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SANITATION CHALLENGES IN URBAN SLUMS: A GEOGRAPHICAL STUDY OF BHOPAL CITY

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Abstract

Urban sanitation in India faces many challenges a huge population specially in slum areas suffering lack of access to basic sanitation. Cleanliness is as important in life as basic necessities as it is closely related to livelihood and income. Slums are inhabited by poor or below poverty line people. These are usually associated with poor quality housing, overcrowding, unhealthy and ill health related to spread of infectious diseases in the cities. In this research paper, the condition of cleanliness in Bhopal's slums has been studied. Bhopal has been divided into two parts, Old Bhopal and New Bhopal, and a comparative study has been done on the basis of family-centric environmental cleanliness. Sanitation still remains a big challenge in slums. Most of the residents here pay very little attention to cleanliness and hygiene etc. Most of the families in these settlements have less than the minimum income. There is a close relationship between income and cleanliness. If the income is low, then the condition of cleanliness will be seen to be very poor. Primary and secondary data have been used in the presented study. Primary data has been obtained through interview schedule from different families of different slum settlements. The study is based on 200 families from 10 slums of 5 zones of different area of Bhopal city specially core (Old Bhopal), Middle and Peripheral (New Bhopal) area. This study also highlighted the sanitation policy issues and recommend draft framework for developing sanitation strategies in study area.

Key Words: - Slum, Sanitation, Environment, Basic Needs, Income.

Introduction

The world's population is rapidly increasing and it is estimated that the population will reach 8 billion by 2025, which has already been achieved in 2022. India is the second-most populous country in the world and is likely to become the most populous country soon. Along with Population growth, Urbanization has also been occurring at a rapid pace. In developing countries, overpopulation is a major issue, followed by poverty. Due to the lack of Employment Opportunities in rural areas people are migrating to cities in large numbers, hoping to find better job prospects and improve their standard of living. However, upon arrival, they often face harsh realities. The high cost of living in cities makes it difficult for them to afford basic necessities like food, clothing, and shelter. While they can manage to arrange for food and clothing, building a house becomes impossible. As a result, they resort to living in slums. Today, slums have become a major problem in cities, and their expansion is increasing rapidly. In almost all cities in India the majority of the population are poor and their settlements are informal and unplanned. Between 1990 and 2025, the total urban population is expected to grow from 300 to 700 million.

Slums are settlements where living conditions are often felt to be hellish. They are characterized by filth, small, makeshift rooms, and overcrowding, with 5-7 people often sharing a single room. Basic amenities like clean water, electricity, sanitation, and toilets are lacking. Due to the absence of toilets, residents are forced to use community toilets, public toilets, or even open spaces for defecation. According to the 2011 census, India's population was approximately 121 crores, with around 6.5 crore people living in slums. Sanitation is a fundamental necessity, just like water is needed to clean dirty drains, the human body needs sanitation to clean itself. It is estimated that by 2030, two billion people will be living in slums. Sanitation-related issues are particularly detrimental in high-density slums (Tomlinson, 2015). Sanitation can be described as the management of human waste and wastewater to protect human health and the environment, and includes the provision of toilets, sewage treatment, and waste disposal systems. It is a critical component of public health infrastructure, and is essential for preventing the spread of diseases and promoting a clean and healthy environment. By investing in sanitation infrastructure and promoting good hygiene practices, communities can reduce the risk of waterborne diseases and improve overall health and well-being. Extent of sanitation deprivation in Bhopal's poverty pockets. Multiple situational analyses and UN-Habitat/WaterAid field reports document large sanitation gaps in Bhopal's poverty pockets — many households lack private latrines, and a substantial share continue to rely on open defecation or communal facilities. These surveys highlight wide heterogeneity between pockets in access and use of sanitation infrastructure, underlining the need for area-specific planning UN-Habitat/WaterAid (2008).

Health impacts in slum environments (Bhopal evidence). Epidemiological work from Bhopal and similar Indian cities documents high burdens of diarrhea disease among under-five children correlated with poor WASH conditions and inadequate drainage. Recent cohort and ecological analyses in Bhopal link built-environment deficiencies to higher incidence of waterborne and sanitation-related illnesses. These studies emphasize that improved sanitation can lower disease burden but must be combined with water quality and drainage improvements Sabde, Y.D., et al.

(2023). Solid waste, drainage and flooding interact with sanitation. Local reporting and municipal data for Bhopal show blocked drains, uncollected solid waste and informal dumping exacerbate sanitation risks, increase vector breeding sites and lead to flooding during monsoon—further undermining sanitation infrastructure and increasing public-health risk in slum neighborhoods. Integrated waste-drainage-sanitation planning is therefore critical. Sanitation workforce and governance issues. Investigations into sanitation service delivery in Bhopal highlight gaps in labor protections for frontline sanitation workers and uneven municipal performance: improvements recognized in nationwide rankings can coexist with poor working conditions and incomplete service delivery in practice. Governance constraints—funding, coordination, and political economy of land and tenure—limit durable sanitation improvements in slums Times of India (2025).

Emerging evidence and research gaps for Bhopal. While several high-quality local studies (health cohorts, built-environment analyses) and NGO/UN reports provide robust snapshots, gaps remain: longitudinal impact evaluations of communal vs household solutions in Bhopal, rigorous cost-effectiveness analyses of different financing models, in-depth studies on the sanitation impacts of planned relocations, and participatory research on user preferences are all needed. Recent publications from India's urban WASH literature highlight the urgent need for integrated, context-specific research and programmatic pilots Sabde, Y., Mandal, et al. (2024).

Sanitation has many benefits for all of us, including disease prevention, better basic health, better quality of life, access to health centers, improved water quality, growth of economic activities, improved housing and ultimately, improved quality of life. In early 2000, two-fifths of the global population (2.4 billion people) did not have access to improved sanitation. Most of these people live in Asia and Africa. Africa has the lowest sanitation coverage of the global regions (Africa, Asia, Latin America and the Caribbean, Oceania, Europe and North America), second only to Asia. In Africa, 60 have improved sanitation, but the situation is even worse in rural areas with only 45 of the rural population having improved sanitation Okun (1988). The World Health Organization has highlighted serious inequalities in health globally, with people living in slums having a reduced life expectancy due to inadequate health services, poor sanitation and environmental hazards. India is lagging on 19 out of 33 indicators, including those related to gender equality, poverty, hunger and health. India's commitment to achieving the Sustainable Development Goals (SDGs) by 2030 is challenging WHO/UNICEF (2000). The number of people living in slums has increased rapidly worldwide in the twenty-first century. By 2020, approximately 1.1 billion people lived in urban slums, and by 2050, an additional 2 billion people are expected to live in urban areas (United Nations Sustainable Development Goals Report, 2024). Cities are home to more than 55 of the world's population and play a key role in economic development, but people living in slums face challenges such as poor housing, unhealthy conditions, and limited access to basic services. People living in slums are also disproportionately affected by the lack of public transportation, which is available to only 51.6 of the urban population worldwide. In India, approximately 65 million people, which is 17.4 of the urban population, live in slums (Census of India, 2011). This situation presents a major challenge to improving the quality of life for people living in slums and achieving

the Sustainable Development Goals. Effective policies and programs are needed to meet the basic needs such as housing, sanitation and health for people living in slums WHO, (2022).

Objective

- To assess the availability and quality of sanitation infrastructure in slums.
- To investigate the relationship between sanitation and hygiene outcomes in slums.
- To compare sanitation conditions in different types of slums (Core, Middle & Peripheral).

Methodology and Data Base

The primary objective of this research paper is to conduct an in-depth study of sanitation challenges in 10 slums surveyed across five zones of the Bhopal urban area. With specific reference to Bhopal city, the slums were surveyed using a structured questionnaire to collect data; keeping in mind that at least two slums were sampled from each of the five zones. The nature of the data collected is given below:

Table 1: Slum Wise Distributional of Respondents			
Zone no.	Ward no.	Sampled Slums	Sample size
02	06	Sahid Nagar	20
02	08	Bajpai Nagar	20
04	07	Bag Munshi Khan	20
04	15	Bafna Nagar	20
10	44	Shanti Nagar	20
10	45	Arjun Nagar	20
01	01	Abbas Nagar	20
01	02	Nai Basti	20
11	50	Indira Nagar	20
11	52	Bagmugaliya	20
Total			200
Source: Primary Survey, 2022			

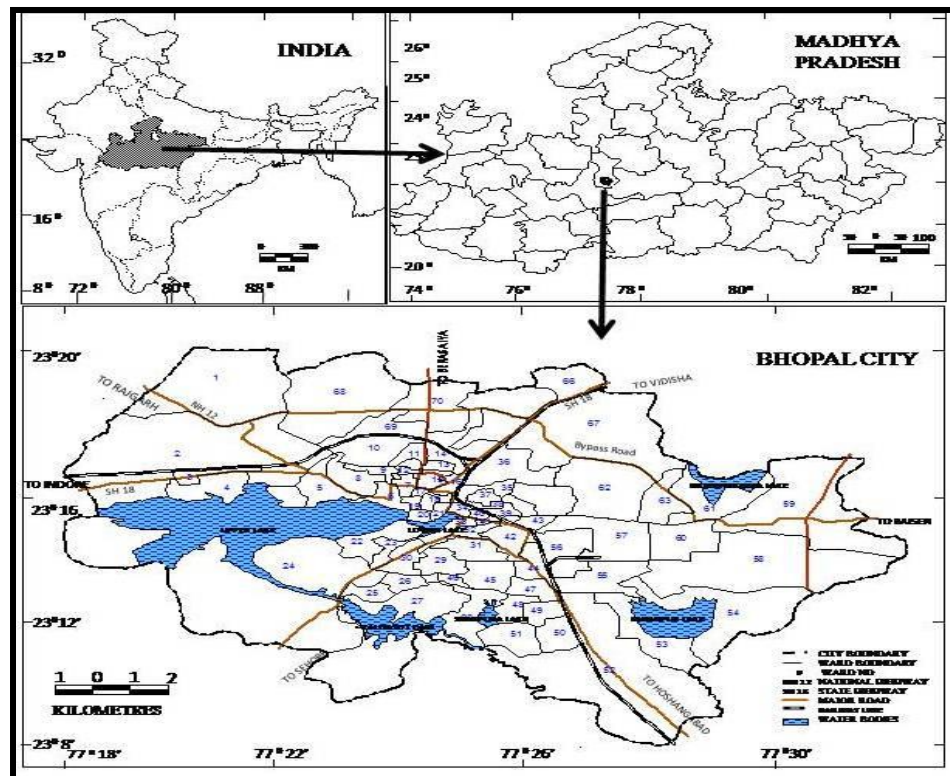
The table presents the distribution of respondents in sampled slums across Bhopal, with a total sample size of 200. The slums are spread across different zones and wards, with 10 slums selected for the study. Each slum has a sample size of 20 respondents. The sampled slums include Sahid Nagar, Bajpai Nagar, Bag Munshi Khan, Bafna Nagar, Shanti Nagar, Arjun Nagar, Abbas Nagar, Nai Basti, Indira Nagar, and Bagmugaliya. These slums are located in various zones, including Zone 2 (Sahid Nagar and Bajpai Nagar), Zone 4 (Bag Munshi Khan and Bafna Nagar), Zone 10 (Shanti Nagar and Arjun Nagar), Zone 1 (Abbas Nagar and Nai Basti), and Zone 11 (Indira Nagar and Bagmugaliya). The data provides a representative sample of the population in these slums, allowing for insights into their living conditions, socio-economic status, and other relevant factors. By analyzing this data, researchers can gain a better understanding of the challenges faced by residents in these slums and identify potential areas for improvement.



The sample size and distribution enable meaningful conclusions to be drawn about the population. The study's findings can inform policy decisions and interventions aimed at improving the lives of slum residents. The data serves as a foundation for further research and analysis. The study's results can contribute to a deeper understanding of urban poverty and slum dynamics. By examining the experiences of residents in these slums, researchers can develop targeted recommendations for improvement. The study's insights can ultimately inform strategies for promoting more sustainable and equitable urban development. The data provides a valuable resource for stakeholders working to address the challenges faced by slum residents. By leveraging this data, policymakers can create more effective solutions. The study's findings can have a positive impact on the lives of slum residents. The research can contribute to creating better living conditions and opportunities for residents.

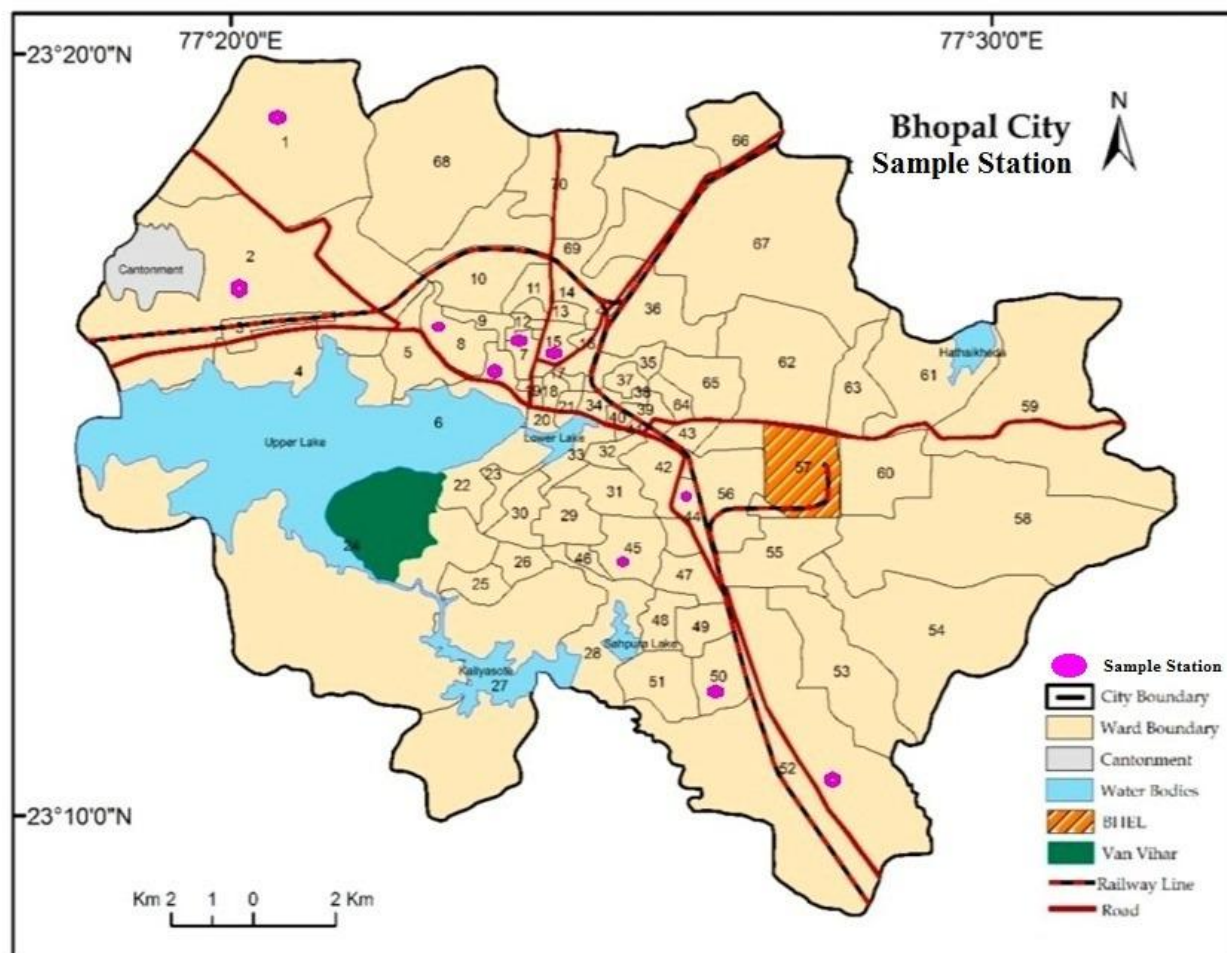
Study Area

Madhya Pradesh, known as the heart of India, has its capital in Bhopal, which is home to the state's administrative headquarters. Bhopal is geographically located between 23°08' and 23°20' N latitude and 77°18' and 77°30' E longitude, with a maximum elevation of 495.76 meters and a minimum elevation of 180 meters above sea level. The city experiences a tropical monsoon climate, with an average annual rainfall of 992 mm. The total area of Bhopal city is 2859 square kilometers. According to the 2011 census, the population of Bhopal is approximately 1,798,218, with around 491,860 residents living in slum areas. For administrative convenience and efficient urban governance, Bhopal Municipal Corporation (BMC) divided the city into 14 administrative zones (BMC,2011). Each zone was created to decentralize municipal functions and ensure better implementation of urban services such as sanitation, water supply, health, and infrastructure management. The 14 administrative zones covered both the old city areas and the newly developed colonies and peripheral regions, reflecting the socio-economic diversity of Bhopal. Each zone was headed by a Zonal Officer responsible for coordinating municipal services within that jurisdiction.



Sanitation in Bhopal's Slums:

Slums are mostly inhabited by people who have come in search of employment, have only the lowest level of education, and these slum dwellers are not considered important in society.



Their standard of living is also very low. These settlements are characterized by filth, mosquitoes and flies, lack of ventilation, and unsanitary conditions. Five to seven people live in a small house, and the condition of the houses is very dilapidated. Living in these mud houses is very difficult during the rainy season. And when there is a lack of sanitation in these slums, the difficulties are even greater. Sanitation is as essential to the life of every healthy person as food is to a hungry stomach. Just as we cannot survive for long without food, we cannot remain healthy for long without sanitation.

Results and Discussion

Bhopal's Slums and Aspects of Health and Hygiene

Residents of Bhopal's slums face significant health and hygiene challenges, as revealed through interviews during the primary survey. The health status and hygiene practices of slum dwellers are influenced by various factors. Due to financial constraints, many residents tend to avoid seeking medical attention unless they have a severe illness, instead relying on traditional remedies. This delayed treatment can lead to serious consequences, including fatalities, if the condition is not addressed promptly. Typically, slum dwellers only seek medical care when they suspect an

infectious disease, whereas non-infectious diseases may not receive timely attention. As a result, patients' health often deteriorates further before receiving proper treatment.

Nutrition: The nutritional level of people living in slums is generally very low. Most families manage to eat two meals a day, but limited income prevents them from consuming protein-rich foods, leading to malnutrition. This situation particularly adversely affects the health of pregnant women and infants, leading to various diseases.

Education level: The education level of a family, especially that of the mother, has a profound impact on a child's health. The survey revealed that educated mothers are more aware of their child's health problems and seek medical advice when necessary.

Environment: The physical and social environment of slums is also a key factor affecting health status. The unhygienic and dilapidated environment, which is a common feature of these settlements, contributes to the spread of respiratory, gastrointestinal, and infectious diseases. In such an environment, one person's illness can affect the entire community. Awareness about these diseases and timely treatment are essential for a healthy life.

Table 2: Slum Wise House Type				
Name of Slum	Kachcha	Semi-Pakka	Pakka	Total
Abbas Nagar	10.0	11.3	5.9	10.5
Nai Basti	10.0	9.8	5.9	9.5
Sahid Nagar	18.0	8.3	0.0	10.0
Bag Munshi Khan	8.0	12.0	0.0	10.0
Bajpai Nagar	18.0	8.3	0.0	10.0
Bafna Nagar	4.0	13.5	0.0	10.0
Shanti Nagar	0.0	10.5	35.3	10.0
Arjun Nagar	0.0	11.3	29.4	10.0
Indira Nagar	16.0	7.5	11.8	10.0
Bagmugaliya	16.0	7.5	11.8	10.0
Total Number & Percentage	50 (25.00)	133 (66.50)	17 (8.5)	200 (100.00)
Source: Primary Survey, 2022				

The table presents data on the **types of houses** in various slum areas of Bhopal, showing the distribution of *Kachcha*, *Semi-Pakka*, and *Pakka* houses. It is evident that housing conditions vary significantly across the surveyed localities. Areas such as **Sahid Nagar**, **Bajpai Nagar**, and **Bag Munshi Khan** show a higher proportion of *Kachcha* houses, indicating poor housing quality and limited access to durable construction materials. In contrast, **Shanti Nagar** and **Arjun Nagar** stand out with a substantial share of *Pakka* houses (35.3 and 29.4, respectively), suggesting relatively better living standards and improved infrastructure. Localities like **Abbas Nagar**, **Nai Basti**, and **Bafna Nagar** have a balanced proportion of *Semi-Pakka* houses, reflecting a transitional stage of housing development where families are upgrading from temporary to more permanent structures. The overall distribution reveals that out of 200 households surveyed, 50 live in *Kachcha* houses, 133 in *Semi-Pakka*, and only 17 in *Pakka* houses, showing that permanent housing remains limited.

This pattern highlights the socio-economic disparities within slum settlements, where economic constraints and lack of formal ownership hinder residents from investing in durable homes. The dominance of *Semi-Pakka* houses also indicates gradual improvement efforts, possibly due to government housing schemes or self-initiated modifications. However, the low share of *Pakka* housing underscores persistent vulnerabilities in terms of safety, sanitation, and resilience to environmental hazards. Overall, the data reflects that while some progress has been made, a majority of Bhopal's slum dwellers still live in substandard housing conditions requiring urgent attention and policy intervention for sustainable urban development.

Table: 3 Slum Wise Types of Roof						
Name of Slum	Bamboo %	Plastic, Polyethylene %	Cement %	Tin Sheets %	Other Types %	Total %
Abbas Nagar	0.0	3.8	16.7	12.9	0.0	10.0
Nai Basti	0.0	3.8	16.7	12.9	0.0	10.0
Sahid Nagar	14.3	26.9	0.0	7.9	0.0	10.0
Bag Munshi Khan	28.6	11.5	0.0	9.4	0.0	10.0
Bajpai Nagar	14.3	26.9	0.0	7.9	0.0	10.0
Bafna Nagar	14.3	11.5	0.0	10.8	0.0	10.0
Shanti Nagar	0.0	0.0	0.0	9.4	46.7	10.0
Arjun Nagar	0.0	0.0	0.0	8.6	53.3	10.0
Indira Nagar	14.3	7.7	33.3	10.1	0.0	10.0
Bagmugaliya	14.3	7.7	33.3	10.1	0.0	10.0
Total Number & Percentage	(14) 7	(26) 13	(6) 3	(139) 69.5	(15) 7.5	(200) 100
Source: Primary Survey, 2022						

The slum-wise distribution of roof types in Bhopal reveals significant disparities in housing quality. Abbas Nagar and Nai Basti have mostly cement and tin sheet roofs, indicating relatively better housing conditions. In contrast, Sahid Nagar and Bajpai Nagar have a high proportion of plastic and bamboo roofs, suggesting poor and temporary housing. Bag Munshi Khan and Bafna Nagar exhibit a mixed pattern, with a combination of bamboo, plastic, and tin sheets, indicating semi-permanent and vulnerable housing. Shanti Nagar and Arjun Nagar have a high percentage of unconventional or makeshift roofing materials. Indira Nagar and Bagmugaliya have better roofs, with a significant proportion of cement and tin sheets. The aggregate totals show that tin sheets dominate, used by 69.5 of households, due to affordability and availability. Plastic and polyethylene roofs are used by 13 of households, indicating poverty-driven housing choices. Bamboo roofs are used by 7 of households, while cement roofs are scarce, at only 3. The data highlights significant housing inequality among slums, with some areas relying on permanent materials and others using temporary roofs. The use of tin sheets is widespread across all slums.

Permanent roofs are scarce, indicating low investment in durable housing. The type of roofing material used is closely linked to socio-economic conditions, with areas using bamboo and plastic indicating poorer conditions. The data underscores the need for targeted interventions to improve housing quality and promote more durable and sustainable housing options. By addressing these disparities, policymakers can work towards reducing housing inequality and improving living conditions in urban slums. The findings have important implications for urban planning and development initiatives.

Table: 4 Slum Wise Amount of Water Availability

Name of Slum	Below 20 LPCD %	20-60 LPCD %	60-100 LPCD %	More 100 LPCD %	Unlimited %	Total %
Abbas Nagar	13.3	6.5	8.3	30.0	50.0	10.0
Nai Basti	13.3	6.5	8.3	30.0	50.0	10.0
Sahid Nagar	26.7	8.1	7.3	0.0	0.0	10.0
Bag Munshi Khan	13.3	21.0	3.1	0.0	0.0	10.0
Bajpai Nagar	26.7	8.1	7.3	0.0	0.0	10.0
Bafna Nagar	6.7	17.7	7.3	0.0	0.0	10.0
Shanti Nagar	0.0	0.0	20.8	0.0	0.0	10.0
Arjun Nagar	0.0	0.0	20.8	0.0	0.0	10.0
Indira Nagar	0.0	16.1	8.3	20.0	0.0	10.0
Bagmugaliya	0.0	16.1	8.3	20.0	0.0	10.0
Total Number & Percentage	(30) 15	(62) 31	(96) 48	(10) 5	(2) 1	(200) 100
Source: Primary Survey, 2022						

The table reveals a varied picture of water availability across Bhopal's slum areas. Abbas Nagar and Nai Basti have a significant proportion of households with access to unlimited water (50 each) and more than 100 LPCD (30 each). In contrast, Sahid Nagar and Bajpai Nagar face significant water scarcity, with 26.7 of households having below 20 LPCD. Bag Munshi Khan and Bafna Nagar also struggle with limited water access, with 13.3 and 6.7 having below 20 LPCD, respectively. Shanti Nagar and Arjun Nagar have a relatively better situation, with 20.8 of households having 60-100 LPCD.



Indira Nagar and Bagmugaliya have a mix of water availability, with some households having access to 60-100 LPCD and 20 having more than 100 LPCD. Overall, 15 of households have below 20 LPCD, while 31 have 20-60 LPCD, and 48 have 60-100 LPCD. Only 5 have more than 100 LPCD, and 1 have unlimited water access. The data highlights the need for improving water infrastructure in these slums to ensure equitable access to this essential resource. By addressing water scarcity, we can improve public health, hygiene, and overall quality of life. The findings have important implications for urban planning and development initiatives. Efforts should be made to ensure that all households have access to sufficient water.

Table: 5 Slum Wise Availability of Toilet

Name of Slum	Yes %	No %	Total %
Abbas Nagar	14.4	2.7	10.0
Nai Basti	14.4	2.7	10.0
Sahid Nagar	8.8	12.0	10.0
Bag Munshi Khan	9.6	10.7	10.0
Bajpai Nagar	8.8	12.0	10.0
Bafna Nagar	12.8	5.3	10.0
Shanti Nagar	4.8	18.7	10.0
Arjun Nagar	4.0	20.0	10.0
Indira Nagar	11.2	8.0	10.0
Bagmugaliya	11.2	8.0	10.0
Total Number & Percentage	(125) 62.5	(75) 37.5	(200) 100
Source: Primary Survey,2022			

The table provides a detailed breakdown of toilet availability in Bhopal's slum areas. Abbas Nagar and Nai Basti have the highest proportion of households with toilets, at 14.4 each. In contrast, Arjun Nagar and Shanti Nagar have the lowest proportion of households with toilets, at 4.0 and 4.8 respectively. Sahid Nagar and Bajpai Nagar also have a significant proportion of households without toilets, at 12.0 each. The overall data shows that 62.5 of households have access to toilets, while 37.5 do not. The distribution of toilet availability varies significantly across slums, highlighting disparities in sanitation infrastructure. Some slums, like Abbas Nagar and Nai Basti, have relatively better toilet coverage, while others, like Arjun Nagar and Shanti Nagar, face significant challenges. The data underscores the need for targeted interventions to address these disparities and improve sanitation infrastructure. By prioritizing toilet availability, policymakers can work towards reducing health risks and improving living conditions. The table provides valuable insights into the sanitation needs of different slums. The data can inform policy decisions and resource allocation. Improving toilet availability is crucial for promoting public health and well-being.

Table: 6 Slum Wise Availability of Community Toilets

Name of Slum	One %	Two %	More than Two %	None %	Total %
Abbas Nagar	0.0	1.9	0.0	25.0	10.0
Nai Basti	0.0	1.9	0.0	25.0	10.0
Sahid Nagar	11.3	9.4	50.0	0.0	10.0
Bag Munshi Khan	18.9	13.2	0.0	3.9	10.0
Bajpai Nagar	11.3	9.4	50.0	0.0	10.0
Bafna Nagar	15.1	9.4	0.0	9.2	10.0
Shanti Nagar	11.3	26.4	0.0	0.0	10.0
Arjun Nagar	9.4	28.3	0.0	0.0	10.0
Indira Nagar	11.3	0.0	0.0	18.4	10.0
Bagmugaliya	11.3	0.0	0.0	18.4	10.0
Total Number & Percentage	(53) 26.5	(53) 26.5	(18) 9	(76) 38	(200) 100
Source: Primary Survey,2022					

The distribution of community toilets in Bhopal's slum areas reveals a concerning picture of inadequate sanitation infrastructure. A significant 38 of households lack access to any community toilet, highlighting a major gap in sanitation services. Meanwhile, 26.5 of households have access to one community toilet, and another 26.5 have access to two community toilets. Only 9 of households have access to more than two community toilets. The slum-wise distribution shows that Abbas Nagar and Nai Basti have limited access to community toilets, while Sahid Nagar and Bajpai Nagar have relatively better infrastructure. In contrast, slums like Bag Munshi Khan, Shanti Nagar, and Arjun Nagar have limited toilet availability. Indira Nagar and Bagmugaliya also face

challenges, with 18 of households lacking access to community toilets. The data underscores the urgent need for improving sanitation infrastructure in these slums. By prioritizing sanitation facilities, policymakers can work towards reducing health risks and improving living conditions. The findings have important implications for urban planning and development initiatives.

Table: 7 Slum Wise Garbage Dumping Site						
Name of Slum	Open %	Garbage Bins Kept By BMC %	In The Nearby Pit %	In Front of The House %	In The Garbage Cart %	Total %
Abbas Nagar	0.0	2.9	50.0	0.0	14.0	10.0
Nai Basti	0.0	2.9	50.0	0.0	14.0	10.0
Sahid Nagar	40.0	25.7	0.0	0.0	3.9	10.0
Bag Munshi Khan	6.7	0.0	0.0	47.4	7.8	10.0
Bajpai Nagar	40.0	25.7	0.0	0.0	3.9	10.0
Bafna Nagar	13.3	0.0	0.0	52.6	6.2	10.0
Shanti Nagar	0.0	20.0	0.0	0.0	10.1	10.0
Arjun Nagar	0.0	22.9	0.0	0.0	9.3	10.0
Indira Nagar	0.0	0.0	0.0	0.0	15.5	10.0
Bagmugaliya	0.0	0.0	0.0	0.0	15.5	10.0
Total Number & Percentage	(15) 7.5	(35) 17.5	(2) 1	(19) 9.5	(129) 64.5	(200) 100
Source: Primary Survey, 2022						

The table reveals a varied picture of garbage dumping sites across Bhopal's slum areas. The majority of households (64.5) dispose of garbage through garbage carts, while 17.5 have garbage bins kept by the municipal corporation. However, 7.5 of households dump garbage in open areas, and 9.5 dispose of it in front of their houses or in nearby pits. Abbas Nagar and Nai Basti have a significant proportion of households (50 each) dumping garbage in nearby pits. In contrast, Sahid Nagar and Bajpai Nagar have a higher percentage of households (40 each) dumping garbage in open areas. Bag Munshi Khan and Bafna Nagar have a notable proportion of households (47.4 and 52.6, respectively) dumping garbage in front of their houses. The data highlights the need for improving waste management infrastructure in these slums to ensure proper garbage disposal and reduce health risks. By prioritizing waste management, policymakers can work towards creating cleaner and healthier environments for residents. The findings have important implications for urban planning and development initiatives. Efforts should be made to provide adequate waste management facilities and promote proper garbage disposal practices. By doing so, we can improve the overall quality of life for residents in these slums.

Table: 8 Slum Wise Types of Drainage

Name of Slum	Underground Drain %	Pit %	Open Drain %	Total %
Abbas Nagar	11.6	6.2	12.5	10.0
Nai Basti	11.6	6.2	12.5	10.0
Sahid Nagar	0.0	27.7	5.0	10.0
Bag Munshi Khan	4.2	7.7	27.5	10.0
Bajpai Nagar	0.0	27.7	5.0	10.0
Bafna Nagar	5.3	6.2	27.5	10.0
Shanti Nagar	21.1	0.0	0.0	10.0
Arjun Nagar	21.1	0.0	0.0	10.0
Indira Nagar	12.6	9.2	5.0	10.0
Bagmugaliya	12.6	9.2	5.0	10.0
Total Number & Percentage	(95) 47.5	(65) 32.5	(40) 20	(200) 100
Source: Primary Survey, 2022				

The distribution of drainage systems in Bhopal's slum areas reveals a mixed picture of infrastructure development. Almost half of the households (47.5) rely on underground drains, indicating partial modernization in drainage infrastructure. However, 32.5 of households use pit drains, suggesting traditional or semi-sanitary methods are still prevalent. Open drains are used by 20 of households, highlighting areas at risk for waterborne diseases. Shanti Nagar and Arjun Nagar have fully transitioned to underground drains, while Sahid Nagar and Bajpai Nagar rely heavily on pit drains. Bag Munshi Khan and Bafna Nagar have a significant proportion of open drains, indicating possible sanitation challenges. Abbas Nagar and Nai Basti have a mix of all three drainage types, showing moderate infrastructure development. The data underscores the need for improving drainage infrastructure, particularly in areas with open drains. By addressing these challenges, we can reduce the risk of waterborne diseases and promote better health outcomes. Slums with higher open drain usage require immediate intervention for health and sanitation improvements. The findings have important implications for urban planning and development initiatives. Efforts should be made to upgrade drainage infrastructure and promote proper sanitation practices. By understanding the distribution of drainage systems, policymakers can prioritize areas for improvement and promote more sustainable urban development. By working together, we can create healthier and more sustainable environments for residents. The importance of proper drainage infrastructure cannot be overstated. It is crucial for preventing waterborne diseases and promoting public health.

Table: 9 Slum Wise Distribution of Respondent's Satisfaction About Sanitation Facility Provided By The Authority

Name of Slum	Fully Unsatisfied %	Unsatisfied %	Partially Satisfy %	Satisfy %	Fully Satisfy %	Total %
Abbas Nagar	50.0	15.4	5.9	10.3	13.3	10.5
Nai Basti	50.0	15.4	5.9	8.0	13.3	9.5
Sahid Nagar	0.0	23.1	20.6	0.0	0.0	10.0
Bag Munshi Khan	0.0	11.5	0.0	19.5	0.0	10.0
Bajpai Nagar	0.0	23.1	20.6	0.0	0.0	10.0
Bafna Nagar	0.0	11.5	0.0	19.5	0.0	10.0
Shanti Nagar	0.0	0.0	0.0	16.1	40.0	10.0
Arjun Nagar	0.0	0.0	0.0	17.2	33.3	10.0
Indira Nagar	0.0	0.0	23.5	4.6	0.0	10.0
Bagmugaliya	0.0	0.0	23.5	4.6	0.0	10.0
Total Number & Percentage	(4) 2	(26) 13	(68) 34	(87) 43.5	(15) 7.5	(200) 100.0
Source : Primary data, 2022						

Table No.9 shows the area-wise distribution of respondents' satisfaction regarding sanitation facilities provided by the authorities in different slum areas of Bhopal. The data reveals that a majority of respondents, about 43.5, were satisfied with the sanitation services, while 34 were partially satisfied. Only 7.5 expressed full satisfaction, indicating that very few residents found the facilities to be adequate. On the other hand, 13 of respondents were unsatisfied, and 2 were fully unsatisfied, highlighting certain deficiencies in sanitation management. Areas like Shanti Nagar and Arjun Nagar show higher satisfaction levels, while Abbas Nagar and Nai Basti report more dissatisfaction. The variation among slums suggests unequal distribution and maintenance of sanitation services. This reflects that although some improvement has been made, consistent and efficient sanitation efforts are still needed. Overall, the table indicates moderate satisfaction, with scope for better facility provision and maintenance by the authorities.

Conclusion

Based on the overall analysis of health, hygiene, and infrastructure indicators across Bhopal's slum areas, Arjun Nagar and Shanti Nagar emerge as relatively better-off settlements, showing higher proportions of Pakka houses (29.4 and 35.3), permanent roofing, and a complete shift to underground drainage systems. These areas also have better housing materials, though they still lag in toilet availability (4 & 4.8 %), indicating uneven development. In contrast, Sahid Nagar and Bajpai Nagar are identified as the most deprived slums, suffering from poor housing quality dominated by Kachcha houses, plastic and bamboo roofs, low water availability (below 20 LPCD), and open garbage dumping (40), coupled with limited sanitation facilities. Abbas Nagar and Nai

Basti show moderate conditions, with some access to toilets (14.4) and relatively better drainage, while Bag Munshi Khan and Bafna Nagar face issues of poor waste disposal and open drains. Indira Nagar and Bagmugaliya perform fairly well in terms of housing and water availability but still require improved sanitation coverage. Overall, the data indicates that while a few slums like Arjun Nagar and Shanti Nagar show progress in infrastructure, the majority—especially Sahid Nagar and Bajpai Nagar—remain in critical condition, demanding urgent policy attention for improved housing, water, sanitation, and waste management facilities. In summary it may be concluded that Best Performing Slums are Abbas Nagar and Nai Basti (better infrastructure, sanitation, and water access) and Moderately Developed Slums are Indira Nagar, Bagmugaliya, and Bafna Nagar (improving conditions but sanitation gaps remain). It is also identified that Poor Performing Slums are Sahid Nagar, Bajpai Nagar, and Bag Munshi Khan (weak housing, sanitation, and water access). The findings emphasize the urgent need for targeted policy interventions in the most deprived slums to enhance access to sanitation, water supply, and durable housing. Addressing these inequalities is essential for improving the overall health, hygiene, and living standards of Bhopal's urban poor and achieving inclusive urban development.

Suggestions

- **Improvement of Basic Infrastructure:** Ensure universal access to individual household toilets, safe water supply, and drainage systems. Construct durable housing using affordable materials to replace temporary bamboo or plastic structures.
- **Strengthening Waste Management:** Provide regular door-to-door garbage collection and functional garbage bins in all slums. Encourage segregation of waste at source and introduce recycling or composting programs at community level.
- **Health and Hygiene Awareness:** Conduct regular awareness campaigns about hygiene, waste disposal, and waterborne diseases through schools, NGOs, and health workers. Promote behavioral change to discourage open defecation and improper waste disposal.
- **Community Participation:** Involve slum residents in planning, implementation, and maintenance of sanitation facilities. Establish community sanitation committees for monitoring and accountability.
- **Gender-Sensitive Sanitation Planning:** Ensure safe, accessible, and gender-segregated public toilets, especially for women and children. Integrate menstrual hygiene management into sanitation programs.
- **Use of Technology and Innovation:** Introduce cost-effective and eco-friendly sanitation technologies such as bio-toilets, decentralized wastewater treatment, and solar-powered public toilets.
- **Capacity Building and Education:** Train local youth and women's groups in sanitation maintenance, waste management, and hygiene education to generate livelihood opportunities.

Policy Implications

- Integrated Urban Sanitation Policy: A city-wide sanitation policy should integrate water supply, solid waste management, drainage, and health services, ensuring coordination among departments.
- Slum Redevelopment and Tenure Security: Sanitation planning must be embedded within slum redevelopment programs like *Jhuggi Mukh Bhopal Yojana*. Secure tenure encourages residents to invest in permanent sanitation facilities.
- Public-Private and Community Partnerships: Encourage PPP models for construction and maintenance of toilets and waste infrastructure, with clear accountability and subsidy mechanisms for the poor.
- Monitoring and Evaluation: Establish a real-time monitoring system to assess sanitation coverage, waste collection efficiency, and community satisfaction. Data-driven decision-making should guide resource allocation.
- Alignment with SDGs and National Missions: Policies should align with *Swachh Bharat Mission (Urban)* and the *Sustainable Development Goals (SDG 6: Clean Water and Sanitation)* to ensure measurable progress toward universal sanitation access.

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