# Estimating and Forecasting health indicators in Pakistan

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## Abstract

*The present study is aimed to assess the fluctuations that have taken place in expenditures of health indicators in Pakistan during 1998-2006 and to forecast the public health expenditure in Pakistan, with testing the hypothesis that public expenditure on health has an increasing trend in Pakistan. Secondary data about major indicators of health expenditure are number of hospitals, number of dispensaries, number of basic health units and sub health centres, maternity and child health centres, rural health centres, number of total beds etc have been taken from economic survey of Pakistan 2006-2007.The study shows that on average the total public health expenditure on health sector in Pakistan during 1998-2006 was Rs 31354.4 (million). During 1998-2006 the average of number of hospitals is 900.5, dispensaries is 4607.1, basic health units and sub health centres is 5256.6, maternity and child health centres is 881.1, rural health centres is 542.8, TB centres is 279.2, total beds is 9723.7, and total population per bed is 1465.22.There is a continuous rising tendency observed in all variables. Based upon the study as there is an increasing tendency for the demand of such types of facilities, therefore the Government should take into consideration the increasing demand for these facilities. The government should focus on this issue and should increase the shares of budget allocated for this end.*

**Keywords:** Health, Health Indicators, Pakistan

## Introduction

Good health, as people know from their own experience, is a crucial part of well-being. But spending on health can also be justified on purely economic grounds. Improved health contributes to economic growth in four ways, it reduces production losses caused by illness of worker, it permits the use of natural resources that had been totally or nearly inaccessible because of diseases, it increases the enrollment of children in schools and makes them better able to learn, and it frees, for

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alternative uses, resources that would otherwise have to be spent on treating people with poor health and illness. The economic gains are relatively greater for poor people, who are typically most handicapped by ill health and who stand to gain most from the development of underutilized natural resources.

Although health service are only one factor in explaining past success, the importance of their role in the developing world is not in doubt. Public health measures eradicated smallpox and have been central to the reduction in deaths caused by vaccine preventable childhood diseases. Expanded improved clinical services have saved millions of lives from infections, diseases and injuries. But there are also major problems with health systems that, if not resolved, will hamper the progress in reducing the burden of premature mortality and disability and frustrate efforts to respond to new health challenges and emerging disease threats. Public money is spent on health interventions of low cost effectiveness such as surgery for most cancers, But at the same time critical and highly cost-effective intervention, such as the treatment of tuberculosis and sexually transmitted diseases (STDs), remain under funded. In some countries, a single teaching hospital can absorb 20 percent or more of the budget of the ministry of health, even though almost all cost -effective interventions are best delivered at lower level facilities.

Poor people lack access to basic health services and receive low-quality care. Government spending for health is disproportionate to the affluent in the form of free or below-cost care in the sophisticated public tertiary cares hospitals and subsidies to private and public insurance. Much of the money spent on health is wasted for example brand- name pharmaceuticals are purchased instead of generic drugs, health workers are badly deployed and supervised and hospital beds are underutilized. In some middle income developing countries health care expenditure are growing much faster than income. Increasing numbers of general physicians and specialists, the availability of new medical technologies and expanding health insurance linked to fee-for-service payments together generate a rapidly growing demand for costly tests, procedures, and treatments.

The most obvious sources of gain are fewer work days lost to illness, increased productivity, greater opportunities to obtain better-paying jobs, and longer working lives .To take a classic example, leprosy is a disease that effects people in the prime of life, with peak incidence rates among young adults, as many as 30 percent of those affected may be seriously deformed, and their working lives will be Health and nutrition problems effect a child's ability to learn. Nutrition deficiency

anemia reduces cognitive functions. Iodine deficiency causes irreversible mental retardation and vitamin A is the primary cause of blindness among children. Older children are subject to other kinds of diseases. Spending that reduces the incidence of diseases can produce big savings in treatment costs. For some diseases the expenditure pays for itself even when all the indirect benefits such as higher labour productivity and reduces pain and suffering are ignored.

The goal of reducing poverty provides a different but equally powerful case for health investments. The adverse effects of ill health have a direct impact on poor people, mainly because they are ill more often, but partly because their income depends exclusively on physical labour and they have no savings to fall back on. They may, therefore, find it impossible to recover from an illness with their human and financial capital intact. The health consequences of poverty are severe because the poor die younger and suffer more from disability. Spending on health is a productive investment as it can raise incomes, particularly among the poor and reduce the toll of human suffering from ill health. Good health, however, is a fundamental goal of development as well as a means of accelerating it. Targeting health as part of development efforts is an effective way to improve welfare in low-income countries. Ups and downs in public health expenditures remained a serious issue in the history of Pakistan, which adversely affected the health indicators in Pakistan. This study focuses on the forecasting of public health expenditures of Pakistan.

**Literature Review**

Stephen Stambough et al presented most election forecasting models rely on single indicators for such complex variables as the health of the economy, yet each employs different indicators for the identical concept. This article argues that single indicator models are inappropriately dependent upon past correlations, leading to inflated goodness of fit measures and unstable future forecasting success. We develop a multiple indicator model whose performance favorably compares with that of other models and provides additional forecasting stability by addressing the single indicator problem[1].

Robert, studied that in  the International Institute of Forecasters set up the *Journal of Forecasting*, followed in 1985 by the *International Journal of Forecasting*. The primary aim of their foundation, laid out in the first issues, was to take a "multi-disciplinary perspective"; all types of forecasting methods were of interest. Of particular importance were "papers that compare[d] different approaches to actual forecasting situations", the multiple hypotheses approach. This paper evaluates the

success of the two journals in meeting their objectives and in setting the research agenda in forecasting. The approach taken is through citation analysis and the identification of influential forecasting articles using both citations and expert analysis. The two approaches identified the same themes as particularly important, with the econometric advances of Engle and Granger outstanding. A content analysis of the journals was also undertaken, showing that the comparative approach to establishing improved forecasting methods through examining multiple hypotheses has been successfully adopted and is unusual when compared to other journals. Few articles examined the conditions under which one approach outperformed its competitors. By examining the highly cited articles in the forecasting journals compared to other journals in the business, economics, and management area, I conclude that the forecasting journals have covered all areas of forecasting research; however, many influential articles are published across a wide range of other journals. There was little cross-fertilisation between journals. There remain, however, topics, which have been widely neglected. In particular, organisational issues and the effects of forecast error, highlighted as important areas when the journals were founded, have been ignored. These two issues directly impact the gap between theoretical contributions and forecasting practice, a gap that remains unbridged. In short, the journals have made progress in meeting the objectives set by the founders, but there still remains much important research to be done.[2]

Shaista Alam et al presented study analyses the dynamics of fertility and its determinants in a country at very low levels of socio-economic development. It binds the relationship between fertility and its determinants with a particular focus on planned family planning within a multivariate cointegrated Granger-casual framework. The methodology employed uses various unit root test and Johansen's co integration test followed by vector error-correction model, and variance decompositions in order to capture both within-sample and out-of-sample Granger causality between fertility and its determinants. The findings appeared to be consistent with recent theoretical statements that maintain that although in the long-run the sufficient condition of fertility decline may be the result of a complex dynamic interaction with planned family planning and significant socio-economic structural changes. While in the short-run the necessary condition of fertility decline may not need that significant structural change, but may require a client-oriented affordable but persuasive 'planned' family-planning programme, coupled with few years of schooling, particularly female, firmly supported by the political and social elite at all levels of that society, and also adapted to the socio-cultural realities of the vast masses of the people of that country[3].

Patrick Zuber et al studied that Health statistics are at the centre of an increasing number of worldwide health controversies. Several factors are sharpening the tension between the supply and demand for high quality health information, and the health-related Millennium Development Goals (MDGs) provide a high-profile example. With thousands of indicators recommended but few measured well, the worldwide health community needs to focus its efforts on improving measurement of a small set of priority areas. Priority indicators should be selected on the basis of public-health significance and several dimensions of measurability. Health statistics can be divided into three types: crude, corrected, and predicted. Health statistics are necessary inputs to planning and strategic decision making, programme implementation, monitoring progress towards targets, and assessment of what works and what does not. Crude statistics that are biased have no role in any of these steps; corrected statistics are preferred. For strategic decision making, when corrected statistics are unavailable, predicted statistics can play an important part. For monitoring progress towards agreed targets and assessment of what works and what does not, however, predicted statistics should not be used. Perhaps the most effective method to decrease controversy over health statistics and to encourage better primary data collection and the development of better analytical methods is a strong commitment to provision of an explicit data audit trail. This initiative would make available the primary data, all post-data collection adjustments, models including covariates used for farcasting and forecasting, and necessary documentation to the public[4].

## Data and Methodology
This section consists on information about the nature of data, data sources, and variable of the study, analytical framework, and analytical techniques used for this research.

*Nature of Data*
We used secondary data taken from economic survey of Pakistan 2006 – 2007 to find out the tendency of health indicators. [5]

*Analytical Framework*
This technique assumes that whatever has been the pattern of variable in the past, will continue to hold in the future as well. The empirical data can thus be used to predict for the future .In the trend projection method the data is collected and fitted into some kind of trend. This trend is then extrapolated into the future for the forecast period .The trend could be linear or curvilinear or have any other complex shape. The simplest form

of time-series analysis is projecting the past trend by fitting a straight line, to the data either visually or more precisely, by regression model will take the form of

$Y = b_0 + b1X_t + ei^6$

Where Y is the value of the time series to be forecasted for the period t, so is the estimated value of the time series (the constant of the regression) in the base period (i.e. at time period t = 0) $bi$ is the absolute amount of growth per period, and $X_t$ is the time period in which the time series is to be forecasted.

*Nature and Source of Data*

In this study the time series secondary data ranging from 1998 2006 has been used. The data has been obtained from the following source:

i). Statistical    supplement    Pakistan economic survey (2006-2007)

ii). Annual Report, state bank of Pakistan.

*Variable of the Study*

The variable of the study included total public expenditure on health in Pakistan, number of hospitals, dispensaries, Basic health units and sub health centers, maternity and child health centers , rural health centers , TB centers , total beds population per bed.

*Specification of the Model*

To forecast public expenditure on health in Pakistan, the simple regression model has been estimated.

$TPEH = b_o + b1t + \mu i$

$NH = b_o + b1t + \mu i$

$ND = b_o + b1t + \mu_i$

$NBHU = b_o + b1t + \mu_i$

$NMC = b_o b1t + \mu_i$

$NRHC = b_o + b1t + \mu_i$

$NTB = b_o + b1t + \mu_i$

$NB = b_o + b1t + \mu i$

$NP = b_o + b1t + \mu i$

TPEH = Total public expenditure on health in Pakistan NH = Number of hospitals in Pakistan

ND = Number of dispensaries in Pakistan

NBHU = Number of basic health units and sub health centers in Pakistan.

NMC = Number of maternity and child health centers NRHC = Number of rural health centers

NTB = Number of TB centers
NB = Number of total beds in Pakistan
NB = Number of population per bed in Pakistan
"$\mu_i$" is a random term which absorbs the effect of those entire variables which are not included in the model.

The aforementioned model has been estimated using the method of least square, furthermore, to forecast the future level of total public expenditure on health and its components, the ordinary least square method is used. However, forecasting has been done on the basis of previous nine years (1998-2006) information.

To this end, the total public expenditure and its determinants have been regressed on time variable "t" Statistical package Microsoft has been used for deriving the results.

**Analysis of Data**
This section consists of furnish information about sample statistics, percentage changes and forecasting for health indicators in Pakistan

*Sample Statistics*
Table 1: Descriptive statistics of health indicators

| Statistics | TPEH | NH | ND | NBHU | NMC | NRHC | TB | NB | NP |
|---|---|---|---|---|---|---|---|---|---|
| Mean | 31354.4 | 900.5 | 4607.1 | 5256.6 | 881.1 | 542.8 | 279.2 | 9723.7 | 1465.22 |
| Median | 28814 | 906 | 4590 | 5290 | 879 | 550 | 285 | 98264 | 1456 |
| Maximum | 50000 | 924 | 4712 | 5336 | 907 | 560 | 289 | 102073 | 1508 |
| Minimum | 20807.67 | 872 | 4551 | 5155 | 852 | 514 | 263 | 90659 | 1427 |
| Standard deviation | 9733.054 | 19.72 | 50.24 | 72.03 | 25.27 | 15.11 | 11.02 | 4065.89 | 26.59 |
| Skewness | 0.84 | -0.51 | 1.058 | -0.36 | 0.0024 | -0.87 | -0.55 | -0.56 | 0.22 |
| Kurtosis | -0.03 | -1.52 | 1.34 | -1.83 | -2.35 | -0.07 | -1.61 | -1.06 | -1.01 |

Table 1 indicates that the average total public expenditure on health in Pakistan during 1998-2006 is 31354.4 the maximum and minimum total public expenditure on health in Pakistan is 50000 and 20807.61 respectively. The standard deviation of total public expenditure in Pakistan is 9733.054. The skewness of the total public expenditure on health in Pakistan during 1998-2006 is 0.84 showing that the distribution is positively skewed. The kurtosis of total public expenditure on health in Pakistan during 1998-2006 is -0.03 representing that the distribution is platy-kurtic.[7]

The average of number of hospitals in Pakistan during 1998-2006 is 900.5 the maximum and minimum number of hospitals in Pakistan is 924 and 872 respectively. The standard deviation of number

of hospitals in Pakistan is 19.72. The skewness of number of hospitals in Pakistan during 1998-2006 is -0.51 showing that the distribution is negative skewed. The kurtosis of number of hospitals in Pakistan during 1998-2006 is -1.52 representing that the distribution is platy-kurtic.

The average of number of dispensaries in Pakistan during 1998-2006 is 4607.1 the maximum and minimum number of dispensaries in Pakistan is 4712 and 4551 respectively. The standard deviation of number of dispensaries in Pakistan is 50.24. The skewness of number of dispensaries in Pakistan during 1998-2006 is 1.058 showing that the distribution is positive skewed. The kurtosis of number of hospitals in Pakistan during 1998-2006 is 1.34 representing that the distribution is platy-kurtic.

The average of number of NBHU in Pakistan during 1998-2006 is 5256.6 the maximum and minimum number of NBHU in Pakistan is 5336 and 5155 respectively. The standard deviation of number of NBHU in Pakistan is 72.03. The skewness of number of NBHU in Pakistan during 1998-2006 is -0.36 showing that the distribution is negative skewed the kurtosis of number of NBHU in Pakistan during 1998-2006 is -1.83 representing that the distribution is platy-kurtic.

The average of number of NMC in Pakistan during 1998-2006 is 881.11 the maximum and minimum number of NMC in Pakistan is 907 and 852 respectively. The standard deviation of number of NMC in Pakistan is 25.27.the skewness of number of NMC in Pakistan during 1998-2006 is 0.0024 showing that the distribution is Positive skewed. the kurtosis of number of NMC in  Pakistan during 1998-2006 is -2.35 representing that the distribution is  platy-kurtic.

The average of number of NRHC in Pakistan during 1998-2006 is 542.88 the maximum and minimum number of NRHC in Pakistan is 560 and 514 respectively. The standard deviation of number of NRHC in Pakistan is 15.11.the skewness of number of NRHC in Pakistan during 1998-2006 is -0.87 showing that the distribution is negative skewed the kurtosis of number of NRHC in  Pakistan during 1998-2006 is -0.07 representing that the distribution is  platy-kurtic.

The average of number of NTB in Pakistan during 1998-2006 is 279.22 the maximum and minimum number of NTB in Pakistan is 289 and 263 respectively. The standard deviation of number of NTB in Pakistan is 3.67.the skewness of number of NTB in Pakistan during 1998-2006 is -0.55 showing that the distribution is negative skewed the kurtosis of number of NTB in  Pakistan during 1998-2006 is -1.64 representing that the distribution is  platy-kurtic.

The average of number of NB in Pakistan during 1998-2006 is 97233.78 the maximum and minimum number of NB in Pakistan is

102073 and 90659 respectively. The standard deviation of number of NB in Pakistan is 4065.89.the skewness of number of NB in Pakistan during 1998-2006 is -0.56 showing that the distribution is negative skewed the kurtosis of number of NB in  Pakistan during 1998-2006 is -1.06 representing that the distribution is  platy-kurtic.

The average of number of NP in Pakistan during 1998-2006 is 1465.22 the maximum and minimum number of NP in Pakistan is 1508 and 1427 respectively. The standard deviation of number of NP in Pakistan is 26.59.the skewness of number of NP in Pakistan during 1998-2006 is 0.22 showing that the distribution is positive skewed the kurtosis of number of NP in  Pakistan during 1998-2006 is -1.01 representing that the distribution is  platy-kurtic.

*Percentage Changes in Health Indicators*
Table 2

| Years | TPHE | NH | ND | NBHU | NMC | NRHC | NTB | NB | NP |
|-------|------|------|-------|-------|-------|------|-------|------|-------|
| 1998 | &&. | &&. | && | && | &&. | &&. | && | &.. | && |
| 1999 | 6.10 | 0.80 | 0.70 | 0.58 | 0.35 | 3.11 | 0.38 | 1.67 | 0.55 |
| 2000 | 9.98 | -0.35 | 1.13 | -0.27 | 0.11 | 0.18 | 3.78 | 1.88 | 0.55 |
| 2001 | 4.62 | 3.35 | -0.21 | 1.14 | 2.65 | 1.88 | -0.72 | 4.29 | -1.99 |
| 2002 | 13.41 | -0.11 | -0.75 | 1.49 | -1.93 | 1.66 | 4.77 | 0.32 | 1.89 |
| 2003 | 13.85 | 0 | -0.78 | -0.33 | 5.22 | 0.36 | 1.40 | 0.42 | 1.71 |
| 2004 | 15.83 | 1.10 | 0.61 | 0.20 | -0.11 | 0 | 0 | 1.24 | 0.87 |
| 2005 | 5.26 | 0.32 | 1.09 | 0.62 | 0.11 | 0.72 | 0 | 1.58 | -0.60 |
| 2006 | 25 | 0.54 | 1.72 | 0.03 | -0.11 | 0.71 | -0.34 | 0.57 | 1.68 |

Table 2 indicates that 6.10% change took place in total public health expenditure during 1998-99.High increase 25% in total public health expenditure has been occurred during 2005-6. 0.80% change took place in number of hospitals during 1998-99.High increase 3.35% in number of hospitals has been occurred during 2000-2001.  0.07% change took place in number of dispensaries during 1998-99.High increase 1.72% in number of dispensaries has been occurred during 2005-2006.  0.58% change took place in NBHU during 1998-99.High increase 1.49% in NBHU has been occurred during 2001-2002. 0.35% change took place in NMC during 1998-99.High increase 5.22% in NMC has been occurred during 2002-2003. 3.11% change took place in NRHC during 1998-99.High increase 3.11% in NRHC has been occurred during 1998-1999. 0.38% change took place in NTB during 1998-99.High increase 4.77% in NTB has been occurred during 2001-2002. 1.67% change took place in NB during 1998-99.High increase 4.29% in NB has been occurred during 2000-2001. 0.55% change took place in NP during 1998-99.High increase 1.89% in NP has been occurred during 2001-2002.

*Trends and Forecasting Total Public Expenditure on Health in Pakistan*
The trend in total public health expenditure in Pakistan has been depicted in figure 1 in which the time variable has been measured on x-axis while total public expenditure on health on y-axis.

The co-efficient of t possessing positive sign indicating an increasing trend in total public expenditure during time period (1998-2006). Further the highest value of co-efficient of determination (i.e 0.92) that fit is good.



Figure 1: Trends in total public expenditure on Health in Pakistan

TPEH=31354+3422.9t

$R^2 = 0.9276$
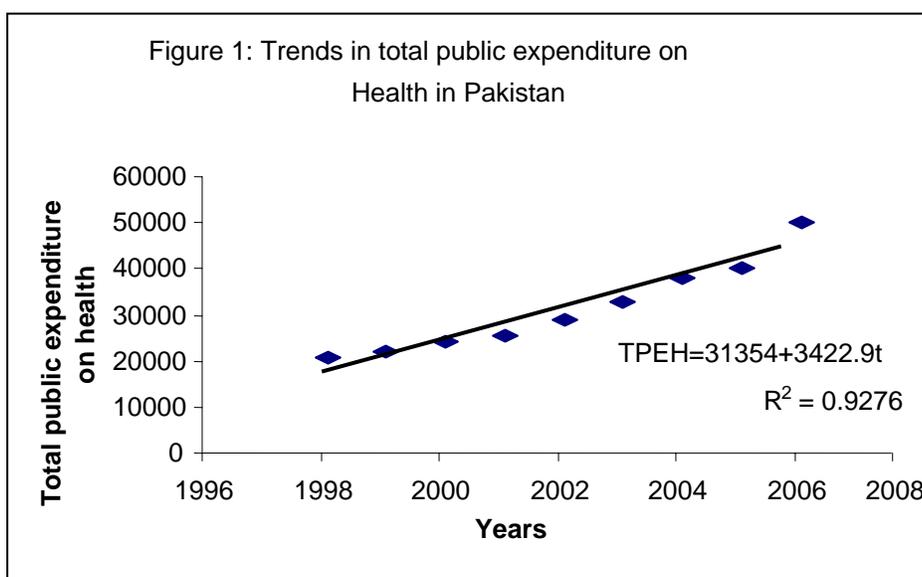
Table 3

| Year | Forecasted Total public expenditure on health TPEH = 31354+3422.9t |
|------|-------------------------------------------------------------------|
| 2007 | 48468.5 |
| 2008 | 51891.4 |
| 2009 | 55314.3 |
| 2010 | 58737.2 |
| 2011 | 62160.1 |
| 2012 | 65583 |
| 2013 | 69005.9 |
| 2014 | 72428.8 |
| 2015 | 75851.7 |

The statistic given in the table 3 indicates that total public expenditure on health   in 2010, 2011,2012,2013,2014 and 2015 will 58737.2, 62160.1, 65583, 69005.6, 72428.8, and 75851.7 respectively.

*Trends and Forecasting Number of Hospitals in Pakistan*
The trend in number of hospitals in Pakistan has been depicted in figure 2 in which the time variable has been measured on x-axis while number of hospitals on y-axis.
        The  co-efficient  of  t  possessing  positive  sign  indicating  an increasing trend in number of hospitals during time period (1998-2006). Further the highest value of co-efficient of determination (i.e 0.88) that fit is good.

Figure 2: Trends in number of hospitals in Pakistan

$NH=900.56+6.7833t$
$R^2 = 0.8871$
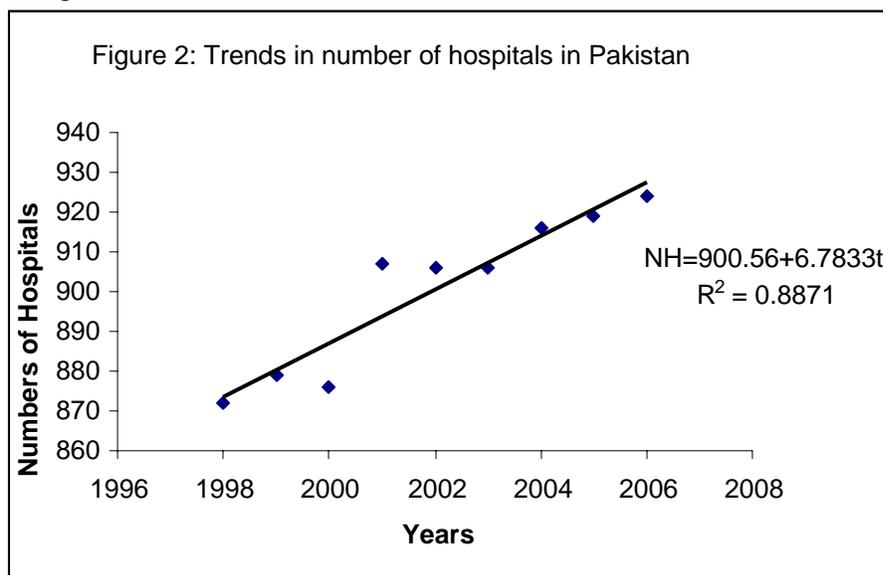
Table 4

| Year | Forecasted Number of hospitals in Pakistan $NH = 900.56+6.7833t$ |
|------|------------------------------------------------------------------|
| 2007 | 935 |
| 2008 | 941 |
| 2009 | 948 |
| 2010 | 955 |
| 2011 | 962 |
| 2012 | 968 |

| 2013 | 975 |
|------|-----|
| 2014 | 982 |
| 2015 | 989 |

The statistic given in the table 4 indicates that total number of hospitals in 2010,2011,2012,2013,2014 and 2015 will 955,962,968,975,982, and 989 respectively.

*Trends and Forecasting Number of Dispensaries in Pakistan*
The trend in number of dispensaries in Pakistan has been depicted in figure 3 in which the time variable has been measured on x-axis while number of dispensaries on y-axis.
        The co-efficient of t possessing positive sign indicating an increasing trend in number of dispensaries during time period (1998-2006). Further the highest value of co-efficient of determination (i.e 0.31) that fit is not good.



Figure 3: Trends in number of dispensaries in Pakistan

$ND = 4607.1+10.233t$

$R^2 = 0.3112$
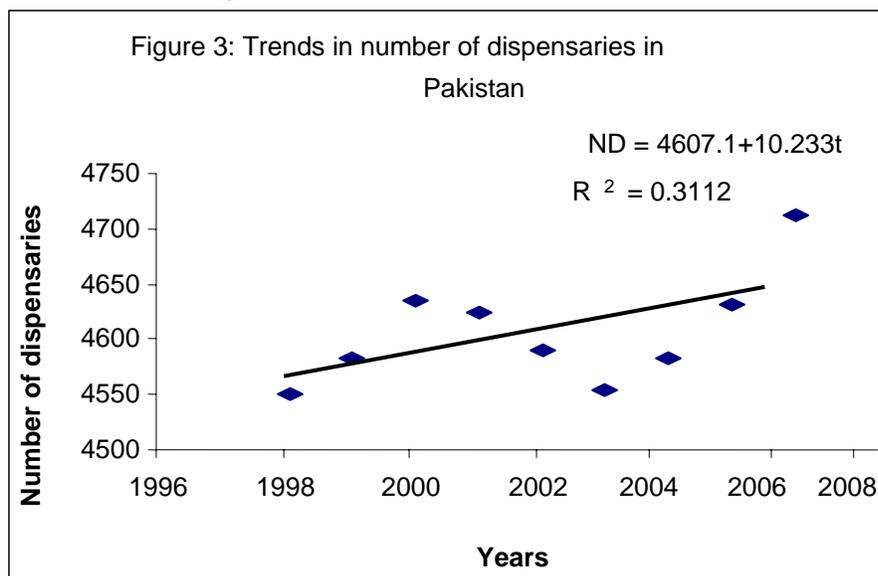
Table 5

| Year | Forecasted Number of dispensaries in Pakistan $ND = 4607.1+10.233t$ |
|------|------------------------------------------------|
| 2007 | 4658 |
| 2008 | 4668 |
| 2009 | 4679 |

| 2010 | 4689 |
|------|------|
| 2011 | 4699 |
| 2012 | 4709 |
| 2013 | 4720 |
| 2014 | 4730 |
| 2015 | 4740 |

The statistic given in the table 5 indicates that total number of dispensaries in 2010, 2011,2012,2013,2014 and 2015 will 4689, 4699,4709,4720,4730, and 4740 respectively.

*Trends and Forecasting Number of Bhus Sub Health Centers in Pakistan*
The trend in number of BHUs sub health centers in Pakistan has been depicted in figure 4.4 in which the time variable has been measured on x-axis while the number of BHUs sub health centers on y-axis.

The co-efficient of t possessing positive sign indicating an increasing trend in number of BHUs during time period (1998-2006). Further the highest value of co-efficient of determination (i.e 0.89) that fit is good.

Figure 4 Trends in number of BHUs sub health Centers

$$NBHU = 5256.7 + 24.85t$$
$$R^2 = 0.8926$$
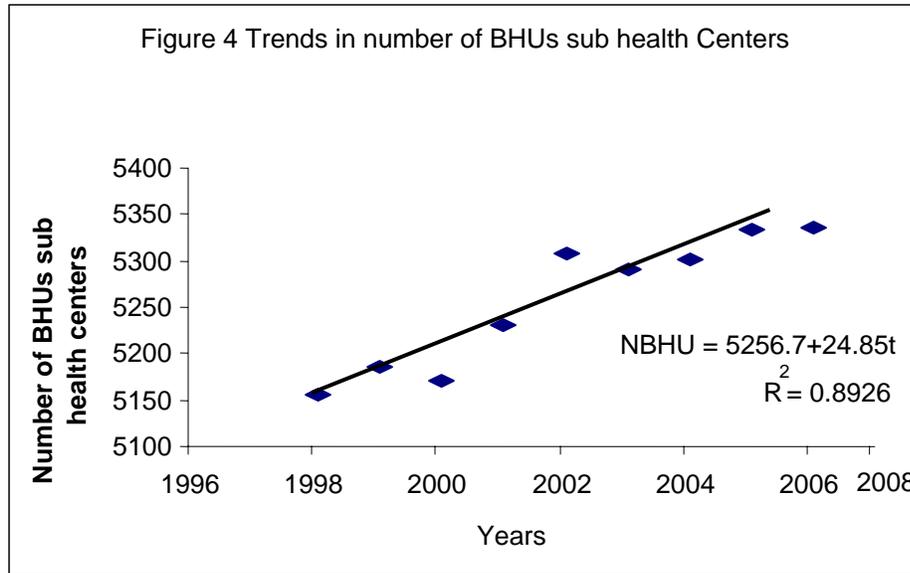
Table 6

| Year | Forecasted Number of basic health units and sub health centers in Pakistan NBHU=5256.7+24.85t |
|------|-----------------------------------------------------------------------------------------------|
| 2007 | 5381 |
| 2008 | 5406 |
| 2009 | 5430 |
| 2010 | 5456 |
| 2011 | 5480 |
| 2012 | 5505 |
| 2013 | 5530 |
| 2014 | 5555 |
| 2015 | 5580 |

The statistic given in Figure 4 indicates that number of BHUs sub health centers in 2010, 2011,2012,2013,2014 and 2015 will 5456, 5480, 5505, 5530, 5555, and 5580 respectively.[8]

*Trend and Forecasting Number of Maternity and Child Health Centers in Pakistan*
The trend in number of maternity and child health centers in Pakistan has been depicted in figure 5 in which, the time variable has been measured on x-axis while number of maternity and child health centers on y-axis.
The co-efficient of t possessing positive sign indicating an increasing trend in number of maternity and child health centers during time period (1998-2006). Further the highest value of co-efficient of determination (i.e 0.81) that fit is good.

Figure 5: Tends in number of maternity and child health centers in Pakistan

NMC = 881.11+8.33333t

$R^2$ = 0.8156
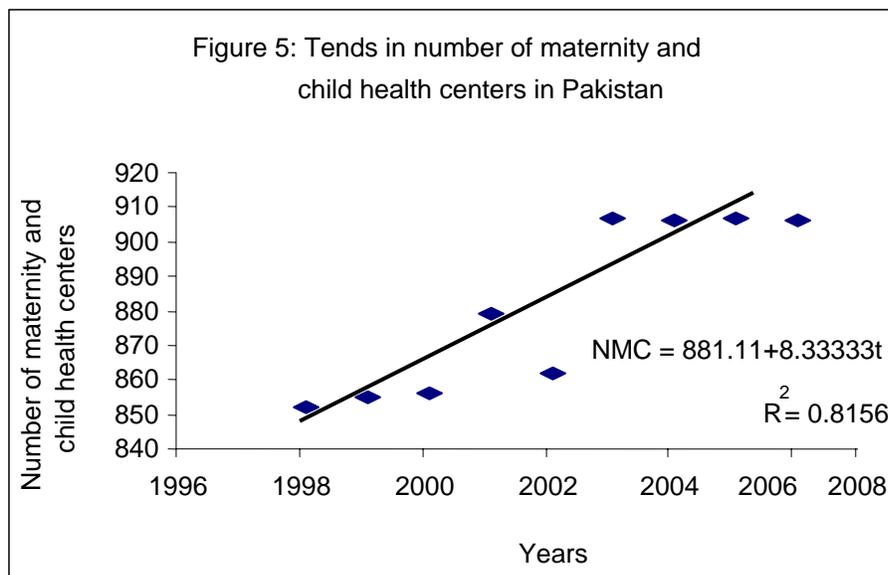
Table 7

| Year | Forecasted  Number of maternity and  child health centers in Pakistan NMC = 881.11+8.3333t |
|------|--------------------------------------------------------------------------|
| 2007 | 923 |
| 2008 | 931 |
| 2009 | 939 |
| 2010 | 947 |
| 2011 | 956 |
| 2012 | 964 |
| 2013 | 973 |
| 2014 | 981 |
| 2015 | 989 |

The statistic given in table 7 indicates that number of maternity and child health centers in 2010,2011,2012,2013,2014 and 2015 will 947,956,964,973,981,,and 989 respectively.

*Trends and Forecasting Number of Rural Health Center in Pakistan*
The trend in number of rural health centers in Pakistan has been depicted in figure 6 in which the time variable has been measured on x-axis while

number of rural health centers on y-axis.

The co-efficient of t possessing positive sign indicating an increasing trend in number of rural health centers during time period (1998-2006). Further the highest value of co-efficient of determination (i.e. 0.905) that fit is good.



Figure 6: Trends in number of rural health centers in Pakistan

$$NRHC = 542.89+5.25t$$
$$R^2 = 0.9052$$
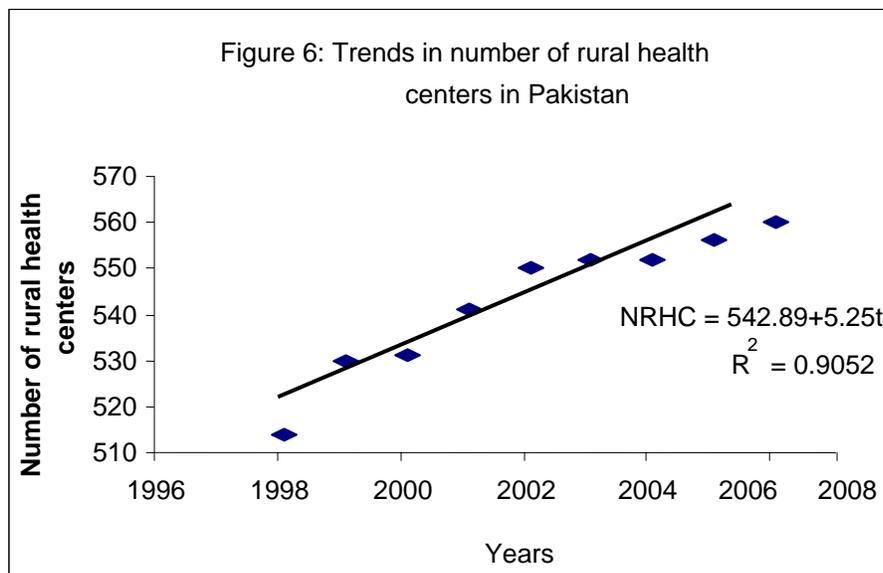
Table 8

| Year | Forecasted Number of Rural health centers in Pakistan NRHC = 542.89+5.25t |
|------|---------------------------------------------------------------------------|
| 2007 | 569 |
| 2008 | 574 |
| 2009 | 579 |
| 2010 | 585 |
| 2011 | 590 |
| 2012 | 595 |
| 2013 | 601 |
| 2014 | 606 |
| 2015 | 611 |

The statistic given in table 8 indicates that number of rural  health centers in 2010,2011,2012,2013,2014 and 2015 will 585,590,595,601,606,and 611 respectively.

*Trends and Forecasting Number of T.B Center in Pakistan*
The trend in number of T.B centers in Pakistan has been depicted in

figure 6 in which, the time variable has been measured on x-axis while number of T.B centers on y-axis.

The co-efficient of t possessing positive sign indicating an increasing trend in number of T.B centers during time period (1998-2006). Further the highest value of co-efficient of determination (i.e 0.845) that fit is good.



Figure 7: Trends in number of TB centers in Pakistan

$NTB = 279.22+3.7t$

$R^2 = 0.8454$
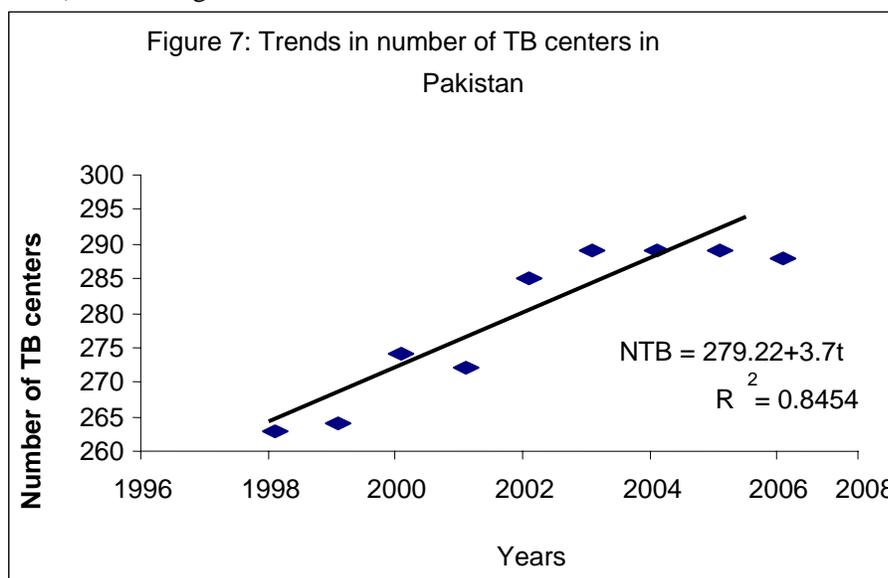
Table 9

| Year | Forecasted Number of TB centers in Pakistan $NTB = 279.22+3.7t$ |
|------|------------------------------------------------------------------|
| 2007 | 298 |
| 2008 | 301 |
| 2009 | 305 |
| 2010 | 309 |
| 2011 | 313 |
| 2012 | 316 |
| 2013 | 320 |
| 2014 | 324 |
| 2015 | 327 |

The statistic given in figure 7 indicates that number of T.B centers in

2010, 2011,2012,2013,2014 and 2015 will 309,313,316,320,324 and 327 respectively.

*Trends and Forecasting Number of Total Beds in Pakistan*
The trend in number of Total beds in Pakistan has been depicted in figure 8 in which the time variable has been measured on x-axis while number of Total beds on y-axis.

The co-efficient of t possessing positive sign indicating an increasing trend in number of Total beds during time period (1998-2006). Further the highest value of co-efficient of determination (i.e 0.93) that fit is good.



Figure 8: Trends in number of total beds in Pakistan

$NB = 97234+1439.1t$

$R^2 = 0.9396$
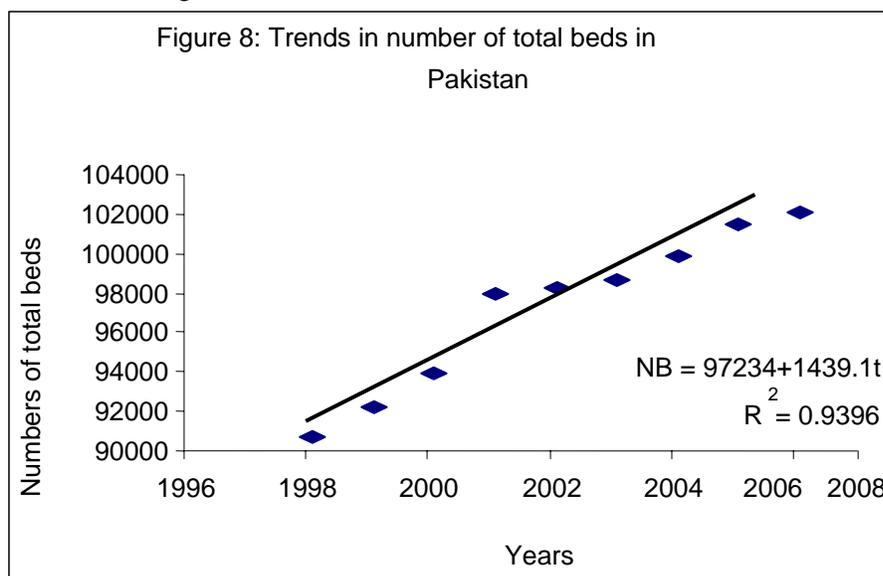
Table 10

| Year | Forecasted Number of Total beds in Pakistan $NB = 97234+1439.1t$ |
|------|------------------------------------------------------------------|
| 2007 | 104430 |
| 2008 | 105869 |
| 2009 | 107308 |
| 2010 | 108747 |
| 2011 | 110186 |
| 2012 | 111625 |
| 2013 | 113064 |

| 2014 | 114503 |
|------|--------|
| 2015 | 115942 |

The statistic given in tabke 10 indicates that number of total beds in 2010, 2011,2012,2013,2014 and 2015 will 108747, 110186, 111625, 113064, 114503, and 115942 respectively.

*Trends and Forecasting Number of Population per Bed in Pakistan*
The trend in number of Population per bed in Pakistan has been depicted in figure 9 in which the time variable has been measured on x-axis while number of Population per beds on y-axis.
         The co-efficient of t possessing positive sign indicating an increasing trend in number of Population per beds during time period (1998-2006). Further the highest value of co-efficient of determination (i.e 0.73) that fit is good.



Figure 9: Trends in number of population per bed in Pakistan

$NP = 1465.2 + 8.35t$

$R^2 = 0.7394$
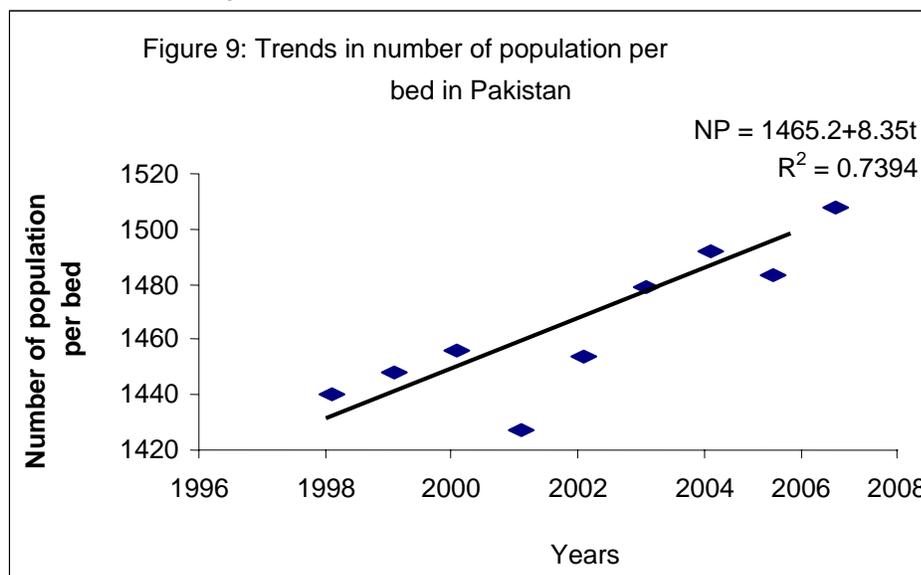
Table 11

| Year | Forecasted Number of population per bed in Pakistan $NP = 1465.2+8.35t$ |
|------|------|
| 2007 | 1507 |
| 2008 | 1515 |
| 2009 | 1524 |
| 2010 | 1532 |

| 2011 | 1540 |
|------|------|
| 2012 | 1549 |
| 2013 | 1557 |
| 2014 | 1565 |
| 2015 | 1574 |

The statistic given in 4.11 indicates that number of population per beds in 2010, 2011,2012,2013,2014 and 2015 will 1532,1540,1549,1557, 1565 and 1574 respectively.

## Conclusion and Recommendation
*Major finding, Conclusion and Policy Recommendation*
Better health, as people know from their own experiences, is a crucial part of well-being. But spending on health can also be justified on purely economic grounds.

Improved health contributes to economic growth in four ways, it reduces production losses caused by illness of workers, it permits the uses of natural recourses that had been totally or nearly inaccessible because of diseases, it increases enrolment of children in schools and makes them better able to learn and it frees, for alternative uses, recourses that would otherwise have to be spent on treating people with poor health and illness. The present study is aimed to assess the fluctuation that has taken place in health indicators in Pakistan during the period (1998-2006) to and to forecast the further public health expenditure in the economy.

## Major Findings and Conclusion
The results and decisions show the following major findings.
- The study shows that the average total public expenditure on health in Pakistan during 1998-2006 is 31354.4. The average of number of hospitals in Pakistan during 1998-2006 is 900.5. The average of number of dispensaries in Pakistan during 1998-2006 is 4607.1
- The average of number of basic health units and sub health centres in Pakistan during 1998-2006 is 5256.6. The average of number of maternity and child health centre in Pakistan during 1998-2006 is 881.1The average of number of rural health centres in Pakistan during 1998-2006 is 542.8.
- The average of number of TB centres in Pakistan during 1998-2006 is 279.2. The average of number of total bed in Pakistan during 1998-2006 is 9723.7. The average of number of population per bed in Pakistan during 1998-2006 is 1465.22

- High increase i.e. 25% in total public health expenditure has been occurred during 2005-2006. High increase 3.35% in number of hospitals has been occurred during 2000-2001. High increase 1.72% in number of dispensaries has been occurred during 2005-2006.

- High increase 1.49% in number of basic health unit and sub health centres has been occurred during 2001-2002. High increase 5.22% in number of maternity and child health centre has been occurred during 2002-2003.High increase 3.11% in number of rural health centres has been occurred 1998-1999.

- High increase 4.77% in number of TB centres has been occurred during 2001-2002. High increase 4.29% in number of total beds   has been occurred during 2000-2001. High increase 1.89% in number of population pre bed has been occurred during 2000-2001.

- The trend of total public health expenditures in Pakistan has also been analyzed and the study indicating an increasing trend in total public health expenditures during time period 1998-2006. Further the highest value of co-efficient of determination shows (i.e. 0.88) that the fit is good. The trends in number of hospitals in Pakistan possessing positive sign indicating an increasing trend in number of hospitals during time period 1998-2006.The trends in number of dispensaries in Pakistan possessing positive sign indicating an increasing trend in number of dispensaries during time period 1998-2006.

- The trends in number of basic health units and sub health centres in Pakistan possessing positive sign indicating an increasing trend in number of basic health units and sub health centres during time period 1998-2006.The trends in number of maternity and child health centres in Pakistan possessing positive sign indicating an increasing trend in number of  maternity and child  health centres during time period 1998-2006.

- The trends in number of rural health centres in Pakistan possessing positive sign indicating an increasing trend in number of  rural health centres  during time period 1998-2006. The trends in number of  TB centres in Pakistan possessing positive sign indicating an increasing trend in number of  TB centres  during time period 1998-2006.

- The trends in number of total beds in Pakistan possessing positive sign indicating an increasing trend in number of total beds during time period 1998-2006.

- The trends in number of population per bed in Pakistan possessing positive sign indicating an increasing trend in number of population per bed during time period 1998-2006.

*Policy Recommendation*

The study recommends that major indicators of public health expenditure in Pakistan are number of hospitals, number of dispensaries, number of basic health units and sub health centres, number of maternity and child health centres, number of rural health centres, number of TB centres, number of total beds, number of population per bed.

The study also recommends an increasing trend in total public health expenditure, number of hospitals, dispensaries, basic health units and sub health centres, maternity and child health centres, rural health centres, TB centres, total beds, population per bed in Pakistan is showing positive growth. So the government or the concerned authority should consider this phenomena.

Lastly the study suggest that as in each and every health indicators there is an increasing demand, so government should also consider it for policy implications.

## End Note

[1]  Stephen J. Stambough, Gregory R. Thorson, "Toward stability in presidential forecasting: the development of a multiple indicator model" *International Journal of Forecasting*, Volume 15, Number 2 (1999): 143_152.

[2] Robert Fildes, "The forecasting journals and their contribution to forecasting research: Citation analysis and expert opinion", *International Journal of Forecasting*, Volume 22 Number 3 (2006): 415-432.

[3] Shaista Alam, Mohsin H. Ahmed, Muhammad S. Butt, "The dynamics of fertility, family planning and female education in Pakistan", *Journal of Asian Economics*, Volume 14 Number 3 (2003) : 447-463

[4] Patrick L.F. Zubera, Laure Dumolarda, Meredith Shireyb, Ivone Rizzoc and John Marshalld, "Forecasting demand for Hib-containing vaccine in the world's poorest countries: A 4-year prospective experience", Vaccine, Volume 27, Issue 3 (2009), Pages 410-415.

[5]  The data has been taken from Pakistan Economic Survey 2006-07. available at: http://www.accountancy.com.pk/docs/economic-survey-of-pakistan-2006-07.pdf (retrieved on 23 June, 2010)

[6] The projection of the data has been made by using simple linear regression model. This is the most commonly used technique.

[7] Along with simple linear regression model, descriptive statistics have been used to know the average behavior of the given data set.

[8] The data from statistical supplement of Pakistan Economic survey 2006-07 has been taken from all tables and then projection has been made on the basis of given data set.