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# Level of neighborhood environmental factors related to noncommunicable diseases in selected wards of urban Puducherry, South India

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## Abstract:

**BACKGROUND:** Noncommunicable diseases (NCDs) are the leading causes of mortality worldwide. Environmental factors play an important role in development of risk factors. Hence, the study was done to assess the neighborhood environmental factors related to NCDs in urban area.

**METHODOLOGY:** This community-based cross-sectional study was carried out among three selected wards of urban Puducherry. All shops/establishments related to the risk of NCDs within the study area were study units. Information regarding tobacco, alcohol, diet, and physical activity-related establishments was assessed using pretested semi-structured pro forma. Shops/establishments were labeled either as “favorable” (prevents the risk of NCDs) or “unfavorable” (increases the risk of NCDs).

**RESULTS:** Among 655 establishments, 372 (56.8%) belonged to favorable and 283 (43.2%) to unfavorable category, respectively. Tobacco-related establishments amount to 15.1% (95% confidence interval: 12.6–18.1) of the total establishments. Among these tobacco establishments, almost one-third were selling tobacco to minor and located within 100 m of school. Fruits and vegetable markets contributed to 21.8% of the total establishments. About 22% of the establishments were fast-food outlets. Public health sports facilities were only 6.8% of the total establishments.

**CONCLUSION:** The current study reported almost equal distribution of favorable and unfavorable establishments. However, among unfavorable establishments, tobacco establishments raised concern as one-third of those were selling tobacco to minors. Healthy diet and physical activity related establishments were also found to be less. Hence, corrective measures are to be implemented which will reduce the burden of behavioral risk factors.

## Keywords:

Exercise, noncommunicable diseases, tobacco products

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## Introduction

Noncommunicable diseases (NCDs), especially cardiovascular diseases, diabetes mellitus, and stroke are the leading causes of mortality worldwide.<sup>[1]</sup> Morbidity, mortality, and disability attributable to the major NCDs account for almost 60% of all deaths and 47% of the global burden of disease.<sup>[2]</sup> Majority of deaths occur among low- and middle-income countries like India

and China.<sup>[3]</sup> NCDs accounts for 53% of all deaths in India.<sup>[4]</sup> Most of the NCDs have common risk factors like unhealthy diet, physical inactivity, tobacco use, and harmful use of alcohol.

Several studies have been conducted worldwide to assess the individual demographic factors related to the risk of NCDs.<sup>[5,6]</sup> However, only individual factors cannot fully explain the causal pathway

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of NCDs. Research also shows that interventions directed at individual level had limited impact on reducing the burden of risk factors such as dietary habits and physical activity. Environmental factors, especially the built environment play a major role in the development of habits related to the risk of NCDs.<sup>[7]</sup> The World Health Organization states that environmental factors contribute to about 23% of NCD-related deaths worldwide.<sup>[2]</sup> Built environment includes the food, recreational environment and advertisements related to dietary habits, physical activity, and tobacco or alcohol usage. These neighborhood-level characteristics can have positive or negative impact on the burden of NCDs depending on the type of establishments or advertisements.<sup>[8]</sup>

Important neighborhood environment characteristics that can have significant impact on burden of NCDs were walkability, green spaces, noise level, air quality, resources and amenities such as vegetable, fruit shops, fast food outlets and tobacco and alcohol shops. These factors can impact on the development of behavioral risk factors such as tobacco and alcohol use, high sodium and saturated fat intake, and physical inactivity. Finally, the pathway leads to increased risk of morbidity and mortality due to NCDs.<sup>[7]</sup>

Apprehending the relationship between the neighborhood environmental factors and increasing burden of risk factors related to NCDs is essential, especially in countries undergoing rapid urbanization and economic development like India. Evidence from other developing countries also showed that lower access to environmental support such as public sports facilities and fruits and vegetables specialized food markets can lead to unhealthy dietary habits and inadequate physical activity which can increase the burden of overweight and obesity.<sup>[8,9]</sup> At the same time, ease of access to tobacco, alcohol shops, and fast-food outlets can also contribute to the burden of NCDs.

Most of the research work assessing the environmental risk factors for NCDs has been done in developed countries like the USA and New Zealand.<sup>[10]</sup> Very few studies have been conducted in this regard among the developing countries.<sup>[9]</sup> Hence, the current study was done to assess the neighborhood environmental factors such as recreational environment includes space for physical activity, shops/establishments and advertisements related to dietary habits, physical activity, and tobacco or alcohol use that were related to NCDs among the selected wards of urban Puducherry.

## Methodology

A community-based cross-sectional study was carried out among the three selected wards of urban Puducherry,

a union territory in the southern part of India. Puducherry with a density of 2547 individuals per square kilometer has the highest age-adjusted prevalence of diabetes among both urban men (34%) and women (30%) in India, whereas the age-adjusted prevalence of hypertension is about 34% among urban men and 25% among urban women.<sup>[11]</sup> Regarding the behavioral risk factors, among urban men, the prevalence of tobacco smoking and alcohol consumption is 39% and 29%, respectively.<sup>[12]</sup>

Shops/establishments related to the risk of NCDs were considered as study units along with the presence of walking space and advertisements in the streets. Shops/establishments were labeled into two categories: Favorable (prevents the risk of NCDs) and unfavorable (increases the risk of NCDs). Tobacco shops, alcohol shops, restaurants, fast-food restaurant, bakery, meat shops, junk food stalls, and advertisements including surrogate one related to tobacco, alcohol, and junk food were classified under the unfavorable category. Vegetable shops, fruit shops, parks, gym, yoga centers, temples/churches, footpaths, advertisements related to health promotion, harmful effects of tobacco, physical activity promotion, and "no smoking signs" were classified under the favorable category respectively.<sup>[13-16]</sup>

Sample size was calculated by OpenEpi (v 3.01 updated on 2013, Developed by AG Dean, KM Sullivan, MM Soe, Centers for Disease Control and Prevention, Atlanta, USA)<sup>[17]</sup> using anticipated prevalence of tobacco shops in the study area as 20% with 5% alpha error and absolute precision of 4% sample size was estimated to be 384. However, all the shops in the study area were included. The study was carried out in the three selected urban areas which were selected conveniently. However, we included all shops/establishments in the selected urban areas for the study.

Permission was obtained from all the shopkeepers in the area to perform the study. After which, data collection was started using a pretested semi-structured questionnaire. The questionnaire consisted of five different types of forms: S form (street assessment form), E form (establishment form), G form (general/grocery shop form), R form (restaurant form), and T form (tobacco shop form). Direct observation of the shops/establishments and advertisements was done in all the three selected study sites. S form contained data related to number of favorable and unfavorable establishments in a particular street that were used initially for mapping of streets in the study area. E form contained questionnaire to capture the different types of groceries or eatables such as chocolates, chips and other junk food items, sweetened beverages, and biscuits that were sold in a particular establishment. G form was similar to E form which was extensively used for Grocery shop. R form was used to collect the types of

food items that were sold in the restaurants such as salad, fast foods, and sugar-free food items and also to capture the display of salt and/or pickles in the table and type of oil used for cooking in the restaurant. T form was used to collect details regarding the tobacco establishments which included advertisements for sale and/or ill effects of tobacco products, type of tobacco product sold, cost for each of the types, display of tobacco products such that it is visible to public, any school or educational institutions near tobacco establishments, and any tobacco establishment which sold tobacco product to or by minor was also recorded. Results from both questionnaire and direct observation were combined and final outcome was interpreted into favorable and unfavorable depending on the number of shops/establishments related to the risk of NCDs in the study area.

Data were entered into EpiData v 3.01 software (EpiData Association, Odense, Denmark) and analysis was done using SPSS version 19.0. Prevalence of shops/establishments in the study area was summarized as proportion with 95% confidence interval.

## Results

A total of 655 establishments were observed in all the three wards, of which 372 (56.8%) establishments belonged to favorable category and 283 (43.2%) establishments belonged to unfavorable category. Favorable and unfavorable entities related to tobacco among the selected wards are described in Table 1. Tobacco shops contributed for about 15.1% (95% confidence interval [CI]: 12.6–18.1) of the total establishments. Regarding the unfavorable entities in relation to promoting the tobacco usage, presence of tobacco advertisements were found among 63 (63.6%) of the 99 tobacco establishments and 51 (9.2%) among the other 556 establishments. More than one-third of the tobacco establishments were within 100 m of school premises; <10% of the establishments had employed children <18 years.

Regarding the favorable entities to prevent the tobacco usage among the tobacco establishments, the presence of “no smoking sign” was seen in 21 (21.6%) establishments; only 6 (6.2%) of the establishments had sign, displaying that the sale of tobacco products to children <18 years is illegal; signs showing ill-effects of tobacco were seen in 18 (18.6%) of the total tobacco establishments.

Table 2 depicts the diet and physical activity-related establishments among the study area for its favorable and unfavorable entities. In total, 294 establishments related to diet and physical activity was present in the study area; 105 (35.7%) were favorable and 189 (64.3%) establishments were unfavorable. Favorable establishments related to diet and physical activity

**Table 1: Tobacco establishments for favorable and unfavorable entities among the selected wards of urban Puducherry (n=99)**

Characteristics	Frequency, n (%)
Favorable entities	
Presence of “no smoking sign”	21 (21.6)
Sign displaying the sale of tobacco to children is illegal	6 (6.2)
Signs displaying ill-effects of tobacco	18 (18.6)
Unfavorable entities	
Presence of advertisements promoting tobacco	63 (63.6)
Selling tobacco to children <18 years	31 (32)
Tobacco products visible to the public	71 (73.2)
Tobacco shops within 100 m of school	33 (34)
Employed children <18 years	9 (9.3)

**Table 2: Diet and physical activity-related establishments for favorable and unfavorable entities among the selected wards of urban Puducherry (n=294)**

Characteristics	Frequency, n (%)
Favorable establishments	
Fruits and vegetable specialized markets	64 (21.8)
Public health sports facilities	20 (6.8)
Recreational centers	21 (7.1)
Unfavorable establishments	
Restaurants	84 (28.6)
Bakery shops	40 (13.6)
Fast-food outlets	65 (22.1)

included 64 (21.8%) of fruits and vegetables specialized stores and 21 (7.1%) of recreational or spiritual centers such as temples, churches, and meditation centers. Unfavorable establishments comprised 84 (28.6%) restaurants, 40 (13.6%) of bakery shops, and 65 (22.1%) of fast-food outlets.

Among the 84 restaurants, 25 (29.8%) had kept salt on the table, 21 (25%) had pickle on the table, 12 (14.3%) had sugar on the table; regarding the type of oil and frequency of oil change in the restaurants, 73 (86.9%) were using refined oil for cooking purpose and 31 (32.6%) were reusing the oil used on the previous day.

Totally, there were 18 (2.7% 95% CI: 1.7–4.3) of alcohol establishments found in the study area. However, none of the establishments had signboards prohibiting the alcohol use.

## Discussion

This community-based cross-sectional study assessed neighborhood characteristics related to tobacco, alcohol, diet, and physical activity in selected urban wards. Our study showed that around 15.1% of the total establishments were selling tobacco products. Favorable

establishments related to diet and physical activity was found in 16% of the total establishments which included fruits and vegetable markets, public health sports facilities, and recreational centers. However, unfavorable establishments were found to be more than favorable in the study area, that is, 28.9%. Establishments selling alcohol products were observed to be 2.7%.

Regarding the tobacco establishments near the school premises, the current study found that more than one-third was selling tobacco products within 100 m of school premises. A study done in Mangalore, India, showed that almost half of the tobacco shops were within 100 m of schools.<sup>[18]</sup> Similar findings were found in a study done in Chandigarh in the northern part of India.<sup>[19]</sup> However, a study done in Rajasthan showed contrast findings where only <10% of tobacco shops were located within 100 m of educational premises.<sup>[20]</sup> Relevant stakeholders need to be informed regarding the importance of this issue, as it is shown to influence the behavior of school-going children and adolescents in the future.

The current study showed that almost one-third of tobacco establishments were selling tobacco products to minors. Nonetheless, a study done in Rajasthan reported only 12% of the tobacco establishments were selling to the minors.<sup>[20]</sup> Regarding availability of "no smoking" signage, 21% of establishments in the study area had the display of signage. But in a study done in Chandigarh, nearly half of the establishments reported display of signage.<sup>[19]</sup> Actions must be taken for strict enforcement of such practices under Cigarettes and Other Tobacco Products Act, for significant and sustainable reduction in tobacco use among the general population.

Diet and physical activity-related establishments showed more of unfavorable entities such as fast-food outlets, restaurants, and pastry shops. Similar findings were found in a study done in Canada where favorable establishments such as fruits and vegetable shops, public health sports facilities, and recreational centers found to be lesser than unfavorable entities. Such fast-food outlets and restaurants usually have high amount of added salt in the food items, which has direct adverse effect over health leading to hypertension and cardiovascular mortality. Thus, streamlining of such fast-food outlets and restaurants could be a possible population-wide public health effort for restricting sodium intake, thus preventing kidney disease, stroke, and cardiovascular diseases.<sup>[21,22]</sup>

Strengths of the study were the objective way of measuring the risk factors related to NCDs. The current study also adds to the limited literature available regarding the environmental studies related to the

behavioral risk factors. In spite of these strengths, there were certain limitations in the study. Individual-level characteristics could have been assessed and relationship between neighborhood characteristics and development of NCDs might have been reported. We did not assess other environmental risk factors for NCDs such as noise and air pollution levels.

Research related to the built environmental characteristics needs to be done in large scale throughout the country to develop a multifactorial approach for disease prevention. Such evidence will help to develop neighborhood-level intervention which can be tailor-made to reduce the burden of NCDs. Need for health promotion materials related to the diet, physical activity, tobacco, and alcohol in the establishments has to be emphasized. Social environment can also influence the development of behavioral risk factors. Hence, an integrated approach has to be made to assess the social, environmental, and individual factors related to NCDs.

## Conclusion

The current study reported almost equal distribution of favorable and unfavorable establishments in the study area. More than one-third of tobacco establishments were found within 100 m of school premises and also selling tobacco products to the minors. Establishments related to diet and physical activity was also found to be mostly unfavorable such as fast-food outlets, bakery, and restaurants. Hence, information regarding the status of establishments needs to be informed to the stakeholders to take corrective measures which will in turn reduce the burden of behavioral risk factors.

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## Conflicts of interest

There are no conflicts of interest.

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