Geographic Proximity of Waterpipe Smoking Establishments to Colleges in the U.S.

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Introduction: Waterpipe tobacco smoking is prevalent among college students in the U.S. and increasing in popularity. Waterpipe smoking establishments are almost completely unregulated, and limited information exists documenting the expansion of this industry. The objective of this study was to identify U.S.-based waterpipe establishments and measure their proximity to colleges/universities.

Methods: Waterpipe establishments and their addresses were compiled using five Internet-based directories during 2014 and analyzed in 2015. Addresses were geocoded and overlaid on a U.S. map of accredited colleges/universities. Proximity of colleges/universities to the nearest waterpipe establishment was measured in 3-mile increments. Multinomial logistic regression was used to model the factors associated with proximity of waterpipe establishments to colleges/universities.

Results: A total of 1,690 waterpipe establishments and 1,454 colleges/universities were included in the study. Overall, 554 colleges/universities (38.1%) were within 3 miles of a waterpipe establishment. Proximity of waterpipe establishments to colleges/universities was associated with higher full-time student enrollment. Public colleges/universities and those with a smoke-free campus policy were at lower odds of having waterpipe establishments within 3 miles of their campuses.

Conclusions: Waterpipe smoking establishments are more likely to be located near large colleges/universities. This study should inform initiatives aimed at reducing retail tobacco establishment exemptions.

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Introduction

Waterpipe smoking is an emerging trend, especially among U.S. college students, of which approximately 10% are current users.[1–4] Waterpipe smoking is misperceived as less harmful and delivering less nicotine than cigarettes because the smoke is filtered through water.[2,5,6] Recent evidence refutes such claims, suggesting waterpipe smoking may lead to cigarette smoking.[7–9]

Waterpipe establishments (WPEs) are often exempted from clean indoor air laws, creating an opportunity for them to flourish.[10] Estimates suggest that the number of WPEs has grown over the past decade,[11,12] although divergent methods used in these studies make it difficult to establish a definitive increase.

Greater density of WPEs may promote waterpipe smoking, as a greater density of tobacco retailers is associated with higher levels of cigarette smoking.[13–15] Therefore, the purpose of this study is to describe the landscape of the U.S. WPE industry and examine the extent to which businesses are located near colleges/universities.

Methods

A database of U.S.-based WPEs was compiled during August/September 2014 using five Internet directories. Building on prior studies using Hookah-Hookah, Better Business Bureau, and

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Hoovers directories,[11,16] the Yellow Pages and Yelp were included as additional sources. Yelp's unique search algorithm captured all references to *hookah* from customer reviews and included a variety of businesses offering waterpipe tobacco (e.g., bars, restaurants, and cafés), but whose description does not include the terms *hookah*, *hookah bar*, or *hookah lounge*. Such businesses were called to verify whether waterpipe smoking was allowed on premises. Additional inclusion/exclusion criteria are presented in Figure 1.

Educational institutions included all accredited colleges/universities from the Integrated Postsecondary Education Data System (N=2,847).[17] Institutions with dormitory capacity <250 beds were excluded (n=1,393) because the primary focus was on proximity of residential college/university students to WPEs. For each college/university, city population density was linked using ZIP code. Smoke-free campus status was included to examine whether tobacco-free policies are associated with proximity of WPEs.[18]

ArcGIS, version 10.2, was used to geocode street addresses of WPEs and colleges/universities. The point straight-line distance was calculated from each college/university to the nearest WPE, and between WPEs. The number of WPEs within each distance category was reported, stratified by full-time student enrollment. Clustering of WPEs was measured as the percentage of establishments with at least one other WPE within a specified radius (≤3.0, 3.1–6.0, and 6.1–9.0 miles). WPE density was calculated by dividing the number of establishments by the area population and converted to number of WPEs per 100,000. Thematic maps with gradient color displayed the colleges/universities coded in 3-mile increments based on distance to the nearest WPE. Multinomial logistic regression was used to evaluate the impact of full-time student enrollment, population density, and smoke-free campus policies on distance from colleges/universities to the nearest WPE. The dependent variable included four distance categories (reference, >9.0 miles). SAS, version 9.4, was used for all analyses conducted in February 2015. A p-value <0.05 was considered statistically significant.

Results

Overall, 1,690 WPEs met the inclusion criteria. The largest concentrations of WPEs coincided with large metropolitan areas (Figure 2A): for example, (Northeast) Boston and New York; (Southeast) Atlanta and Miami; (Midwest) Detroit and Chicago; and (West) Los Angeles

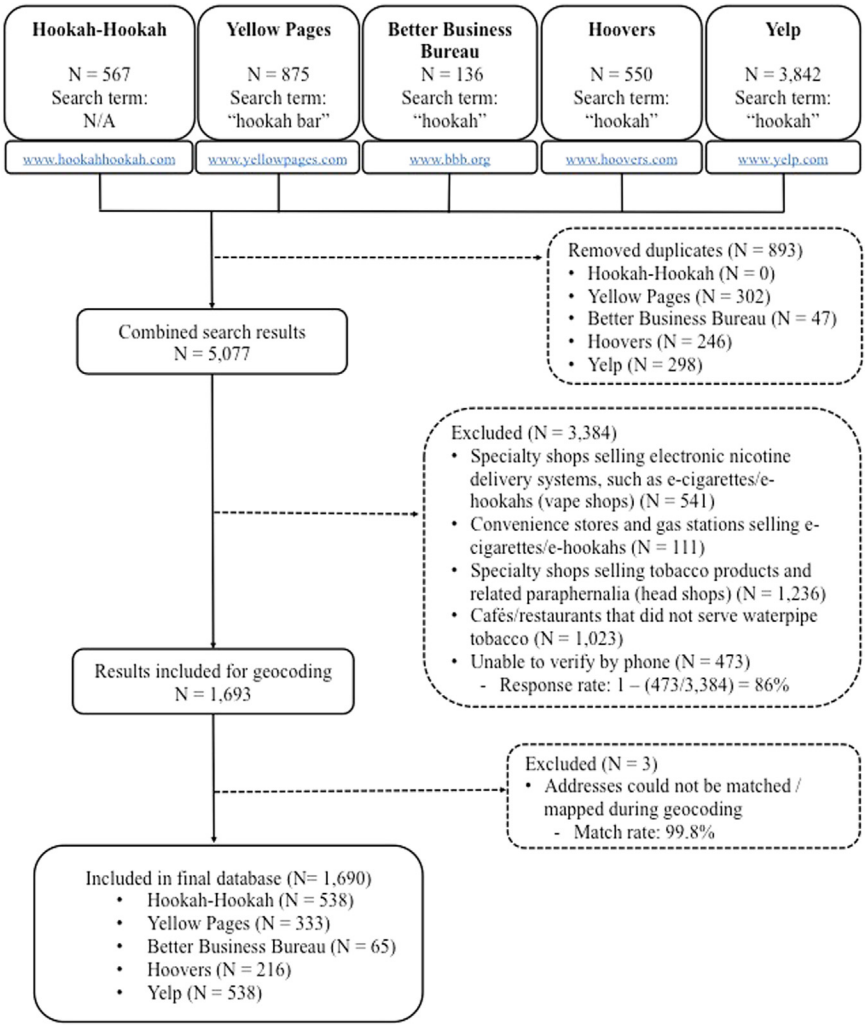

Figure 1. Selection of waterpipe establishments using internet directories.