

The Impact of Housing Openings' Physical Features on Residents' Health Tailoring Contextualized Data Collection Methods and Assessment Criteria for Saudi Arabia

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Abstract:

The low rate of ventilation in housing impacts children's health. It may promote or inhibit infant allergic and respiratory symptoms, one of this decade's most common diseases in early childhood. The physical characteristics of housing openings have a role in that. The fresh air that comes through house openings is vital for compensating for the composition of indoor air and reducing the amount of indoor pollutants and carbon dioxide concentrations. The indoor housing environment has many resources that produce air pollution, like building materials and different finishes. Also, some human cultures and habits, including smoking, bad cooking habits, and lifestyle traditions, affect human health in the long term. There is a lack of studies about the relationship between residential buildings and allergies and respiratory diseases in early childhood in hot, dry climate regions such as Saudi Arabia, compared to the accomplished studies about the effect of cold climate regions such as Nordic countries. Saudi children live in houses that depend mainly on artificial ventilation. The outdoor climate is scorching, dry or humid, and dusty. Children under three years old usually spend most of their time at home or in their grandmothers' homes. From the socio-cultural perspective, Many Saudi families prefer to keep their windows closed for more privacy. The research aims to find the impact of the physical characteristics of housing openings on residents' health—a particular focus on allergies and respiratory diseases in early childhood in Saudi Arabia.

Keywords:

Housing Openings,
Allergies, Respiratory,
Early Childhood, Hot Dry
Climate Ventilation.

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1. Introduction:

Several research studies have been reviewed in this chapter to better understand the association between housing openings and allergies and respiratory diseases in early childhood in the Eastern Region of Saudi Arabia.

1.2. Background:

Universally, the occurrence of asthma and allergic diseases among children has increased in industrialized countries, and it is coinciding with the decrease in ventilation rates. (Bornehag, et al,2004) (Dimitroulopoulou, C., 2012). Children in their early childhood spend over 16 hours a day indoors at home. Thus, the low ventilation rate affects their health as they become more exposed to indoor air pollution.

The low ventilation rates may increase the concentration of indoor-generated pollutants (IAP), leading to serious health outcomes. The indoor environment has many resources that produce air pollution (Sundell et al., 2011), such as building type, age, materials, and finishes. Also, some human cultures and activities, such as smoking, lousy cooking habits, and lifestyle, affect human health in the long term (Sundell, J, and others, 2011).

Applying passive climate control strategies, such as adjusting windows' location, size, orientation, and elements such as temperature variations and wind

direction, can benefit them. This characteristic helps cool indoor environments while decreasing energy consumption. While energy efficiency and sustainability are the highest priority in arid and consuming regions such as Saudi Arabia, passive climate control methods are consistent with the region's socioeconomic and environmental priorities.

1.3. Problem Statement:

Many Western scientific literatures suggest and believe that low ventilation rates increase the concentration of indoor pollutants (IAP) and, thus, asthma and allergic diseases among children. On the other hand, there is a lack of research in this field in Arab countries. Moreover, compared to European countries, there are no standards or regulations for the appropriate ventilation rate in housing buildings in hot climate regions such as Saudi Arabia.

Many Saudi families live in apartments built with concrete slabs, which could increase the risk of asthma, allergic diseases, and recurrent wheezing. Limited openings in a single unit, high indoor humidity, and cheap commercial building materials characterize the apartment building. In addition, the extra indoor air pollution concentrations refer to many emission sources inside homes. Moreover, the behavior of the Saudi occupants follows their

socio-cultural norms (more or less conservative), and many of them prefer to keep their windows closed for privacy reasons. This latter condition results in poor benefits from outdoor ventilation and reliance on mechanical ventilation systems only.

There is an increase in asthma and allergic diseases among children in Saudi Arabia. Children in Saudi houses are exposed to a permanent artificial environment with a low ventilation rate and more indoor pollutants. They would face a dusty climate even if they considered opening the windows outdoors. Also, children under three usually spend most of their time at home.

The current research:

aims to investigate how the physical characteristics of housing openings impact residents' health, focusing on allergies and respiratory diseases in early childhood in Saudi Arabia.

1.3. Research Hypothesis:

The physical characteristics of housing openings increase allergies and respiratory diseases in early childhood in the Eastern Region of Saudi Arabia.

1.4. Research Objectives:

The research aims to determine the impact of the physical characteristics of housing openings on residents' health. In terms of allergies and respiratory diseases in early childhood in the Eastern Region of Saudi Arabia through the following topics:

- Understanding the importance of fresh air and appropriate ventilation rate;
- Understanding the impact of concentrated indoor pollutants on human health;
- Finding the impact of the housing openings on the increase of allergies and respiratory diseases in early childhood.
- Finding the role of occupant's behavior toward house ventilation and window openings
- We are developing a data collection method and establishing assessment criteria centered around the previously mentioned topics.



Figure (1) the impact of low ventilation rate

Many Western scientific works of literature have studied the effect of ventilation in the indoor environment on adults' and children's health regarding respiratory and allergic symptoms. The

2. Literature review:

2.1 Allergies and Respiratory Diseases in Early Childhood

Universally, asthma and allergy rates have increased over the past three decades (Bornehag et al.,2004). Outdoor air pollution has long been considered a considerable risk to human health (Franklin, P., 2007). However, today's studies show that indoor air pollution (IAP) has an equal or even more significant impact on human health. It is the major contributor to the global disease burden and the second most significant environmental contributor to ill health worldwide (Franklin, P., 2007). There are associations between allergic symptoms in children and the concentration of air pollution and dust in their homes (Bornehag et al.,2004).

People spend most of their time indoors, with a wide range of indoor emission sources and an increased concentration of some pollutants indoors compared to outdoors. Moreover, pre-nursery children (0-3 years) spend over 16 hours a day indoors and often exceed 85% of their time at home. Therefore, their exposure to low ventilation rates and IAP in the environment may promote some severe health issues like allergies and respiratory diseases.

Recently, many studies have observed the association between insufficient ventilation and increased allergic diseases among children. (Dimitroulopoulou, C., 2012).

2.2. Ventilation rate:

In the past decades, asthma and allergic diseases have increased in industrialized countries, coinciding with the decrease in ventilation rates. (Dimitroulopoulou, C., 2012). The low ventilation rates may result in increased concentration of indoor-generated pollutants, which may be associated with sick building syndrome symptoms, comfort (perceived air quality), health effects (inflammation, infections, asthma, allergy) and Productivity (Dimitroulopoulou, C., 2012). A poorly balanced ventilation system in the building might create conditions that increase the risks for recurrent wheezing in young children. (Emenius, G. et al, 2003).

number of researchers in houses was lower than in offices, and they were in cold climate regions like Nordic countries (Bornehag, C, 2005; Wickman, M, 2004; Øie, L,1999) (Sundell, J et al., 2011).



2.2.1 Importance of ventilation and using outdoor air:

Ventilation is the way for fresh air to come from outside through building openings and circulates throughout to remove or reduce the pollutant or 'stale' air and maintain good air quality as well (Dimitroulopoulou C., 2012) (Sundell, J et al., 2011). The poor ventilation rate and the increment of carbon dioxide concentrations are linked to some health outcomes (Sundell, J, and others, 2011).

Opening windows to use the fresh air from outdoors has been used historically for people living or working, considering their health, comfort, and productivity (Dimitroulopoulou, C., 2012). (Sundell, J et al, 2011).

2.2.2. The standard of ventilation rate:

Table (1) The ventilation rate and its impact

Ventilation rate	The impact
Low ventilation rate (0.3 h-1 and lower)	Increase the risks of bronchial obstruction from sources of air pollution (e.g., dampness or polyvinyl chloride).
Moderate ventilation rate (0.4 - 0.5 h-1)	The standard for ventilation rate in homes to maintain human health
High ventilation rate (above 0.5 h-1)	I have recommended and associated with a reduced risk of allergic manifestations among children.

Despite the standard, the studies of ventilation measurement in Europe show that its rate is lower than the standard (Dimitroulopoulou, C., 2012). That is one of the reasons for the increment in the concentration of indoor pollutants and, thus, the risk to human health (Dimitroulopoulou, C., 2012). Only the Netherlands and the Mediterranean countries (Greece and Portugal) reported a high ventilation rate, more significant than 0.5 h-1. It reached 1.5 h1 in Greece and 1.2 h1 in Portugal (Dimitroulopoulou, C., 2012).

2.2.3. Windows as ventilation system:

Windows and other house openings are essential factors in determining the air change and ventilation and their effect on the level of concentration of contaminants in homes. (Howard-Reed, C., et al., 2002). The different physical characteristics of openings in the building have a role (Emenius, G. et al., 2003). Sometimes The air change rate depends on occupant's behavior, are they opening their windows and doors or not (Howard-Reed, C., et al., 2002)

The air change rate increases during the periods when windows are open and decreases during periods when houses are closed (Howard-Reed, C. et al., 2002), and thus it may impact infant wheeze, one of the most common causes of hospital admissions in early childhood (Emenius, G. et al., 2003). Different variables must be considered before opening any window to influence the air change rate in the indoor air environment (Howard-Reed, C. et al., 2002):

As mentioned previously, there is an association between a low ventilation rate and asthmatic symptoms. (Sundell, J et al, 2011). Therefore, the data has clarified that the minimum accepted ventilation rate inside homes is 0.5 of air change per hour, and it is recommended to increase it for better benefits (Sundell J et al., 2011) (Dimitroulopoulou, C., 2012). The European countries put a standard and regulation reference regarding the ventilation rate for the whole building. For example, in Finland, the minimum accepted is 0.4 h-1. In Belgium, Denmark, and Norway, it increased to 0.5 h-1. In France, the airflow for a house is counted by the number of habitable rooms. (Dimitroulopoulou, C., 2012).

- The area of the window opening
- The number of windows in the house
- The location of window openings
- The outdoor wind speeds
- The indoor/outdoor temperature difference
- The height of the neutral pressure level where the indoor pressure equals the outdoor pressure.

Having at least one window open is recommended to maintain a high air change even in mild meteorological conditions. (Howard-Reed, C., et al., 2002).

2.2.4. Another ventilation system:

Ventilation strategies in indoor environmental control go beyond the straightforward action of opening windows. Mechanical ventilation systems and other modern strategies have become crucial elements in regulating the condition of indoor air. Several ventilation systems are described by Dimitroulopoulou (2012), each with its own set of characteristics and applications.

2.2.4.1 Mechanical ventilation:

Mechanical ventilation systems are widely used internationally to ensure a constant availability of clean air in indoor spaces. These systems operate mechanically, frequently employing fans or air exchange devices. Although both natural and mechanical ventilation are adequate, their selection depends on several variables, including design preferences, cost, outdoor climate, heating and cooling needs, and indoor air quality requirements.

2.2.4.2. Variable Methods of Ventilation:

- **Single-Sided Ventilation:** This strategy promotes air circulation in a unidirectional manner by utilizing apertures located on a single side of a structure. Single-sided ventilation may be implemented, as well as advantageous architectural configurations that are suitable for temperate climates. (Nicol, J. F., & Humphreys, M. A. (1973).
- **Cross ventilation:** Cross ventilation is a passive climate control strategy that utilizes specially constructed openings to facilitate air circulation throughout indoor areas, as mentioned earlier. It is particularly effective in

regions where natural cooling is critical, such as Saudi Arabia. (Givoni, B. (1994).

- **Passive stack ventilation system:** The passive stack ventilation system operates by utilizing buoyancy-driven circulation to promote ventilation. When warm air naturally ascends, the stack effect removes stale air from the building. Passive stack ventilation is frequently selected due to its energy efficiency and compatibility with particular architectural configurations. (Dimitroulopoulou, C., 2012). (Awbi, H. B. (2003).

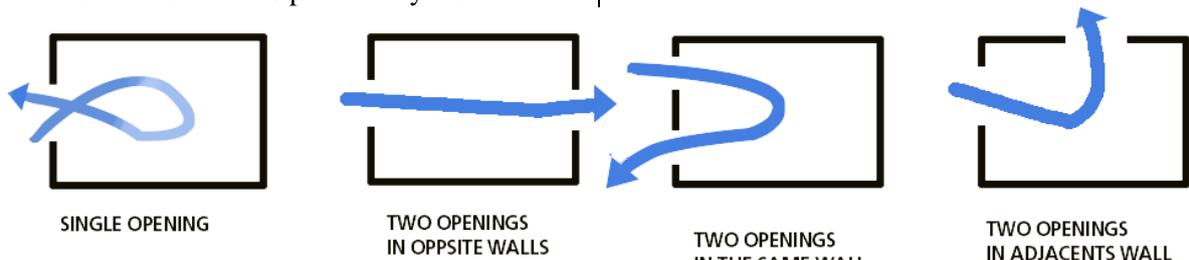


Figure 2: Single and cross-ventilation methods

2.2.4.3. Climate-Dependent Choices:

Often, regional climatic conditions influence the decision between mechanical and natural ventilation. For example:

- **Temperate climates** (e.g., Britain) prefer natural ventilation due to its ability to regulate indoor comfort effectively. (Nicol, J. F., & Humphreys, M. A. (2002
- **In colder climates** (e.g., Scandinavian Countries), mechanical ventilation becomes imperative to ensure minimum ventilation rates are met. This is particularly true during cooler periods when natural ventilation may be inadequate. (Awbi, H. B. (2003).
- **In warmer regions**, mechanical and natural ventilation reduces energy consumption during the cooling season. (De Dear, R. J., & Brager, G. S. (2002).

2.2.4.4. Optimal Selection Considerations:

Selecting the optimal ventilation system necessitates a nuanced assessment of various factors, including:

- **Indoor Air Quality Requirements:** Specific air quality standards are necessary to meet indoor air quality requirements. (Sundell, J., Levin, H.,191-204)
- **Heating and Cooling Loads:** Achieving a balance between heating and cooling loads to sustain thermal comfort. (ASHRAE. (2017).
- **Outdoor Climate:** Adaptation to the surroundings. (Yi, W., Hong, T., & Chou, S. K. (2015).

- **Cost:** Operating expenses, in addition to initial investment, are considered. (Coppi, M. (2016).
- Design Preference:** Consistency in the architectural vision.

The choice of a ventilation system is an essential component of architectural Planning, contingent upon a confluence of climatic, financial, and design factors. (Heschong, L., Wright, R., & Okura, S. (2002).

2.3. Indoor environment and air pollution:

During the past decades, the home environment has changed considerably in many countries due to altered building technology, new building components, and strong demands for energy conservation (Emenius et al., 2003).

The studies of pollutant concentration usually depend on ventilation rates (Dimitroulopoulou, C., 2012). The higher the ventilation rates, the lower the concentration of indoor pollutants. Therefore, there is a clear need to identify the type and source of the dominant pollutant to:

- 1- Change its status from steady-state concentration to an acceptable 'comfort' or 'safe' concentration.
- 2- Remove and replace it using other low-emitting materials and products. (Dimitroulopoulou, C., 2012)

In several studies, it has been observed that there is an association between the indoor environment and the development of respiratory symptoms in children (Emenius et al., 2003). The indoor environment has many resources that produce air pollution (Sundell et al., 2011). The building type,

age, material, and finishes contribute to reducing or increasing the risk of early respiratory symptoms. Also, some human cultures and activities, such as

smoking, lousy cooking habits, and lifestyle, affect human health in the long term (Sundell et al., 2011).

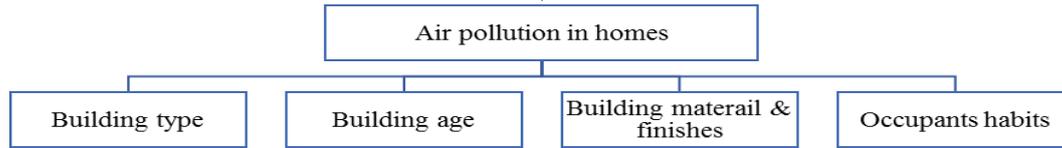


Figure (3): Air pollution in homes

2.3.1. Building type:

The type of building has a role in human health. Some studies found that living in old brick buildings, in single-family homes, or on farms reduces the risk of early recurrent infant wheezing. (Sundell, et al, 2011) (Emenius, et al 2003). On the other hand, public houses have been associated with poor health effects (Northridge et al., 2010). A high occurrence of asthma was found in public houses due to cockroaches, rats, and water leakages, while private housing had lower odds of asthma (Northridge et al., 2010). Living in an

apartment or a private home created by concrete slabs could also increase the risk of recurrent wheezing (Emenius et al., 2003). The apartment building is characterized by high indoor humidity and wintertime windowpane. (Emenius, et al, 2003). Some apartment studies reported more symptoms and perceptions of poor indoor air quality than house occupants (Dimitroulopoulou, C., 2012). The naturally ventilated houses also reported more symptoms and perceptions of poor indoor air quality than houses with balanced ventilation (Dimitroulopoulou, C., 2012).

Table (2) types of building

Buildings that may decrease human health	Buildings that may increase human health
1- Old brick building erected before 1940 2- Single-family home 3- Balance ventilated houses	1- Apartment 2- A private home created by the concrete slab 3- Public building 4- The naturally ventilated houses only

2.3.2. Building materials and finishes:

Several factors within the indoor physical environments of the house may promote or inhibit children's health (Bahobail, M., 2013) (Northridge et al., 2010) (Franklin, P., 2007). The new building materials and furnishings are known to produce organic chemicals in indoor air, which are associated with some health outcomes such as bronchial obstruction and asthma.

Volatile organic compounds (VOCs) from house furniture, painting, and cleaning products, biological contamination, and combustion pollutants are all good resources for indoor pollutants (Bahobail, M., 2013). The indoor air pollution concentrations refer to the many emission sources inside homes and buildings and housing types (Northridge et al., 2010) (Franklin, P., 2007). The table below shows different kinds of indoor air pollution and their source in a home:

Table (3) Indoor air pollution and their source in the home

Pollutant	Domestic sources
Environmental tobacco smoke (ETS)	Cigarettes, cigars, pipes
Biologicals (e.g. house dust mite, animal dander, mould, cockroaches)	Dampness, moisture, floor dust, bedding, insects, pets, pests
Nitrogen dioxide	Combustion sources, particularly unvented gas or kerosene appliances
Formaldehyde	Composite wood products such as particleboard, furnishings, combustion sources, ETS, cosmetics, paints
Volatile organic compounds	Cleaning agents, aerosol sprays, pesticides, paints, solvents, building materials, combustion sources, glues
Particulate matter	Outdoors, combustion sources such as cigarettes, wood stoves, and candles, cooking, cleaning, and general activity
Polycyclic aromatic hydrocarbons	Vehicle exhausts, cigarette smoke, cooking, woodsmoke
Pesticides	Commercial and residential application of insecticides and herbicides, treated wood Products
Radon	Soil and bedrock under homes, groundwater

2.3.3. Occupants' habits:

The residents play an essential role in the ventilation level in their homes as the air change rate depends on the occupant's behavior. (Howard-Reed, C., et al., 2002). The long hours of gas-cooking, overuse of chemical cleaners, drying clothes in the living room, and smoking may cause indoor air pollution (Dimitroulopoulou, C., 2012). Some temperate climate countries that adopted naturally ventilated systems only, such as Britain, reported better ventilation in summer than in winter due to occupants' behavior in opening windows during warmer months (Dimitroulopoulou, C., 2012).

Despite the standardizations of residential ventilation and regulations in Europe, the studies in these countries show that although occupants generally think that ventilation is essential, their understanding of the ventilation systems in their own houses is low, resulting in under-ventilated homes (Dimitroulopoulou, C., 2012).

Increasing the ventilation rate may add extra cost and energy to the building. However, the recovery cost after an illness may be higher in health-related economic benefits than the early cost (Sundell et al., 2011).

2.4. The case of Saudi Arabia:

In Saudi houses, there is weak air circulation and ventilation, and they depend mainly on the mechanical system for ventilation (Bahobail, M., 2013). The weather outside is scorching and dusty. The dusty weather reflects the quality of the indoor atmosphere quality and creates a good environment place for biological contaminants (Bahobail, M., 2013)

In 2017, the General Authority for Statistics conducted a housing survey for the residential properties of Saudi households. The survey included the type of house, housing age, flooring material, construction material, properties type, fuel usage in the kitchen, and the use of pesticides. (The General Authority for Statistics, 2017).

There are five typical house types: traditional house, villa, a floor in a villa, a floor in a traditional house, and an apartment (The General Authority for Statistics, 2017). According to the Housing Survey, most of the eastern region population live in apartments by 48%, then villas by 33%. The typical building age is 10-30 years (The General Authority for Statistics, 2017).

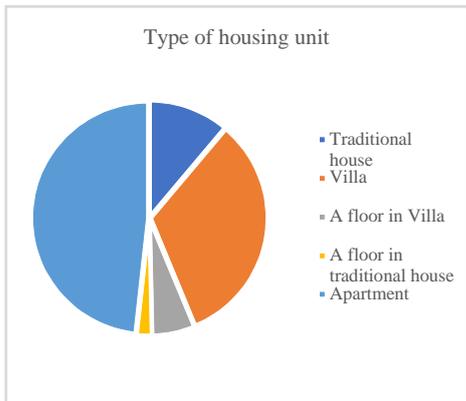


Figure (4) Type of housing unit

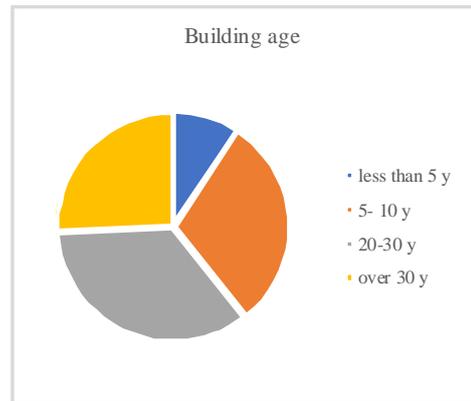


Figure (5) Saudi Building age

The primary building material used is concrete, at 92%, while brick and stone are used only for traditional houses. In their kitchen, gas is used for

cooking fuel more than electricity by 73% (The General Authority for Statistics, 2017).

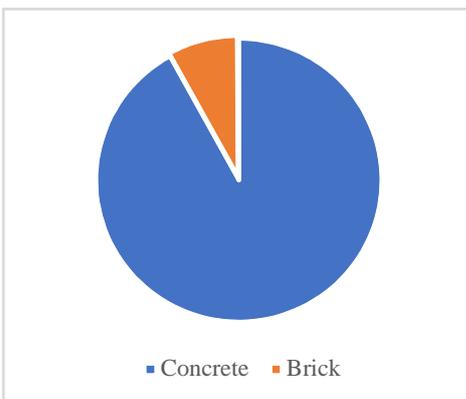


Figure (6) construction material

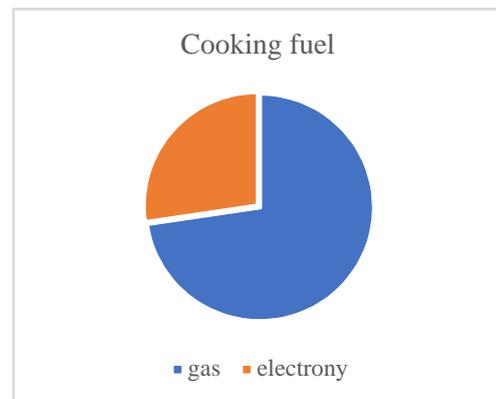


Figure (7) cooking fuel

In terms of using insecticide, the majority of the population in the Eastern Region uses it when needed, as shown in the figure below:

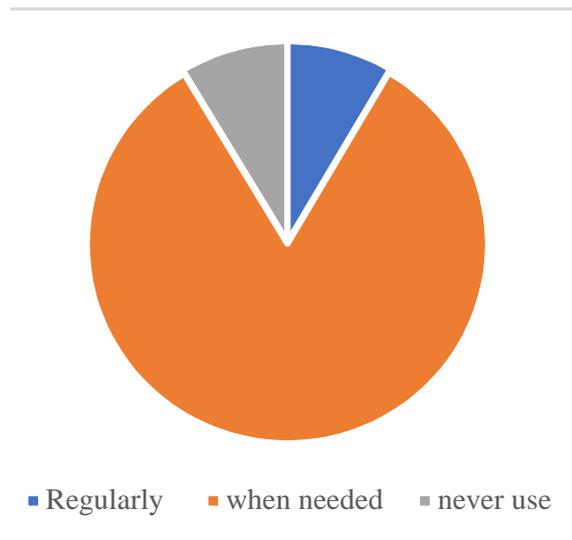
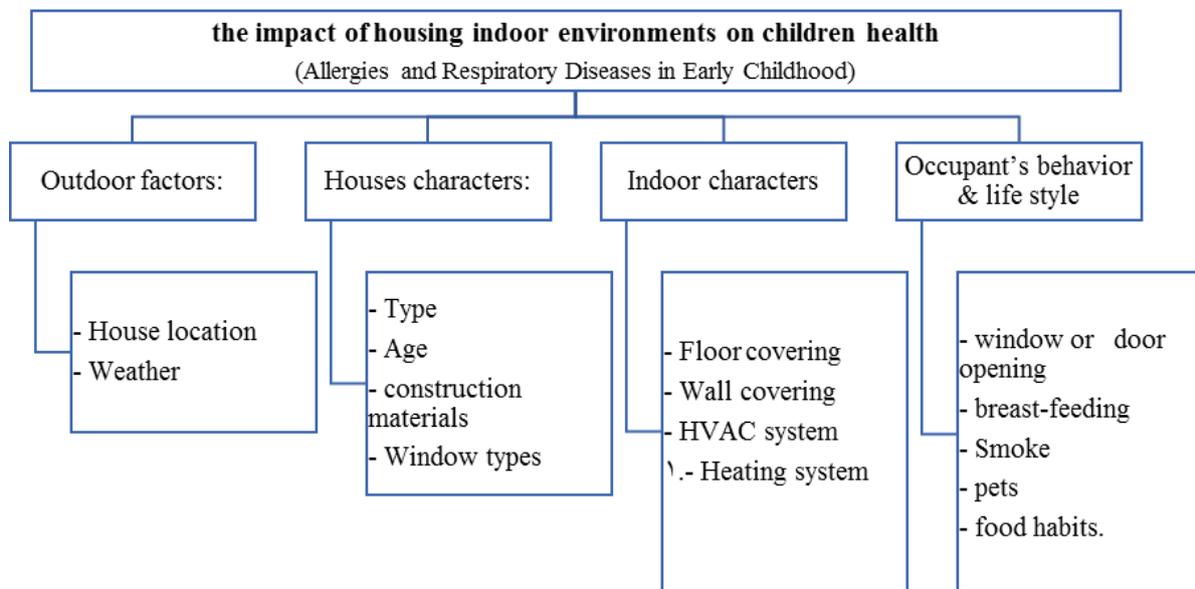


Figure (8) using insecticide



3. Methodology

3.1. Introduction:

In this chapter, the methodology used throughout the research shall be explained. It discusses the means used by the researcher for collecting the data.

3.2. Research Method:

The research used a descriptive method to find the impact of the physical characteristics of housing openings on residents' health regarding allergies and respiratory diseases in early childhood in Eastern Saudi Arabia.

3.3. Data Type and Source:

2.5. Conclusion:

Ventilation requirements receive significant attention in building regulations across Europe. The ventilation standards cluster around common values for recommended ventilation rates. On the other hand, there are no such requirements in hot, dry regions such as Saudi Arabia. There are rare studies on Saudi Arabia's situation regarding ventilation, indoor pollutants, and asthma.

The buildings in hot regions need to be airtight as much as possible. Air infiltration through the building may lead to energy waste and sometimes discomfort.

To study the impact of housing indoor environments on children's health, many factors need to be taken into consideration, such as the outdoor factors, the house characters, the indoor house characters, and the occupant's behavior and lifestyle, as shown in the figure below:

Descriptive data has been collected from the field, literature review, and Saudi Families who live in the Eastern Region.

3.4. Research Community:

The research community was predominantly Saudi children (0-3 years) who live in the Eastern Region of Saudi Arabia.

The criteria of case selection:

- 1- The family is living in the Eastern Region in Saudi Araba
- 2- The cases can be reached and accessed
- 3- Reports of at least two incidents of eczema, wheezing, or rhinitis without cold during the preceding 12 months

- 4- The cases have not changed homes for one year at least.
- 5- Not genetic disease

Tools of Collecting Data

The research used a checklist as a tool for collecting the data to get the most valuable and accurate data. The checklist has been divided into five (5) sections to cover all aspects of the study:

- 1- **The general information:** Gender, age, breastfeeding, health outcome and family history in terms of allergies and respiratory diseases;
- 2- **The occupant's lifestyle:** Smoking habits, cooking habits, having pets, using insecticides, and using chemical cleaners.
- 3- **Housing character:** Housing location, type, age, and construction materials.
- 4- **Window details:** Window types, their location, and Size by centimeters. Their opening timetable (daily opening, never open or open sometimes).
- 5- **Indoor housing character:** Floor covering types, wall covering, and HVAC system.

In summary, the study emphasizes the significant correlation between the physical attributes of vacant housing and the well-being of occupants, with a particular emphasis on respiratory ailments and allergic reactions among young children residing in the Eastern Region of Saudi Arabia. The extant literature from around the world demonstrates an international increase in asthma and allergic diseases among children, underscoring the significance of ventilation rates in residential structures.

The distinct circumstances of Saudi Arabia, which include a prevalent reliance on artificial ventilation and a hot, arid climate, present unique obstacles to interior air quality. The lack of research regarding the correlation between housing attributes and respiratory illnesses underscores a substantial lacuna in the literature. This research aims to address this disparity by examining the influence of housing vacancies on health results, specifically focusing on the socio-cultural conventions and preferences typical of Saudi households.

Establishing local standards and regulations about suitable ventilation rates in residential buildings in humid climate regions, including Saudi Arabia, is crucial for developing a regulatory framework. By engaging in collaborative endeavors with health and construction authorities, developing guidelines considering the distinctive environmental challenges specific to the region is possible.

It is of the utmost importance to initiate awareness campaigns targeting Saudi families. Providing knowledge to the general public regarding the significance of sufficient ventilation, the influence of housing attributes on indoor air quality, and the possible health hazards linked to inadequate ventilation can enable people to develop well-informed choices regarding their living quarters.

Architectural Considerations: Incorporating natural ventilation-promoting architectural elements, such as thoughtfully designed windows and openings, into newly developed construction endeavors can substantially enhance interior air quality. Architects and builders must give precedence to designs that effectively integrate air circulation and energy efficiency.

Research Investment: It is crucial to promote and provide assistance for additional research endeavors in the region. Further inquiry into the correlation between housing attributes and health results, encompassing extended-term analyses of children's respiratory health, can contribute to a more comprehensive comprehension of the underlying factors.

Public health interventions consisting of targeted measures to tackle particular issues, such as advocating for healthier cooking practices, discouraging the use of chemical cleaners, and promoting smoking cessation, can be effectively integrated with more comprehensive initiatives aimed at enhancing indoor air quality and reducing the incidence of respiratory ailments.

Through implementing these suggestions, it is conceivable to envision a future in which Saudi households experience enhanced interior environments, thereby promoting the overall welfare of inhabitants, with a particular emphasis on the susceptible demographic of young children.

Appendix:**The Research checklist**

Section 1: General Information			
Gender:			
<input type="radio"/> Boy	<input type="radio"/> Girl		
Child age:			
<input type="radio"/> 0-1 Y	<input type="radio"/> 1-2 Y	<input type="radio"/> 2-3 Y	
Breast Feeding:			
<input type="radio"/> Yes	<input type="radio"/> No		
The health outcome:			
<input type="radio"/> wheeze	<input type="radio"/> a dry cough	<input type="radio"/> rhinitis	
<input type="radio"/> eczema	<input type="radio"/> asthma	<input type="radio"/> allergic rhinitis	
The history of the family member in allergies and respiratory diseases:			
.....			
.....			
Section 2: Occupant's behavior & lifestyle			
Smoking habits:			
<input type="radio"/> Yes	<input type="radio"/> No		
Cooking habits:			
<input type="radio"/> Gas	<input type="radio"/> Electronic		
Having pets:			
<input type="radio"/> No			
Using insecticide			
<input type="radio"/> Regularly	<input type="radio"/> Never use	<input type="radio"/> When needed	
Using chemical cleaner:			
<input type="radio"/> Regularly	<input type="radio"/> Never use	<input type="radio"/> When needed	
Section 3: House Character			
Housing location:			
<input type="radio"/> Al Khobar	<input type="radio"/> Al Dharan	<input type="radio"/> Ad Dammam	
<input type="radio"/> Al Hasa	<input type="radio"/> Al Qatif	<input type="radio"/> Al Jubail	
Housing type:			
<input type="radio"/> traditional house	<input type="radio"/> Villa	<input type="radio"/> a floor in a villa	
<input type="radio"/> a floor in a traditional house	<input type="radio"/> apartment		
Housing age:			
<input type="radio"/> Less than five years	<input type="radio"/> 5-10	<input type="radio"/> 10- 20	
<input type="radio"/> 20-30	<input type="radio"/> Over 30	<input type="radio"/>	
construction materials			
<input type="radio"/> Concrete	<input type="radio"/> Brick		
Section 4: Window Details			
Window type	Location	Size by cm	
Window 1			<input type="radio"/> Daily open <input type="radio"/> Never open <input type="radio"/> Sometimes
Window 2			<input type="radio"/> Daily open <input type="radio"/> Never open <input type="radio"/> Sometimes
Window 3			<input type="radio"/> Daily open <input type="radio"/> Never open <input type="radio"/> Sometimes
Window 4			<input type="radio"/> Daily open <input type="radio"/> Never open <input type="radio"/> Sometimes
Window 5			<input type="radio"/> Daily open <input type="radio"/> Never open

	○ Sometimes
Section 5: Indoor Environment Character:	
Floor covering	
○ Marble	○ Ceramic
○ Plain Tiles	○ Carpet
	○ Parquet
	○ Other
Wallcovering	
○ Paints	○ Wallpaper
	○ Other
HVAC system	
○ Window Ac	○ Split system
○ Central air condition	○ Cassette system

The selected research methodology, which consists of employing a descriptive approach and a data collection method, is suitable for accomplishing the research objectives for several reasons:

Investigation of Specific Variables: By employing the checklist method, one can methodically examine particular variables about the attributes of housing, the conduct of occupants, and the health results among pre-nursary Saudi children.

The framework offers a systematic approach to gathering comprehensive data on various factors, including but not limited to housing type, construction materials, window particulars, interior environment, and occupant behaviors.

Thorough Data Collection: The list includes relevant variables compatible with the research objectives. These factors consist of housing conditions, occupant behaviors, and health outcomes. This all-encompassing methodology aids in comprehending the complexity of the correlation between housing attributes and its residents' well-being.

Integration of Qualitative and Quantitative Data: The checklist incorporates qualitative and quantitative data, including occupant habits and lifestyle factors, and quantitative data (e.g., window dimensions and construction materials).

By integrating this integration, a deeper understanding of the influence of physical housing attributes on health outcomes can be achieved by incorporating statistical observations and contextual data.

Significance in the Local Context: This list has been customized to suit the particular circumstances of Saudi Arabia, considering socio-cultural norms, the prevalence of artificial ventilation, and the country's hot and dusty climate.

Focusing on the local context guarantees that the gathered data are instantly relevant to the research objectives while considering the distinctive environmental and cultural environment of Saudi households.

Ease of Implementation: The checklist method is appropriate for collecting data from a diverse sample of Saudi families due to its practicability and simplicity of implementation.

It effectively enables data collection while minimizing participants' workload, a critical factor in ensuring the acquisition of precise and dependable information.

Consistency with Research Objectives: This research attempts to comprehend the influence that the physical attributes of uninhabited housing spaces have on the well-being of occupants, with a specific emphasis on respiratory illnesses and allergies that appear during the formative years.

The checklist method effectively supports collecting relevant information related to housing attributes, ventilation, and health results, thus directly following these objectives.

The utilization of the checklist enables the organized collection of data from various households, allowing researchers to conduct comparative analyses. This analysis could reveal correlations or patterns between housing attributes and health outcomes.

The checklist covers a wide range of topics, including general information, occupant behavior, house attributes, window details, and indoor environment characteristics. In order to optimize the checklist and guarantee a comprehensive examination of variables that impact ventilation, health, and overall well-being, it is recommended to incorporate the subsequent items:

Geographical location should be specified as a neighborhood or territory within the selected city. The local climate and environmental conditions may be impacted as a result; the Lifestyle and Behavior of the Occupant and the Ventilation Methods

explain to what extent inhabitants deliberately ventilate their dwellings. (weekly, daily, etc.), in addition, Are mechanical ventilation or natural methods (such as opening windows) utilized for ventilation purposes? In addition, for the Insulation of House Character, we can Request information regarding the house's insulation, with a particular focus on the condition of the doors and windows. We can Permit respondents to offer any further observations or comments pertaining to their health, living environment, and ventilation.



In conclusion, this research emphasizes the strong connection between housing openings and the well-being of residents, with a specific emphasis on respiratory illnesses and allergic reactions among young kids residing in the Eastern Region of Saudi Arabia. Conclusions highlight barriers such as inadequate air circulation, reliance on mechanical ventilation, and the widespread adoption of concrete construction in residential areas, all contributing to increased health risks. The research paper promotes the implementation of customized regulations, passive climate control in using the strategy of natural and cross ventilation, The study was to highlight multiple aspects through the application of a descriptive method and data collection from prenursary Saudi children and their families. These aspects comprised the importance of unpolluted air, the consequences of concentrated indoor pollutants, and the influence of housing apertures. General information, occupant lifestyle, housing characteristics, window details, and internal housing characteristics were all included on the utilized checklist.

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