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Unidirectional Circular Movement: A Healthier Way to Hospital Administration for Effectual Patient Care

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Abstract

A well-planned movement inside hospitals is indispensable for healthy and smooth administration to afford protected suitable services of social distancing among health service providers, patients and bystanders. This paper proposes an optimized model of a new healthier way to hospital administration– the unidirectional circular movement at hospitals for achieving effectual patient care. Primary data for the study was collected from doctors and postgraduate students through a structured questionnaire survey. Structural equation modelling was carried out to investigate the structural relationships among the observed and latent variables of the unidirectional circular movement inside hospital infrastructure. The proposed unidirectional movement in hospitals is likely to effectively avoid face-to-face interactions to maintain social distancing, which is of utmost importance in our fight against the Covid-19 pandemic. The proposed method and the variables of hospital infrastructure will heighten service quality by eliminating the fear of disease spread and its related infections and hurry up the facility deliverance method, thus relieving the pressure of long waiting hours.

Keywords: *Hospital administration, Unidirectional circular movement, Patient care, Service quality, Social distancing*

Introduction

In recent years, there has been an increasing attention towards healthcare operations management research . It has been realized that sufficient physical arrangements are vital for efficient and effective provisioning of medical service delivery (Benitez et al., 2019). A well-planned hospital design will provide a fine, superior service at the least cost, thus ensuring elevated significance to human protection and health (Di Sarno et al., 2019). In the regular hospital set-up, a patient approaches the reception area and frequently moves through a bunch of investigations prior to reaching the real target (Prato et al., 2019), and usually there are a series of long waits and delays in such a set-up (Wolf et al., 2017). Also, to approach a particular department, a patient needs to take various round-about routes, up-down, Such unnecessary movements can, result in higher risks of infections from various other diseases within the hospital premises. Research has shown that patients often prefer hospitals that reduce their movement within the premises, and in minimum time (Advani & Fakih, 2019).

The unidirectional circular movement trail design for patients is a perfect option for an effectual hospital administration and reduces the confusion in managing a large number of patients and their subsequent interaction points. In this kind of set up patients move in clockwise direction with no zig-

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zag movements, thus ensuring the shift from the congested conventional functional movement. With this unidirectional movement, the traffic intensity is extremely guarded as the movement flow is firmly unidirectional. Redusing traffic congestions in hospitals has become althe more necessary in the existing circumstances where a pandemic similar to Covid-19 thrives. The research paper presents a more efficient set up in hospital administration and logistic and explores the structural relationship by incorporating a unidirectional circular movement of patient and other stakeholder pathways in hospitals.

Literature Review

An effectual hospital designs guarantee the best quality service to the associated people at the lowest cost but at the same time attaches priority consideration and importance to safety along with protection of health (Hughes, 2008). The movements inside the hospital infrastructure are planned to utilize the available area optimally by reducing the travelling distance (Arnolds and Gartner, 2018). At the same time, providing quality of patient care is vital, which can be achieved by making qualified health professionals accessible (Price et al., 2005). However, currently it seems that patients take to unfamiliar movement paths to reach their destination requiring more travel time (Greene et al., 2020). This also increases the chances of getting infected by other diseases (Meddings et al., 2019). Patient health and safety considerations must be a vital element in the hospital design, which can prevent the spread of diseases and its related infections. Parsia & Fadzline (2018) introduced the significance of healthcare facility layout plan in providing quality medical services. Appropriate layout designs will reduce the risks and, with improved service quality, is likely to increase customer satisfaction.

Various operations research tools and techniques aid in designing healthcare facilities in a manner that optimizes the space, thus reducing the operational layout problems inside the hospital (Hughes, 2008). Pillai (2021) focused on developing a functional layout that will provide ease, accessibility and economy with boosted quality of medical care. A circular unidirectional facility layout in hospitals will successfully prevent face-to-face encounters of patients and their bystanders while arriving at and leaving from the hospital, which will safeguard them from infections of diseases and hasten the service delivery procedure (Shojania et al., 2001). The paper focus on proposing a unidirectional circular movement inside hospitals to attain better patient care and explores the variables related for effectual hospital administration.

Methodology

Primary data for the research was collected from doctors and postgraduate students using a well-structured questionnaire. A sample size of 75 was engaged by applying probability sampling approach. A five-point Likert scales was used for research questions. Only the current doctors and postgraduate students working in medical colleges of the state of Kerala were surveyed and this limited scope may not be consistent with other types of health service sectors. Data were collected regarding the effects of social distancing, effective management of hospital infrastructure with higher service quality for unidirectional circular movements and its relationship towards patient care in reducing congestion in movements, relieving the pressure of long waiting hours and finally lessening the fear of disease spread by providing swift medical attention. Structural Equation Modelling (SEM) was carried out to investigate the structural relationships among the observed and latent variables of the unidirectional circular movement for effectual hospital administration.

Analysis and Results

The observed endogenous variables considered in the model were (i) effective management of hospital infrastructure, (ii) reduction of congestion in movement, (iii) relieving the pressure of long waiting time, (iv) lessening the fear of disease spread, (v) swift medical attention, (vi) social distancing and (vii) heightening the service quality. Uni-directional circular movement was the observed exogenous variable. Hospital administration and patient care were the unobserved endogenous variables. All the error variables from e1 to e9 were the unobserved exogenous variables. The total number of variables in the model was 19 with 8 observed variables and 11 unobserved variables. The exogenous variable count was 10 and endogenous variable count were 9. The regression weights among the variables were calculated and is shown in Table 1.

Table 1: Regression Weights

Variables	Estimate	Standard Error	Critical Ratio	Probability
Patient care <--- Hospital administration	0.477	0.074	6.439	0.000
Effective management of hospital infrastructure <--- Hospital administration	1.433	0.174	8.238	0.000
Reduction of congestion in movement <--- Patient care	1.000			
Relieving the pressure of long waiting time <-- - Patient care	1.088	0.063	17.229	0.000
Lessening the fear of disease spread <--- Patient care	1.104	0.078	14.152	0.000
Swift medical attention <--- Patient care	1.158	0.072	16.035	0.000
Effective management of hospital infrastructure <--- Uni-directional circular movement	0.436	0.061	7.126	0.000
Social distancing <--- Uni-directional circular movement	0.202	0.067	3.011	0.003
Heightening the service quality <--- Uni-directional circular movement	0.449	0.063	7.179	0.000
Heightening the service quality <--- Hospital administration	1.000			
Social distancing <--- Hospital administration	0.780	0.110	7.064	0.000

The regression weight of hospital administration with patient care is 0.477, estimated with a standard error of 0.174 and critical ratio or Z value of 8.238 and with a probability of 0.000 (Table 1). The probability of receiving a critical ratio as large as 8.238 in absolute value is less than 0.001. The partial regression weight for hospital administration in the prediction of patient care is, therefore, significantly different from 0 at 1%. The estimated regression weight of hospital administration with effective management of hospital infrastructure is 1.433, estimated with a standard error of 0.174 and critical ratio of 8.238 with probability of 0.000. The probability of getting a critical ratio as large as 8.238 in absolute value is less than 0.001. The partial regression weight for hospital administration in the prediction of effective management of hospital infrastructure is significantly different from 0 at 1%.

The estimated regression weights to determine patient care with reduction of congestion in movement is 1.000. The estimated regression weights to determine patient care in relieving the pressure of long waiting time is 1.088 with standard error of 0.063, critical ratio of 3.492 and probability of 0.000. The estimated regression weights of patient care in lessening the fear of disease spread is 1.104 with standard error of 0.078 and critical ratio of 14.152 with a probability of 0.000. The regression weight of patient care for swift medical attention is 1.158, estimated with a standard error of 0.072 and critical ratio of 16.035 at the probability of 0.000. Therefore, the partial regression weight for patient care in predicting the reduction of congestion in movement, in relieving the pressure of long waiting time, in lessening the fear of disease spread and for swift medical attention is significantly different from 0 at 1%.

The estimated regression weights of uni-directional circular movement in predicting effective management of hospital infrastructure is 0.436 with standard error of 0.061, critical ratio of 7.126 and probability of 0.000 and the estimated regression weights of uni-directional circular movement in predicting social distancing is 0.202 with standard error of 0.067, critical ratio of 3.011 with a probability of 0.003. Also, the estimated regression weights of uni-directional circular movement in predicting service quality is 0.449 with standard error of 0.063, critical ratio of 7.179 and probability of 0.000. The partial regression weight for uni-directional circular movement in predicting effective management of hospital infrastructure, social distancing and service quality is significantly different from 0 at 1%.

The estimated regression weight of hospital administration in determining the heightening the service quality is 1.000 and estimated regression weight of hospital administration in determining the social distancing is 0.780, estimated with a standard error of 0.110 and critical ratio of 7.064 at the probability of 0.000. The partial regression weights for hospital administration in predicting heightening the service quality and social distancing is significantly different from 0 at 1%.

Table 2: Standardized Regression Weights

Variables	Estimate
Patient care <--- Hospital administration	0.477
Effective management of hospital infrastructure <--- Hospital administration	0.850
Reduction of congestion in movement <--- Patient care	0.846
Relieving the pressure of long waiting time <--- Patient care	0.871
Lessening the fear of disease spread <--- Patient care	0.756
Swift medical attention <--- Patient care	0.825
Effective management of hospital infrastructure <--- Uni-directional circular movement	0.367
Social distancing <--- Uni-directional circular movement	0.176
Heightening the service quality <--- Uni-directional circular movement	0.385
Heightening the service quality <--- Hospital administration	0.603
Social distancing <--- Hospital administration	0.479

The standardized regression weights (Table 2) of hospital administration with patient care and effective management of hospital infrastructure are 0.477 and 0.850, respectively. The standardized regression weights of patient care with reduction of congestion in movement, relieving the pressure of long waiting time, lessening the fear of disease spread and for swift medical attention are 0.846, 0.871, 0.756 and 0.825, respectively. The standardized regression weights of uni-directional circular movement with social distancing and heightening the service quality are 0.176 and 0.385, respectively. The standardized regression weights of hospital administration in heightening the service quality and social distancing are 0.603 and 0.479, respectively.

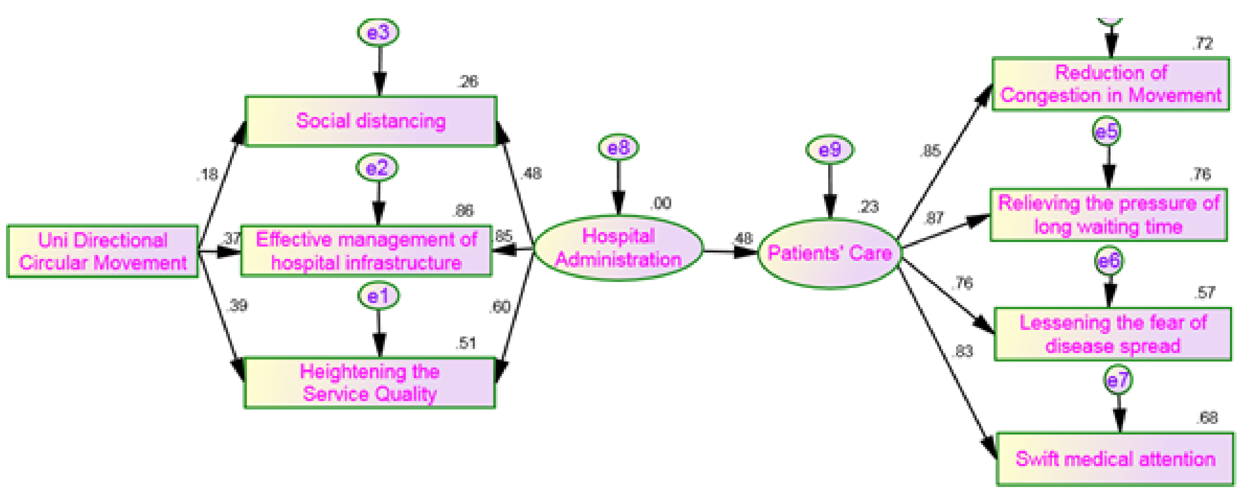
Table 3: Variances

Variables	Estimate	Standard Error	Critical Ratio	Probability
Unidirectional circular movement	1.012	0.087	11.619	0.000
e8	0.501	0.097	5.164	0.000
e9	0.388	0.049	7.854	0.000
e3	0.986	0.092	10.764	0.000
e1	0.671	0.077	8.725	0.000
e2	0.203	0.103	1.967	0.049
e7	0.315	0.036	8.833	0.000
e6	0.458	0.046	9.909	0.000
e4	0.200	0.024	8.319	0.000
e5	0.190	0.025	7.510	0.000

Table 4: Squared Multiple Correlations

Variables	Estimate	Error Variance
Hospital administration	0.000	100.0%
Patient care	0.228	77.2%
Heightening the service quality	0.513	48.7%
Social distancing	0.260	74%
Swift medical attention	0.681	31.9%
Lessening the fear of disease spread	0.572	42.8%
Relieving the pressure of long waiting time	0.758	24.2%
Reduction of congestion in movement	0.715	28.5%
Effective management of hospital infrastructure	0.858	14.2%

Figure 1: SEM Model – Uni-directional circular movement for effectual hospital administration



All the variances for the observed and unobserved exogenous variables, including the uni-directional circular movement and all error variables from e1 to e9 are statistically significant at 1% (shown in Table 3). Squared multiple correlation/R-squared was investigated (Table 4) which determines the coefficient of determination. The coefficient of determination for hospital administration is 0.000, which shows that the predictors of hospital administration (independent variables) explain 0% of its variance. Therefore, the error variance of hospital administration is 100%. The coefficient of determination for patient care, heightening the service quality, social distancing, swift medical attention, lessening the fear of disease spread, relieving the pressure of long waiting time, reduction of congestion in movement and effective management of hospital infrastructure are 0.228, 0.513, 0.260, 0.681, 0.572, 0.758,0.715 and 0.858, respectively, and the error variance of the variables are approximately 100.0%, 77.2%, 48.7%, 74%, 31.9%, 42.8%, 24.2%, 28.5% and 14.2%, respectively. The SEM (Figure 1) shows the structural relationships between the variables of hospital administration and the constructs of patient care.

Table 5: Model Fit Summary

Model	NPAR	CMIN	DF	P	CMIN/DF	RMR	GFI
Default Model	18	67.201	17	0.000	3.953	0.078	0.924
	AGFI	PGFI	NFI	RFI	CFI	RMESA	
	0.939	0.436	0.911	0.954	0.925	0.035	

In the model (Table 5), the CMIN value is 67.201 and the default model has degrees of freedom equal to 17. Assuming that the default model is correct, as the probability of getting a discrepancy as large as 67.201 is 0.000 and CMIN divided by DF for the default model is 3.953. Thus, the null hypothesis is accepted. There is a goodness of fit in the structural relationship between the variables of hospital administration with uni-directional movement and the constructs of patient care. GFI, the Goodness of fit value of the given model, is 0.924, AGFI value is 0.939, PGFI value is 0.436, NFI value is 0.911, RFI value is 0.954 and CFI value is 0.925. All values are greater than 0.9 which support the given model. The RMR and RMSEA value is favourable to the model, which is 0.078 and 0.035, respectively, highly supporting in explaining the structural relationship among the variables of hospital administration and the constructs of patient care. The given model perfectly explains the structural relationship between the variables of hospital administration with uni-directional circular movement and the constructs of patient care that includes effective management of hospital infrastructure, reduction of congestion in movement, relieving the pressure of long waiting time, lessening the fear of disease spread, swift medical attention, social distancing and heightening the service quality.

Conclusion

An effective hospital administration is one of the key factors in improving the efficiency of health systems. High intensity patient traffic and subsequent congestions in hospitals need to be addressed in the existing situation where a pandemic such as Covid-19 exists. By implementing a hospital administration system in the form of promoting a unidirectional circular movement of patients will no longer obstruct the movement of incoming and outgoing patients, thus reducing the chances of disease spread and its infections. In this research paper, efforts have been made to recommend a new optimized unidirectional circular movement in hospitals using a SEM to guarantee social distancing, which is critical in the existing circumstances of COVID-19 spread. The given model perfectly explains the structural relationship between the variables of hospital administration with uni-directional circular movement and the constructs of patient care that includes effective management of hospital infrastructure, reduction of congestion in movement, relieving the pressure of long waiting time, lessening the fear of disease spread, swift medical attention, social distancing and heightening the service quality.

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