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Neighbourhood Satisfaction and Density Perception in Indian Cities of Bhopal and Nagpur

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ABSTRACT

Density is an important urban form component. It is a tool that has been used for guiding the way cities are planned for living. Indian cities have been following high-density living, but some researchers showcase that high-density has negative effects. An investigation is necessary to verify the crowding effect and NH sustainability. The paper aims to find if residents are satisfied with the high-density living in the Indian cities of Bhopal and Nagpur. The study identifies context-specific NH satisfaction indicators using Analytical Hierarchy Process (AHP). Based on indicators, data is collected from differing density neighbourhoods. It uses Descriptive as well as Inferential analysis to arrive at results. Further, sensitivity analysis is made using Aggregated Index (AI). Descriptive analysis found a trend of density variation as per each indicator. Inferential statistics (MANOVA) confirms that public perception about density mostly differs in NHs of varying density. The results show that high density proves to be sustainable for variables like NH quality, Community wellbeing and Social equity.The study discusses certain NH interventions that can be useful in deriving future NH design guidelines and framing housing policies in India. Neighbourhood (NH) satisfaction assessment can comment upon the sustainability in a NH. The method can be a starting point to test the sustainability NHs for Indian cities.

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1. Introduction

Satisfaction is a key component to measure the quality of life (Kahn & Juster, 2002). The fast economic growth and urbanisation in India are leading to a situation that is socially, financially, and environmentally unsustainable (Gore & Gopakumar, 2015). The major challenge faced by public policymakers is to accommodate future growth along with improving the quality of life of residents (Ahluwalia, 2019). Accommodating growth is leading to high-density developments worldwide (World-Bank, 2013). With such a situation, compact cities are advocated as a sustainable solution (Jenks & Dempsey,

2005). However, there are contrasting reports regarding high-density living in urban areas. Some studies endorse high-density living (Dave, 2011). It is said to improve social vibrancy (Raman, 2010), ensure social satisfaction (Delmelle, 2013), bring social equity (Burton, 2000), etc. Whereas some studies report on the social and psychological problems (Churchman, 1999), safety issues (Bramley, 2006), reduced social ties (French S. W.-C., 2014), etc. Therefore, assessing people's satisfaction and acceptance of density shall be an essential component of study. Moreover, some researchers have empirically proved the relationship between acceptance and quality of life and NH satisfaction (Elfstrom et al., 2005; Butler & Ciarrochi, 2007); (Howley, Scott, & Redmond, 2009); (Mouratidis, 2020).

Worldwide, researchers have studied the impact of density on urban life. These include studies on social satisfaction, quality of the neighbourhood (NH) (Kearney 2006; Walton 2008; Delmelle 2013), NH ties, sense of community (Freeman, 2001) (French, et al., 2014), social sustainability (Raman 2010; Dempsey, Brown and Bramley 2012), privacy (Lindsay, Williams, & Dair, 2010), social equity (Burton, 2000), affordability (Aurand, 2010), condition of houses (Bello & Egresi, 2017), quality of life (Chan & Lee, 2009), and so on. Although density is a quantitative term, it has a significant amount of effect on social and psychological health. Thus, it has also been a subject of interest not only to urban planners but also to sociologists, psychologists, and policymakers.

The paper aims to find if residents are satisfied with the high-density living in the Indian cities. This investigation is necessary to verify the crowding effect and NH satisfaction for commenting upon NH sustainability. The paper is divided in certain sections, following this section is section 2 of literature review. Section 3 presents methodology, section 4 provides results, section 5 discusses the findings and section 6 concludes the study.

2. Literature Review

2.1 Satisfaction

Worldwide, satisfaction studies relate various NH features like presence of nearby nature (Kaplan & Austin, 2004), natural view from residents window (Kaplan & Kaplan, 1989), vegetation (Hur, Nasar, & Chun, 2010), built environment elements (Parra, et al., 2010), NH characteristics (Mouratidis, Commute satisfaction, neighborhood satisfaction, and housing satisfaction as predictors of subjective well-being and indicators of urban livability., 2020), and so on. A very few studies on satisfaction are conducted in India. Some of them focus upon green space availability (Mukherjee, et al., 2017), slum rehabilitation scheme (ALAM & Matsuyuki, 2018), social satisfaction (Karuppannan & Sivam, 2011), etc. and rare studies assess satisfaction associated with high-density living (Bardhan et al., 2015). Moreover, these couple of studies are conducted in metropolitan cities that are not comparable to other Tier II high-density cities occupying a high in number in the country.

2.2 Density and Assessment Scale

Density can be measured as physical and perceived density. Physical density accounts for the number of people/units in geographical areas. Many researchers have carried on their research undertaking this measure (Lewis, 2017; Bello & Egresi, 2017). It is an objective measure that quantifies physical entities like buildings, people, etc. The number of certain physical elements affects sustainability (Dave, 2008). Just as having high coverage of public transit (Teriman, 2012) or having a low building footprint has a positive impact on sustainability (Brabec, 2009).

Perceived density accounts for the social density as created by people or how they perceive space (Dave, 2008). This measure can determine the acceptability of density levels and sustainability of NHs. Perceptions of density have an impact on social interaction, community cohesion, satisfaction levels and the quality of life (Churchman, 1999; Howley et al., 2009). Density is used in various fields for interpretation, such as anthropology (Hunn, 1994), psychology (Abass & Tucker, 2018), economics (Meng & Han, 2018), ecology (Riede & Pedersen, 2018), environment-behaviour studies (Rapoport, Toward a redefinition of density, 1975), human and social interaction (Howley, Scott, & Redmond, 2009), and so on.

Density more than an acceptable level is termed as a crowding effect (Rapoport, Toward a redefinition of density, 1975). Crowding leads to stress, anger, frustration (Hotwani & Tripathi, 2017), social withdrawal (Aiello, Thompson, & Baum, 1985), depressed immunity systems (Fuller, Edwards, Sermsri, & Vorakitphokatorn, 1993), chronic diseases (Hotwani & Tripathi, 2017), etc.

Studies in urban environments involve various scales. They may range from regional-level, city-level, or NH-level scales. Most perception studies affecting society are conducted at the NH level. Moreover, NH is the immediate environment where society comes together. A NH-level scale is used to study many health-related and psychological factors affecting society (Leslie, et al. 2005; Lee, et al. 2012). Most of the above-mentioned perception studies are conducted at the NH level. A NH is composed of people and their immediate surroundings. The characteristics of these immediate surroundings have a deep effect on people. It affects public health, wellbeing, and psychology. Therefore, NH is an appropriate scale for perceived density assessment that can guide upon the NH satisfaction (Radberg, 1996).

2.3 Contrasting Density Endorsement

There are conflicting reports regarding high-density living in urban areas. Certain studies endorse high-density living for sustainable development (Dave, 2011). However, some studies report psychological problems (Churchman, 1999), safety issues (Bramley, 2006), and reduced social ties (French, et al., 2014) caused by high-density living. Some countries follow high-density NH development policies, claiming that they are beneficial. These include Britain, America, etc. (Raman, 2010). However, cities and NHs around the world have different morphological features

such as roads, land use patterns, layouts, and so on (Karimi, 1998). This affects people's density perception. Moreover, the acceptability of density varies according to history, culture, social conditions, and so on (Churchman, 1999). Hence, considering the implications of various factors, density needs to be studied not only from a development point of view, but its perception by residents also needs to be seen as a matter of prime importance.

2.4 Density Mediating Variables

Some researchers argue that density does not have a direct effect on the people (Dave, 2011). Various variables can react with density and change their perception. Thus, density can be measured using density-mediating variables. However, researchers caution against some factors while conducting a perception survey. These factors are the socio-economic status (Nelson 1978; Bramley and Power 2009; Quastel, Moos and Lynch. 2012) and years of stay in a NH (Kasarda and Janowitz 1974; French, et al. 2014). These factors can profoundly influence the mediating variables and alter people's perceptions of density.

To operationalize the aim, certain mediating density variables have been identified from the literature. Researchers have worked on the effect of density on these variables and vice-versa. Table 1 summarizes certain sustainability studies, where relation with density were derived. Multiple variables provide better results of density evaluation than a single variable (Jenks & Dempsey, 2005). Moreover, it is the various variables that affect the perception of residents and not density (Howley, Scott, & Redmond, 2009). Hence, the study adopted multiple variables to arrive at the results. The selection of variables was based on certain characteristics: 1) variables that relate to social psychology studies, 2) variables that have a relation to population/residential density, and 3) variables studied in the context of the urban NH. The studies show that effect of density may have differed effect on perception, and is purely contextual. The study of variables also suggested the mode of density study (perceived/physical/physical + perceived), and the density level that it endorses (high/low/study doesn't find any relation).

Table 1. Mediating variables that can affect density perception

Variables	Reference	Density study mode	Density levels		
			High	Low	No relation
NH quality†	(Delmelle, 2013)	Perceived	✓		
	(Kearney, 2006)	Perceived			✓
	(Walton D. S., 2008)	Perceived		✓	
	(Bardhan, Kurisu, & Hanaki, 2015)	Physical			✓
NH ties†	(Brueckner, 2008)	Perceived		✓	
	(Freeman, 2001)	Physical + Perceived			✓
	(French, 2014)	Perceived		✓	
Community wellbeing†	(Ancell & Thompson-Fawcett., 2008)	Perceived	✓		
	(Dave, 2011)	Physical + Perceived	✓		
	(Dempsey, Brown, & Bramley, 2012)	Perceived	✓		
	(Raman, 2010)	Physical + Perceived	✓		
Privacy	(Lindsay, Williams, & Dair, 2010)	Physical + Perceived		✓	
Social equity	(Burton, 2000)	Physical + Perceived	✓		
	(Wang, et. al, 2023)	Physical			✓
Housing affordability	(NHPAU, 2010)	Physical + Perceived			✓
	(Aurand, 2010)	Physical + Perceived	✓		
	(Alshubiri, F., & Al Ani, M. K. 2024)	Physical	✓		
Walkability	(Oakes, 2007)	Physical			✓
	(Quastel, Moos, & Lynch., 2012)	Physical + Perceived	✓		
	(Lotfi & Koohsari, 2011)	Physical	✓		
Travel demand*	(Lewis, 2017)	Physical	✓		
	(Frank L. D., 1994)	Physical	✓		
	(Cervero, 1997)	Physical	✓		

Variables	Reference	Density study mode	Density levels		
			High	Low	No relation
Urban form	(Pont & Haupt, 2007)	Physical			✓
	(Yigitcanlar, Kamruzzaman, & Teriman, 2015)	Physical + Perceived	✓		
Scope for intensification	(Aquino, Livert, & Gainza, 2014)	Physical			✓
	(Alawadi & Benkraouda, 2017)	Perceived			✓
	(Pérez & Rey, 2010)	Physical			✓
Mixed use	(Song & Knaap, 2004)	Physical	✓		
	(Foord, 2010)	Physical + Perceived	✓		
	(Mallick & Rahman, 2012)	Physical	✓		
Condition of houses*	(Bello & Egresi, 2017)	Physical		✓	
	(Roy, et al.,2024)	Physical		✓	
Climate*	(Giridharan et al., 2008)	Physical		✓	
	(Coutts, 2007)	Physical		✓	
Energy consumption	(Hachem, 2016)	Physical	✓		
	(Holden, 2005)	Physical + Perceived	✓		
	(Li, Song, & Kaza, 2017)	Physical	✓		
	(Norman, MacLean, & Kennedy, 2006)	Physical	✓		
	(Brownstone & Golob, 2009)	Physical	✓		
Environmental quality†	(Chan & Lee, 2009)	Perceived	✓		
	(Oyedepo, 2008)	Physical		✓	
	(Hall, 2011)	Physical	✓		
Quality green space	(Gupta et al.,2012)	Physical		✓	
	(Raman, 2010)	Physical + Perceived		✓	
	(Smith, Clayden, & Dunnett, 2009)	Physical	✓		
	(Kamble, et al.,2022)	Physical			✓

*=Variables studied only with Physical mode

†=Indicators selected by expert opinion for further study

2.5 Density Policies in India

In India, density is measured with prescriptive components such as floor space index (FSI), floor area ratio (FAR), and so on under government regulations. Currently, policies in India are based on physical density evaluation. Physical density quantifies certain aspects; however, they do not involve qualitative aspects of a NH (Sokido, 2014). The overall growth of Indian cities has been well documented (Kamble & Bahadure, 2021). Today's cities have developed organically, although following a typical pattern. The literature mentions that traditional old city NHs were of high density with mixed land use to facilitate ease of accessibility to work, play, and so on. It was helpful to reduce travel while maintaining a good quality of life. With the rise in population and advances in transportation facilities, education, technology, science, and so on, the extent of cities started increasing. Urban settlements roughly developed in concentric circles, with newly formed low-density NHs occupying outer rings (Kamble & Bahadure, 2021).

Today, urban areas have pockets with a mix of low-, medium-, and high-density NHs. This alteration in population has affected the psychological health of the residents (Dhingra & Chattopadhyay, 2016). At the policy level, India followed a densification policy almost until the 1970's (Shaw, 1999). However, new policies show different trends (Dave, 2010). Therefore, such policies need to be evaluated considering people's perception to avoid adverse effects on resident's health.

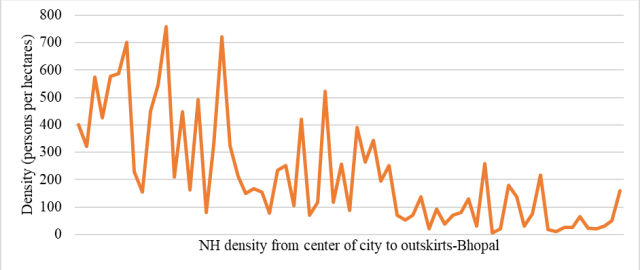
3. Methodology

The methodology of the study is as follows:

3.1 City Selection

The literature revealed that cases may have different density endorsement. Hence, selection of cities shall be from the same zone. The study was restricted to central Indian cities that are similar in size and growth of many other Tier II cities in the country. Therefore, two cities Bhopal and Nagpur are dealt with.

Both the cities have good connectivity with major cities and would not face any connectivity issues on containment policies. The cities have a moderate climate and therefore favourable for high-density planning (Mehta, 2005). The old city areas in the centre have high-density developments (Figure 1). It is universally seen that under such circumstances, people move out of the NHs and settle in the outskirts due to crowding and congestion. Density cannot be increased beyond a limit; hence, low-density outgrowths have started coming up in these cities. Such uneven density distribution needs to be investigated in terms of people's satisfaction.



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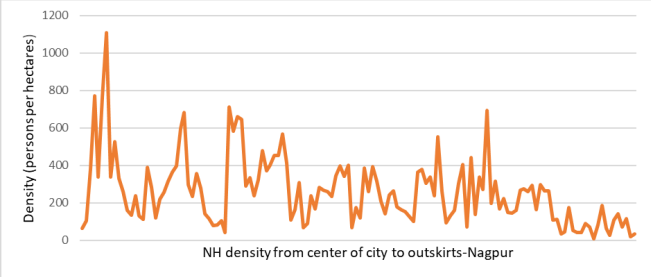


(b)

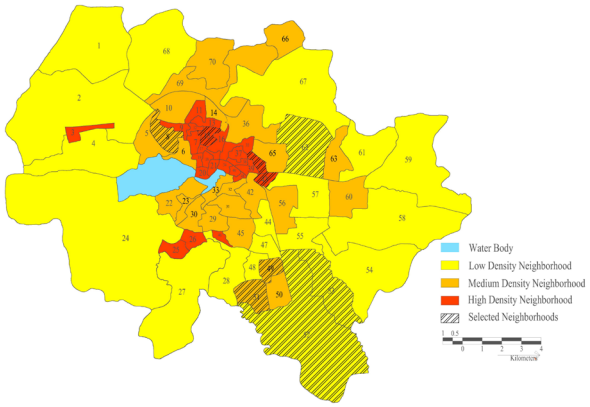
Figure 1. Neighbourhood density from centre of city to the outskirts

3.2 NH satisfaction indicators

The study relied on satisfaction variables discussed in the literature (18 nos, Refer Table 1) related to density as NH satisfaction indicators. Some indicators, however, were assessed only by physical methods, and thus were not considered in this study. The remaining 13 indicators were put forward for an expert opinion survey and analysed by Analytical Hierarchy Process (AHP) method. AHP is an effective tool for identifying indicators in a framework (Ding, 2008). A pairwise matrix compares expert opinions and reduces them to square matrices A=[αij]nxn. Further, scores are normalised (Nmax) in AHP for all identified experts. The indicators that were finalized and their percentage score are: 1) NH quality (25.16); 2) Community wellbeing (23.52); 3) Environmental quality (20.11); 4) Social equity (18.21); and 5) Social ties (13.00).

3.3 NH selection

The study identified varying density NHs in the city. The threshold for low, medium, and high-density NHs were set as 15th -25th, 45th-55th, and 75th-85th percentile of NH density respectively. Three low-density (NH1, NH2, NH3), three medium-density (NH4, NH5, NH6) and three high-density (NH7, NH8, NH9) NHs were identified (Refer Figure 2). Selection of range (15th -85th) allows removing the possibility of selecting outliers as well as it helps in selecting NHs that are mostly residential (Walton, Murray, & Thomas, 2008).



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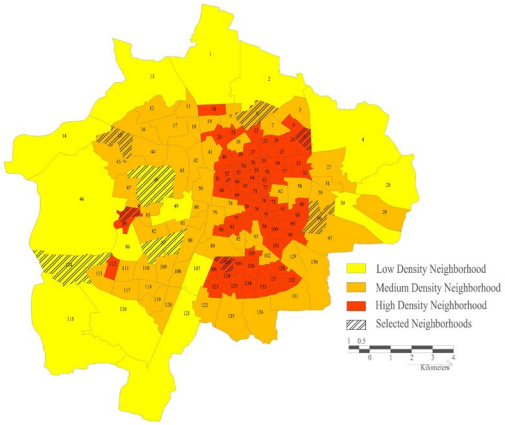

(b)

Figure 2. Selected Neighborhoods (a) Bhopal city; (b) Nagpur city

Many studies on Indian cities consider wards as neighbourhoods (Bhatta, 2009); (Ramachandra, Bharath, Kulkarni, & Han, 2018). Census data is reported ward-wise, therefore, information about NHs is easily available (Table 2). Since the perception of population density by residents had to be verified for a particular density level, the study identified certain NHs of varying density in the city. This helped in comparing low, medium, and high-density NHs for their acceptability.

Table 2. Data of selected NHs (Census, 2011)

NH Type	NH Number	NH Density (pph)	Good condition houses (%)	Owned houses (%)	NH Number	NH Density (pph)	Good condition houses (%)	Owned houses (%)
	Bhopal				Nagpur			
Low density	52	30	63.2	72.3	48	41	83.4	37.3
	62	69	79.1	71.4	87	69	88.5	79.6
	53	65	63.8	84.5	114	64	86.5	70.6
Medium density	8	162	54.6	74.1	8	142	73.1	69.7
	49	138	78.4	76.1	15	152	80.7	76.3
	51	137	69.4	66	96	138	72.8	76.8
High density	15	400	81.2	60.3	5	289	42.1	81.6
	43	421	68.9	72.7	84	310	73.2	77.1
	64	343	91	67.1	105	340	76.3	64

3.4 Sample for Survey Selection

A public opinion survey made the perceived assessment of indicators. The equation (EQ1) calculated the sample size (Dhingra, Singh, & Chattopadhyay, 2016). Thirty persons each from nine NHs were surveyed. Residents who had been living in the NH for more than 15 years were asked to fill out the survey forms. Moreover, middle-class families with similar incomes were selected. This ensured that the group was homogeneous with similar socio-economic and residential stay status. The mean sample age was 42 years (SD = 12.1 years); the mean years of stay in the NHs were 17 years. An equal number of male and female participants were tried to be selected for the survey. Thus, a total of 270 persons were asked their opinion on density mediating variables from each city. The questionnaire included a 5-point Likert scale on which the indicators were rated. One represented "least satisfied" and five represented "highly satisfied."

$$n = \frac{z^2\, p(1-p)}{m^2} \qquad \text{EQ1}$$

Where, n=required sample, z=value of confidence level (for 90% it comes 1.645), p=estimated prevalence of variable of interest (assumed to be 30%), m=margin of error (assumed to be 20%).

Table 3. Socio-economic data of respondents

Socio-economic variables		NH1	NH2	NH3	NH4	NH5	NH6	NH7	NH8	NH9
Age (Min,Max)	Nagpur	19, 70	18, 61	20, 63	29, 64	18, 55	19, 68	18, 66	17, 73	18, 66
Sex (M,F)		17, 13	19, 11	15, 15	12, 18	19, 11	15, 15	16, 14	21, 9	10, 20
Monthly HH income (Min, Max)		30K, 1.5L	20K, 2L	8K, 40K	12K, 45K	15K, 1.2L	18K-1L	8K, 30K	15K, 35K	20K, 75K
College degree/higher education (Out of 30 respondents)		19	20	10	11	21	16	9	11	24
Age (Min,Max)	Bhopal	15, 66	17, 70	19, 68	25, 72	16, 66	20, 68	19, 69	16, 66	20, 68
Sex (M,F)		16, 14	17, 13	18, 12	16, 14	19, 11	20, 10	17, 13	16, 14	14, 26
Monthly HH income (Min, Max)		35K, 1.2L	35K, 1.5L	10K, 2.5L	32K, 1L	40K, 1.2L	15K-1.5L	35K, 3L	15K, 1L	30K, 95K
College degree/higher education (Out of 30 respondents)		19	20	10	11	21	16	9	11	24

3.5 Analysis

Descriptive as well as inferential statistics were used to analyse the data. Descriptive statistical analysis was conducted to understand the data in varying density NHs. MANOVA examination was used to conduct the inferential analysis. A multivariate followed by univariate analysis was performed to confirm any statistically significant differences ($p \leq 0.05$) in varying density NHs.

3.6 Aggregate Index

The indicator score of each NH was aggregated to obtain the Aggregated Index (AI) (Equation 2). The averaging of scores makes the indicator values comparable and the aggregation makes the varying density NHs comparable. AI is converted into percentage scores (Equation 3) for ease of comparison.

$$\text{Aggregate Index (AI)} = \sum_{s,c} a \quad \text{EQ2}$$

$$\text{Percentage score} = \frac{(AI)_{sc} \times 100}{\sum(AI)} \quad \text{EQ3}$$

Where, s=satisfaction indicator, c=indicator category, and a= indicator average score

4. Results

4.1 Descriptive Statistics

The mean values of variables from the low-, medium-, and high-density areas show differing perception in varying density NHs. The standard deviation is near 1; this shows a reasonably homogeneous set with not many variations in the data set and validates the mean scores. A trend line on the mean values shows high density scoring high, however, cannot be differentiated distinctly from other groups.

4.2 Inferential Statistics

Table 4 presents the results of the MANOVA Box's test. MANOVA confirms that a significant difference is seen across the groups and is similar in both the cities. A t-test was performed on the mean density opinions data. This confirmed the exact density groups showing differences under each indicator. The test was conducted between low-density and medium-density residents' opinions; and medium-density and high-density residents' opinions. It is found that indicators that showed high density as perceived better, shows significant difference between medium- and high-density NHs. Thus, it can be said that NH quality, community wellbeing and social equity is perceived distinctly better in high density NHs. The indicator environmental quality showed a drop in ratings as density increased. The result of t-test confirms that low density is distinctly perceived better by the residents. The social ties results show differing results across cities. It verifies that medium density is distinctly perceived better than low- and high-density NHs in Bhopal, whereas endorses high density in Nagpur.

4.3 Sensitivity Analysis

The average indicator scores and the AI (values and its percentage conversion) are given in Table 5. It is seen that AI more in high density NHs. This shows that there is no negative effect of crowding in the residents and high density NHs have a high satisfaction index in totality. The sensitivity analysis is useful to show the combined effect of all the indicators.

Table 4. Results of statistical analysis

Indicators	Bhopal		Nagpur	
	LD-MD	MD-HD	LD-MD	MD-HD
NH quality	0.0700	*	0.5570	*
Community wellbeing	0.4400	*	0.0850	*
Environmental quality	*	0.0757	*	0.4200
Social equity	0.0660	*	0.1333	*
Social ties	*	*	0.065	*

Table 5. Aggregated Index of neighbourhoods

Indicators	NH quality	Community wellbeing	Environmental quality	Social equity	Social ties	Aggregate Index (AI)	Percentage conversion
Expert score	**25.16**	**23.52**	**20.11**	**18.21**	**13**		
Bhopal NHs							
NH 1	2.5	2.03	2.93	2.34	2.03	238.569	81
NH2	2.57	2.47	2.71	2.44	3.03	261.076	89
NH3	2.5	2.32	2.83	2	2.53	243.688	83
Mean low-density NH percentage AI							**85**
NH4	2.23	2.13	2.33	2.5	2.47	230.696	79
NH5	2.5	2.2	2.57	2.13	2.67	239.824	82
NH6	2.8	3	3.1	2.63	3.17	292.451	100
Mean medium-density NH percentage AI							**87**
NH7	3.17	2.6	2.1	2.9	2.54	268.969	92
NH8	2.5	2.73	2.23	2.4	2.63	249.849	85
NH9	2.83	2.81	2.21	2.73	2.01	257.58	88
Mean high-density NH percentage AI							**88**
Nagpur NHs							
NH 1	2.75	2.67	2.77	2.01	2.7	259.395	90
NH2	2.81	2.67	3.01	2	2.14	258.269	89
NH3	2.22	2.47	3.03	1.8	2.43	239.251	83
Mean low-density NH percentage AI							**87**
NH4	2.73	2.9	2.47	1.67	2.87	254.287	88
NH5	2.54	2.63	2.11	1.83	3.13	242.21	84
NH6	2.5	2.14	2.45	1.93	2.34	228.068	79
Mean medium-density NH percentage AI							**84**
NH7	2.87	2.93	2.01	2.77	3.1	272.286	94
NH8	2.9	2.93	2.13	2.3	3.07	266.505	92
NH9	3.1	3.03	2.32	2.17	2.97	274.043	95
Mean high-density NH percentage AI							**94**

5. Discussion

The study was based on the aim to verify the satisfaction level of varying density NH residents in an Indian city. The objective was to check if the high-density in urban NHs supports the wellbeing of the residents. The study provides an empirical investigation of varying density NHs. Density can be studied at various scales including the national, regional, city, NH, etc. The study considers a NH scale since most of the public health-related factors affecting society have been studied at this scale (Leslie et al., 2005; Lee et al., 2012). Multiple indicators are argued to give better results of density evaluation than a single indicator (Jenks & Dempsey, 2005). Hence, the study adopted multiple indicators to arrive at results. Identification of indicators from NSA systems gave NH sustainability indicators. Experts helped in screening context-based indicators.

Most of the policies in India and many other parts of the country are based on physical density evaluation. The paper presents empirical evidence that can build concrete theories when tested and validated with a larger set of cities in India. India has followed high-density growth since history, but the government lacks the skill of getting benefit out of this high-density planning (Dave, 2010). It is observed that despite density norms followed similarly

throughout the city, there lies a significant difference in density levels of the NHs. A similar methodology could be adopted to study other Indian cities and derive inferences to plan sustainable cities.

Developing countries are facing a high-density rise and do not have sufficient planning policies to encounter them. There has been a great deal of research in developed countries over the density of a healthy society (Walton 2008; Fassio, Rollero and De Piccoli 2013). These results, however, cannot be applied in developing countries. This is because the social conditions are different in both contexts (Kamble & Bahadure, 2019). Moreover, lessons from developed countries when followed in developing countries give strange results (Menon, 1997). Most of the density policies in India is driven based on population density, floor space index, etc. and not upon people's opinion. This study is, thus, an effort to verify the perception of density levels of Indian NHs.

The study provides an empirical investigation of varying density NHs. The current study used various variables and obtained the perception of residents from a central Indian city, Bhopal. This study was conducted in the local language to obtain appropriate results. Perception of density is said to have a strong effect on the health and psychology of residents (Gillis 1983; Boyko and Cooper 2014).

The results show that most of the identified variables like NH quality, Community wellbeing, Social equity, and sense of community are perceived better in high-densities. Indian residents have been living with high density for years and hence, they might not find it a crowding issue. Researchers have found that background or densities at preceding stay affect the perception of density (Torshizian, 2017). This affects the acceptance of density. However, environmental quality is perceived better in low density NH and social ties are perceived better in medium density NHs. The study also proves that contrasting density endorsement is present in the studied cities.

NH quality: Kearney (2006) finds that density does not have any effect on NH quality while Mouratidis (2018) endorses high-density living for the same. The former study is from Washington, US while the latter is from Oslo, Europe. Thus, contextual differences can be witnessed in the endorsement of density. The present study agrees with the latter case and shows preference of high density. NH quality is said to depend on various factors such as the availability of natural features (Kearney, 2006). Out of the selected NHs, some low-density NHs have natural features and good views, but this does not seem to affect the present study. Howley, Scott, and Redmond (2009) and Buys and Miller (2012) have found specific design criteria that can enhance perception of density levels by residents, such as the position of a residence, its design, and facilities, and so on.

Community wellbeing: For community wellbeing, a study by Dempsey (2008) endorses high density that matches with current study results. Dempsey, however, cautions that there are many aspects that alter the perception of people. She warns that a single boarded home or a burnt car can also influence the perception of a NH. Dave (2010) comments that residents judge a NH by the standard of public or private services and not by density. However, she finds that high density leads to high pollution and stress-related health issues. Therefore, healthcare professionals are said to play a strong role in density studies (Boyko, 2017). Some researchers have found that there exist certain design characteristics of a NH that may influence the behaviour of people and result in long-term health benefits (Badland, et al., 2017). The current study agrees with this since the appearance of the NH influenced the samples.

Environmental quality: Many researchers provide suggestions on how to improve environmental quality. Some studies say that the interrelation of multiple stakeholders involved in the density planning of a NH is very crucial (Dempsey, 2008). Some researchers focus on the role of stakeholders in providing place-specific solutions (Lau, et al., 2018). Zhang et al. (2012) discuss the spatial configuration of built forms for better environmental quality. Fassio, Rollero, and De Piccoli (2013) conclude in their study that density has a strong effect on psychology and environmental quality but has no effect on physical aspects. The current research finds that people experience better environmental quality when their residence is close to an open space or park. Thus, location is an influencing factor and not density. The statistical test, however, finds a higher environment quality in low density neighbourhoods.

Social equity: The current study finds that social equity works better in high density NHs. Same results are obtained when calculated by physical assessment, that is, using the complete spatial randomness (CSR) method (Bahadure & Kamble, 2019). It is found that high-density NHs have more facilities and get access to more amenities in the NHs that have been studied. Researchers have listed the benefits and problems of high population density, such as improved public transport, reduced social segregation, and access to better facilities (Burton, 2000). When considering problems such as reduced living space and lack of affordable housing, designers and planners should focus on attractive as well as liveable NHs (Burton, 2003). Thus, planning interventions may lead to reduce the negative effects of high density.

Social ties: Fassio, Rollero, and De Piccoli (2013) show that low population density results in better psychological health and a better quality of life. An interesting conclusion drawn by another study reveals that a wide network with few strong social ties is witnessed in low density, whereas small networks but strong ties are found in high density (Raman, 2010). There are certain studies that relate other factors that influence social ties. Kasarda and Janowitz (1974) find that as a person grows older, social networks in formal organizations are found to be more than in informal NH contacts. Similarly, a study finds that people's social contacts are influenced by the degree to which the residents are dependent on the automobile (Fassio, Rollero, & De Piccoli, 2013). The current study is conducted in a region in India that has high vehicle ownership, and this factor has altered the people's social ties. Residents rely on their convenient two-wheelers and have easy access to distant friends and relatives. The results show differing results in both cities and need further investigations to have concrete conclusions.

In the case of India, people are less educated on social fronts. Being a developing country, the focus remains on food, economy, and so on. Thus, while performing the survey, the residents had to be given an elaborate understanding of each indicator before it was conducted. The study finds that to have a healthy participatory approach, residents must be trained and given proper counselling to obtain better results. Moreover, planning implications can alter the effect of density as revealed by various case studies. The future scope of the study remains conducting similar studies for a larger set of cities and finding out design features that may affect the perception of residents in Indian cities. Moreover, looking at the current density pattern that varies throughout the cities, a single policy cannot be adopted. Thus, the density policies should be framed accordingly.

Thestudy has certain limitations that can be incorporated in the study model for future urban areas assessments. Some studies show that satisfaction is related to respondents' socio-economic variables like age, income, education, employment, and marital status (Blanchflower and Oswald, 2011). The inclusion of such control variables in the model will have wider implications for the study. The survey results showed similar and average answers, the addition of a few control questions can verify the level of understanding by respondents.

6. Conclusion

The escalated growth in Indian countries is creating pressure on land, public health, and the psychology of residents. This makes density policies important criteria for planners and public policymakers for regulating this growth and making life better in urban areas. Perceived assessments in NHs can reveal the existing situations and effects of policies upon the society. The study shows that indicators for satisfaction assessment may vary according to the context.
However, the study presented a list of indicators in the paper that can be useful for deriving similar frameworks for assessment in other cities too. The study shows that a single policy cannot be adopted in urban areas. Perceived assessment studies can bring more theoretical and empirical inputs on the subject and avoid the negative implications on public health and psychology. This in general can guide a sustainable living pattern in urban areas. The current population growth in the Indian urban areas shows the need for densification for sustainable development. This can curb the ill-effects on the surrounding landscape and ecosystem by containing urban growth. In turn, it might affect the society. It has been suggested that India with its high urban growth should undergo densification and compaction policies. Its effect on people (say, crowding) and people's perception of high density is unexplored. The study provides empirical findings on this issue. The results clearly show that the densification policy that is said to be sustainable is adaptable by urban Indian residents. However, certain indicators should be planned consciously to maintain sustainability since indicators endorse contrasting density. The study discusses certain design and planning concerns need to be followed to make a NH attractive and liveable despite being dense.

This study raises a question to other countries that rely on physical investigations for density policies like India. There is certainly a need to revise the density policy regulations in India. Factors such as land use planning, city characteristics, growth pattern, cultural acceptance, urban-rural migration, regional planning are important factors while framing density policies. However, its perception by the residents needs to be evaluated considering their health and wellbeing. The study concludes that mediating density variables can be useful to address perception of density. It also concludes that although high density is acceptable by Indian residents, it is not true for every variable. Hence a conscious NH planning effort is required. This study can be a starting point for the creation of a densely populated yet sustainable and healthy environment in Indian urban NHs.

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