Effect of Living Environment on Health: A Prospective Study

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Abstract:
Background: In the rural areas three out of four Indians (77%) are under poor living conditions. Provision of adequate housing and amenities are major challenges for human development, particularly among low income rural households in developing countries.
Objective: The objective of this study was to determine the relationship between living environmental condition and its impact on human being.
Methods: The study consists of 200 houses randomly selected from rural area of satbhirawa village in which 680 people were live. Demographic data of participants were collected with the help of questionnaires, weighing machine, and sphygmomanometer. House conditions were noted on observational basis. Physical examination was conducted on these residents which include- eye examination by examine the color of conjunctiva; ear, nose, throat, nail examination; pulse rate, respiration rate; chest expansion during inspiration.
Result: Majority of population (65%) live in semipucca houses. 80% houses have no separate kitchen. LPG used as cooking fuel in 40% houses. Only 10% houses have good ventilation and 80% houses have good entry of sunlight. 60% houses were located in greenery area. 22% people live in overcrowded conditioned. 35.29% residents were suffering from disease.
Conclusion: It was found that majority of population resides in poor housing conditions which lead their health status poorer. Systematic improvements in housing can improve health and reduce inequalities in health.

Keywords: House, overcrowding, ventilation

INTRODUCTION

It was Hippocrates who first related health disease to environment, later Pettenkofer in Germany received the concept of disease-environmental association[1]. The living environment is defined as an assembly of the natural and built environment which is offered to the inhabitants of the place who perform various kinds of social, cultural, religious, economic, and political activities[2]. The environmental factors range from housing, water supply, psycho-social stress and family structure through social and economic support system, to the organization of health and social welfare services in the community[3]. Housing environment constitutes one of the major influences on health and well-being. Health is linked not only to the physical structure of a housing unit, but also to the

neighborhood and community in which the house is located. There are a number of aspects of housing such as the structure of housing; internal conditions such as damp, cold, indoor contamination and the behavior of the occupants have a direct impact on health[4]. Indoor and outdoor housing conditions, material, social aspects of housing, neighborhoods also have an impact on the health of occupants[5]. If the environment is favorable to the individual, he can utilize his physical and mental capacities. Types of housing affect the health in context to psychological, physiological and spread of infection. Healthful housing provides physical protection and shelter. It provides adequately for cooking, eating, washing and excretory functions. It is designed constructed, maintained and used in a manner such as to prevent the spread of communicable diseases. It provides for protection from hazards of exposure to noise and pollution. It is free from unsafe physical arrangement due to construction or maintenance, and from toxic and harmful materials. It encourages personal and community development, promotes social relationships, reflects a regard for ecological principle and by these means promotes mental health.

The interaction between human diseases and living environment has been extensively studied. Worldwide, World Health Organization (WHO) has estimated that thirteen million deaths annually occur due to preventable environmental causes[6]. Various respiratory infections including diseases have been associated with different aspects of the indoor living environment[7]. The objective of this study was to know the impact & relation between room size and number of person occupying one room and also know that how greenery, type of cooking fuel, ventilation, sun light in living environment affect the health.

METHODS

The study was done in village- Satbhirawa, Po-Majhaulia, District-West champaran, Bihar. 200 houses were selected in a village Satbhirawa in which 680 persons were live. Questionnaire method of data collection was used to know the pattern of living and prevalence of different diseases. Verbal consent for participation in the study was taken. Information regarding type of house, number of rooms, window, floor, kitchen, types of cooking fuel, ventilation, overcrowding, greenery, was scored and housing condition was graded as Poor, medium, good. Living environment conditions including overcrowding and inadequate cross ventilation were defined as per textbook standards[7]. Physical examination was conducted on these residents which include- eye examination- to see the color of conjunctiva; ear, nose, throat, nail examination; pulse rate, respiration rate; chest expansion during inspiration.

Statistical analysis: All data sets were entered into Microsoft excel and analyzed by SPSS version 16.0. Descriptive analyses were done and percentages were calculated to represent the data.

RESULTS AND DISCUSSION

The present study based on observation of main features of 200 houses and 680 residents living in these houses which were randomly selected from village Satbhirawa.

Table 1: **Diseases related with types of fuel**

Disease	Cause
1. anthracosis	Coal dust
2. Bagassosi	bagas
3. Farmer's lung	Grain dust

Table 2: **Living environmental conditions in village Satbhirawa**

Criteria	Types	No.	%
Type of houses	Kaccha	40	20
	semipucca	130	65
	Pucca	30	15
Window position	With window	180	90
	Without window	20	10
Kitchen	No kitchen	160	80
	Separate kitchen	40	20
Types of cooking fuel	LPG only	80	40
	Electricity/LPG/ biogas	36	18
	Kerosene/coal/lignite/charcoal	84	42
Entry of sunlight in house	Good	80	40
	medium	80	40
	Poor	40	20
ventilation	Good	20	10
	medium	60	30
	Poor	120	60
House location	In greenery area	120	60
	In non-greenery area	80	40

1. Characteristics of houses and its surrounding area (Table 2):

1.1) Types of houses: The percentage of kaccha, semipucca, and pucca houses were 20%, 65%, 15% respectively. House made from mud, thatch, or other low quality materials are called kaccha houses. House that are partly low quality and partly high quality materials are called semipucca house. Houses that are made from high quality material are known as pucca houses[9].

1.2) Window: These data shows 10% houses without window and 90% houses with window. Without window houses were not recycle air so infectious agents multiply rapidly and affect the health. In standard housing every living room should be provided with at least two windows and at least one of them should open directly on to an open space. The windows should be placed at a height of not more than 3 feet above the ground in living rooms. Window area should be 1/5 of the floor area. Doors and windows combined should have 2/5 of the floor area. It was found that the respiratory infection like common cold, tuberculosis, influenza, bronchitis, measles and whooping cough were more common in that house which are without window.

1.3) Kitchen: This table shows 20% houses have separate kitchen and 80% houses have no separate kitchen. Every dwelling house must have a separate kitchen. The kitchen must be protected against dust and smoke; adequately lighted; provided with arrangement for storing food, fuel and provisions; provided with water supply; with a sink for washing utensils and with arrangements for proper drainage. The floor of the kitchen must be impervious. These conditions found in the kitchen prevent the spread of infectious agent /breeding of insect.

1.4) Cooking fuel: This table shows 40% of them are exclusively using Liquefied Petroleum Gas (LPG) and 18% of them use both firewood and LPG while cooking. That means except 58% of the respondents, rest of them (84) do not possesses LPG in their house. They depend on firewood, charcoal, cow-dung cake, and kerosene while cooking. Many of the developing world populations (e.g., India and China) use un-vented biomass stoves for cooking and heating in tightly confined dwellings. Depending on how it is burned, wood produces fine particles (FPs, or $PM_{2.5}$, with a mass mean diameter of less than 2.5 micrometer) at 0.1–0.4% by weight of fuel, as well aliphatic/olefinic hydrocarbons, aromatic hydrocarbons and PAH, oxy-hydrocarbons and oxy-PAH, and CHCs. Butadiene, benzene, benzopyrene, catechols/hydroquinones/semiquinones, and PCDD/F have all

been identified in wood smoke[10]. Many types of disease (Table 1) are more common in the house used the kerosene /lignite /charcoal. Other problems like- Heat hyperpyrexia, Heat exhaustion, Heat syncope, Heat cramps, burns, local effects such as prickly heat, occupational cataract, cancer of skin/lung/bladder, dermatitis, eczema, neurosis, hypertension and peptic ulcer were detected.

1.5) Sunlight: The ratios of entry of sunlight in houses were 2: 2: 1; for good, medium and poor conditions. When sunlight enter through all four walls of house consider as 'good'. If it enter through three walls of house consider as 'Medium sunlight' and if there is no sunlight entry or from one side wall consider as 'poor sunlight'. The benefit of sunlight is its ability to increase the body's vitamin D supply. At least 1,000 different genes governing virtually every tissue in the body are now thought to be regulated by 1,25-dihydroxyvitamin D_3, the active form of the vitamin, including several involved in calcium metabolism and neuromuscular and immune system functioning[11]. The observation that day light cause the in vitro degeneration of bilirubin is now being use as therapeutic measure in premature infants with hyperbilirubinemia. Other biological effects of light include, effect on biological rhythms of body temperature, physical activity, the stimulation of melanin synthesis, the activation of precursors of vitamin–D, adrenocortical secretion and food consumption. The daylight factor should exceed 1% over half the floor area. In well lighted houses the incidence of bony disease like osteoporosis was low.

1.6) Ventilation: For proper lighting and ventilation, there have to be an open space all around the house; this is called set back. In rural area it is recommended that the area covered by house should not exceed the 1/3rd of the full area. The set back should be such that there is no obstruction to lighting and ventilation. 10% houses have good ventilation in which incidence of respiratory diseases were low in comparison to poor ventilated (60%) houses. Due to poor ventilation the process of respiration change the composition of air breathed to approximately 16% oxygen, 75% nitrogen, 4% carbonic acid and 5% water vapor[12]. Effects of exposure to low oxygen concentration can include giddiness, mental confusion, loss of consciousness and death[13].

1.7) Distribution of greenery: Percentage distributions of greenery near or inside houses were 60% and percentage distributions of houses near non-greenery area were 40%. Common respiratory disease was less in greenery area because the oxygen concentration of these areas was high in day time but allergic disease like allergic rhinitis, allergic sinusitis, allergic conjunctivitis and bronchial asthma was more prevalent in greenery area because the pollen grains are the main causative agents for these diseases.

1.8) Overcrowding in house: Table 3 shows study of relationship between number of rooms and number of persons living in them (less than 12 month child is not counted). Out of 200 houses, in 44 houses (22%), people were living in overcrowding condition. Overcrowding is consider to exist if 2 person more than 9 years old; not a couple; of opposite genders are obliged to sleep in the same room. It is the situation in which more people are living within a single dwelling so that movement is restricted, privacy secluded, hygiene impossible; rest and sleep become difficult[8]. Overcrowding leads health issue. It promotes the spread of the respiratory infection, for example, tuberculosis, flu, diphtheria and its consequences for psychosocial health were bring about irritability, disappointment, frustration, lack of sleep, anxiety, depression, violence and mental disorders. It is a psychosocial stress, prompting despondency and psychosomatic and mental issue. Infectious disease spreads quickly under conditions of overcrowding. High morbidity and death rates were observed where housing conditions are sub standard.

Table 3: **Normal and overcrowded houses**

Number of houses	Number of rooms	Number of person in each house	Conditions
29	1	1-2	Normal
34	2	1-3	Normal
47	3	1-5	Normal

43	4	1-7	Normal
03	5	1-10	Normal
08	1	>2	Overcrowding
14	2	>3	Overcrowding
12	3	>5	overcrowding
09	4	>7	overcrowding
01	5	>10	overcrowding

Table 4: **The accepted standards with respected to overcrowding**

Number of room	Number of person per room
1	2
2	3
3	5
4	7
5	10*

Additional 2 for each further room

1.9) Residents suffering from diseases: Out of 680 persons majority of residents i.e. 240 persons (35.29%) were found suffering from disease (Table 5). In well lighted houses, low incidences of osteoporosis were found. Residents living in houses with good greenery area were more suffering from allergic diseases. Infectious disease and psychological disease were more common in residences which were living in overcrowded houses. Psychological, physiological and infectious diseases were more common in residents which were living in kaccha houses. Hypertension, heat syncope, heat cramp, antracosis, bagasosis, farmer's lung and upper respiratory tract allergic/infection were more common in residents which were using cooking fuel like, kerosene oil/lignite/charcoal/grain/dung cake and grasses.

Table 5: **Diseased distribution**

Diseases	No of person suffering from diseases	Percentage (%)
Upper respiratory tract (Ear, nose, throat)	34	5.00
Lower respiratory tract	20	2.94
allergy	53	7.79
psychological disorder	08	1.18
Skin disease	56	8.24
Bone disease	57	8.38
hypertension	12	1.76
Total (disease)	240	35.29

2. Standard house criteria

2.1) *Number of living rooms*: Should not be less than two, at least one of which can be closed for security. The other might be open on one side is a private patio. The number and area of rooms should be increased according to size of family; with the goal that the suggested floor space per individual might be made accessible.

2.2) *Floor*: The floor should be firm and compact. It should be watertight so that it can be easily washed and kept clean and dry. Mud floor crack after few days and dust accumulates in it which causes allergic rhinitis, allergic conjunctivitis, allergic sinusitis and bronchial asthma. The floor must

be smooth and free from cracks and crevices to prevent the breeding of insect and harborage of dust. Insect like houseflies, mosquito, fleas, bug and rat infestation helps in spreads of infectious agents. Infectious agent causes food poisoning malaria plague and skin diseases. The floors should be damps proof. The height of the plinth should be 2 to3 feet (Table 6).

Table 6: **Floor space of room: The accepted standards**

Floor space in sq.ft	Number of person
110 and more	2
90 – 110	1.5
70 – 90	1
50 – 70	0.5

Baby under 12 months is not counted; children between 1 to 10 years counted   as a half a unit.

2.3) *Walls***:** The walls should be strong and smooth. It has a low heat capacity. Wall should be weather resistant. It should be incompatible for harborage of rodents and vermin. These principles can be accomplished by 9 inch brick-wall plastered smooth and light colored.

2.4) *Roof***:** The height of the roof should be more than 10 feet. The roof should be heat resistant.

3. Suggestion for keeping environmental congenial for health

3.1) *Fresh air infusion:* The modest and simple initial step to better indoor air is to bring some fresh outside air inside. Be sure to ventilate effectively, especially in cold climate. Leave the window open for about 5 minute then close them up tightly again. Repeat 2-3 times every day.

3.2) *Avoid use of synthetic carpeting:* Synthetic carpeting is a critical wellspring of indoor pollutants. The best wager is to use carpet of natural fibers; for example, fleece, cotton, silk or jute.

3.3) *Low cooking temperature:* Carcinogenic agent nitrosamines were formed when meat is cooked at high temperature.

3.4) *Avoid plastic toys from child:* Plastic act as carcinogenic agents.

3.5) *Avoid pesticides:* Household pesticides contaminate land, air, food, water and seriously harm native animals, pets and human being.

3.6) *Use of exhaust fan in humid area of house:* The humid place of houses (kitchen and bathroom) were favorable place for growth of molds and mildews. These are act as allergens. So use of exhaust fan and vacuum cleaner will reduce incidence of allergic disease like asthma.

3.7) *Drop the dry cleaning:* Traditional dry cleaning uses solvent perchloroethylene which has been linked to risk of bladder, esophageal and cervical cancer, reduce fertility, and cause irritation. Traces of this chemical remain in clothing after dry cleaning and spread into the air once at home. So wear such cloth that does not require dry cleaning.

3.8) Use house plants: Indoor plants like Pothos, Aloe Vera, spider Plant, Areca Palm, etc improve the oxygen level in houses and act as natural air filter.

CONCLUSION

The present study was carried out on 680 residents who were living in 200 randomly selected houses. 22% houses shows overcrowding. The percentage of kaccha, semipucca, and pucca houses were 20%, 65%, 15% respectively.10% houses had without window; 80% houses have no separate kitchen; most

of the houses used cooking fuel as electricity/LPG/and biogas (58%); Most of the houses had good or medium entry of sunlight (80%), 60% houses were located in greenery area; 35.29% residents were found to be unhealthy. The root cause of all these disease summarized in table 6 was people's living condition. Moreover, systematic improvements in housing can improve health and reduce inequalities in health.

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