International Journal of Advances in Business and Management Research (IJABMR) https://doi.org/10.62674/ijabmr.2023.v1i01.005

https://ejournal.svgacademy.org/index.php/ijabmr/

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DEVELOPING A UNIQUE MODEL ON BED PER DOCTOR & BED PER NURSE FOR INCREASED PATIENT SATISFACTION IN INDIA POST COVID-19 OUTBREAK

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Original Article

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Abstract

The Indian healthcare sector has gone through huge stress during the COVID-19 outbreak. The COVID-19 outbreak has shown that there is a huge need for a huge number of doctors, nurses, and paramedics, including beds in hospitals, during such a pandemic situation. Though the pandemic is slowly easing, the medical system in India still faces a lot of challenges. With a huge population, climatic conditions, and hygiene problems, India suffers from several vector-borne diseases like malaria, dengue, etc. As space is an issue in urban India and slums are prevalent in major cities, community-borne diseases transmit quickly, adding to the need for hospitalization. The number of hospitals in rural India is not as per requirement, and getting beds and proper healthcare services is a challenge. To add to all this, the cost of treatment is also high, though the central and state governments have several health insurance schemes for the benefit of the population. In this paper, 500 patients across 25 healthcare centers were questioned using a Likert scale to understand their satisfaction level with the prevalent medical system in India. Through factor analysis, the two important factors that played a major role in patient satisfaction (PS) were identified. Through a simple linear regression equation, two models were derived that would increase the PS. It may be noted that two parameters were analyzed in this paper, though there are several other factors that need to be investigated by other researchers.

Keywords: Manpower Planning; Healthcare System; Patient Satisfaction; Beds per Doctor; Bed Per Nurses

Introduction

The first COVID-19 case was detected in Kerala on January 30, 2020. Though COVID-19 news was coming from China earlier in 2109, people thought it was a Pacific disease. The general perception was that COVID-19 would not affect India until the first case was reported. Though even after the first COVID-19 case, the rise of the pandemic in India was not significant in the next two months. Only in the second week of March 2020, India reported its first COVID-19-related death. The major death cases in the month of March were patients over 65 years old, and their younger counterparts were thought to be somewhat protected from COVID-19-related deaths due to immunity factors. Soon the government took the decision to implement lockdown; first it was implemented in Kerala on March 23, 2020, followed by the rest of India on March 25, 2020. As the months passed, the rate of COVID-19 transmission got severe, and a population of varied age groups got affected by the pandemic.

Soon hospitals started filling up, and getting admission into hospitals became a challenge. Rural patients started pouring into the urban cities for proper care, which added to the already stretched health system in the urban areas. In the beginning, there was total chaos, which led to ambulances charging sky-high prices and preventive medicines flying out of the pharmacy. The front-line health workers looked after the infected population day and night. The pandemic spread throughout India and infected a huge percentage of the population. The condition further worsened as frontline health

Received 2 August 2023; Revised 14 August 2023; Accepted 26 August 2023

workers also started getting COVID-19 and needed two weeks of rest. This led to a severe manpower shortage in the healthcare system. Though by September 2020, the number of cases had started falling, by January 2021, the number of cases had significantly decreased. As the population started to lower their guards and their livelihoods were slowly normalizing, the second wave began in March 2021. The second wave was much more devastating, with the new COVID-19 cases touching 4 lakh every day in India. Maharashtra, Kerala, and Delhi were the major contributors, followed by other states. Hospitals were overwhelmed. Doctors, nurses, lab technicians, paramedics, etc. are getting the disease. Due to the severity of the second wave, patients needed more hospitalization. Severe cases were much higher than the first wave, which led to a rush for ICU beds. Oxygen went out of the market due to intensive demand, and even hospitals were finding it hard to procure adequate oxygen cylinders. A black market for oxygen and different medicines was also reported, though the government was quick to stop these miscreants. Medicines that were needed to treat the patients were flying off the shelves of pharmacies. India became the leading nation with active cases in the world in April 2021, and everyone was worried about the future. As there is always light at the end of a dark tunnel, slowly the cases started falling. The Indian government took a proactive role in vaccination. Though vaccinating a large population like India was a great challenge, the Indian Government, with mass campaigning and excellent logistics, was able to vaccinate the majority of the population. This resulted in the controlled spread of the pandemic. Though several lives were lost, and the economy also took a lot of pressure due to the lockdown.

The whole COVID-19 pandemic showed that there was an urgent need to drastically increase healthcare facilities in India. Also, there was an urgent need to drastically increase the number of frontline health workers if adequate healthcare facilities were to be provided to our ever-increasing population. In the healthcare system, manpower planning plays a vital role. Doctors and nurses are the heart of a healthcare system. Ultra-modern equipment may facilitate the diagnostic procedure, but the treatment will come from doctors and nurses. In the healthcare sector, the role of manpower planning becomes more important as it deals with human lives. If manpower planning is ignored, it could lead to the loss of human lives. COVID-19 is to be treated as a wake-up call to make the Indian healthcare system more modern and increase healthcare manpower drastically. Also, there is a need to increase the number of hospitals so that more beds can be added, and a shortage of beds should never be a reason to lose even one single life. Every life is precious, and research should be conducted urgently in this area so that if any other pandemic crops up, the Indian healthcare system will be ready to tackle it without losing any lives.

This paper will try to develop a model that will enhance the satisfaction level of patients through proper treatment. The model will try to determine the adequate number of doctors and nurses needed in the healthcare system for optimal patient satisfaction. The research will mainly look into the patient department (IPD). Unfortunately, in the rural belt, the number of doctors and nurses is significantly lower than its urban counterpart. This discrepancy may lead to the dissatisfaction of patients, especially when they need urgent care. During the COVID-19 outbreak, a huge population of patients had to travel from rural belt to urban belt to get the proper treatment. Not only doctors and nurses, but rural healthcare facilities lack infrastructure and modern machines. The paper, though, looks only at the manpower factor.

Literature Review

The National Ad Hoc Working Group gave a report on Physician Resource Planning in 1995 that first indicated the need for manpower planning on the basis of need in the healthcare sector [1]. Looking into the costs present for doctor resource planning, the working group developed an inventory plan for doctors. They wanted to first determine the doctor-to-patient ratio as the basic standard before dividing it into further specialist-to-patient ratios. The group thought, though, that the ratio could be looked at according to age and sex factors, measures of health service utilization, the number of full-time doctor equivalents, and geographic locations. The group gave the most importance to emergency patients for the manpower planning of doctors. This referred to the minimum number of doctors needed for a given geographic location to give adequate and quality services to the patients. The idea of critical mass looks into the issues of on-call needs, minimum volumes of work required to maintain clinical competencies, the level and type of backup required, and staffing differences that may result from geographic locations. So, in the rural belt, critical mass needs for doctors may be greater than those required in the urban part. This may lead to a situation where specialists are not available in the rural belt but are readily available in the urban belt.

Roos et al. [2-5] from the Manitoba Centre for Health Policy looked into the need for forecasting methods for the manpower planning of doctors. They took into account both general doctors and specialists when developing the models. They emphasized a need-based forecasting model. In the beginning, he did a gap analysis to find the need for doctors across the states. They also tried to analyze the needs of doctors and actual patient footfall by looking into doctor bills. Once the gap was identified, they tried to analyze why there was one. They found the gap was mainly due to the

economic constraints of the population as well as some social issues. They then compared the projected "need" from the given population with what actually happened in terms of doctor visits. Their research found that the popular ideology that Manitoba suffers from a doctor shortage was wrong.

Their research found that there was a great concentration of doctors in Winnipeg. These numbers were not required, and they were draining the finances of the hospitals. So, it was thought that manpower planning needed to be reformed. This experiment showed that need-based forecasting of doctors was the need of the hour, rather than just adding doctors based on perception. This research would help the hospital in Winnipeg rationalize the number of doctors and increase profitability.

The three most important approaches to doctor manpower planning were deemed to be supply, demand, and needs-based forecasting. Combining the three aspects, proper manpower planning for doctors can be incorporated, and this model can be simulated throughout the world. O'Brien-Pallas et al. [6] looked into the development of a model utilizing the needs of the patients, location of doctors in the state, health of the population, age of the population, economic power of the population, and health risks of the population.

Fried [7], Sekscenski et al. [8], and Goodman et al. [9] looked into the concept of benchmarking. They identified benchmarking as a more scientific mode of looking into the manpower planning of doctors. Benchmarking tries to identify factors that require a relatively low number of clinically active doctors without hurting the quality or need for healthcare services for patients. These factors are taken as the initial starting point for creating an optimal doctoral level. After that, specific changes are made according to age, sex, and other characteristics across different population groups. Then the optimal level is adjusted to meet the actual need for doctors in the population. If required, further adjustments can be made for key health factors and the economic and social needs across populations to increase or decrease the number of doctors.

In benchmarking, it is taken into consideration that a certain area is the best predictor for the need for doctors, keeping in mind that the quality of healthcare service is not compromised and meets the needs of the patients. It is better than other models that look at doctors needs based on assumptions rather than research. Earlier models were built on mainly assumptions or the concept that as the population increases, a proportional increase in doctors is needed. Benchmarking does not do this. Geographic locations or healthcare systems that are seen as mirrors of the future of health care are deliberately selected as the benchmarks for future manpower planning. The issue with benchmarking arises with the choice of region as the indicator for optimal doctor level and also the geographic location.

Manpower planning for nurses is much less clear than for doctors. Though several researchers looked into manpower planning and the modelling of doctors with patients, unfortunately, nurses were neglected. Benchmarking nurses also has certain challenges. This is due to the fact that the number of nurses is generally regulated by the increase or decrease in the budget of the hospitals. For nurses, the needs of patients took a back seat when it came to the availability of finance.

Buchan & O'May [10] looked into the issues facing nurses. They looked at five key indicators: vacancy rates, turnover and waste rates, agency and bank nurse employment, overtime and excess hours worked, and nurse unemployment rates. They deduced that if these five parameters were effectively studied, then optical utilization of nurses could be done, leading to proper manpower planning for nurses. This will result in patients getting adequate healthcare services.

Grumbach et al. [11] looked into both subjective and objective factors while developing manpower planning for nurses. They identified two factors: the nurse vacancy rate and the self-reported shortage. The correlation between self-reported shortages and residential nurses per inpatient year and between self-reported shortages and overall regional supply was weaker. The majority of this problem was due to the absence of a generalized standard for nurse manpower planning. In healthcare services, normative standards do not meet the service needs of patients. A new approach was derived where the number of nurses was calculated for the whole population of the state rather than hospital beds.

The main problem in considering forecasting methods is finding the overall policy goal of healthcare manpower planning. The best methodological approach cannot be planned without understanding the concept. Though several manpower planning and forecasting methods have been developed, such as to meet demand for immediate services, to provide a certain level of service that is somehow determined to be appropriate, to meet the needs of health service providers, or to improve the health of the population, In most probability, all of the above methods are practicable, but without a definitive purpose by the policymakers, manpower forecasting methods in the healthcare sector will remain

vague. It is evident that researchers are looking into several parameters and identifying several factors that will lead to a unique model formulation that can be used in any geographical location. There is clear recognition in the literature that a combination of factors and methods will yield the best results.

Research Objective

In India, research on manpower planning in the healthcare sector is much needed after the COVID-19 outbreak. India is the second-densely populated nation in the world. It is quite evident that a large population will require huge healthcare services compared to the rest of the world. As much of India is under the rural belt, the need for proper healthcare facilities in rural India will also be vast.

Again, India is a tropical country by nature, so the number of seasonal diseases in India will be higher than in the western world. Looking at the geographical position of India, it is evident that India has extreme summers and high rainfall. Both of these phenomena increase the probability of vector-borne diseases. Summer brings with it a bacteria-related stomach ailment. Even sunstroke is quite common in many parts of India. The rainy season brings with it a host of diseases ranging from malaria, dengue, and diarrhoea.

The coastal region of India has extreme rainfall; the western and eastern regions of India have humid weather; and the northern region of India has bitter winters and hot summers. So, a country with such geographical diversity will host a lot of bacteria and viruses that will make the population sick and increase the need for hospitals and nursing homes. To add on to it, the prevalent slums in major cities make the transmission of disease fast. Apart from the climate, the majority of our population does not have proper toilet training. Many households in the rural belt do not have access to toilets. This again gives rise to diseases. India is considered youth-dominated, but it needs to be kept in mind that these youth will age, and then there will be a need for even larger healthcare facilities to look after the population.

In this paper, the authors will try to find out how we are positioned to fight so many adversaries. We will try to look into the following points:
The paper will try to look into the satisfaction level of the patients (PS). To make the research diverse, the survey was carried out in private as well as public healthcare facilities. The paper analysed two major factors that have a direct relationship to patient satisfaction. Those are:

a. Beds to Doctor Ratio (BDR)
b. Beds to Nurse Ratio (BNR)

Methodology

A patient feedback survey was conducted in 25 reputed public and private healthcare centres across West Bengal, India, after the COVID-19 outbreak. In each healthcare centre, 20 patients were given a questionnaire comprising 10 questions on a Likert scale. Thus, a total of 500 feedbacks were generated. This was exploratory research trying to analyse the satisfaction level of the patient parties in different healthcare centres.

The sampling plan used in this research was non-probability sampling. The category of non-probability sampling plan used was convenient sampling.

The reason for using a sample rather than an entire population was likely to produce more reliable results. This is mostly because errors are lower when using a sample rather than the whole population, as it takes less time and reduces fatigue and the probability of errors. In the research, since it was impossible to get the entire population as many patient parties were reluctant to answer and many were too busy with the events in healthcare, it was idealistic to use a sample.

Convenience Sampling was chosen because, as the name implies, it refers to the collection of information from patient parties who are conveniently available to provide it. It is also known that convenient sampling is most often used in the exploratory phase of a research project and is perhaps the best possible way of getting some basic information quickly and efficiently. The design of the questionnaire was made in such a way that it could be easily understood by the general public.

It can be seen that the questionnaire was designed in such a way that the actual feedback from patients could be derived from the healthcare manpower's performance. The questionnaire tried to find out if the patient was satisfied with the

number of doctors, nurses, technicians, etc. As it is well known, due to a manpower shortage, a patient has to wait hours before he or she can meet a doctor or get admission to a hospital, which reduces the satisfaction level drastically. In several healthcare settings, a patient has to wait until a ward boy comes to take the patient to his or her bed. So, a lot of factors were incorporated into the questionnaire.

From the factors in the questionnaire, the major two factors that were affecting patient satisfaction were determined through factor analysis. Once the factors were determined, a regression equation was done to find out the mathematical model for manpower planning that would increase the satisfaction level of patients.

Result & Discussion

Once the data were analyzed the Reliability of the Survey stood at 0.954. Which means that the data was 95.4% reliable. It means the data can be relied upon. The total collected data was 500 Patients Feedback from 25 private and public healthcare centers in and around West-Bengal. Cronbach's Alpha value was 0.95. This again shows that all the 10 questions are interrelated and are well written so that the result can give us a clear picture rather than a vague picture [12].

From the beginning of this research, a relationship between manpower planning and patient satisfaction was analyzed. Once the factors were identified it was easy to zero in on the most important factors that is Doctors and Nurses. It was found that the satisfaction of patients greatly depended on these two factors. So, a mathematical modelling was designed on these two factors to see the end result [13].

A Linear Regression Model proposed taking satisfaction as the dependable variable and Beds per Doctor and Beds per Nurse were taken as independent variables. While the analysis was done, Doctors per Bed was not chosen as WHO recommends 5 Beds per Doctor. This means there cannot be more than 1 doctor per bed. That is why Beds per Doctor was taken as independent variable. For the same reasons Beds per Nurse was chosen as the other independent variable.

During the test it was found that when both the independent variables that is Beds per Doctor and Beds per Nurse were used the model was having multi collinearity. The collinearity value was 2.334. This meant that the two independent variables were connected to one another. For a model formation this is not an ideal situation. To make the model free of multicollinearity the independent variables were analyzed separately (refer to table 1 below). Once the independent variables were analyzed separately the problem of multicollinearity was resolved [14].

Table 1: Linear Regression for Bed per Doctor

Model	**Unstandardized Coefficients**		**Standardized Coefficients**	**T**	**Sig.**	**Collinearity Statistics**	
	B	**Std. Error**	**Beta**			**Tolerance**	**VIF**
1 (Constant)	3.791	0.243		15.491	0.000		
Beds Per Doctor	-0.48	0.026	-0.593	-3.128	0.006	1.000	1.000

Source: Collected by Author

As the questionnaire was a 5-point Likert scale, the maximum satisfaction level was 5 and the minimum was 1. It was found that when the analysis was done with beds per doctor, the R square value came in at 0.386. Collinearity was 1, so the value could be accepted. The constant value was 3.791, and the -0.48

So, it is very clear that a model can be derived for beds per doctor as an independent variable. After the modelling, the result was as follows:

Patient Satisfaction = 3.791-0.48 * Beds per Doctor

So, if 1 bed is allocated to 1 doctor, satisfaction will be 3.791-0.48=3.311. So as the number of beds decreases for each allocated doctor, satisfaction levels go up, and as the number of beds increases, satisfaction levels go down. So, it is clear that satisfaction level increases with a smaller number of beds per doctor, but even in the best of scenarios, it will not reach the highly satisfied stage as there are other associated factors that influence satisfaction (see table 2 below).

Table 2: Linear Regression for Bed per Nurse

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
1 (Constant)	3.907	0.228		16.708	0.000		
Beds Per Nurse	-0.14	0.056	-0.643	-3.565	0.002	1.000	1.000

Source: Collected by Author

Once the analysis was done with beds per nurse, the R square value came to 0.388. Collinearity was 1, so the value can be accepted. The constant value was 3.907, and the -0.14

So, it is very clear that a model can be derived for bed per nurse as an independent variable. After the modelling, the result was as follows:

Satisfaction = 3.907-0.14 beds per nurse

So, if there is 1 bed for 1 allocated nurse, satisfaction will be 3.907 + 0.14 = 3.767. So as the number of beds decreases for each allocated nurse satisfaction level, it goes up, and as the number of beds increases per allocated nurse satisfaction level, it goes down. So, it is clear that satisfaction level increases with a smaller number of beds per nurse, but even in the best of scenarios, it will not reach the highly satisfied stage as there are other associated factors that influence satisfaction [15].

Now there is a very interesting finding here: the R square value for beds per nurse is higher than beds per doctor. That is, the R square value for beds per nurse was 0.388, whereas the R square value for beds per nurse was 0.386.

This clearly shows that the satisfaction level of the patient depended more on beds per nurse and a bit less on beds per doctor. As per the analysis of the data for patient satisfaction, nurses are more important than doctors [16,17].

Conclusion

It is quite evident from the research that patient satisfaction greatly depends on doctors and nurses. Still, there are many more factors that have an influence on patient satisfaction. It was seen that with 1 nurse per bed, the maximum satisfaction that could be reached was 3.767 out of 5. This showed that there were other important factors as well, but nurses played a vital role in patient satisfaction. In the case of doctors, it was seen that 1 doctor per bed made the patients satisfied by 3.331. So, we can deduce that PS of bed per nurse > PS of bed per nurse. It is quite understandable as nurses give day in support for IPD patients, whereas doctors give 1 to 2 rounds a day. So, the patients depend on nurse's care more, so the satisfaction level for nurses is higher than that of doctors.

As of today, for IPD, it is 1 nurse for 4 beds and 1 doctor for 5 beds, as per WHO recommendation. If 1 nurse for 4 beds is incorporated in the model derived, then PS will stand at 3.347. If the same is done with the WHO recommended standard for doctors, PS will stand at 1.391. This again gives a clearer picture of patient needs. If only 1 doctor or 1 nurse is taken into consideration per bed, then satisfaction is higher for nurses. As the number of beds increases, satisfaction is seen drastically reducing for each bed per doctor. This means that nurses are needed more in day-to-day work, but treatment importance is also on the patient's mind. If there are more beds per doctor, then the quality of treatment may get hampered, reducing patient satisfaction. The quality of service provided by nurses may also be reduced with an increase in the number of beds. But satisfaction is reducing slowly as patients understand that the main

treatment will come from the doctors, whereas nurses will look after their needs. It is clear that the satisfaction of patients drastically reduces as the number of beds per doctor increases in comparison to the number of beds per nurse. In India, especially in the rural belt, the ratio is pathetic, which in turn reduces patient satisfaction. This could be one of the main reasons why rural patients travel to urban hospitals for treatment.

Post Covid-19 The importance of such a model is extremely necessary so that the healthcare system is ready for any such adversity in the future. If the above model can be implemented in the healthcare system, then patient satisfaction will drastically improve. In the future, to increase patient satisfaction, the models that have been derived can be implemented by healthcare centers. It is evident that there are other factors associated with patient satisfaction that other researchers can work on.

Conflict of Interest

The authors declare that they have no conflict of interests.

Acknowledgement

The authors are thankful to the institutional authority for completion of the work.

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