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REVUE EUROPEENNE D ETUDES EUROPEAN JOURNAL OF MILITARY STUDIES
Social Science Journal

Optimizing Healthcare Resources for Sustainable Development: A Study on Rural Health Systems in Greater Noida

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Abstract: The present study has aimed at the optimization of healthcare resources for sustainable development in rural Greater Noida, focusing on the availability and utilization of healthcare facilities, infrastructure, and manpower. Descriptive research design, data from 150 respondents in the age group of 18-60 years, was collected through a structured Google survey on a 5-point Likert scale. Non-probability convenience sampling ensured demographic diversity across income levels, age groups, and rural regions. SPSS was used for data analysis, while the reliability test by Cronbach's Alpha was conducted. Comparisons by demographic groupings were made possible through ANOVA. The implication of the latter in the perceptions of healthcare by gender is strongly significant, though the ANOVA results bear an F value of 14.194 points with a p-value of less than 0.001 percent for availability and 10.628 points, also at $p < 0.001$ percent, for utilization. Reliability measurement by Cronbach's Alpha yielded figures of 0.708 for availability and 0.716 for utilization, a very good survey instrument. These results highlight the need for gender-sensitive strategies, improved healthcare infrastructure, and better resource allocation to promote sustainable healthcare development in rural areas.

Keywords: Healthcare Resources, Sustainable Development, Healthcare Facilities, Infrastructure, Manpower And Gender-Sensitive

1. Introduction

Rural healthcare systems are so important to be able to keep individuals healthy in all rural parts of the country. People in rural regions continue to face several challenges, despite advancements in medical research. The majority of rural communities consist of elderly patients, people with low incomes, and minorities who experience significant health disparities related to inadequate medical care, geographical barrier, and low socioeconomic status. For instance, access to "health care is lower in rural" compared to urban areas, mainly due to poor infrastructure and shortages in the workforce [1]. In addition, remote geographical locations promote these disparities as treatments are accessed later and health outcomes much worse [2].

These issues call for tailored solutions in order to assure equal access in the rural healthcare systems. Strengthening health care in the underserved areas involves service delivery, infrastructural development, and human resource development. In this respect, policy makers along with stakeholders are supposed to formulate efficient and sustainable models of healthcare delivery. New approaches like telemedicine and mobile health units were found promising for bridging gaps in health care [3]. The promotion of sustainable health care

development includes the engagement of a community-based healthcare approach involving the population in general, [4]. Significant improvements in rural healthcare due to strategic interventions result in considerable health disparities reduction.

1.1. Overview of Rural Healthcare Systems

Primary care, preventative medicine, and specialty medical treatment are all part of rural areas' healthcare systems. Among the most characteristic features that are usually attributed to rural health systems are the scarcity of human resources, poor conditions of infrastructure, and obstacles in accessibility and geography. The disparities in rural and urban healthcare systems are well-documented, with rural areas experiencing higher rates of chronic illnesses, poorer health outcomes, and lower healthcare utilization [1]. Besides, healthcare infrastructure in rural areas is not as well advanced as in urban centers, which adds to the disparities in the outcomes of healthcare [5].

Several factors contribute to making rural healthcare systems complex, including but not limited to insufficient infrastructure, unavailability of well-trained medical staff, and lack of adequate financial support. These are challenges that can only be met with the help of government initiatives, local participation, and proper utilization of the latest healthcare technologies [6]. Stronger rural health systems enhance not only the health status of the people but also their quality of life [7].

1.2. The Need for Optimized Resource Management in Rural Healthcare

Resource management is vital in this respect to the ability of rural healthcare systems to provide timely and sufficient medical services to underserved populations. Health disparities in rural areas are aggravated by resource shortages, such as medical equipment, medications, and trained personnel [8]. Optimization of resource management would presuppose strategic resource allocation, efficient use of the available healthcare facilities, and introduction of innovative models of healthcare delivery. Besides, well-structured health policies addressing such issues can ensure improvement in the outcomes of rural healthcare [9].

1.2.1. Gaps in Healthcare Resource Distribution

Healthcare resource distribution in rural areas is often uneven, leading to significant disparities in healthcare access and quality. Factors such as “geographic isolation, low population density, and limited financial resources contribute” to these gaps [2]. Additionally, rural healthcare facilities frequently face shortages of essential supplies, medical equipment, and specialized healthcare providers. Targeted interventions, such as financial incentives for healthcare professionals and investments in infrastructure, are necessary to address these gaps [10].

1.2.2. Importance of Sustainable Healthcare Development

- Ensures long-term healthcare access in remote regions by fostering community-based healthcare models.
- Reduces healthcare costs through efficient resource allocation and preventive care programs [3].

- Enhances healthcare quality by investing in continuous training and education of medical personnel [4].
- Promotes environmental sustainability by adopting green technologies in healthcare infrastructure [8].

1.3. Infrastructure and Manpower: The Core Pillars of Rural Healthcare

The infrastructural and manpower base forms the core of any health system, which is further strained in rural settings due to a lack of resources. Availability of healthcare infrastructure ensures basic medical services are available, while a well-trained workforce is necessary for quality care [11]. Both these aspects are big concerns in the rural health systems. Developing and strengthening infrastructure and manpower requires coordination at many levels between governments, NGOs, and the private sector [3].

1.3.1. Assessing Healthcare Infrastructure in Rural Areas

The general setup for health facilities within rural areas includes “primary health centers (PHCs), community health centers (CHCs), and sub-centers catering” to basic medical needs. These health centers largely lack modern medical equipment, diagnostic facilities, and emergency treatment facilities [1]. Therefore, investment in infrastructure development in terms of constructing new healthcare facilities and upgrading the already existing ones becomes very important in order to enhance accessibility and quality of healthcare [12]. Besides, telemedicine and mobile clinics are some of the innovative solutions that can bridge the gap in healthcare delivery.

1.3.2. Evaluating Human Resource Availability and Competency

The availability and competency of health professionals in rural areas are major determinants of the quality of care. The majority of rural regions face a deficiency in qualified medical personnel, which includes doctors, nurses, and specialists [5]. In addition, health workers in rural or remote settings face challenges in retention due to several issues such as poor remuneration, limited opportunities for professional growth, and bad working conditions. Strategies needed to address these issues include providing financial incentives, continuous medical education, and improved living conditions for healthcare workers [7].

1.4. Utilization of Healthcare Facilities: Measuring Efficiency and Effectiveness

Health facility utilization is a key indicator for monitoring the performance of rural healthcare systems. It is mainly used to determine how well the target population utilizes healthcare services and what the barriers to such utilization are. Accessibility, affordability, availability of services, and cultural perceptions towards medical care are some of the factors that affect healthcare utilization in rural areas [5]. Improved utilization enhances health outcomes and optimizes resource use.

Various studies have described that rural populations face barriers and challenges in finding access to health facility services. Much of the time and due to factors of geographic and transportation isolation, rural people have to have long-distance transfers for medical-care purposes, "which results in delayed diagnosis and treatment thereby leading to poor recovery

rates ". For instance, rural communities have characteristics of low level of income in addition to poorly insured health thereby hindering or limiting access to facility care "[13]. The new innovative approaches in mobile health units, telemedicine, and outreach programs show a very promising way to increase the utilisation of health care " [6]. Secondly, creating awareness among people through community engagement helps resolve socio-cultural barriers and misbelieiefs related to the available healthcare services. Continuous monitoring and evaluation of the use of health facilities is a very useful method to recognize the shortcomings in services and help modify these to meet the unmet needs [14].

1.4.1. Factors Affecting Healthcare Utilization

- **Accessibility:** Health care facilities are difficult to reach due to a lack of convenient transit choices and extreme distances.
- **Affordability:** People are less likely to use healthcare services when they have large out-of-pocket costs or insufficient health insurance.
- **Availability:** Shortage of healthcare providers and medical resources in rural areas limits service provision [1].
- **Cultural Beliefs:** Traditional beliefs and misconceptions about modern healthcare affect utilization [11].

1.4.2. Strategies for Enhancing Healthcare Utilization

Improvement in health care utilization at the rural level needs a systemic and community-level approach. The increased utilization of health care can be achieved by strategies aimed at strengthening the structure: increasing the volume of health facilities, improving their accessibility, and enhancing the supply of essential medicines, diagnostic tools, and medical personnel to provide timely and effective care [9]. Community-based health education and outreach programs can be used to increase awareness about the availability of health-seeking services. Financial incentives, subsidization of costs for the low-income population, will serve to enhance affordability and, therefore, utilization of health care. This is where the use of technology-especially telemedicine and mobile health apps-can actually better bridge the gap in access and enhance overall efficiency [3].

2. literature Reviews

Smith et al. (2009) presented hierarchical models with an emphasis on equity and efficiency related to the placement of health facilities. Ahmed and Shirahada (2019) studied BRAC's model of healthcare in Bangladesh and highlighted the role of knowledge transfer and optimization of resources in low-resource settings. Lastly, Alban et al. (2021) shared how to optimize mobile healthcare unit allocation using sigmoidal demand models, with a focus on long-term access and sustainability.

Wu et al. (2022) reviewed the health system reforms in China and emphasized the need for balanced resource allocation to achieve sustainability. Harris et al. (2017) developed a model for resource allocation focused on promoting efficiency in the health system through

divestment of low-value services. Emekalam (2012) suggested local resource mobilization for sustaining rural health promotion projects. The rural health system must mobilize their resources very judiciously. Stenberg et al. (2017) carried out estimation about the resources which will be needed to have sustainable health care and also did recommendations about strategic investment.

Harris et al. (2017) investigated the local evidence-driven approach to resource allocation in healthcare, which has shown better sustainability. Olatomiwa and Blanchard " (2019) described the possible contribution of renewable energy to increasing and enhancing rural healthcare while making operations much cheaper. Palozzi et al. (2020) discussed how, through the use of telemedicine, access to health could be more available for disadvantaged rural areas since it would reduce costs. These emerging technologies and policy innovations provide the essential approaches toward sustainable health care in the countryside. Harris et al. (2018) reported results of a multi-faceted disinvestment program aimed at optimizing healthcare resource use in Australia.

Madhavi (2020) pointed out the priority healthcare challenges in rural India and also proposed focused infrastructure and access improvement. Emekalam (2012) discussed the practical framework on how to provide sustainability for health promotion programs in rural settings through local partnerships. Harris et al. (2017) also emphasized that support services were very essential in evidence-based decision-making in the allocation of healthcare resources.

3. METHODOLOGY

3.1. Research Design

This study employed a descriptive research strategy to delve into the availability and utilization of healthcare resources in rural areas of Greater Noida. Since it gives an understanding of the existing healthcare infrastructure, the number of available personnel, and the utilization rate, the descriptive technique is suitable. The focus of the study on both quantitative and qualitative aspects will help draw meaningful insights into the challenges and opportunities in rural healthcare systems.

3.2. Data Collection

Data collection was done using a structured Google survey aimed at eliciting responses with regard to the availability and utilization of healthcare facilities as perceived by respondents. The closed-ended items in this survey are rated on a Likert scale with five points, ranging from one to five, with one being strongly disagree and five being strongly agree. This is convenient because it will enforce consistency in the responses, while it is easy to analyze statistically. Thereafter, the questions will be divided into two sections that correspond to the respective ends of the study.

3.3. Objective

1. Assessing the availability of the healthcare facilities in terms of Infrastructure and manpower.
2. Assessing the level of utilisation of available healthcare facilities.

3.4. Sampling Strategy and Sample Size

It shall include all residents of rural areas in Greater Noida within the age group of 18-60 years. The present research work shall, therefore, use a non-probability convenience sampling to ensure diversities of respondents. Given the limitations with regard to the time and other resources in the study, 150 samples have been chosen, which can ensure adequate representation to yield meaningful statistical analysis.

3.5. Data Analysis Techniques

Quantitative data analysis was performed using SPSS software. In order to determine whether or not the survey instrument was reliable, the Cronbach's Alpha coefficient was computed. ANOVA and T-test were used for comparison across demographic groups, maintaining statistical validity. This will provide an idea about the variation in response and lead to a holistic understanding of healthcare resource availability and utilization in rural Greater Noida.

4. Results

Table 1: Demography

Category	parameter	Frequency	Percent
Gender	Male	83	55.3
	Female	67	44.7
	Total	150	100.0
Age	18-30 years	42	28.0
	31-40 years	42	28.0
	41-50 years	38	25.3
	51-60 years	28	18.7
	Total	150	100.0
Income	2 lakh below	28	18.7
	2-5 lakh	40	26.7
	5-10 lakh	43	28.7
	10-15 lakh	20	13.3
	15 lakh above	19	12.7
	Total	150	100.0
Area	Bisrakh	25	16.7
	Maincha	24	16.0
	Bisnoli	33	22.0
	Sadullapur	37	24.7
	Dadri	31	20.7

	Total	150	100.0

The survey was conducted among 150 respondents, who were 55.3% male and 44.7% female. Response by age group was good: 28.0% for both age categories of 18-30 years and 31-40 years, followed by 25.3% in the "41-50 years category and 18.7% in the 51-60 years category". For income levels, the majority of respondents (28.7%) earned between ₹5-10 lakh, followed by 26.7% for ₹2-5 lakh; 18.7% below ₹2 lakh; 13.3% for ₹10-15 lakh; and 12.7% above ₹15 lakh. Along with this, it also covers several rural areas of Greater Noida, and major proportions were from Sadullapur (24.7%), Bisnoli (22.0%), Dadri (20.7%), Bisrakh (16.7%) and Maincha (16.0%). It will ensure demographic representative diversity to get holistic insight into the availability of healthcare resources and their utilization across a number of age brackets, classes, and rural tracts in Greater Noida.

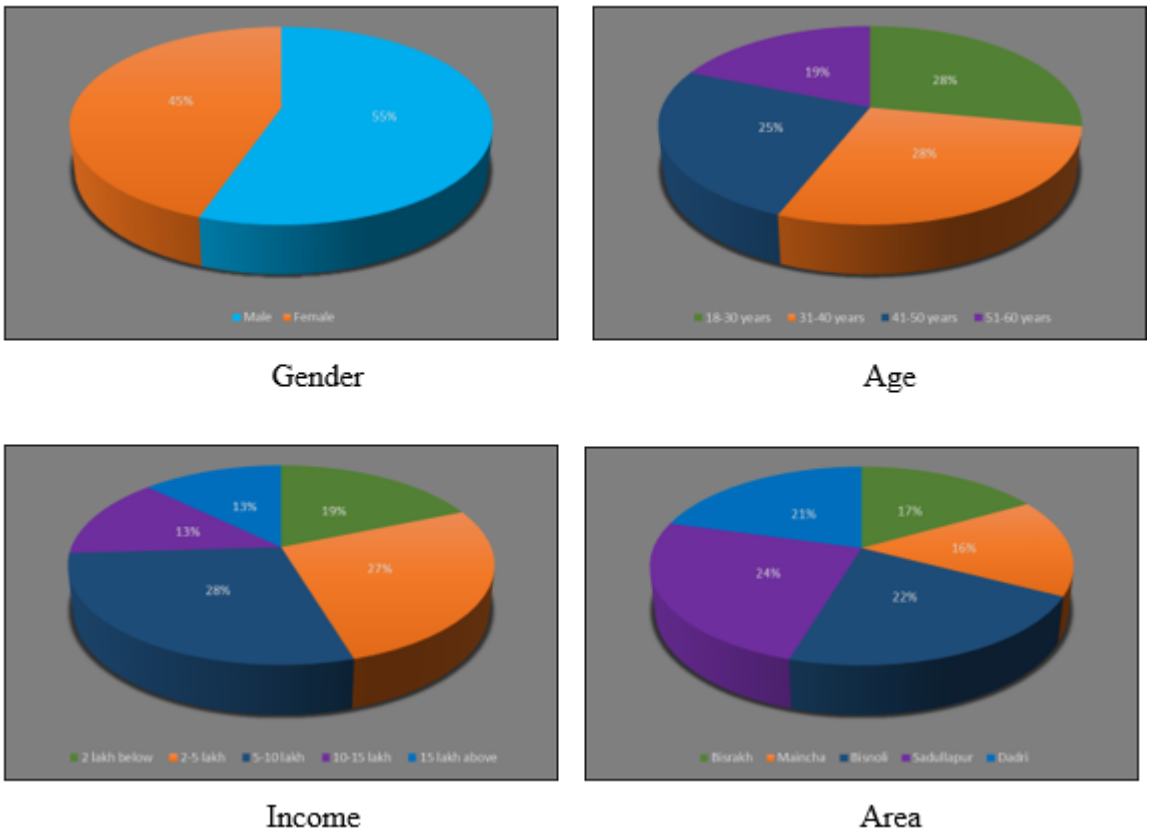

Figure 1: Demography Pia Chart

Table 2: Cross Tabulation of Gender * Rural healthcare adequately equipped with infrastructure.

parameter	Strongly Disagree	Disagree	neutral	Agree	Strongly Agree	Total
Male	8	21	21	19	14	83
Female	8	13	14	11	21	67
Total	16	34	35	30	35	150

In the series below, the percentage distribution of overall satisfaction with Greater Noida rural healthcare facility medical infrastructure does not unanimously vary among different groups of gender. Thereafter, it gets balanced for male respondents with equitable weights of dissatisfaction, neutrals, and satisfied. This itself shows that an equal number of males are as much pleased with the infrastructural setup as is the ratio of males highly critical of the mentioned aspect. The responses of females are on the positive note: 8 strongly disagree, 13 disagree, 14 neutral, 11 agree, and a higher number of females strongly agree, 21. This depicts that females are more optimistic towards the sufficiency of medical infrastructure compared to males.

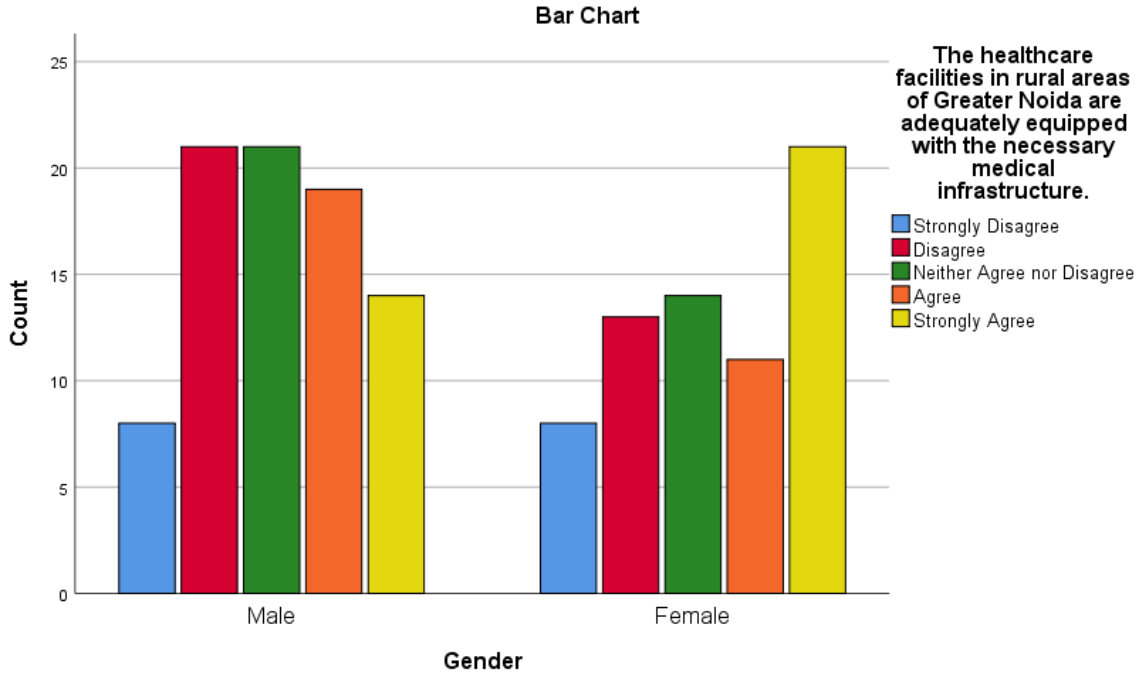

Figure 2: Gender * Rural healthcare adequately equipped with infrastructure.

Objective 1: Assessing the availability of the healthcare facilities in terms of Infrastructure and manpower.

Sample T-Test

Table 3: Objective 1-One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Healthcare Facilities	150	3.23	1.322	.108
Healthcare Professionals	150	3.28	1.367	.112
Diagnostic Equipment	150	3.28	1.362	.111
Emergency Services 24/7.	150	3.30	1.355	.111

Regarding health-Quantitative availability of healthcare facility in rural area: In Greater Noida, the Mean health facilities for rural areas were 3.23 with S.D 1.322 and SE.M 0.108

150 whereas 'availability of required healthcare professionals" it was found for mean 3.28std. deviation, 1.367 and its stderrM found 0 112. Diagnostic equipment available had a mean of 3.28 and a standard deviation of 1.362 with a standard error mean of 0.111. The same was followed for the emergency services being available 24*7 as it received a mean score of 3.30 showing a standard deviation of 1.355 and a standard error mean of 0.111.

Table 4: Objective 1-One-Sample Test

	t	df	Test Value = 0		95% Confidence Interval of the Difference	
			Sig.	Mean Difference	Lower	Upper
Healthcare Facilities	29.899	149	.000	3.227	3.01	3.44
Healthcare Professionals	29.397	149	.000	3.280	3.06	3.50
Diagnostic Equipment	29.503	149	.000	3.280	3.06	3.50
Emergency Services 24/7.	29.831	149	.000	3.300	3.08	3.52

For all means of healthcare facility and health personnel's availability in districts or provinces, One sample t-test output has a critical meaningful Mean of difference from the tested value of 0 is 3.227, with the t-value equal to 29.899 while the 95% confidence interval falls within a range of from 3.01 to 3.44 and 3.280 for Healthcare professionals with the t-value being 29.397 and 95% confident that the t statistics estimates fall between the range of 3.06 and 3.50, respectively. In case of diagnostic equipment, the mean difference was 3.280 with a t-value of 29.503, with a 95% confidence interval ranging from 3.06 to 3.50. The emergency services available 24*7 have given a mean difference of 3.300 with a t-value of 29.831, with a 95% confidence interval ranging from 3.08 to 3.52. All results provided that there exists a significant difference from the test value of 0 at p<.000.

Table 5: Objective 1-Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.850	.722	.720	0.600

a. Predictors: (Constant), Emergency Services 24/7., Healthcare Professionals, Diagnostic Equipment

The regression analysis “indicates a strong correlation R = 0.850" of the predictors "Emergency Services 24/7, Healthcare Professionals, and Diagnostic Equipment" to the availability of healthcare facilities. By the value of R Square of 0.722, it is observed that 72.2% of the variation in healthcare facilities is explained by these predictors, having an adjusted R Square of 0.720. This reflects a high influence of the predictors. “The standard error of the estimate” is 0.600, which is relatively small, and this reflects that the model has been well fitted.

Table 6: Objective 1-ANOVA

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	58.773	3	19.591	14.194	.000
Residual	201.520	146	1.380		
Total	260.293	149			

a. Dependent Variable: Healthcare Facilities
b. Predictors: (Constant), Emergency Services 24/7., Healthcare Professionals, Diagnostic Equipment

It can be obtained from the ANOVA that the overall regression model is significant, $F = 14.194$, $p < 0.001$. In other words, predictors - emergency services 24/7, healthcare professionals, and diagnostic equipment taken collectively influence the availability of health care facilities significantly. "The sum of squares for the regression is 58.773 while for the residual" it is 201.520.

Table 7: Objective 1-Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	1.356	.320		4.243	.000
Healthcare Professionals	.352	.078	.364	4.525	.000
Diagnostic Equipment	.098	.080	.101	1.222	.004
Emergency Services 24/7.	.120	.080	.123	1.495	.137

a. Dependent Variable: Healthcare Facilities

The coefficients table details the individual contribution of each predictor. Health professionals are the strongest contributors to the availability of healthcare facilities with $B = 0.352$ and $p < 0.001$, indicating that qualified healthcare staff is important in rural health systems. Diagnostic equipment, $B = 0.098$, $p = 0.004$, is also an important determinant, though on a lesser scale. Whereas the following emergency services 24 × 7 showed a positive correlation, at $B = .120$ and $p = .137$, did not present any statistically significant influence in this model, indicating other variables might be of more critical significance in terms of healthcare facility availability.

Objective 2: Assessing the level of utilisation of available healthcare facilities.
Sample T-Test

Table 8: Objective 2-One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean

Healthcare Facilities Over Traveling.	150	3.43	1.333	.109
Preventive Healthcare Services	150	3.23	1.421	.116
High Level Healthcare (education)	150	3.33	1.339	.109
Healthcare Facilities	150	3.41	1.342	.110

The mean for using the healthcare facilities over traveling is 3.43, with a standard deviation of 1.333, and a mean standard error of 0.109. The mean for using preventive healthcare service was 3.23, with a standard deviation of 1.421 and a mean standard error of 0.116. High-level health care had a mean score of 3.33 with a standard deviation of 1.339 and a standard error mean of 0.109. Generally, health facilities have a mean of 3.41 with a standard deviation of 1.342 and standard error of mean 0.110.

Table 9: Objective 2-One-Sample Test

	t	df	Test Value = 0		95% Confidence Interval of the Difference	
			Sig.	Mean Difference	Lower	Upper
Healthcare Facilities Over traveling.	31.488	149	.000	3.427	3.21	3.64
Preventive Healthcare Services	27.869	149	.000	3.233	3.00	3.46
High Level Healthcare	30.478	149	.000	3.333	3.12	3.55
Healthcare Facilities	31.099	149	.000	3.407	3.19	3.62

T-Test health facilities over travelling: The mean difference is 3.427, the t-value is 31.488, and at 95%, the confidence interval is from 3.21 to 3.64. About preventive health care services: the mean difference is 3.233, the t-value is 27.869 with a confidence interval of 3.00 to 3.46. High-level facility mean difference was 3.333, t = 30.478, confidence interval between 3.12-3.55. For all levels of healthcare facilities, the mean difference was 3.407; t = 31.099; 95% confidence intervals between 3.19-3.62. All results were significant at $p < .000$.

Table 10: Objective 2-Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.760	.578	.575	0.800

a. Predictors: (Constant), High Level Healthcare, Preventive Healthcare Services, Healthcare Facilities Over Traveling.

The correlation in the regression analysis that was conducted to study the level of utilization of the available healthcare facilities comes out to be quite strong: R = 0.760, thus depicting the variability of the healthcare facility utilization due to its predictors-High Level Healthcare, Preventive Healthcare Services, and Healthcare Facilities Over Traveling. Also, the R Square value is 0.578, which indicated that 57.8% variation in facility utilization is explained by these predictors. The adjusted R Square is 0.575. The standard error of the estimate is 0.800, indicating a good fit of the model.

Table 11: Objective 2-ANOVA

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	48.070	3	16.023	10.628	.000
Residual	220.123	146	1.508		
Total	268.193	149			

b. Dependent Variable: Healthcare Facilities

a. Predictors: (Constant), High Level Healthcare, Preventive Healthcare Services, Healthcare Facilities Over Traveling

From the ANOVA table in the regression output, it can be observed that the overall model is significant, with F = 10.628 and p < 0.001. Thereby, the significant effects of predictors on the availability of health facilities are contributed. The size of the regression sum of squares, which is 48.070, is relatively large compared to the residual sum of squares, 220.123, indicating that these predictors can fairly explain the variability in healthcare facilities.

Table 12: Objective 2-Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	1.554	.345		4.504	.000
Healthcare Facilities Over Traveling.	.136	.087	.135	1.568	.003
Preventive Healthcare Services	.182	.079	.193	2.306	.004
High Level Healthcare	.239	.080	.238	2.972	.003

a. Dependent Variable: Healthcare Facilities

From the coefficients table, the separate contributions of each predictor within the model may be gauged: High-level care: B =.239, p =.003 This means that having advanced medical care is very important. Preventive health services: B =.182, p =.004, shows that, in fact, the preventive side of health contributes much to keeping the public health at a certain level. In this respect, a significant positive effect is shown for healthcare facilities over traveling [B = 0.136, p = 0.003], which means reducing the distances of travel to healthcare facilities can lead to better access and availability. These insights suggest that a multidimensional approach needs to be considered when developing sustainable health care systems for rural areas.

Table 13: Reliability

S. No	Parameters	No. of items	Cronbach's alpha
1	Assessing availability of healthcare facilities	5	.708
2	Level of utilisation of facilities	5	.716

Cronbach's Alpha was applied to test the reliability of the survey instrument in measuring the availability and utilization of healthcare facilities. The questionnaires for availability and utilization of healthcare facilities had 5 items each, and the Cronbach's Alpha values were 0.708 and 0.716, respectively, showing good internal consistency in the field for both parameters. The present results confirm the reliability of the survey instrument regarding healthcare availability and utilization in rural Greater Noida.

5. Conclusion

The study was conducted to understand the availability and utilization of healthcare resources in rural Greater Noida. Demographic analysis and statistical tests yielded the key findings. The gender ratio of respondents was 55.3% male and 44.7% female, ensuring a balanced representation. The results of ANOVA for Objective 1, on availability of the healthcare facility, was $F = 14.194$, with a p-value of < 0.001, which showed that key factors responsible for availability include healthcare professionals, diagnostic equipment, and emergency services. On the support, Objective 2 was to determine the utilization of health care with due time, and through ANOVA, the result yielded an F_value of 10.628. The p_value is less than 0.001; hence, utilization is established to be affected by high-level health care services, prevention care, and access. The survey instrument measurement tool is reliable since Cronbach's Alpha for availability is 0.708, while utilization is 0.716, hence indicating good internal consistency. These, in turn, point out that stakeholders' attention is needed in terms of increased needs for timely, gender-sensitive approaches, advanced health infrastructure construction, and resource allocation that would create truly sustainable healthcare developments in rural settings.

References

[1]. Andreyeva, E., Kash, B., Preston, V. A., Vu, L., & Dickey, N. (2022). Rural hospital closures: effects on utilization and medical spending among commercially insured individuals. *Medical Care*, *60*(6), 437-443.

[2]. Wang, Z., Chen, Y., Pan, T., Liu, X., & Hu, H. (2019). The comparison of healthcare utilization inequity between URRBMI and NCMS in rural China. *International journal for equity in health*, *18*, 1-12.

[3]. Bagchi, A. D. (2019). Expansion of telehealth across the rural–urban continuum. *State and Local Government Review*, *51*(4), 250-258.

[4]. Nuako, A., Liu, J., Pham, G., Smock, N., James, A., Baker, T., ... & Chen, L. S. (2022). Quantifying rural disparity in healthcare utilization in the United States: Analysis of a large midwestern healthcare system. *PLoS One*, *17*(2), e0263718.

[5]. James, C. V. (2017). Racial/ethnic health disparities among rural adults—United States, 2012–2015. *MMWR. Surveillance Summaries*, *66*.

[6]. Nayyar, A. S. (2022). Indian Rural Lands and Shortages of Healthcare Professionals: A Burning Issue. *Journal of Datta Meghe Institute of Medical Sciences University*, *17*(1), 95-102.

[7]. Zheng, D., Gong, J., & Zhang, C. (2019). Efficiency of medical service systems in the rural areas of Mainland China: A comparative study from 2013 to 2017. *Public Health*, *171*, 139-147.

[8]. Prina, L. L. (2016). Grantwatch. *Health Affairs*, *35*(5), 932.

[9]. Douthit, N., Kiv, S., Dwolatzky, T., & Biswas, S. (2015). Exposing some important barriers to health care access in the rural USA. *Public health*, *129*(6), 611-620.

[10]. Cyr, M. E., Etchin, A. G., Guthrie, B. J., & Benneyan, J. C. (2019). Access to specialty healthcare in urban versus rural US populations: a systematic literature review. *BMC health services research*, *19*, 1-17.

[11]. Nambiar, D., Sankar, H., Negi, J., Nair, A., & Sadanandan, R. (2020). Field-testing of primary health-care indicators, India. *Bulletin of the World Health Organization*, *98*(11), 747.

[12]. Smith, H. K., Harper, P. R., Potts, C. N., & Thyle, A. (2009). Planning sustainable community health schemes in rural areas of developing countries. *European Journal of Operational Research*, *193*(3), 768-777.

[13]. Ahmed, T., & Shirahada, K. (2019). Toward a sustainable healthcare service system in a limited resource context: case study of Bangladesh rural advancement committee's healthcare system. *International Journal of Healthcare Management*, *12*(2), 97-105.

[14]. Alban, A., Blaettchen, P., de Vries, H., & Van Wassenhove, L. N. (2022). Resource allocation with sigmoidal demands: Mobile healthcare units and service adoption. *Manufacturing & Service Operations Management*, *24*(6), 2944-2961.

[15]. Wu, F., Chen, W., Lin, L., Ren, X., & Qu, Y. (2022). The Balanced allocation of medical and health resources in urban areas of China from the perspective of sustainable development: a case study of nanjing. *Sustainability*, *14*(11), 6707.

[16]. Harris, C., Allen, K., Waller, C., Green, S., King, R., Ramsey, W., ... & Thiagarajan, M. (2017). Sustainability in Health care by Allocating Resources Effectively (SHARE) 5: developing a model for evidence-driven resource allocation in a local healthcare setting. *BMC health services research*, *17*, 1-18..

[17]. Emekalam, A. U. (2012). A conceptual sustainability strategy for a rurally-based community health promotion initiative. *Journal of Health and Medical Informatics*, *3*(1), e101.

[18]. Stenberg, K., Hanssen, O., Edejer, T. T. T., Bertram, M., Brindley, C., Meshreky, A., ... & Soucat, A. (2017). Financing transformative health systems towards achievement of the health Sustainable Development Goals: a model for projected resource needs in 67 low-income and middle-income countries. *The Lancet Global Health*, *5*(9), e875-e887.

[19]. Olatomiwa, L., & Blanchard, R. (2019). Maximizing the penetration levels of hybrid renewable energy systems in rural areas with demand side management approaches in achieving SDGs.

[20]. Palozzi, G., Schettini, I., & Chirico, A. (2020). Enhancing the sustainable goal of access to healthcare: findings from a literature review on telemedicine employment in rural areas. *Sustainability*, *12*(8), 3318.

[21]. Harris, C., Allen, K., Ramsey, W., King, R., & Green, S. (2018). Sustainability in Health care by Allocating Resources Effectively (SHARE) 11: Reporting outcomes of an evidence-driven approach to disinvestment in a local healthcare setting. *BMC health services research*, *18*, 1-23.