

SYNOPSIS

TITLE:

Assessing Indoor Air Pollution Exposures and Acute Respiratory Infection in Children Under 5 in Urban Slum Areas of Gandhidham City: A Community-Based Study

INTRODUCTION:

The use of inefficient and solid fuels within the home produces household air pollution, which is composed of a variety of health-damaging pollutants, including small particulates that can enter the bloodstream and deeply infiltrate the lungs (1). Typically, the fuels are burned ineffectively, and on unvented household cook stoves, which, along with inadequate ventilation, produce a lot of smoke indoors (2). 1.1 billion individuals are exposed to high amounts of respirable particles due to indoor air pollution, which ranks eighth among risk factors for all diseases and deaths in developing nations (3). With two million deaths globally, acute respiratory infections are the leading cause of morbidity and mortality among children under five (4). Children under five exposed to polluted air due to the combustion of unprocessed biomass fuel are most vulnerable to health hazards. They are more affected than adults as they inhale large amounts of polluted air compared to their body size due to increased minute ventilation as they are more active (5). The sub-Saharan African nations and Southeast Asia have the highest incidence of ARI, accounting for about 80% of all cases worldwide (6). ARI accounts for more than two-thirds of all pediatric diseases in Indian slum regions (7). Although reliable epidemiological data on the frequency of childhood ARI are not readily available, it remains a serious public health concern in India. Young newborns, malnourished children, children who aren't exclusively breastfed, and those who have been exposed to solid biomass combustion are also at higher risk (8). Acute respiratory infections (ARIs) account for 14.3% of fatalities in infants and 15.9% of deaths among children aged 1 to 5 in India, with the majority of these deaths being preventable. Because of the high rates of morbidity and mortality associated with ARIs, the healthcare system still faces significant challenges in controlling them (9).

RESEARCH QUESTION:

Is there an association between exposure to indoor air pollution from burning firewood for cooking and the incidence of acute respiratory infection in children under 5 years old living in the slums of Gandhidham City?

OBJECTIVES:

- To determine the prevalence of respiratory symptoms and diseases in children under 5 years of age in households using solid fuel combustion in Gandhidham city.
- To determine the association between indoor air pollution and prevalence of Acute respiratory infection in children under the age of 5.

HYPOTHESIS:

Children under 5 years of age living in slum households of Gandhidham city who are exposed to indoor air pollution from solid fuel combustion will have a higher prevalence of respiratory symptoms and diseases compared to children not exposed to such pollutants.

This hypothesis establishes an expected relationship between the independent variable (Type of fuel used for cooking) and dependent variables (Respiratory health outcomes). It poses that the household use of solid fuel for cooking directly affects respiratory health outcomes.

MATERIAL AND METHODS

Study Design: Cross-sectional study.

Setting: The research is conducted in the urban slum areas of Gandhidham city, Kutch (Gujrat). The study primarily focuses on children under the age of 5 residing in the slum area in households without separate kitchens in Gandhidham City.

STUDY POPULATION

Inclusion criteria:

- Urban slum population of Gandhidham city
- Children under the age of 5 years
- Participants who consent to be part of the study.
- Households use solid fuel for cooking.
- Households without separate kitchen

Exclusion criteria:

- Children above the age of 5 years.
- Children with chronic respiratory diseases.
- Households use clean fuel for cooking.
- Households with separate kitchen and proper ventilation (windows, exhaust fan).

STUDY TOOLS

Surveys: The survey will be conducted to assess the prevalence of respiratory disease among children under the age of 5 residing in the slum area of Gandhidham city. The questionnaire contains questions related to the type of fuel used for cooking practices, the household having a separate kitchen with proper ventilation, and the symptoms associated with acute respiratory infections.

Data Analysis: Statistical software will be used to analyze collected data, employing descriptive statistics, inferential analyses, and correlation assessments. This analysis will determine the relationship between cooking on solid fuel in poorly ventilated households and respiratory health outcomes in children under the age of 5 years.

Duration of Study: 3 Months.

SAMPLE SIZE: 100 children under the age of 5 living in the urban slums of Gandhidham city.

SAMPLING TECHNIQUE:

Data Collection Procedure

The data collection procedure will primarily involve surveying the slum area of Gandhidham city. The questionnaire is related to household characteristics, cooking practices, and respiratory health symptoms in children. The caregivers or parents will be interviewed to gather information on cooking fuel types, ventilation practices, household demographics, and respiratory health history of children.

DATA ANALYSIS PLAN:

- **Software:** The data collected for the study will be analyzed using SPSS software.
- **Descriptive Statistics:** Descriptive statistics will be used to summarize the characteristics of the study participants.
- **Chi-square test:** To compare the prevalence of respiratory symptoms and ARI between children in solid fuel and non-solid fuel households.
- **Logistic Regression:** This is the key method to assess the association between exposure to indoor air pollution (independent variable) and ARI (dependent variable). It's a statistical modeling technique that estimates the probability of an event (ARI) occurring given a set of predictors (indoor air pollution level, along with potential confounders like age or socioeconomic status).
- **Tests of Significance:**
 - **Univariate Analysis:** Univariate analysis will be conducted to examine the distribution and characteristics of individual variables, such as the use of solid fuel and the prevalence of respiratory disorders.
 - **Bivariate Analysis:** Bivariate analysis may be employed to explore relationships between two variables, such as the impact of solid fuel and poorly ventilated kitchen.

- **Multivariate Analysis:** Multivariate analysis may be utilized to assess the combined effect of multiple variables on outcomes related to respiratory disorders among children under the age of 5 living in urban slums.
- **Level of Significance:** The level of significance for statistical tests will be set at $p < 0.05$.

OPERATIONAL DEFINITIONS

- **Acute respiratory infections:** According to the WHO's (1997) definition of an acute respiratory infection (ARI), a new episode was defined as one that occurred in an individual who had been free of symptoms for at least three consecutive days or more. This included children with any one or combinations of symptoms and signs such as cough and cold, running or blocked nose, sore throat, rapid breathing, noisy breathing, stopping feeding and/or drinking, chest indrawing, etc.
- **Ventilation:** Adequate: Window area one-fifth of the floor area or doors and windows combined two-fifths of the floor area.
- **Overcrowding-** Overcrowding is when the per capita floor space area of the living room is below 50 sq foot, or otherwise when there is no sex separation in case of individuals more than 9 years of age, not husband and wife.
- **Type of fuel-** Solid fuels for cooking which includes biomass (e.g. wood, crop residues, animal dung, and charcoal) and coal.

ETHICAL CONSIDERATIONS:

- **Confidentiality:** Participant data will be treated with strict confidentiality, and only authorized personnel involved in the study will have access to the collected information. Data will be used for research purposes only and will not be shared with third parties without consent. Participant information will be anonymized and stored securely to prevent unauthorized access or disclosure.

IMPLICATIONS OF RESEARCH:

- **Population Impact:** The research findings from the study on Assessing indoor air pollution exposure and respiratory health outcomes in children under 5 in Urban Slum Areas of Gandhidham City can contribute to encourage the use of clean fuel for cooking and reducing indoor air pollution. Thus, in turn, may lead to improved respiratory health of children in vulnerable populations.
- **Industry Relevance:** The insights gained from the study can provide the development of policies to implement regulations or initiatives for promoting clean cooking technologies or alternative fuels in urban slum areas. Policy interventions targeting indoor air pollution could lead to improved respiratory health outcomes among children.

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