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ANALYSING THE IMPACT OF SUSTAINABLE DEVELOPMENT IN RURAL HEALTH CARE SYSTEMS ON GENDER, INCOME, AND MARITAL STATUS

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ABSTRACT

This study explores the impact of sustainable development initiatives in rural healthcare systems on key demographic factors such as gender, income, and marital status. The present study analyzed the stated factors for health facility utilization in rural populations. Data collection was through a structured questionnaire, adapted to suit respondents' preference for a sample size of 150 from rural areas. It also established that economic status and healthcare access significantly lower the gap in healthcare access between males and females and, thus, are critical factors in promoting gender equity. However, factors like family size and education were less influential in determining healthcare usage and income levels. Marital status, in particular, showed minimal impact from these "predictors, suggesting that other factors may play a more significant role in shaping healthcare access in rural settings". These findings have significant implications for targeted economic status interventions for improving health equity in rural areas, while at the same time pointing toward the importance of further research into the cultural and social dynamics that shape access to care.

KEY WORDS: sustainable development, rural healthcare, demographic factors, gender, income, marital status, healthcare facility, economic status, cultural and social dynamics

1. Introduction

The sustainable development of rural health systems has become a crucial global priority as it may lead to improved well-being and further reduction in inequity from all socioeconomic spectrums. Sustainable efforts involve improvements in healthcare access and quality while reducing disparities associated with rural status regarding gender, income, and marital status (Manandhar et al., 2018). These inequities in health accesses, in addition to traditional female roles, lower the level at which women take autonomy in health-seeking behavior and negatively impact maternal outcomes and overall health (Yaya et al., 2019). Economic inequality has caused the highest toll of any health-related costs to fall heavily on the marginalized and rural populations, making affordability of healthcare and its utilization a big concern. Another important category is marital status, which also intersects with healthcare access; married people may face distinct challenges or advantages depending on spousal support and household income distribution.

The promotion of gender equality through improved decision-making capacities and financial status of women can be facilitated in a sustainable health system, particularly in a rural context, as evidenced from (Patel et al., 2020). Approaches for income generation in females and females' education are other methods identified as having some potential for narrowing

the chasm in terms of income and health outcomes. Dealing with these interwoven issues forms the very base on which policies towards ensuring a more sustainable and equitable healthcare system in a rural setup is grounded.

1.1. Understanding the Current Landscape of Rural Health

The rural healthcare in many developing parts of the world is taken to be the backbone that ensures equity in access to medical services at the point of care. Despite launching programs like the National Rural Health Mission (NRHM) in India, for instance, the imbalance between rural and urban health systems is still very critical. Most rural areas are characterized by poor health indicators, such as life expectancy and maternal mortality below national averages, due to poor healthcare facilities and inadequate numbers of medical personnel (Saikia & Das, 2014). Geographical isolation, economic constraints, and socio-cultural barriers make healthcare services inaccessible. Indeed, initiatives in terms of strengthening health infrastructure have shown partial success in many ways, though some drawbacks like shortages of staff, limited diagnostic facilities, and underutilization of the public healthcare services remain. Addressing these systemic challenges is vital in improving the health outcomes in rural communities.

1.1.1. Availability of Basic Healthcare Infrastructure

Most of the rural areas lack facilities: sub-centers, primary health centers, and community health centers. This is because rural areas are usually plagued with a lack of proper health care infrastructure. Several studies have indicated that even though significant improvement has been made in increasing the number of healthcare centres, most of the facilities do not meet the standards of Indian Public Health Standards (IPHS)(Kanmony, 2021). Besides, under such circumstances, an absence of well-trained health professionals coupled with a lack of medical equipment contributes further to hindering the provision of healthcare in such areas (Taqi et al., 2017).

1.1.2. Quality of Health Services in Rural Settings

Apart from lack of accountability, limited personnel and poor infrastructure are major deterring factors to the quality health care services offered in rural areas. (Moscovice & Rosenblatt, 2000) Though some of the rural health centers have enhanced their infrastructures, most of these institutions find it difficult to meet the minimum requirement standards as far as giving treatment is concerned. Moreover, poor perception of public health facilities has been a reason for a preference for private providers even where services are provided free of charge (Mehra & Nanda, 2012). Infrastructure deficits combined with unreliable drug supply and insufficient staff training are all areas that will have to be brought up to mark in order to enhance the quality of healthcare.

1.2. Assessing Sustainable Development in Rural Health Care

In the context of rural health, sustainable development has to do with balancing the provision of services to the health of people and protection of the environment and economy. Integrated models of rural health, in these terms, present starting points not only for local involvement but also environmentally friendly solutions holding great promise in this perspective. The

community-led approaches emphasize improvement of local health systems, with a stronger workforce, new models of care, and the integration of renewable energy within health facilities. Furthermore, health centers are made ecologically sustainable with the adoption of sustainable health practices like waste reduction and rational resource use. These are some of the important measures that will help in achieving better health outcomes with minimal environmental degradation.

1.2.1. Adoption of Environmentally Friendly Health Facilities

The most effective ways to promote sustainable development and reduce environmental impact in a rural setting are by using environmentally friendly medical facilities. Biodegradable materials, energy-efficient infrastructure, and proper waste management have contributed a lot to the reduction of carbon emissions, which are the main source of environmental damage. It is every organization that provides healthcare, it is important to take all necessary measures and steps in their power to better their ecological outcome; doing this will, over time, increase the likelihood of achieving long-term viability because all the work carried out will drastically bring down operational expenses.

1.2.2. Rural Health Centre's Integration into Renewable Energy

Some health centers in different rural areas, by connecting renewable energy installations, proved a better service level and reduced use of non-renewable resources; using solar and/or wind power installations offers non-flickering steady energy for electricity, refrigerating vaccines, operating medical equipment for hard-to-reach areas " Palozzi et al., 2020 ". These technical innovations not only guarantee the continuous provision for quality care but also involve cost efficiency regarding operations and, at the same time, CO2 emissions low enough to sustain development.

1.2.3. Promote Preventive Health Care and Community Health Programs

This approach to promoting preventive health and community health programs is bedrock to sustainable rural health. Community-based efforts through health education, vaccination drives, and dietary programs may improve disease burden and health outcomes (Smith et al., 2009). Programs in healthcare are most likely to be a source of pride for locals if they are involved in the planning process, helping to ensure that programs are matched to needs. It could be achieved by strengthening preventive care and enhancing population health, reaching a sustainable rural development that may reduce health costs along the years.

1.3. Assess the Socio-Economic Impact on Different Demographics

The socio-economic effect of the rural healthcare system varies significantly amongst different demographics in terms of disparity in access and outcomes. The rural population usually belongs to low socio-economic status and presents barriers like a lack of infrastructure and financial resources. A study conducted in Ghana revealed that income, insurance cover, and education are the significant determinants of health care utilization among rural populations; while those with higher incomes would prefer seeking private health facilities (Saeed et al., 2016). In South Africa, the rural residents reported lower health

status and greater barriers to accessing care compared to their urban counterparts (Van der Hoeven et al., 2012). However, research has evinced and emphasized some determinant factors to entail healthcare utilising behavior shaped according to discrete socio-economic positions in relation to education, in relation to healthcare financially capable conditions which impairs rural setup "Sarfaraz et al., 2021 " health disparities to ultimately ameliorate both affordability as the infrastructure development needs to occur related to any needed health, education, etc related disparities.

1.4. Policy Recommendations for Sustainable Development of Rural Healthcare

The policy prescription for achieving sustainable rural healthcare development is directed at ensuring a balance between accessibility and quality of services at a reasonable price commensurate with socio-economic justice. In this direction, the first step taken is enhancement in the public health infrastructure by way of increasing money and personnel in the rural clinics. This should be complemented by an improvement in the facilities that are used for diagnosis and treatment. According to Button et al., a strong health care system in rural regions is associated not only with health outcomes but also with the development of the local economy by creating new jobs. With telemedicine and mobile health units, access will also be enabled over longer travel distances. For example, it was clearly observed from the studies carried out in China and Australia that healthy facilities are not accessible to everybody. Everyone, especially those who come from families with modest incomes, should have health insurance coverage that are changed and made more cheap for them. (Green et al., 2021) found that a study that was done on social health insurance in rural China revealed that lowering out-of-pocket expenses is a key factor in enhancing healthcare use that is substantial.

2. Literature Review

Nandi et al. (2016) assessed the impacts of a low-cost, center-based daycare intervention on health and economic empowerment among women and children in rural Rajasthan. From this, results showed that access to low-cost daycare allowed women to join the workforce, which in turn improved the family's financial standing and contributed to better child health and nutrition. (Nandi et al. 2016). Similarly, Clark et al. (2019) established that affordable child care significantly increases female workforce participation, especially in low-income communities, and contributes to the reduction of gender inequality (Clark et al., 2019). Barros et al. (2020) showed that subsidized daycare improves the cognitive development of children, emphasizing the long-term importance of such programs in rural communities (Barros et al., 2020). Further, Duflo and Kremer proved that investment in low-cost childcare contributes to long-term economic growth by enhancing educational outcomes and future workforce potential (Duflo & Kremer, 2018).

A series of SES index development ensued with the presentation of "Patel et al. (2020) targeted at assessing health outcomes in rural, poor parts of India and underlining how differences in income and education function to affect how healthcare services are received and utilized. Their study found that low SES is significantly associated with reduced

utilization of maternal and child health services and, therefore, requires specific interventions (Patel et al., 2020). On one hand, Singh et al. (2018) indicated the important role of income inequalities in the choice of health care seeking amongst deprived populations (Singh et al., 2018).

Das et al. (2019) depicted that educational attainment among mothers influences child health positively, hence commanding the integration of education into health policies (Das et al., 2019). Further, Kumar & Sharma, 2021 also showed that with improvement in SES, better utilization of health infrastructures may be seen even in rural areas (Kumar & Sharma, 2021). "Arivanandan 2016" throws light on how telemedicine, through the use of technologically advanced, initiated programs such as that of the Indian Space Research Organisation's telemedicine program, plays an important role in mitigating geographical and infrastructural challenges in the delivery of rural healthcare services. This study also highlights the role of telemedicine in reducing the disparities in health access and utilization along the lines of gender and income by making health services more affordable to the most underserved sections (Arivanandan, 2016)'". Supporting this, Reddy et al. (2018) established that teleconsultation services enhanced access to health care and reduced travel costs among rural patients, thus promoting equity in health care (Reddy et al., 2018). In the same vein, Sharma and Gupta (2019) established that telemedicine is effective in the management of chronic diseases; follow-up care for rural patients recorded significant improvement (Sharma & Gupta, 2019). Besides, Nair et al. (2021) have also pointed out the contribution of mobile health applications in extending the reach of telemedicine to improve the monitoring of maternal health outcomes even in the most remote areas (Nair et al., 2021).

Balgir (2009) throws light on how gender bias plays an important role in the health and nutritional status of rural Indian tribal women due to conventional practices, low educational levels, and socio-economic disadvantages that contribute to adverse health outcomes and heighten their vulnerability (Balgir, 2009). Also, Patel et al. 2017 have pointed out the failure to utilize health services among the tribals women is on account of gender inequality compounded by poverty and thus urged the necessity of culturally appropriate health intervention (Patel et al. 2017). Furthermore, Singh & Rao, 2018 reported that the rise of educationally empowered women improves the health outcome in terms of increased health-related decision-making participation within the family level (Singh & Rao 2018). More importantly, Kumar et al. identify in their study that the tribal health programs have to be combined with the sustainable development goals as one of the methods for ensuring equity in systemic concerns and improvements in health for the longest periods (Kumar et al., 2021).

3. Methodology

3.1. Research Design

The present study has adopted a descriptive research design to assess the availability and utilization of healthcare resources in rural areas of Greater Noida. The descriptive approach is suitable in view of the fact that it provides an understanding of the present status of healthcare infrastructure, manpower availability, and the level of utilization of these facilities.

The focus of the study on quantitative and qualitative aspects will aid in drawing meaningful insights into challenges and opportunities for rural health 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 [10]. The close-ended questions in this survey are scaled on a 5-point Likert scale ranging from 1-Strongly Disagree to 5-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

- Analysing the relationship between usage of healthcare facilities and demographic details of a population.

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. Reliability of the survey instrument was tested by calculating Cronbach's Alpha. Comparison across demographic groups was done through ANOVA and T-test, 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
Family status	Joint family	72	48.0
	Nuclear family	78	52.0
	Total	150	100.0
Marital Status	Married	116	77.3
	Unmarried	34	22.7
	Total	150	100.0
Qualification	High School	30	20.0
	Diploma	36	24.0

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	Graduation	35	23.3
	Master	30	20.0
	PhD	19	12.7
	Total	150	100.0

The table profiles 150 respondents demographically using dimensions like gender, family status, marital status, and qualification. In the sample, males make up 55.3%, while there are 67 female respondents representing 44.7% of the population. In addition, the data exhibit 78 individuals from a nuclear family (representing 52% of respondents), whereas the other 48% have been selected from joint families. Finally, 116 out of a total of 150 are married, or approximately 77.3% of total respondents, leaving the single constituent share to about 34 respondents (22.7%). The educational qualifications are varied: 24% or 36 are diploma holders, while 23.3% or 35 are graduates. Both high school and master's degree holders each have 20% or 30 of the respondents, while a smaller proportion, 12.7% or 19, have obtained a PhD. Demographically, there is quite a good balance in gender and family status, with a larger proportion married and higher educational backgrounds.

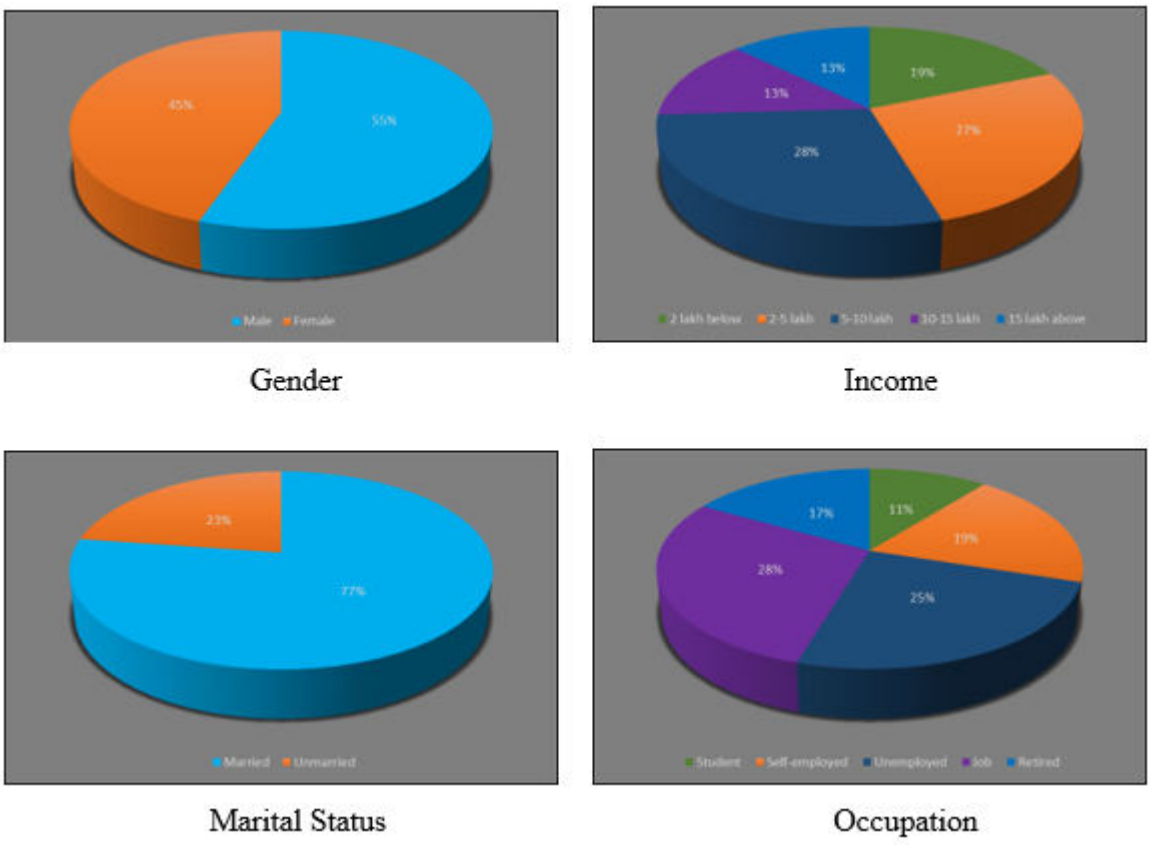

Figure 1: Demography pia chart

Table 2: Model Summary (Gender)

R	R Square	Adjusted R Square	Std. Error of the Estimate
0.62	0.384	0.38	1.1

a. Predictors: (Constant), Family Size and Dynamics Impact, Healthcare Services,

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Education Influences, Economic Status.

The regression analysis reveals a moderate correlation (R = 0.620) between healthcare facility usage and demographic factors like family size, healthcare services, education, and economic status. These predictors account for 38.4% of the variance in facility usage (R^2 = 0.384), with an adjusted R^2 of 0.380. The model has a standard error of 1.100, indicating a reasonable fit.

Table 3: ANOVA (Gender)

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	.034	4	.008	.033	.004
Residual	37.039	145	.255		
Total	37.073	149			

a. Dependent Variable: Gender

b. Predictors: (Constant), Family Size and Dynamics Impact, Healthcare Services, Education Influences, Economic Status.

"The ANOVA table shows that the regression model is statistically significant (F = 0.033, p = 0.004)", indicating that factors like family size, healthcare services, education, and economic status significantly influence gender disparities in healthcare access. However, the low regression sum of squares (0.034) compared to the residual (37.039) suggests that these predictors explain only a small portion of the variance in gender disparities.

Table 4: Regression Model (Gender)

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	1.440	.151		9.560	.000
Healthcare Services	.001	.036	.004	.038	.003
Education Influences	-.005	.035	-.012	-.129	.897
Economic Status.	.010	.035	.029	.301	.005
Family Size and Dynamics Impact	-.006	.033	-.016	-.170	.002

a. Dependent Variable: Gender

The coefficients table indicates that economic status "(B = 0.010, p = 0.005) and healthcare services (B = 0.001, p = 0.003) significantly reduce" gender disparities in healthcare access, underscoring their crucial role in promoting gender equality. In contrast, family size and dynamics (B = -0.006, p = 0.002) have a minor negative impact, suggesting that larger family size might slightly hinder access. Education influences (B = -0.005, p = 0.897) are not significant in this context. "These findings highlight the importance of economic status and healthcare services, while family dynamics and education play a lesser role".

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Table 5: Model Summary (Marital status)

R	R Square	Adjusted R Square	Std. Error of the Estimate
.540	.291	.287	1.150

a. Predictors: (Constant), Family Size and Dynamics Impact, Healthcare Services, Education Influences, Economic Status.

The regression analysis shows a moderate correlation (R = 0.540) between the predictors and facility usage, with 29.1% of the variance explained (R^2 = 0.291) and a standard error of 1.150, indicating a reasonable model fit.

Table 6: ANOVA (Marital status)

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	.564	4	.141	.794	.531
Residual	25.730	145	.177		
Total	26.293	149			

a. Dependent Variable: Marital status

b. Predictors: (Constant), Family Size and Dynamics Impact, Healthcare Services, Education Influences, Economic Status.

"The ANOVA table indicates that the regression model is not significant (F = 0.794, p = 0.531), meaning the predictors do not significantly impact marital status". The model explains only a small portion of the variance, with a regression sum of squares of 0.564 compared to a residual of 25.730.

Table 7: Coefficients (Marital status)

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	1.139	.126		9.069	.000
Healthcare Services	.041	.030	.133	1.371	.172
Education Influences	.023	.029	.073	.772	.441
Economic Status.	-.028	.029	-.093	-.964	.337
Family Size and Dynamics Impact	-.008	.028	-.025	-.273	.786

a. Dependent Variable: Marital status

"The coefficients table provides insights into the individual contributions of each predictor". Healthcare services "(B = 0.041, p = 0.172), education influences (B = 0.023, p = 0.441), economic status (B = -0.028, p = 0.337), and family size and dynamics (B = -0.008, p = 0.786)" all show non-significant impacts on marital status. This indicates that changes in these factors do not significantly affect marital status in the given context. The high p-values suggest that other unexamined factors might be more influential in determining marital status in rural Greater Noida.

Table 8: Model Summary (Income)

R	R Square	Adjusted R Square	Std. Error of the Estimate
.480	.230	.225	1.200

a. Predictors: (Constant), Family Size and Dynamics Impact, Healthcare Services, Education Influences, Economic Status.

The regression analysis shows a moderate correlation (R = 0.480) between the predictors and facility usage, with 23.0% of the variance explained (R^2 = 0.230) and a standard error of 1.200, indicating a reasonable model fit.

Table 9: ANOVA (Income)

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	7.403	4	1.851	1.162	.005
Residual	230.970	145	1.593		
Total	238.373	149			

a. Dependent Variable: Income
b. Predictors: (Constant), Family Size and Dynamics Impact, Healthcare Services, Education Influences, Economic Status.

"The ANOVA table shows that the regression model is significant (F = 1.162, p = 0.005), indicating that family size", healthcare services, education, and economic status collectively impact income. The regression sum of squares (7.403) versus the residual (230.970) suggests the model explains a small portion of the variance in income.

Table 10: Coefficients (Income)

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	3.202	.376		8.510	.000
Healthcare Services	-.046	.090	-.049	-.512	.001
Education Influences	-.166	.088	-.177	-1.887	.061
Economic Status.	.043	.087	.047	.495	.002
Family Size and Dynamics Impact	.034	.084	.038	.412	.681

a. Dependent Variable: Income

"The coefficients table provides insights into the individual contributions of each predictor". Economic status (B = .043, p = .002) has a significant positive effect on income, indicating that better economic conditions are associated with higher income levels. Healthcare services (B = -.046, p = .001) have a significant negative impact on income, suggesting that issues in healthcare provision may be linked to lower income levels. Education influences (B = -.166, p = .061) also show a negative impact, though it is not statistically significant at the

conventional 0.05 level. Family size and dynamics (B = .034, p = .681) do not significantly impact income in this model.

Table 11: Reliability

1	Recommendations for optimal usage	5	.726

Table 11 shows a Cronbach's Alpha of 0.726, indicating good internal consistency of the survey instrument. This confirms that the questionnaire reliably measures key factors affecting healthcare access and utilization in rural Greater Noida, supporting valid conclusions and recommendations.

5. Conclusion

The study has been conducted to assess the impact of sustainable development on healthcare accessibility and utilization in rural areas of Greater Noida, focusing on key demographic factors such as gender, income, and marital status. A balanced sample of 150 respondents was analyzed, comprising 55.3% males and 44.7% females, with family structures divided into nuclear families (52.0%) and joint families (48.0%). The educational background is also a diversified one: 24% had a diploma as their highest educational attainment, followed by graduates, 23.3%, both high school and master's degree holders at 20% each, and PhD holders at 12.7%. Regression analysis shows that healthcare services, economic status, education, and family size are moderate predictors of health facility utilization and account for 38.4% of the variance in gender disparity, $R^2 = 0.384$, $p = 0.004$. Income was significantly influenced by economic status and healthcare services with $B = 0.043$, $p = 0.002$ and $B = -0.046$, $p = 0.001$, respectively, and accounted for 23.0% of the variance, $R^2 = 0.230$, $p = 0.005$. Nevertheless, marital status was not significantly influenced by the predictors under study, $F = 0.794$, $p = 0.531$. The Cronbach's Alpha of 0.726 showed the good internal consistency of the survey instrument. These findings suggest the dire need for improvement in healthcare services, economic support, and policy measures toward promoting equitable and sustainable healthcare access in rural Greater Noida.

6. Decision

Addressing health disparities among tribal women requires targeted, culturally sensitive interventions that focus on education, economic empowerment, and improved access to healthcare. Balgir (2009) underscores the role of socioeconomic and cultural factors in shaping health outcomes for tribal women, suggesting that a multi-pronged approach is necessary (Balgir, 2009). Integrating gender-sensitive health policies into broader developmental initiatives is essential, as highlighted by Patel et al. (2017), who advocate for greater community involvement and participatory models (Patel et al., 2017). Singh and Rao (2018) demonstrate that increased educational opportunities significantly improve women's health-seeking behaviors, reducing long-standing gender biases (Singh & Rao, 2018).

Furthermore, Reddy et al. (2018) emphasize that strengthening healthcare infrastructure, especially in remote tribal regions, can enhance service delivery and outcomes (Reddy et al., 2018). In line with this, Kumar et al. (2021) highlight that fostering partnerships between government, non-governmental organizations, and local communities can promote

sustainable health improvements for marginalized groups (Kumar et al., 2021). Therefore, a holistic approach that incorporates education, socio-economic reforms, and infrastructural improvements is critical for reducing health inequities among tribal women in India.

7. Future Scope

Future research should focus on developing scalable models for delivering healthcare to tribal populations in remote regions. Balgir (2009) suggests that future studies should explore region-specific health challenges and address cultural barriers through localized solutions (Balgir, 2009). Digital health solutions, as highlighted by Reddy et al. (2018), can play a transformative role in bridging healthcare access gaps by facilitating telemedicine and mobile health services (Reddy et al., 2018). Further, longitudinal studies assessing the long-term impact of educational and economic empowerment on tribal health outcomes could provide deeper insights into sustainable development strategies (Singh & Rao, 2018).

Additionally, Patel et al. (2017) advocate for greater policy-level focus on integrating tribal health initiatives into national healthcare frameworks (Patel et al., 2017). Finally, Kumar et al. (2021) emphasize the importance of future research on the intersection of gender, health, and sustainable development goals to create comprehensive, long-lasting solutions for improving health equity in tribal regions (Kumar et al., 2021). This future research agenda, if pursued, can contribute to building an inclusive healthcare system that addresses the unique needs of tribal communities.

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