Title page

Title of the paper: AN ALTERNATIVE EMPIRICAL FORMULATION OF EXPLAINING THE RELATIONSHIP BETWEEN MANAGEMENT PRACTICES AND FIRMS' PERFORMANCE: USING DATA OF NEPALESE HOSPITALS

A running head: hospital performance using management approach

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Abstract:

Recent research in economics of management has suggested a new way of measuring the performance of hospitals that defines and measures the management practices. The literature confirms that management practices determine economic performance of firms; however, literature ignores inherently unobservable concepts when formulating a model. This study considers management as latent variable anda model is constructed such that latent variable jointly explains management practices and performance of the hospitals. The study found that management practices determine the hospital performance in terms of bed occupancy rate and IP-practice scores. The reformulated model provides better information for policy makers to improve management practices. Among the different management practices, regular performance monitoring of the employees and target setting are found to greatly contribute to the performance indicators. In conclusion, use of management as the latent variable leads to the better understanding of the role of management practices to improve the hospital performance.

1. Introduction

In recent literature, there has been considerable discussion on importance of management practices in improving performance of hospitals. For example, Pettersen and Nyland (2006), McConnell, Lindrooth et al. (2015), Hartwig, Pashman et al. (2008), Douglas and Judge (2001) and Besstremyannaya (2011) have argued for adopting successful management practices to improve hospital performance and quality of health care. Nair (2006) described the positive association between management practices and performance of firms by utilizing a comprehensive meta-analysis. Measuring and identifying management practices, however, is not straightforward, and it is important to develop a robust method of distinguishing among various discrete practice patterns. In recent years, an interview based survey methodology has been developed to define and measure systematically the management practices, and the method has been successfully implemented across large firms, hospitals, educational institutions, etc. in both developed and developing countries, for example, Bloom and Reenen (2007), Bloom, Propper et al. (2010), Bloom, Sadun et al. (2012), Bloom, Eifert et al. (2013), and McConnell, Lindrooth et al. (2015). This approach recognized four key areas of management: performance monitoring, target, operations and people management. This methodology identified 18 key management practices and scored each from 1 (worst possible practice) to 5 (the best practice). The details of the methodology can be found in Bloom, Dorgan et al. (2005), Bloom, Sadun et al. (2014) and McConnell, Lindrooth et al. (2015). A number of evidence has indicated that management practices at the aggregate level can be useful in understanding the variability of productivity across hospitals (Bloom and Van Reenen 2006, Bloom, Propper et al. 2009, McConnell, Hoffman et al. 2009, Delfgaauw, dur et al. 2011, Bloom, Sadun et al. 2014). It is also of interest to examine how the four key areas of management practices are associated with hospital

performance and what relative weights can be assigned to each type of management practice for explaining hospital performance. Nair (2006) attempted to identify the relationship between dimensions of management practices and performance of firms through a comprehensive review of published studies. Some of the studies produced conflicting results and methodologies adopted to link management practices with performance were not robust Nair (2006).

2. Previous empirical work and the estimation problems

The benchmark methodology to measure and define management practices provides some information on how and why management practices vary across countries, firms and industries. Most of the studies (Bloom, Dorgan et al. 2005, Bloom and Van Reenen 2006, Bloom, Propper et al. 2009, Delfgaauw, dur et al. 2011) used aggregate or single index of management practice to estimate its impact on organizational performance. Simple OLS method was used to estimate the causal relationship between management practices and firm performance assuming that all the correlated heterogeneity is captured by the control variables (Bloom and Reenen 2007). Firm production function has also been used to estimate the impact of different management practices on production. The fundamental problem of trying to measure the marginal productivity of "management", however, is that management is inherently a latent concept and not directly observable through data collection on inputs and outputs. To address this problem, management scientists have developed proxy measures based on an interview with managers. Many factors affect organizational performance including unobserved variables like hospital managers' unique characteristics, the degree of social awareness of local people and political forces at work, and many of these also affect the management practices adopted. Gobillon and Milcent (2013) have described a number of hospitals unobserved factors, which are related to capacity, efficiency and management. Since these variables are difficult to measure and often uses indirect approaches to quantify them, this gives rise to the problem of endogeniety. Similarly, the scoring system for valuing management practices is highly dependent on the phrasing of the survey which again may lead to endogeneity problem. Incorporating the management practices as explanatory variables in regression equation ignores the fact that latent variables contain measurement error, and thus can lead to inconsistent estimates (Ashok, Dillon et al. 2002). In addition, average management score doesn't provide sufficient information to policy makers for improving the management system. For example, among the four key areas of management practice, the empirical models often fail to indicate which one is more effective in improving the overall management score and performance of the production unit. This paper intends to address these limitations by reformulating the causal relationship between management practices and hospital performance. The paper adopts the Structural Equation Modelling (SEM) approach to develop and estimate the relationship. Details of the model and the estimation technique are provided in next section.

3. Data

For this analysis, a survey of 100 randomly selected hospitals (public and private) was carried out in Nepal in 2014. To measure the management practices, the survey has used the methods, tools and process developed by Bloom and Reenen (2007) and Bloom et al. (2009). All procedures suggested by Bloom and Reenen (2007) were adopted to ensure the accuracy of data collection. Details of the survey have been reported in Adhikari and Sapkota (2015).

After the completion of the management-focused survey, a general hospital survey was conducted to collect data on basic hospital characteristics and outputs so that hospital performance indicators can be derived. The performance indicators of the hospitals include Infection Prevention (IP) practice score and bed occupancy rate. Bed occupancy rate is a widely used key indicator to measure the performance of hospitals as suggested by Waheb, Kamel et al. (1997). Bed-occupancy indicates the capital and recurrent resources employed in the hospital. Infection Prevention (IP)-practice score was used to represent the quality of services produced. It is based on national standard for quality improvement developed by the Ministry of Health and Population of Nepal (MoHP 2013). Process quality of service provision is a major concern in hospital service delivery in developing countries (Lindelöw and Wagstaff 2003). Improving the process quality of hospital services for Essential Health Care Services (EHCS) is one of the important policy objectives envisioned by the national policy and strategies (MoHP 2009, Government of Nepal 2013). Most of the service-related information and performance indicators were collected from the Health Management Information System (HMIS). Structural Quality score was developed by observing the availability of minimum equipment as outlined by national quality standard for health institutions (MoHP 2013).

4. Empirical formulation of the model

To estimate the effect of management practices on hospital performance, this paper has adopted the Structural Equation Modelling (SEM) technique. In this approach, management is assumed to be a latent character manifested through a series of management practices. Figure 1 provides the basic outline of the reformulation we have used. This idea of reformulation has been derived from a number of previous studies, such as, Ben-Akiva, Walker et al. (1999); Bolduc, Ben-Akiva et al. (2005); Ashok, Dillon et al. (2002); Daly, Hess et al. (2012) and Hess and Beharry-Borg (2012). The proposed Structural Equation Model includes two components: Multiple Indicator Multiple Cause (MIMIC) type factor analytic model and structural regression model. In the first part, management is estimated from a range of management practices using confirmatory factor analysis, which is also called *measurement model*. The latent character, the management practice, is then explained based on the structural relationship with other covariates. This sub-model resembles multiple indicators multiple causes (MIMIC) type factor analysis.

In the second part, management is included in the structural model as an independent variable along with a range of other covariates explaining hospital performance. When this system is estimated simultaneously, it explicitly describes how the underlying latent structure "management" explains the observed management practices, and how the management practices, in turn, affects the performance of hospitals. Because the latent variables may contain measurement error (Ashok, Dillon et al. 2002), the probability of observing hospital performance and management practices must be integrated over the distribution of latent variable (management) in order to obtain consistent estimates.

Figure 1

4.1 Structural Equations

Let Y be the performance measure of hospital and it is considered a function of a set of variables like management (M), a vector of hospital specific characteristics (H) and a vector of community characteristics (X). Formally, Y can be expressed as

$$Y = f(M, H, X) + \varepsilon \qquad \text{Eq. 1}$$

Where ε is the random component which is assumed to be independently and identically distributed In the empirical model, we consider two performance measures – Bed Occupancy Rate and Infection Prevention (IP) practice score.

Bloom, Sadun et al. (2014) show that "management" is positively associated with hospital performance in both developed and developing countries as well as in various industries within an economy. In order to identify the effect of management practices, the model should incorporate many control characteristics in addition to "management" that are likely to be correlated with both management and performance indicators. The control characteristics include hospital specific characteristics (H) such as public or private ownership, size of the hospital in terms of number of beds etc. Various community characteristics (X) may affect bed occupancy rate (such as local burden of disease) and should also be incorporated in the model. Prevalence of infectious diseases is a common indicator used to measure disease burden in developing countries. The incidence of diarrhoeal disease has also been included as a control because of the importance of the disease among vulnerable population groups. To account for unobserved geographic differences, regional dummies were also included. Bed occupancy rate of any hospital depends upon many other unobserved hospital-specific and community-specific characteristics. In order to address this, we have included bed occupancy rate of previous fiscal year as a control variable. It is assumed that inclusion of all these control variables will be able to take into account the unobserved characteristics that can confound the association between management and performance. The IP-practice score, which

reflects the clinical quality of care provided by the hospital, should correct for the tendency of the population to use better quality facilities at a higher rate than others. To simplify the econometric estimation, we assume that the performance indicators, which are defined as continuous variables, are linearly related with the set of variables(M, H, X). Therefore, equation 1 can be rewritten as

$$Y_g = M_g\alpha_g + H_g\beta_g + X_g\gamma_g + \varepsilon_g \qquad \text{Eq. 2}$$

Where the subscript g = 1, 2 indicates two linear regression equations each for bed occupancy rate and IP-Practice score. In the above equation other characteristics are assumed to be exogenous except the management variable (M).

As mentioned above, we consider management (M) as a latent character of the hospital and it is manifested by four primary management practice indicators: operational management, monitoring, target setting and people management. The variable (M) is assumed to be a function of Hospital density (D) and characteristics of manager and hospital (W). Some noise control (C) variables were also included in the function. The error term υ is the random component which is assumed to be independently and identically distributed.

$$M = f(D, W, C) + \upsilon_j \qquad \text{Eq. 3}$$

In the literature, management is considered a function of various personnel, hospital and community characteristics. Hospital density (D), a proxy indicator of competition, may encourage the adoption of improved management practices, especially for private entities (Bloom, Propper et al. 2010). Manager's characteristics (W) such as clinical background and total tenure in the current position are also important in explaining adoption of effective management practices (Bloom, Sadun et al. 2014). Hospital specific characteristics such as private ownership, structural quality score of the hospital and size of the hospital in terms of number of beds may also be important (Bloom, Propper et al. 2010). Finally, reliability score of the interview and duration of the interview were also included as general control variables (C). The equation can be expressed in a linear form as shown below (Bloom, Sadun et al. 2014).

$$M = D\delta + W\eta + C\omega + \upsilon \qquad \text{Eq. 4}$$

4.2 Measurement Equations

The final component of the model in figure 1 is the measurement equations for management practices. Management (M) is considered a latent construct, and it is estimated from four dimensions of management: operational management, monitoring performance, target setting and people management. The measurement model can be written as.

$$I_s = Ma_s + \psi_s \qquad \text{Eq. 5}$$

Here I_s gives s^{th} observed management practice. a_s is a $s \times 1$ coefficient vector, which provides the measure of how well the latent variable (management) explains the value of observed management practices I_s. To avoid the estimation of unnecessary parameters, the mean of each management practice was subtracted from the original indicator variables to redefine all indicators to be centred around zero, obviating the need for estimating the constant term. Therefore, all the variations in four management practices can be attributed to latent character "management" and error term.

4.3 Model Estimation

The objective of the study is to estimate various coefficients ($a, \alpha, \beta, \gamma, \omega, \eta$ and δ) and parameters related to the distribution of random components ε, υ and ψ. It is reasonable to assume that the random components have mean zero (or standard mean value), and therefore, only the covariance matrices of random components will be estimated. The error term ε is assumed to have variance of f^2 and ψ is assumed to follow multivariate normal distribution with mean zero and diagonal covariance matrix $\sum$ having σ_s^2 in the diagonal. The third error term, υ is also assumed to follow the normal distribution pattern with zero mean and unit variance for identification reason (Bolduc, Ben-Akiva et al. 2005, Daly, Hess et al. 2012).

In order to estimate the model, we adopted maximum likelihood estimation methodology. For each hospital, we have considered two performance measures: Bed Occupancy Rate and IP practice score. The probability of observing the performance $Y = (Y_1, Y_2)$ conditional on M is given by

$$P(Y_g|M) = \prod_g \frac{1}{f_g^2} \phi\left(\frac{Y_g - M_g\alpha_g - H_g\beta_g - X_g\gamma_g}{f_g^2}\right) \qquad \text{Eq. 6}$$

Where, ϕ is a standard normal probability function. Since the management is an unobserved character, the conditional probability is integrated over the distribution of management (M) to get the unconditional probability.

$$P(Y_g) = \int_m \prod_g \frac{1}{f_g^2} \phi\left(\frac{Y_g - M_g\alpha_g - H_g\beta_g - X_g\gamma_g}{f_g^2}\right) f(M)\, dm \qquad \text{Eq. 7}$$

For the measurement equations, the likelihood of observing each management practice (I) conditional on management (M) is given by the following equation

$$P(I_s|M) = \frac{1}{\sigma_s^2} \phi\left(\frac{I_s - Ma_s}{\sigma_s^2}\right) \qquad \text{Eq. 8}$$

The likelihood of observing the sequence of four management practices (I_1 ... ... I_4) can be written as

$$P(I_s|M) = \prod_s \frac{1}{\sigma_s^2}\phi\left(\frac{I_s - Ma_s}{\sigma_s^2}\right) \quad \text{Eq. 9}$$

The conditional probability is integrated over the distribution of management (M) to get the unconditional probability.

$$P(I_s) = \int_m \prod_s \frac{1}{\sigma_s^2}\phi\left(\frac{I_s - Ma_s}{\sigma_s^2}\right) f(M)\, dm \quad \text{Eq. 10}$$

The key step in developing the estimation procedure is that the likelihood of jointly observing Performance measures (Y_g) and management practice (I_s) is given by the product of likelihood of observing different performance measures (Eq. 7) and the likelihood of observing management practices (Eq. 10). Because of the assumptions about independence of the error terms, we can write the joint probability as follows

$$P(Y_p, I_s) = \int_m \left[\prod_g \frac{1}{f_g^2}\phi\left(\frac{Y_g - M_g\alpha_g - H_g\beta_g - X_g\gamma_g}{f_g^2}\right) \times \prod_s \phi\frac{1}{\sigma_s^2}\left(\frac{I_s - Ma_s}{\sigma_s^2}\right)\right] f(M)\, dm \quad \text{Eq. 11}$$

The distribution of latent variable management is determined by the distribution of error component (υ) having unit variance. Substituting the value of M from equation 4 in the above, we get the final likelihood function for jointly observing hospital performance and management practice.

$$P(Y_p, I_s) = \int_\upsilon \left[\prod_g \frac{1}{f_g^2}\phi\left(\frac{Y_g - (D\delta + W\eta + \upsilon)\alpha_g - H\beta - X\gamma}{f_g^2}\right) \times \prod_s \frac{1}{\sigma_s^2}\phi\left(\frac{I_s - (D\delta + W\eta + \upsilon)a_s}{\sigma_s^2}\right)\right] f(\upsilon)\, d\upsilon \quad \text{Eq. 12}$$

The estimation process involves summing up the log-likelihood over the sample of size N, and then maximizing the log-likelihood function to estimate the parameters in the model. Let the parameters be collectively represented by **θ** and then the joint log-likelihood can be written as

$$L_n(\boldsymbol{\theta}) = \sum_{i=1}^{N} \ln(P(Y_p, I_s)) \quad \text{Eq. 13}$$

Log-likelihood function in equation 13 has been written in Python-Biogeme (Bierlaire 2003) for estimation purposes. This software provides a flexible platform to estimate complex models using maximum-likelihood methodology.

5. Empirical Results

5.1 Summary statistics

Table 1 reports total management score across public and private hospitals. Management scores do not differ, on average, between public and private hospitals. Component wise mean scores show some differences between public and private sector. Monitoring and target-setting related practice scores are higher (though not statistically significant) for public hospitals. Scores for people management and operational management are higher for private hospitals than public hospitals.

Table 1

Table 2 reports the summary statistics for the estimated model. R squared for the model is 78%. Total number of estimated parameters from the model is 42. Among them, 36 were coefficients for measurement and structural models, and 6 were estimated standard deviations for residuals of the structural and measurement equations.

Table 2

The items were averaged to get a structural quality score between 0 and 1 for each of the 100 hospitals in the sample. Infection prevention (IP) practice score was measured by observing 48 aspects as per the guideline of Ministry of Health (MoHP 2013). A simple average of 48 variables was used to create a composite index for IP practice. Higher value for IP practices indicates higher level of service quality. Among the hospitals in the survey, 33% were public and the remaining was private hospitals. Fifty-nine percent of hospital managers had clinical training, and they average years of tenure as manager was 3.58 years. Average bed occupancy ratio for the hospitals was found to be 43% and average IP practice score was 82%.

A series of community and district specific characteristics such as hospital density, diarrheal disease incidence rate, etc. were obtained from the Central Bureau of statistics, Nepal Human Development report (UNDP 2014) and Annual Health Report 2068/69 (Department of Health Services 2014).

Table 3

5.2 Measurement Model

Table 4 shows the results of the measurement model to estimate the latent variable "management". Among the four management practices, Monitoring and target setting load heavily on the management

due to relatively higher values of respective coefficients. Capacities of operation and people management show almost equal weight. The coefficients in table 4 provide some idea about the components of the latent variable-management. All the coefficients are positive and statistically significant at 0.1 percent level.

Table 4

5.3 Structural Model (management)

Table 5 shows results from a structural model estimated to explain the latent variable-management. Hospital density was found to be positively associated with management at 5% significance level. Managers' non-medical background was found to be associated with better management, and this association is statistically significant at 10% level. Number of available beds (a proxy for hospital size) was also found to be positively associated with management. Hospital being private shows negative association with management and the association is statistically significant. Structural quality score was also found to be positively associated with management.

Table 5

5.4 Structural Models (Performance)

Table 6 shows various factors along with management explaining the variation in performance measures viz. bed occupancy rate and IP practice score. Management was found to be positively associated with bed-occupancy rate implying that improved management is associated with higher level of bed-occupancy rate. Management was also found to be positively associated with improved IP-practice score. Private hospitals showed significantly higher level of IP-practice score than public hospitals. Other factors were included in the equation as control variables.

Table 6

6. Discussion

A number of empirical studies have demonstrated positive relationship between aggregate management scores and performance of hospitals or other production units (Bloom and Reenen 2007, Bloom, Propper et al. 2010, Bloom, Sadun et al. 2012, McConnell, Lindrooth et al. 2015) but the roles of various dimensions of management on performance and service quality appear uncertain. For example, previous studies reported positive association of performance monitoring with overall performance of the firm but operational management practices show no effect on performance (Nair 2006). Similarly, some of the dimensions of management practices do not improve the quality of products (Nair 2006). Most of these studies used simple correlation or OLS to estimate the relationship between management practices and

performance of hospitals. Simple correlation and regression analyses are not appropriate for understanding the relationship between dimensions of management practices and performance of production units. This paper has used a rigorous econometric estimation technique to obtain a reliable estimate of the effects of management on hospital performance and service quality.

SEM was used to estimate the effects of various management practices on hospital performance through the estimation of the latent construct "management". The model clearly identifies the factors that determine the management practices and the weight of each management practice that derives performance and quality of services of the hospitals.

The management variable is assumed to be a function of various hospitals and manager specific characteristics. The results indicate that hospital density in the local area, a proxy for market competition, is positively associated with management. This finding is consistent with the hypothesis that higher level of competition is associated with adoption of better management practices (Nickell 1996, Kessler and McClellan 1999). Another important deriver of hospital management is the structural quality of hospital in terms of availability of a range of instruments and devices (MoHP 2013). Hospitals with better structural quality were found to adopt improved management practices implying iterative relationship between structural quality, management and overall service quality. Our finding that non-clinician managers show better management practices compared to managers with clinical training is not consistent with the findings by Bloom, Propper et al. (2009) and Dorgan, Layton et al. (2010), who found clinicians as better managers. In the context of Nepal, Chadwell, Bhitrakoti et al. (2012) and Khadka, Gurung et al. (2013) found that hospitals with clinical managers are ill-prepared for the management tasks. Improving the management skills of managers with medical background can be an important strategy to improve hospital performance and quality. In line with the Bloom, Sadun et al. (2014), we found that size of the hospital is positively associated with better management practices.

Regarding the relationship between management practices and performance of the hospitals (measured by bed occupancy rate), we found a positive effect of management on performance. Prior studies reported positive effects of "management" on IP-practice score, a measure of procedural quality of hospital service sees Bloom, Sadun et al. (2014). As shown in figure 1, it is also possible to explain how each of the dimensions of management practice is associated with the performance measures through the latent variable "management" because a system of equations was estimated simultaneously. Among the various management practices, monitoring performance shows the highest contribution to performance followed by the dimension "Target setting". Therefore, the activities ensuring good performance monitoring of employees can potentially have a strong impact on hospital performance. Various practices related to better target setting like providing performance target to staffs at all levels, clearly defining the short and

long term targets, adopting a participatory approach for target setting, regular comparison of target achievements, etc., improve performance outcomes.

The paper has a number of limitations. In the literature, five performance-related indicators are widely used. These are total inpatient days, IP practice score, bed occupancy rate, inpatient days per technical staff and recurrent expenditure per inpatient day. Since the sample size of this study is quite small (100 hospitals in the survey), we have limited the analysis to two performance indicators while estimating the structural equations.

This paper presents a complete model to describe the casual link between management practices and performance of hospitals. Joint estimation of a system of equations is consistent with the theory that "management" is an unobserved characteristic consisting of a number of dimensions, and better management improves performance of hospitals. We have estimated the entire system by considering the fact that management practices and performance indicators are affected by the latent variable "management", which, in turn, is affected by a series of exogenous variables. The joint estimation technique proposed here provides consistent and efficient parameter estimates, and therefore, should be superior to the sequential estimation of equations (Ben-Akiva, Walker et al. 1999). Due to simultaneous estimation of parameters, it has been possible to infer how the management practices are ultimately linked to hospital performance indicators, and how the exogenous factors contribute to hospital performance through management. The paper proposes a new method that has a number of benefits. First, we explicitly considered management as latent variable which is manifested through various management practices. Second, the entire model, structural regression equation for performance, latent variable model for management and measurement equations for management practices has been estimated simultaneously. Third, the advantages of latent variable framework over the deterministic approach are clear; the model is not affected by endogeneity bias, and it explicitly can address the fact that latent variables contain measurement error. In this paper, we find that the use of latent variable models leads to an improved understanding of management and performance of hospitals.

This paper clarifies the causal link between "management" and performance of hospitals (including quality of services) and provides motivation for further studies in the development and measurement of management practices. An improved understanding of a causal link between management practices and performance of hospitals helps policy-makers in designing interventions in order to improve efficiency and effectiveness of health institutions.

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Figure 1: Reformulation of Management Practice and Hospital Performance Relationship

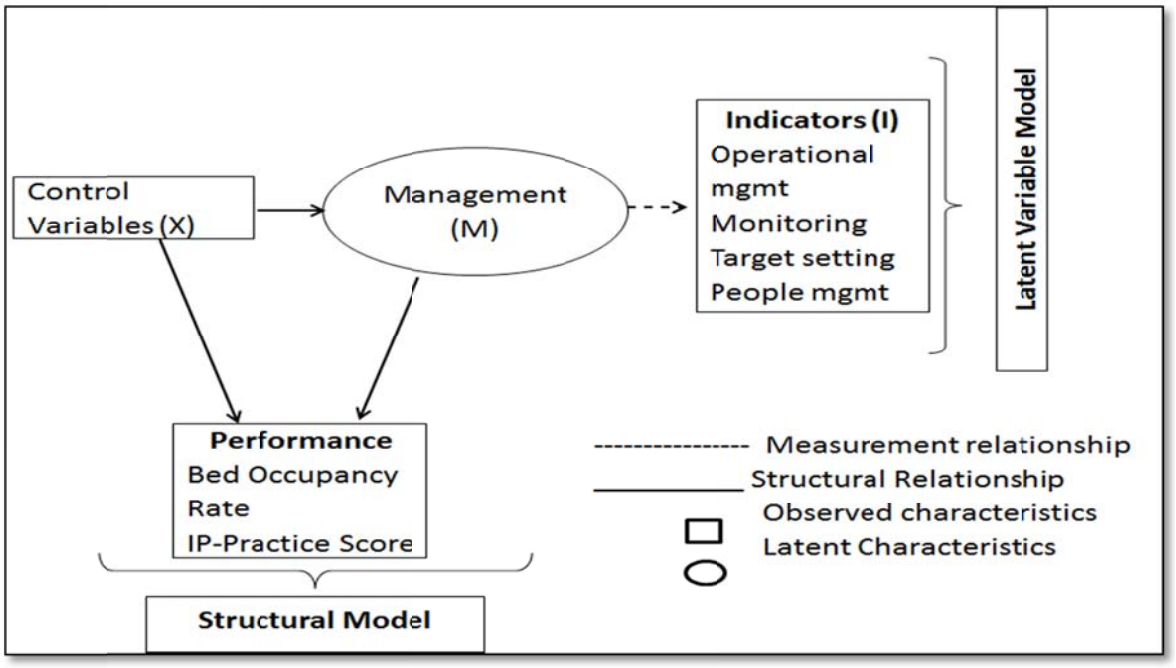
Control Variables (X)
Management (M)
Indicators (I)
Operational mgmt
Monitoring
Target setting
People mgmt
Latent Variable Model
Performance
Bed Occupancy Rate
IP-Practice Score
Structural Model
Measurement relationship
Structural Relationship
Observed characteristics
Latent Characteristics

Table 1: Management Score (N=100)

Management Dimensions	Public	Private	t-stat(p-value)
Operational Management	1.99(0.53)	2.114(0.693)	-0.99(0.323)
Monitoring	2.313(1.178)	2.244(0.84)	0.3(0.764)
Target Setting	1.909(0.713)	1.878(0.617)	0.22(0.829)
People Management	1.792(0.666)	2.156(0.502)	-2.77(0.008)
Total Management Score	**2.001(0.671)**	**2.098(0.572)**	**-0.71(0.48)**

Source: Authors estimation

Table 2: Model summary

Sample size	100
Initial log-likelihood	-719.497
Final log-likelihood	-113.23
Total no. of estimated parameters	40
Coefficients	34
standard deviations	6
Pseudo-R squared	0.787

Source: Authors estimation

Table 3: Sample Characteristics (N=100)

Characteristics	Public(SD)	Private(SD)	t-stat(p-value)
Bed Occupancy Rate	58.01(20.77)	35.7(24.5)	4.75(<0.001)
Total Impatient Days	17956.91(24406.43)	7078.48(7454.45)	2.5(0.017)
Auxiliary Nurse Midwife (ANM)	7.55(5.39)	4.7(4.18)	2.66(0.01)
Staff Nurse	16.73(20.41)	18.3(18.23)	-0.37(0.709)
Medical Doctor (MBBS)	9.45(10.18)	6.22(5.05)	1.72(0.093)
Specialists	4.3(5.97)	4.24(3.61)	0.06(0.955)
Structural Quality Score	0.58(0.24)	0.77(0.16)	-4.3(<0.001)
IP Practice Score	0.73(0.17)	0.86(0.14)	-3.66(0.001)
Number of available beds	91.76(99.78)	50.73(34.05)	2.3(0.028)
Total Tenure of manager	2.27(2.14)	4.23(3.46)	-3.48(0.001)
Total Number of technical staff	59.12(50.56)	54.1(35.93)	0.51(0.612)

Source: Authors estimation

Table 4: Measurement model (N=100)

Name	Coefficient	Robust Std. Err	Robust t-test	p-value
Operational management(a_1)	0.305	0.0547	5.58	<0.001
Monitoring(a_2)	0.685	0.0549	12.47	<0.001
Target Setting(a_3)	0.464	0.037	12.54	<0.001
People management(a_4)	0.292	0.0559	5.22	<0.001
sigma1 (σ_1)	0.511	0.0347	14.74	<0.001
sigma2 (σ_2)	0.38	0.0608	6.25	<0.001
sigma3 (σ_3)	0.251	0.0493	5.1	<0.001
sigma4 (σ_4)	0.448	0.0375	11.95	<0.001

Source: Authors estimation

Table 5: Structural model (Management) (N=100)

Name	Value	Robust Std. Err	Robust t-test	p-value
Constant	-2.010	0.717	-2.810	0.010
Hospital Density (δ)	0.181	0.097	1.870	0.060
Non-medical background(η_1)	0.451	0.263	1.710	0.090
No. of available beds (η_2)	0.211	0.089	2.360	0.020
Private Hospital(η_3)	-0.856	0.347	-2.460	0.010
Structural Quality (η_4)	3.100	0.755	4.100	0.000
Total tenure(η_5)	-0.004	0.032	-0.140	0.890
Reliability Score (ω_1)	0.062	0.044	1.420	0.160
Duration of interview (ω_2)	-0.027	0.019	-1.430	0.150

Source: Authors estimation

Table 6: Structural model (Bed-Occupancy Rate and IP-practice score) (N=100)

	Bed-Occupancy Rate		IP-practice score	
Name	**Estimate(SE)**	**p-value**	**Estimate(SE)**	**p-value**
Constant	0.166(0.086)	0.05	0.806(0.036)	<0.001
Management (α)	0.019(0.008)	0.02	0.052(0.009)	<0.001
Public Hospitals	--	--	--	--
Private Hospital(β_1)	-0.055(0.026)	0.04	0.071(0.029)	0.01
IP-Practice score (β_2)	-0.08(0.097)	0.41	--	--
Bed Occupancy (β_3)	--	--	-0.101(0.056)	0.07
Bed Occupancy (t-1) (β_4)	0.895(0.05)	0	--	--
Available Beds (β_5)	0.003(0.012)	0.81	-0.002(0.012)	0.89
Central Region(γ_1)	--	--	--	--
Eastern Region(γ_2)	-0.008(0.042)	0.85	0.006(0.046)	0.89
Western Region(γ_3)	-0.009(0.028)	0.74	0.073(0.03)	0.02
Mid-western Region(γ_4)	-0.013(0.053)	0.81	-0.066(0.041)	0.11
Far-western Region(γ_5)	-0.029(0.048)	0.55	-0.127(0.073)	0.08
Diarrhoeal Disease Incidence(γ_6)	-0.022(0.016)	0.15	-0.034(0.016)	0.03

Source: Authors estimation