicators on earning potential.

$$LE_i = \theta_0 + \theta_1 PDNUT_i + \theta_2 PHEDU_i + \theta_3 AAGE_i + \theta_4 PMAL_i + \theta_5 BEDS_i + \theta_6 BHU_i + \mu_i \quad (3.4)$$

Where,

ALE = Log of average monthly earnings of district i.

PDNUT = Proportion of dummy of all nutrition intakes of district i.

PHEDU = Proportion of higher education of earners in district i.

AAGE = Average age of earners in district i.

PMAL = Proportion of male earners in district i.

BEDS = Beds per earners in district i.

BHU= Basic health unit per earners in district i.

$\mu_i$  = Random error term.

#### **IV. DATA SOURCE AND DESCRIPTION OF VARIABLES**

The data of individual variables has been taken form Household Integrated Economic Survey (HIES) 2010-2011 published by Federal Bureau of Statistics (FBS), Government of Pakistan.

The variable that has been collected at district level is health facilities from four provinces of Pakistan: Punjab, Sindh, Khyber Pakhtun Khaw (KPK) and Baluchistan. The data for Punjab districts is available on Punjab development statistics 2011-2012 published by Punjab Bureau of Statistics. The data for districts of Sindh is available for 2010-2011 given by Sindh



Bureau of statistics on special request. Similarly for Baluchistan it is available for 2011 in District development profile 2011 and data for KPK existed for 2011 provided by KPK Bureau of Statistics on special request.

As our analysis are based on both individual and aggregate aspect therefore variables included in our study has been divided into individual level and district level.

### **1. Description of Variables at Individual Level**

We selected those individuals from HIES for our analysis who are 10 years and above with positive earnings, who worked at least one hour during the reference period and were either “paid employed” or “self-employed” by definition of Labor force survey 2010-2011.

#### **Earnings:**

Our focus is to see the impact of health on productivity of individuals. There are many measures that capture the productivity of individual e.g. earnings, number of hours to work etc. Unfortunately the data for number of hours to work per day is not available in HIES, therefore we are using earnings as proxy of productivity.

#### **1. Health:**

As already discuss that health indicator has been divided into two parts, one is health input and other is health output. After reviewing the related literature it seems that health inputs have more precedence than health output, as when health inputs are good outputs would be ultimately better. Therefore we have chosen health inputs as basis for our study. For individual

level to analyze the impact of health on productivity, we measure health through personal health indicator.<sup>2</sup>

### **Personal Health Indicator:**

Personal health indicators include average height or weight of individual, body mass index, infant mortality rate, nutrition intake and specific diseases etc. Due to data limitation we selected personal health indicator is “nutrition intake” also used by Aziz (1995) and Weinberger (2003) as good nutrition is key for good health, fight against disease and reduces the expected death rate. Therefore one can say that nutrition is input and foundation for health and development

The nutrition intake included in our model are Calories/Energy, Protein and Vitamin A. We selected those nutrition intakes that are necessary for good health. Calories, protein and vitamin A is constructed from the HIES data, HIES gives household value and quantity consumed of 46 food items in a month. These food quantities are converted on daily basis to nutrition intake through Food Composition table for Pakistan, which gives nutrient content of 196 various food items available in Pakistan. This table has been compiled by Planning and Development Division, Government of Pakistan and KPK Agricultural University Peshawar, published first in (1985) and then it was revised in (2001). The nutrition intake is converted to nutrition intake per adult equivalent with the help of equivalence scale. A wide range of equivalence scale exist, we have used the OECD Equivalence Scale. In this the first household member is assigned the value of 1, each additional adult is given value 0.7 and 0.5 is assigned to

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<sup>2</sup> Aggregate (district) level we discussed both personal health indicator and regional health indicator.

each child between age 1 to 15. This scale (also called “Oxford scale”) was mentioned by OECD (1982). Then we got nutrition intakes per adult equivalent at individual level.

Nutrition intake has been divided into two parts one is absolute amount of nutrition intake and second is nutrition dummies.

a) **Absolute Amount of Nutrition Intake**

In the absolute amount of nutrition intake we have taken the exact amount of nutrition intake which the individual has been consumed per day. A well-nourished food intake affects the productivity of individual, measured in earnings.

b) **Nutrition Dummies**

Other variables used as proxy of health included in our study are nutrition dummies for calories, protein, and vitamin A and dummy for all nutrition intakes. Dummy for calories is defined as the individual who are taking the calories per day equal or greater than recommended daily allowance given by Khan (1990). For construction of this variable we generated the dummy variable and assigned the value “1” to those individuals who are taking calories per day equal or greater than recommended daily allowance and “0” otherwise. Same procedure is followed for dummy of protein and dummy of vitamin A.

Dummy for all nutrition intakes is defined as the people whose consumption of calories, protein and vitamin A all are equal or above their requirement. We give the weight 1= those individual whose all calories protein and vitamin A are equal or greater than recommended daily allowance, 0 otherwise.

## **2. Education:**

Education has an important role in increasing earning of the people. It has been believed that by promoting the education in developing countries improves the standard of living and is a key for future growth. With better education or qualification there are more incentives and opportunities for job. We used the total years of schooling of individuals (male and female) for analyzing role of education on earnings.

## **3. Age:**

Age is used as explanatory variable for earners for both male and female. With age people gain work experience that influence the potential of their earnings and its impact is expected to last on earnings till their retirement. This appears that earnings increase in early ages, attain peak around middle age and decline thereafter. There is U-curve-shaped relationship between earnings and age. Therefore we also took age square which assumes negative relationship with earnings.

## **4. Dependency Ratio**

As dependency ratio increases the economic stress on the earners of the household also increases. They earn more to fulfill the needs of their family. Dependency ratio is generated by taking the ratio of non-earners and earners in a household.

## **2. Description of Variables at District Level**

### **Average Earnings:**

To analyze the impact of health on productivity disparities at districts of Pakistan again earnings is used as proxy of economic growth. To construct the average earnings, we considered

the average of monthly individual's earnings (definition of earnings described in description of variables at individual level) district wise.

## **1. Health:**

To analyze the district disparities of earnings function we considered the personal health indicator and regional health indicator as proxies of health.

### **i. Personal Health Indicator**

In the personal health indicator we are taking the **proportion dummy of all nutrition intakes** at district level. Proportion of dummy of all nutrition intakes indicates the proportion of earners of district who are taking various nutrition intakes (calories, protein and vitamin A) at equal or above their recommended requirement given by Khan (1990). To construct the proportion of dummy of all nutrition intakes we aggregated the dummy variables that are constructed for individual level such as calories, protein and Vitamin A and then take its ratio with the population of that district.

### **ii. Regional Health Indicator**

The regional health indicator involves the health insurance, health facilities etc. provided by government. Here we are taking the **health facilities** provided by government as regional health indicator to analyze its impact on earnings at district level. Health facilities consists of number of doctors, number of hospitals, and number of medical care centers etc. provided by the government to a given district. Easy access to health care facilities contributes affectively towards an individual's health, thus increasing his productivity which leads to increase the earning of community.

Our considered health facilities include number of number of beds and basic health units in a district provided by government. Our analysis is based on earners that used the health facilities therefore we have divided the total number of beds on earners and basic health units on the earners of district.

## **2. Education:**

Condition on good health, education also play major role to increase the earnings at district level. The earnings become widen with the high level of education, therefore we are taking the proportion of higher education for district analysis.

## **3. Age**

To analyze the district earning profile we are taking average age of earners of that district. The coefficient of average age shows that with increase in average age, individuals living in that district gain working experience that helps to raise earnings of the district.

## **4. Proportion of Males Earners**

In developing countries there is more wage gap with respect to gender, male earn more times than female. Secondly the proportion of females is very low as compared to males in job sector, especially in Pakistan where females are normally not allowed to work outside the home. Therefore we assume that districts where proportion of males earners are more their earnings are high than other districts.

## V. RESULT OF HEALTH ON EARNINGS: INDIVIDUAL ANALYSIS

All these models are estimated through Ordinary Least Square Method (OLS). As we have used the cross section data, in the cross section data there is problem of heteroscedasticity because data contains great disparities in magnitude, being studied at given point in time. For this reason White Heteroscedasticity-Consistent Standard Error & Covariance is applied to get the robust standard errors in order to avoid any ambiguous outcome for significance of regression coefficients.

### **Result Based on Absolute Amount of Nutrition Intake**

In the first model we estimate the impact of health as absolute amount of nutrition intake on earning dispersion. Table 2 gives the results of absolute amount of nutrition intakes on log of monthly earnings. The  $R^2$  in all four equations are observed on average 0.36. Here  $R^2$  values are not very high which is mostly observed in cross section data with large number of observations. The values of t- statistics represents that our most of coefficients in all equations are significant except the coefficients of few variables.

The values of F test of all four equations shows the overall significance of model or estimated regression line that is whether our dependent variable earnings are linearly related to explanatory variables.

From the regression coefficients of estimated earnings functions show that health has the significant impact on earning of male and female in urban and rural region. The nutrient estimates, calories, protein and vitamin A have positive and significant impact on productivity measured in earnings

**Table 2 Impact of Absolute Amount of Nutrition Intake on Log of Monthly Earnings.**

Explanatory Variables	Urban Region		Rural Region	
	Male	Female	Male	Female
<b>Intercept</b>	78.4022* (40.87534)	59.99249* (8.79)	92.8677* (64.95)	53.06759* (9.61)
<b>calories</b>	0.00189* (7.003696)	0.002888* (3.31)	0.000789* (9.81)	0.001563* (7.93)
<b>protein</b>	0.003688* (7.324211)	0.003991** (2.27)	0.001994* (4.51)	0.003753** (2.61)
<b>Vitamin A</b>	0.010714* (15.4616)	0.008161* (3.29)	0.01041* (20.86)	-0.00067 (-0.316)
<b>Education</b>	2.79522* (38.59986)	3.059566* (21.79)	0.989825* (26.82)	3.347911* (19.178)
<b>Age</b>	0.0283* (26.28692)	1.883951* (5.09)	2.169049* (27.82)	1.366448* (4.59)
<b>Square of Age</b>	1.432706* (-20.99888)	-0.01468* (-3.03)	-0.02307* (-23.51)	-0.01189* (-3.02)
<b>Dependency Ratio</b>	2.772181* (27.39105)	-0.165 (-0.26)	2.841086* (36.21)	7.017134* (11.94)
<b>R-Square</b>	0.4907	0.4255	0.3629	0.3067
<b>F-Values</b>	1253.62	123.16	1022.54	107.88

\*Significance at 1%, \*\* significance at 5%  
t-values in Parenthesis.

The regression coefficient of various nutrition intake is consistent with the literature as its positive and significance of coefficient shows that nutrition intake enhance the individuals' productivity. But its effect is too small, from both male and female aspects. By increasing 1 unit of calories intake associated increase in their monthly earnings is 0.18 percent and 0.23 percent for male and female respectively. Our results are consistent with the studies of [Strauss (1986), Haddad and Bouis (1991), Thomas and Strauss (1997)].

Similarly, by increasing the 1 unit of protein intake associates to increase the average earnings by 0.37 percent for both male and female. Additional Vitamin A intake is also associated with higher wages as by increasing 1 unit of vitamin A raises the earnings by 1.07 percent and 1.09 percent for male and female respectively. Interestingly, result indicates that



nutrition intake, protein and vitamin A have more influence on the productivity of individuals as compared to calories. This is consistent with the theory that calories only provide the energy of a body whereas protein and vitamin A are necessary for all the functions and to regulate the body.

Condition of health, education is also one of most important determinant for earnings. The education has positive significant impact on earnings of male and female in both urban and rural regions. Its coefficients show that by increasing 1 year of education raises the earnings by 141 and 96.8 percent for male in urban and rural region respectively. The result depicts the human capital theory because considerable rise in earnings are attributed to increased educational level, which is in accordance with the results of [Haque (1977), Guisinger *et.al.* (1984), Ahmad (1991) and Ashraf and Ashraf (1996)] who reported that education has positively and significantly influenced the earnings for Pakistan.

The age of earners is also one of the important determinants. With increasing the age, individuals gain work experience which helps to rise their earning. Our results also indicate or prove this hypothesis, in case of male if age increases by 1 year, the average earnings for both urban and rural region are rising on average 253 percent monthly.

The dependency ratio has also significant and positive effect on earnings of male. Similarly, increasing the dependency ratio has more influenced the liability on male then female. By increasing 1 unit of dependency ratio raises the average earnings by 2.80 percent for male individuals. However, the role of dependency ratio on female earners in urban region is negative but insignificant, which is due to the fact that as number of dependents increase in a household this adds more to their home duties rendering less time for office and outdoor jobs.

### Result Based on Nutrition Dummies

In the second model we take the nutritional dummies of calories, protein and vitamin A and other demographic variables to estimate the impact on earnings functions. The R square reported in table 3 is also low for male as it is 0.414 and for female it is 0.345.

**Table 3 Impact of dummies of Nutrition Intake on Log of Monthly Earnings.**

Explanatory Variables	Urban		Rural	
	Male	Female	Male	Female
<b>Intercept</b>	82.44412* (43.11)	67.63401* (9.70)	94.05251* (64.51)	54.91145* (9.61)
<b>Dummy for Calories</b>	4.602957* (8.85)	1.958738 (0.77)	4.612069* (9.91)	10.54479* (4.39)
<b>Dummy for protein</b>	-0.04089 (-0.076)	-0.39797 (-0.173)	2.257416* (4.63)	-5.78369** (-2.44)
<b>Dummy for Vitamin A</b>	7.136889* (16.51)	8.780443* (4.67)	6.186793* (17.48)	-0.85595 (-0.529)
<b>Education</b>	1.509418* (39.96)	3.267937* (24.07)	1.005288* (26.83)	3.499814* (19.79)
<b>Age</b>	2.975435* (27.22)	1.935831* (5.13)	2.264474* (28.17)	1.328322* (4.35)
<b>Square of Age</b>	-0.0302* (-21.73)	-0.01481** (-2.99)	-0.02411* (-23.72)	-0.01137** (-2.82)
<b>Dependency Ratio</b>	2.666966* (26.01)	-0.33666 (-0.529)	2.79544* (35.16)	7.121757* (12.34)
<b>R Square</b>	0.4759	0.4059	0.3459	0.2933
<b>F-Values</b>	1181.48	113.61	949.30	101.21

\*Significance at 1%, \*\* significance at 5%  
t-values in Parenthesis.

The coefficient of dummy of calories is statically significant and indicates that on average healthy male earns 4.6 percent times more than non-healthy male for both urban and rural region. Whereas the dummy of protein has negative sign but it is not significant for the urban region. At the bottom of protein intake impact on earning distribution is large relative to the top of protein intake. As protein intake is equal and below from bench mark level is

effectively impact on earning function but it becomes insignificant when consumption of protein intake becomes high from their bench mark level, consistent with the results of Thomas and Strauss (1997). Medical research also shows that protein intake more than 30 percent from bench mark level could actually harm your body.<sup>3</sup>

Moreover dummy of protein is significantly influencing the productivity of male in rural region. As jobs in rural regions are more related to physical work as compared to jobs in urban sector therefore calories and protein are more effective in rural region. Whereas the dummy of Vitamin A is significantly influence the male productivity. Vitamin A has positively affected the productivity of male in both urban and rural regions. As vitamin A cross the bench mark level the earnings of male rise by 7.13 percent and 6.13 percent for urban and rural regions respectively.

From female aspect, dummies of calories and protein become insignificant for earnings for urban region which indicates that taking calories and protein equal or above from bench mark level they become unproductive, the results are consistent with the Thomas and Strauss (1997) for female in job market. However vitamin A has positive and significant impact on productivity with increasing the consumption of vitamin A the earnings will be increased by 8.7 percent in urban sector. Above discussion shows that vitamin A is more important for the productivity of both male and female. The individuals earn more who meet the consumption of vitamin A according to their bench mark or above it.

The impact of other explanatory variables education, age and dependency ratio is more or less same as in model 1 on male and female earnings in both urban and rural sector. Education and gain in experience with age are remaining most important factors to influence the earnings.

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<sup>3</sup> Dr. Gali Butterfield

## Result Based on Dummy of All Nutrition Intakes

In the third model we are taking the dummy of all nutrition intakes that is defined as the individual whose consumption of all nutrition intakes (calories, protein and vitamin A) are equal or above the bench mark. The dummy variable of all nutrition intakes shows that there is more widen in earnings dispersions that people earn more times whose all nutrition (calories protein and vitamin A) requirement are equal or above the bench mark. The coefficients show significantly that healthy male earns 3.7 and 4.42 times more than non-healthy male in urban and rural region respectively. Similarly, for women it is 3.36 percent and 0.96 percent for urban and rural region.

**Table 4      Impact of Dummy of all Nutrition Intakes on Log of Monthly Earnings.**

Explanatory Variables	Urban		Rural	
	Male	Female	Male	Female
<b>Intercept</b>	81.87382* (42.21)	65.22277* (9.41)	93.31941* (79.12)	55.76316* (9.69)
<b>Dummy for all Nutrition</b>	3.772512* (22.01)	3.362453* (4.19)	4.428939* (26.48)	0.986579*** (1.39)
<b>Education</b>	1.545794* (41.26)	3.302596* (24.62)	1.014417* (28.32)	3.501013* (19.94)
<b>Age</b>	2.961755* (27.29)	1.957889* (5.16)	2.262971* (36.53)	1.353885* (4.43)
<b>Square of Age</b>	-0.03004* (-21.71)	-0.01496* (-3.01)	-0.02409* (-32.08)	-0.01158** (-2.85)
<b>Dependency Ratio</b>	2.60071* (25.31)	-0.24791 (-0.38)	2.758869* (39.62)	7.168439* (12.19)
<b>R Square</b>	0.4703	0.4004	0.3438	0.28714
<b>F-Values</b>	1617.68	155.73	1316.94	137.68

\*Significance at 1%, \*\* significance at 5% and \*\*\*significance at 10%  
t-values in Parenthesis.

Therefore having a well balance diet is mandatory for maintaining good health and subsequently increasing productivity hence raise the earnings of individuals.

## VI. RESULT OF HEALTH ON EARNINGS: DISRICT LEVEL ANALYSIS

The empirical model for district level explained the impact of health on earnings dispersion on districts analysis of Pakistan. Our explanatory variables include health that is measured by proportion of dummy of all nutrition intake and health facilities.

**Table 5 Impact of Health and other Indicators on Log of Monthly Earnings.**

Explanatory Variables	Coefficients	t-values
<b>Intercept</b>	97.8331	8.809*
<b>Proportion of Dummy of all Nutrition Intakes</b>	5.1207	3.082*
<b>Proportion of High Education</b>	57.1455	4.584*
<b>Average Age</b>	0.5422	1.859*
<b>Proportion of Male Earners</b>	39.8575	6.054*
<b>Basic Health Unit per Earners</b>	0.0196	1.938**
<b>Bed per Earners</b>	0.0012	4.439*
<b>R Square</b>	0.5436	
<b>F-Statistics</b>	12.64 (2.20)*	

\*Significance at 1%, \* significance at 5%

The  $R^2$  reported in table 6.1 is observed 054. Here  $R^2$  is not very high which is mostly observed in cross section data. The value of F test shows the overall significance of model or

estimated regression line that is whether our dependent variable earnings are linearly related to explanatory variables.

From the regression coefficients of the estimated earnings function it indicates that health has the major role for earnings at district level. The coefficient for proportion of dummy of all nutrition intake shows by increasing the proportion of earners whose nutrition intake are equal or above their requirement, raises the average earnings of district by 512 %. Therefore, we can conclude that role of health on productivity for individual level is consistent with the district level. Health is the main factor to increase the productivity at district level.

Condition on health; education is also the most important determinant of earnings disparities at regional level. Here we take the proportion of high education; our result indicates by increasing the high level of education would raise the average earnings of districts. An apparent increase in earnings can be seen 5714% higher (more than triple time) at graduation and higher level education than earnings compared to illiterate district.

The age is also important factor to influence the earnings, with age individual gains the work experience that improves his productivity and helps in getting higher earnings. Therefore it predicts that there is positive relationship between average age and earnings of district. The coefficient of proportion of male earners is positive and statistically significant which indicates by increasing the proportion of male earners raises the average earnings of district. The results are consistent with the [Nasir and Nazli (2000), Siddique *et. al.* (2006) and Sabir and Zahar (2007)] for Pakistan.

Enhanced medical facilities help to improve the health of individuals as they get early and better treatment when required. Our result confirms that medical facilities play major role to improve the productivity of workers. With regards to number of basic health units in a district,

the study demonstrates that having more basic health units in the society show better health facilities. The variable, number of basic health units has positive sign with statistically significant at 10 percent level. The coefficient show that by increasing the 1 basic health unit per earners would raise the average earnings of district by 19.6 %. Similarly by increasing number of beds per earners also enhance the labor productivity, hence raise the earnings.

## **VII. SUMMARY AND CONCLUSION**

The main objective of this study is to empirically investigate the link between human capital distribution especially emphasis on the role of health on earning disparities in Pakistan at both individual and aggregate district level to get the robust results. The study attempts to identify the impact of health (personal health indicator and regional health indicator) and some other explanatory variables (education, age and dependency ratio) on earnings distribution.

At individual level results indicate that as nutrition level goes up the person becomes more productive that raises the earnings of individuals. Overall calories, protein and vitamin A positively influence the productivity of male and female in both urban and rural sectors. It has been observed that protein and vitamin A intake have more influenced the earnings, which probably represents the diet quality, of which protein and vitamin A (and its quality) are an important dimension. The dummies of calories, protein and vitamin A have played more important role for male than female in rural sector as compared to urban sector as in urban sector men are mostly engaged in intellectual work whereas women usually doing desk jobs. On the other hand in rural sector almost all jobs are of physical nature. The result of dummy of all nutrition intakes are positively related to men and women in both urban and rural sectors and their coefficients are more times high than separate intake of calories, protein and vitamin A. It

concludes that the individuals who take well balanced diet are more productive and have more capacity to do work hard that helps to raise their earnings.

The impact of health is not only important at individual level but also it has significant role at aggregate level which is confirmed by the results of district analysis from both personal health indicators and regional health indicators. Our personal health indicator, proportion of dummy of all nutrition intakes suggests that the districts where the individuals have well nutritional diet are more productive and that promotes to increase the earning of districts. Food consumption has an immediate impact on productivity through energy availabilities and a possible long-run impact through health status.

The results of regional health indicator, the public provision of health services ( number of beds per earners and basic health unit per earners ) also suggest that better health facilities provided by government is also one of most important determinant for earnings. The finding implies that health polices which can reduce the health dispersion should be implemented to encourage more equitable and fair earnings distribution. Access to better health facilities can contribute positively to economic and social development for districts of Pakistan.

Our results are consistent with the study of ILO (2005) according to this “Poor diet on the job is costing countries around the world up to 20 per cent in lost productivity, either due to malnutrition that plagues some one billion people in developing countries or the excess weight and obesity afflicting an equal number mostly in industrialized economies”. The study of ILO (2005) also conclude that in developing world, a 1 percent kilocalorie (kcal) increase results in a 2.27 per cent increase in general labor productivity.



The results of other indicators education, age and dependency ratio have also significantly influenced the earnings at both individual and aggregate level.

The study concludes that health, measured by nutrition intake and regional health facilities are important elements of human capital. The unequal health distribution causes the earning inequality at both individual and aggregate level. A good nutrition is considered as an investment in human capital that helps to increase their earnings which leads to economic growth of a country. Similarly better health facilities provided to everyone not only lead the healthy society but it also play an important role to enhance the productivity of workers

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## Appendixes

### Appendix A.1

### Estimates of Health Input on Earnings/GDP.

Study	period	Region	Heath Indicators											
			Height	BMI	Weight	Calories	protein	Iron	Vitamin A	DES	PFI	Health Exp	HSI	
Strauss(1986)	1974-75	Rural Sierra Leone				↑								
Deolalikar (1988)	1975	South India		↑		↓								
Haddad and Bouis (1991)	1984-1985	Philippines	↑	↑		↑								
Aziz (1995)	1976-77 and 1977-78	India				↑f, ↓M								
Thomas and Strauss (1997)	1974-75	Urban Brazil	↑	↑		↑	↓							
Arcand(2001)	1960-1991	Sub-Saharan Africa									↑	↑		
Weinberger(2003)	1993 to 1994	India				↓		↑	↓					
Aguayo-Rico <i>et.al.</i> (2005)	1970, 1980 and 1990	Across country (42 countries)----												↑
Traore (2007)	1997-1988	Rural Mali		↓		↑								
Kedir(2008)	1994,1995,1997 and 2000	Ethiopia	↑	↑										
Ogundipe and Lawal (2011)	1985-2009	Nigeria											↑	

Where, DES: Dietary Energy Supply, PFI: Prevalence of Food Inadequacy, Health EXP: Health Expenditure, HSI: Health Service Index.



**Appendix A.2**

**Estimates of Health Output on Earnings/GDP.**

Study	Period	Region	Health Indicators									
			Life Expectancy	Adult Survival Rate	Predicted Mortality	Infant Mortality Rate	Crude Death Rate	AIDS	Malaria Risk	DALY	HEIGHT	
Preston (1975)	1930s, and 1960	57 across countries	↑									
Barro and Lee (1994)	1965-75		↑									
Cuddington and Hancock (1994)	1985-2010	Malawi						↓				
Bloom and Williamson (1998)	1965-90		↑						↔			
Gallup <i>et.al.</i> (1999)	1965–90											
Bloom <i>et.al.</i> (2000)	1965–90		↑									
Ranis <i>et.al.</i> (2000)	1960-1999	Developing Countries	↑									
René (2000)	1990- 1997	African countries						↓				
Arora (2001)		10 developed countries	↑	↑								
Bhargava <i>et.al.</i> (2001)	1965–90			↑								
Sachs (2003)	1995									↓		
Bloom <i>et.al.</i> (2004)	1960-1990		↑									
Scottand Jennifer (2006)	1960 to 1998							↓				
Acemoglu and Johnson (2006)	1940-1980	Western .....	↓		↑							
Malik (2006)	1975-2003	Across country analysis	↑			↑						
Carstensen and Gundlach (2006)		45 Across country								↓		
Weil (2007)	1960-2000	42Across country Analysis		↑								↑
Finlay (2007)	1960-2000		↑									
Audibert. <i>et. al</i> (2010)	1999-2004	159 countries									↑	
Bowser (2010)	1970-2000	United states	↑									
Strittmatter and Sunde (2011)	1820-2010	European countries				↓						



**Appendix B****Recommended Daily Allowances for Pakistani Population  
for Selected Major Nutrients**

Age Group	Energy(kg)		Protein (g)		Vitamin A (RE)	
	Male	Female	Male	Female	Male	Female
0-1	820	820	12	12	350	350
1-3	1250	1250	23	23	400	400
3-5	1510	1510	26	26	400	400
5-7	1710	1710	30	30	400	400
7-10	1880	1880	38	38	400	400
10-12	2170	1925	50	52	500	500
12-14	2360	2040	64	62	600	600
14-16	2620	2135	75	69	600	550
16-19	2820	2150	84	66	600	500
<b>Men moderately active Average 25 years</b>	2550	2550	.75/Kg	.75/Kg	750	750

**Source:** NWFP University of Peshawar, UNICEF Islamabad and Ministry of Planning and Division, Government of Pakistan (2001).