

Original Research Article

Descriptive analysis of spatial distribution and service provision of hookah in establishments in Puducherry, a Union Territory of South India

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ABSTRACT

Background: The usage of novel and emerging tobacco products is increasing among tobacco users, including adolescents and adults. Hence, we aimed to investigate the density of hookah bars and the provision of hookah services in the union territory of South India.

Methods: A cross-sectional study was conducted during May 2024 using online searches, field visits, and resident consultations, focused on tourist spots and college areas, to identify the establishments with hookah availability. A semi-structured questionnaire was used to collect data, including the type of facility (bar, restaurant with bar, or pub), area/street name, presence of hookah services (yes/no), and location through a geotagging app. Prevalence of hookah bars providing services was reported as a proportion with a 95% confidence interval, and geotagging was performed to analyze density patterns.

Results: Among the 290 facilities assessed, a significant concentration of hookah establishments was observed around White Town Beach, a major tourist hotspot. Of these, 151 facilities were accessible, and 51 confirmed offering hookah services, resulting in a prevalence of 33.8% (95% CI: 26.7% - 41.6%). The analysis further revealed that hookah establishments were clustered in urban areas, and their presence was relatively sparse in peripheral regions.

Conclusions: Nearly one-third of facilities offering hookah services are clustered around tourist spots in urban areas. The findings highlight the need for targeted public health interventions and stricter regulatory measures. Further research is required to explore the determinants of hookah availability and usage trends, particularly among youth, to inform effective policy development.

Keywords: Hookah, Hookah establishments, Tobacco products, Spatial analysis

INTRODUCTION

Globally, over 8 million deaths are linked to tobacco use, and it accounts for one in 12 adult deaths.¹ Epidemiologists warn that the rising popularity of hookah smoking among young people could become 'the second global tobacco pandemic', following the widespread adoption of cigarettes, based on global trends.²⁻⁴ The

increasing popularity of hookah lounges in India over the past decade can be attributed to changing perceptions, social acceptance, and the appeal of flavored tobacco like apple, mint, cherry, chocolate, coconut, licorice, cappuccino, watermelon, etc.^{5,6}

In India, approximately 40% of cancer-related deaths are linked to tobacco use, with tobacco-related fatalities

projected to reach 10 million by 2030.⁷ Tobacco is primarily consumed in India by smoking bidis and cigarettes or by chewing it either on its own or mixed with lime, catechu, areca nut, or other spiced ingredients in a sachet.⁸ It is also applied to the gums, such as powdered tobacco, known as a "masher". An alternative form of tobacco use- 'the hookah, sheesha or waterpipe' appears to be on the rise among youth in India.^{5,6}

Despite its perceived safety Hookah smoking poses significant health risks comparable to cigarettes, including cancer, heart disease, and respiratory issues.^{9,10} The surge in hookah's popularity is attributed to its promotion as a fashionable trend, the proliferation of hookah lounges near colleges and tourist spots, the lack of regulation, lower tobacco prices, and Flavors that mask the smell.¹¹

Hookah smoking has seen a notable rise, especially among urban youth and college students in India. Studies conducted in India have reported its prevalence from as low as 6% to as high as 21% among adolescents and college-going students in urban areas, with the majority of users frequenting hookah lounges and perceiving it as a safer alternative to cigarettes, and curiosity and peer influence being primary factors for initiation.¹²⁻¹⁴ These findings underscore the increasing popularity of hookah smoking in urban settings, often facilitated by the proliferation of hookah lounges near educational institutions and the perception of hookah as a fashionable and less harmful form of tobacco use.

Currently, 11.2% of individuals use tobacco in either smoking or smokeless forms, while 2.5% of students aged 13-15 are reported to be tobacco users in Puducherry.^{15,16} As a prominent tourist destination and a popular gathering place for young adults from diverse regions, Puducherry facilitates the exchange of cultural practices, including social behaviors such as hookah smoking. This sociocultural environment, coupled with increased accessibility, makes the area particularly susceptible to a rise in hookah use. Despite these emerging risks, no specific legal provisions or regulatory frameworks are currently in place in Puducherry to monitor or control hookah establishments.

In this context, assessing the density and distribution of hookah establishments in Puducherry, a Union Territory in southern India that attracts a huge number of tourists and has a vibrant youth population, is important. Despite increasing national and global concerns about the health risks of hookah smoking and the enforcement of bans in several Indian states, there is a lack of localized data on the availability and clustering of hookah services in Puducherry. Understanding the spatial distribution of such establishments is essential for identifying potential hotspots of youth exposure and tobacco use. This study aims to fill this evidence gap by providing data-driven insights that can support program managers and policymakers in designing targeted interventions,

enforcing regulations, and addressing the growing public health challenge posed by hookah smoking.

METHODS

Study setting

We conducted a cross-sectional study in the Puducherry district, the capital of the Union Territory of Puducherry, India, known for its unique blend of French colonial heritage and vibrant cultural identity. As a Union Territory, Puducherry comprises four districts: Puducherry, Karaikal, Mahe, and Yanam, with the Puducherry district serving as the administrative and cultural hub. The study assessed the prevalence and distribution of hookah bars within hospitality establishments, defined as commercial venues that provide food, drink, or lodging services, including resto-bars, resto-pubs, hotels, and villa stays. Specific attention was given to prominent tourist spots, bustling shopping areas, and zones with a high density of educational institutions, such as White Town, MG Road, Rock Beach, Nehru Street, ECR Road, Kottakuppam, Auroville, Villianur, Vazhuthavur Road, Thavalakuppam, Serenity Beach, and the Bus Stand area.

Puducherry district is a major tourist destination, attracting visitors from across India and the world due to its picturesque beaches, historical landmarks, and the spiritual community of Auroville. The district also has over 145 higher education institutions, including prominent colleges and universities, creating a vibrant student population.¹⁷ The interplay of a thriving tourism industry and many educational establishments makes Puducherry an ideal setting to study the prevalence of hookah bars and their potential influence on public health and social dynamics.

Data collection

Data collection was performed in May 2024; A multi-faceted approach was used to identify the shops/facilities. Online searches were conducted via platforms such as Google, Zomato, Instagram, and Facebook, supplemented by word-of-mouth consultations and discussions with residents. Field visits were systematically carried out using route maps to ensure comprehensive coverage of the district. Observations were recorded, documenting each establishment's name, type, street name, hookah status, and other relevant details. Geotagging of confirmed establishments was performed using a mobile app named UTM Geo Map to ensure accurate location recording. The density of the hookah bars near the tourist spots was observed with GIS mapping.

Statistical analysis

The data was entered in Microsoft Excel version 23 and analyzed in SPSS version 22. The prevalence of hookah establishments was calculated and presented as percentages with a 95% Confidence Interval (CI). GIS

mapping was performed using ArcGIS software to visualize the clustering and spatial distribution of hookah establishments across the Puducherry district.

The prevalence of hookah-serving establishments was also calculated for each identified location category. The locations were grouped based on major urban and tourist zones in Puducherry and other parts of the town. Chi-square tests were used to assess the statistical significance of differences in hookah availability across locations, with a p-value of less than 0.05 considered statistically significant.

RESULTS

Prevalence of hookah establishments

Out of 236 facilities approached, 81 were excluded due to unconfirmed hookah status, where the presence of hookah services could not be verified through field visits or direct inquiry, and four because the establishments were closed. The study identified 151 establishments across the Puducherry district. Out of 151 establishments, one-third, 33.8% (95% CI: 26.7%-41.6%) confirmed the availability of hookah and offered a hookah smoking facility.

The highest prevalence of hookah establishments was observed in white town (70.5%), followed by ECR road (13.2%), with statistically significant differences in distribution across locations ($p < 0.05$) (Table 1).

Table 1: Spatial distribution and prevalence of hookah facilities in establishments in Puducherry, 2024.

Location	Establishments with hookah (N=51)	
	Number	Percent (95% CI)
White town	36	70.5 (57.0-81.2)
ECR road	7	13.2 (6.8-25.7)
Auroville	3	5.8 (2.0-15.9)
Other parts of Puducherry town	5	9.8 (4.2-20.9)

Density of hookah establishments

The map (Figure 1) depicts the spatial distribution of these 51 hookah establishments, revealing a significant clustering pattern. Notably, around 36 of the 51 total hookah establishments (70.5%) are concentrated in the White Town beach area, a popular tourist destination.

Many establishments were also located near other high-footfall zones such as Rock Beach, Nehru Street, and ECR Road, highlighting the influence of tourism as a key factor in determining their location.

No hookah establishments were found in immediate proximity to educational institutions. However, a notable concentration was observed in urbanized areas,

particularly in the central and eastern parts of the district.

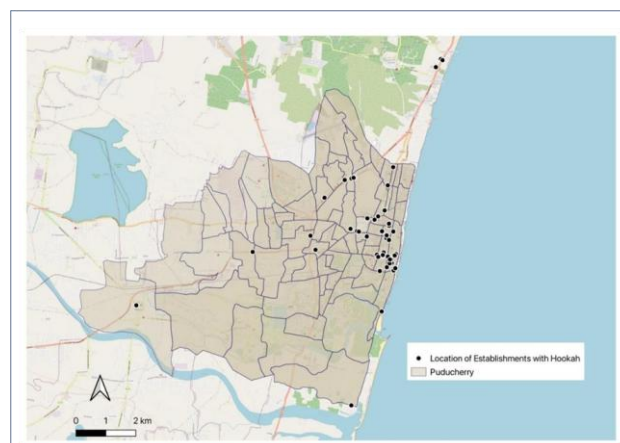


Figure 1: Location of hookah establishments in the Puducherry district showing the clustering of hookah establishments at the beach area.

However, a contrasting pattern is seen in the district's peripheral areas, such as the northeastern and southwestern parts, where the density of hookah establishments is relatively sparse. This combination of clustering in key zones and a more scattered presence across urban areas highlights the multifaceted nature of their distribution within the district. The spatial distribution of hookah bars is shown in Figure 1.

DISCUSSION

Our study found that one-third of the establishments in Puducherry offer hookah smoking facilities, and the hookah establishments were centered around the urban and tourist-centric regions like beaches. While no outlets were found directly next to colleges or universities, Puducherry's compact layout places educational institutions close to popular tourist areas. As a result, students and young residents can easily access beaches, city center attractions, and, by extension, the hookah establishments.

Findings of our study align with the growing trend of hookah use reported in other urban Indian settings. While previous studies have focused on individual usage patterns, such as a 7.6% prevalence among high school students in Indore, 6% among adolescents in urban slums of Mumbai, and 21.1% among college-going women in Delhi, our study complements these behavioral findings by mapping the actual physical presence of hookah facilities in the environment.¹²⁻¹⁴ Notably, unlike studies that observed hookah use near educational institutions, our study did not find hookah establishments near colleges or schools. However, the clustering of hookah venues in central urban and tourist-dense areas indicates high accessibility for youth, given Puducherry's compact urban layout. This reflects a shared national pattern where the perception of hookah as a socially acceptable and less harmful alternative to cigarettes is reinforced by the

visible presence of hookah lounges in youth-frequented zones. The contrasting scarcity of such establishments in peripheral regions further emphasizes the strategic targeting of urban youth and tourists by hookah service providers.

Several studies have highlighted the clustering of hookah establishments in urban and youth-centered environments, reflecting a broader global trend. A study from California analyzing the spatial distribution of hookah lounges found that approximately 50.5% were located within three miles of community colleges and 46.8% within three miles of four-year colleges like universities, suggesting a strategic placement to attract young adults.¹⁸ Research also indicates that hookah smoking is particularly prevalent among urban youth in regions such as the Middle East, the USA, South Asia, and parts of Europe, where urban settings offer a conducive environment for social and recreational tobacco use.¹⁹ A comprehensive review on the global epidemiology of waterpipe smoking further supports this trend, emphasizing the influence of urbanization and globalization in driving the rise of hookah use among youth worldwide.²⁰

Adolescents and youths are exposed to novel tobacco products, which include e-cigarettes and hookah. As per the Global Youth Tobacco Survey (GYTS) for Puducherry, awareness of novel tobacco products like e-cigarettes was high, with 4.2% of boys and 20.1% of girls aware of them indirectly reporting the familiarity with these products. Additionally, 57.5% reported no age-related restrictions when purchasing tobacco products, highlighting weak enforcement of existing tobacco regulations.²¹ This easy accessibility may encourage experimentation among the students.

Furthermore, the role of flavors and peer influence in promoting tobacco use is consistent across all kinds of tobacco products. Gupte et al reported that adolescents referred e-cigarettes as "pen-hookah" and were influenced by flavors, playful tricks with smoke, and peer interactions. Similar trends are observed in hookah smoking, where flavored tobacco and social gatherings encourage its normalization among young adults.²²

The COVID-19 pandemic further contextualizes these findings. While Culbreth et al observed a temporary decline in e-cigarette use among youth during the pandemic, they emphasized that hookah smoking remains a stable yet concerning public health issue, especially with the increase in hookah lounges and insufficient policy regulations. These findings parallel our study, which identified significant clustering of hookah establishments in tourist hubs and urban settings, underscoring the need for stricter regulatory frameworks.²³

The success of hookah bans in states like Maharashtra, Karnataka, and Telangana provides strong precedents for

regulatory action in Puducherry.²⁴⁻²⁶ Despite the absence of a national-level law banning hookah bars, many states have utilized provisions such as Section 144 of the Criminal Procedure Code (CrPC) to restrict their operation in the interest of public health. In Punjab, a study by Kaur et al documented the effectiveness of Section 144 in closing 25 hookah bars and emphasized the need for a permanent legal ban.²⁷ Maharashtra integrated COTPA into restaurant licensing, while Karnataka implemented a comprehensive ban citing health risks, nicotine addiction, and fire hazards.^{28,29} These state-level initiatives demonstrate the feasibility and impact of localized legal interventions and underscore the urgent need for similar action in Puducherry, where no such legal provisions currently exist.

The findings from these studies collectively emphasize the urgent need for targeted public health interventions. Educational campaigns must address misconceptions about hookah safety and the role of flavors in increasing its acceptability. Regulatory measures, such as stricter implementation of health warnings and restrictions on product sales to minors, as highlighted by Rijhwani et al, are critical.³⁰ Furthermore, integrated tobacco prevention programs, like those advocated by Gupte et al, and policies addressing the public health concerns raised by Culbreth et al, are necessary to curb the growing prevalence of hookah use.²³

These examples underline the effectiveness of stringent regulatory frameworks in controlling the hookah menace and highlight the urgent need for Puducherry to adopt comprehensive measures, including bans and strict enforcement mechanisms, to protect public health, especially among vulnerable youth.

A significant strength of our study is its comprehensive data collection, combining online searches, field visits, and local consultations to thoroughly identify hookah establishments in Puducherry. The use of GIS mapping visualizes spatial clustering, providing valuable insights for targeted public health interventions. However, being a cross-sectional study, it captures only a snapshot in time and cannot establish trends. Underreporting is also possible, as some establishments may have concealed hookah services due to regulatory concerns. Despite these limitations, the study offers essential baseline evidence to guide future research and policy efforts.

CONCLUSION

One-third of the establishments approached had hookah smoking facilities. Also, hookah establishments were clustered around urban and tourist areas, reflecting national and global trends. Considering the awareness of the novel products among adults and adolescents in the current setting, a ban on hookah establishments is the need of the hour. The findings provide critical insights for policymakers and public health officials to implement

stricter tobacco control measures, raise awareness, and address regulatory gaps.

Future research should explore the socio-cultural and economic factors influencing hookah availability and demand, and the impact of marketing strategies. This study is a foundation for further research and policy development to mitigate hookah use's growing public health challenge.

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REFERENCES

- World Health Organization. WHO report on the global tobacco epidemic 2019: offer help to quit tobacco use, 2019. Available at: <https://www.who.int/publications/i/item/9789241516204>. Accessed 01 June 2025.
- Cobb C, Kenneth D Ward, Wasim Maziak, Alan L Shihadeh TE. The global epidemiology of waterpipe smoking. *Tobacco Control*. 2011;34(3):275-85.
- Aslam HM, Saleem S, German S, Qureshi WA. Harmful effects of shisha: literature review. *Int Arch Med* [Internet]. 2014;7(1).
- Maziak W, Taleb Z Ben, Bahelah R, Islam F, Jaber R, Auf R, et al. The global epidemiology of waterpipe smoking. *Tob Control*. 2015;24(Suppl 1):i3-12.
- Knishkowsky B, Amitai Y. Water-pipe (narghile) smoking: an emerging health risk behavior. *Pediatrics*. 2005;116(1).
- Pandey P. Rising popularity of “tobacco-free” hookah among youth: A burgeoning public health challenge for India! *Int J Noncommunicable Dis*. 2017;2(2):30.
- National Cancer Registry Programme. Report on sites of cancer associated with tobacco use in India. Available at: <https://www.ncdirindia.org>. Accessed 01 June 2025.
- Chadda RK, Sengupta SN. Tobacco use by Indian adolescents. *Tobacco induced diseases*. 2002;1(2):111.
- Fitzpatrick M, Johnson AC, Tercyak KP, Hawkins KB, Villanti AC, Mays D. Adolescent beliefs about hookah and hookah tobacco use and implications for preventing use. *Prev Chronic Dis*. 2019;16(1).
- Patel MP, Khangoora VS, Marik PE. A review of the pulmonary and health impacts of hookah use. *Ann Am Thorac Soc*. 2019;16(10):1215-9.
- Qasim H, Alarabi AB, Alzoubi KH, Karim ZA, Alshbool FZ, Khasawneh FT. The effects of hookah/waterpipe smoking on general health and the cardiovascular system. *Environ Health Prev Med*. 2019;24(1).
- Anand NP, Vishal K, Anand NU, Sushma K, Nupur N. Hookah use among high school children in an Indian city. *J Indian Soc Pediatr Prev Dent*. 2013;31(3):180-3.
- Gupte H, Mandal G, Chaudhuri L. Hookah use among adolescent school students from urban slums of Mumbai, India. *Tob Induc Dis*. 2018;16(3).
- Anand K, Kanishka, Marwah S. Prevalence and determinants of hookah use among college-going women of Delhi. *Natl Med J India*. 2019;32(5):277.
- GATS A. GATS 2 Global Adult Tobacco Survey [Internet]. 2020.
- National Tobacco Control Programme. Available at: https://ntcp.mohfw.gov.in/surveys_reports_publications. Accessed 01 June 2025.
- Directorate of Higher and Technical Education, Government of Puducherry, India. Statistics. Available at: <https://dhte.py.gov.in/statistics>. Accessed 26 April 2025.
- Sun DL, Schleicher NC, Recinos A, Henriksen L. Spatial clustering of hookah lounges, vape shops, and all tobacco retailers near colleges. *Nicotine Tob Res*. 2022;24(6):834-9.
- Jehi T, Serban P, Joshi A, Matta D, Sharma A, Mutchler M. Prevalence and Determinants of Hookah Smoking Among the Youth: A Scoping Review. *Cureus*. 2025;17(3):e79952.
- Maziak W, Taleb Z Ben, Bahelah R, Islam F, Jaber R, Auf R, et al. The global epidemiology of waterpipe smoking. *Tob Control*. 2015;24(Suppl 1):i3-12.
- GYTS 4 Factsheet_Puducherry.pdf.
- Gupte HA, Chatterjee N, Mandal G, Costa MD. Adolescents and e-cigarettes in India: a qualitative study of perceptions and practices. *APJCP*. 2022;23(9):2991.
- E Culbreth R, J Brandenberger K, Battey-Muse CM, Gardenhire DS. 2021 year in review: E-cigarettes, hookah use, and vaping lung injuries during the COVID-19 pandemic. *Res Care*. 2022;67(6):709-14.
- DNA India. Maharashtra: Bill to ban Hookah bars passed; 3 years jail term, fine up to Rs 1 lakh for violations [Internet]. Available at: https://www.dnaindia.com/mumbai/report-maharashtra-bill-to-ban-hookah-bars-passed-3-years-jail-fine-up-to-rs-1-lakh-for-violations-2598766#google_vignette. Accessed 16 February 2025.
- Drishti Judiciary. Karnataka High Court's Judgment on Hookah Ban. Available at: <https://www.drishtijudiciary.com/editorial/karnataka>

- high-court%27s-judgment-on-hookah-ban. Accessed 16 February 2025.
26. Times of India. Hookah Bars Banned In T: Hookah Bars Banned in Telangana State Assembly. Available at: <https://timesofindia.indiatimes.com/city/hyderabad/hookah-bars-banned-in-telangana-state-assembly/articleshow/107643848.cms>. Accessed 16 February 2025.
27. Kaur A, Singh G. Is ban on Hookah bars under Code of Criminal Procedure (CrPC) effective in controlling the menace: A case study from Punjab, India. *Tob Induc Dis*. 2018;16(3).
28. DNA India. Hookah banned across Maharashtra. Available at: https://www.dnaindia.com/mumbai/report-hookah-banned-across-maharashtra-1595391#google_vignette. Accessed 16 February 2025.
29. Pokhrel S. Karnataka Hookah Bar Ban Notification. 2024;15(1):37-48.
30. Rijhwani K, Hashmi S, Mohanty VR, Balappanavar AY, Kapoor S. Hookah products and online retail marketing strategies in India: A content analysis. *Ind J Cancer*. 2018;55(3):261-4.

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