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How popular is waterpipe tobacco smoking? Findings from internet search queries

Ramzi G Salloum¹, Amira Osman², Wasim Maziak^{3,4}, and James F Thrasher²

¹Department of Health Services Policy and Management, Arnold School of Public Health
University of South Carolina, Columbia, South Carolina, USA

²Department of Health Promotion, Education, and Behavior, Arnold School of Public Health
University of South Carolina, Columbia, South Carolina, USA

³Department of Epidemiology, Stempel College of Public Health and Social Work Florida
International University, Miami, Florida, USA

⁴Syrian Center for Tobacco Studies, Aleppo, Syria

Abstract

Objectives—Waterpipe tobacco smoking (WTS), a traditional tobacco consumption practice in the Middle East, is gaining popularity worldwide. Estimates of population-level interest in WTS over time are not documented. We assessed the popularity of WTS using World Wide Web search query results across four English-speaking countries.

Methods—We analysed trends in Google search queries related to WTS, comparing these trends with those for electronic cigarettes between 2004 and 2013 in Australia, Canada, the UK and the USA. Weekly search volumes were reported as percentages relative to the week with the highest volume of searches.

Results—Web-based searches for WTS have increased steadily since 2004 in all four countries. Search volume for WTS was higher than for e-cigarettes in three of the four nations, with the highest volume in the USA. Online searches were primarily targeted at WTS products for home use, followed by searches for WTS cafés/lounges.

Conclusions—Online demand for information on WTS-related products and venues is large and increasing. Given the rise in WTS popularity, increasing evidence of exposure-related harms, and relatively lax government regulation, WTS is a serious public health concern and could reach epidemic levels in Western societies.

Correspondence to: Dr Ramzi G Salloum, Department of Health Services Policy and Management, Arnold School of Public Health, University of South Carolina, 915 Greene Street, Suite 351, Columbia, SC 29208, USA; rsalloum@sc.edu.

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Waterpipe tobacco smoking (WTS), also known as *hookah*, *shisha*, *narghileh* and *arguileh*, is a centuries old form of tobacco consumption native to the Middle East and South Asia.¹ Commercialisation in the 1990s, including the introduction of flavoured varieties, sophisticated marketing campaigns and transnational distribution networks, has promoted WTS throughout the Middle East and beyond, particularly among young people.¹⁻³ Despite the popular belief that it is less harmful than cigarettes,⁴ WTS has been associated with nicotine dependence along with many of the same health hazards associated with cigarettes.⁵⁶

Over the past decade, a growing line of literature has documented the use of WTS in Western societies, especially in young and vulnerable groups.⁷⁻¹⁸ Among university students in the USA, WTS ranks as the second most common form of tobacco use after cigarettes.¹³ Among current WTS users, roughly half have never smoked cigarettes, suggesting that WTS delivers tobacco to millions of young adults¹⁹ who otherwise would have been naive to nicotine.¹³ Therefore, WTS may facilitate uptake of cigarettes by increasing the appeal of smoking to young people, likely because of its emphasis on flavoured tobacco and social settings for use.⁵⁸²⁰

Until recently, national surveys of tobacco use from the USA and other Western countries had rarely assessed WTS prevalence.¹⁹ In the past few years, surveillance of WTS has been adopted into the Global Adult Tobacco Survey²¹ and the Global Youth Tobacco Survey¹⁹ (in selected countries), the National Adult Tobacco Survey (USA),²² and the Canadian Tobacco Use Monitoring Survey.²³ Despite advances in surveillance of WTS, estimates of national time trends remain unavailable.¹⁴ Although there is evidence of increasing popularity, especially among adolescents and young adults,¹¹³¹⁵²⁴ WTS remains understudied and is often neglected in public health discussions.

The internet has been used successfully to promote and sell WTS products with dozens of web sites offering home delivery.⁸ Online sales facilitate youth access to tobacco products,²⁵ and to date WTS has been exempt from restrictions on credit processing and shipping of tobacco products.²⁶ While national surveillance data of WTS trends remain unavailable, novel web-based tools can be utilised to complement available data that find WTS is increasingly popular. Web-based search monitoring has recently become a valuable source of information about health-related trends. This method has been applied to detect influenza epidemics and other public health phenomena,²⁷ including the rise in popularity of electronic cigarettes.²⁸ Our study builds on earlier work in the area of web-based search monitoring by analysing, for the first time, aggregated data on WTS interest using *Google* search engine technology over the past decade.

METHODS

Data were obtained from *Google Trends* (<http://www.google.com/trends/>), a free and publicly available service that shows how often a particular search term is entered relative to the total search volume across time and in various regions of the world. *Google Trends* produces relative search volume (RSV) indicators scaled to the week where the greatest number of searches was conducted for that specific term (assigned an RSV=100%). All

other weekly search proportions are assigned RSV values relative to the highest search week for that term. The approach of using RSV adjusts for trending (eg, an increase in overall search query volume concurrent with a volume increase in the search term of interest).²⁹

We analysed search queries indicative of WTS in comparison with another nicotine delivery product that emerged in the past decade: electronic nicotine delivery systems (ENDS), more commonly known as electronic cigarettes. We chose ENDS as a comparison group due to inherent similarities with WTS; both products are gaining popularity in an era of stronger tobacco control, suggesting that they may be used to bypass smoking restrictions.²⁸³⁰ The time period for our assessment encompassed the earliest available data (ie, January 2004) to December 2013. We collected search query data in four English-speaking countries: Australia, Canada, the UK and the USA.

Root terms were initiated for each of the two products of interest (ie, WTS and ENDS), and related terms were added, according to their internal consistency, to form a composite product (related root terms that refer to the same product). For ENDS, we started with a list of 12 root terms adopted from Ayers *et al.*²⁸ For WTS, we started with the most popular search term, *hookah* and included the top 11 related terms: *shisha*, *chicha*, *hooka*, *narguile*, *hookah bar*, *nargile*, *sheesha*, *shisha bar*, *hookah lounge*, *hookah hookah*, and *hookah shisha*. *Google Trends* then automatically selected the top 10 most related terms for each of the two lists of 12 root terms (based on the tendency of the query to include the same or similar terms as the root query and the user searching for these terms concurrently with the root term). This approach produced two sets of 121 potential queries (in each set). Term composites were used to derive a single RSV for each of the two products of interest.

A new (β) feature in *Google Trends* makes it possible to measure search interest in *topics*, which provides accurate measurements of overall search interest covering multiple related terms. This feature is currently available in the USA and UK, but unavailable in Australia and Canada. For the USA and UK, the *topic* search feature was used (instead of the composite product) to look up WTS-related terms. At the time of analysis, ENDS was not an available search *topic* in *Google Trends*, and thus we used the composite product approach for ENDS in all four countries. This allowed us to generate a single RSV that includes all related terms. We plotted the RSVs for the two products of interest within the four countries separately, with each country on a separate scale. To facilitate visual comparisons, we plotted the RSVs for WTS-related searches across the four countries and estimated the mean RSV trends using locally weighted scatterplot smoothing (lowess). We compared segmented annual time trends using equality-of-means t tests. All statistical analyses were conducted using STATA V.12.0 (StataCorp, College Station, Texas, USA).

To examine whether searches were motivated by curiosity or shopping behaviour, we replicated our analysis by restricting the models to shopping queries. This limited results to user-solicited purchase information, including prices and shipping costs. Finally, since *Google Trends* does not publically report absolute volumes, we used *Google AdWords* (adwords.google.com) to obtain raw estimates of all WTS relevant queries. The times series estimates from *AdWords* represent average monthly traffic for a specific search term. Of the 121 potential queries for WTS, 20 were low-volume terms (results not shown by *Google*),

34 duplicates, and 12 unrelated or unclear terms were excluded, yielding 55 unique and relevant terms. We transformed *AdWords* estimates for these terms into weekly volumes by multiplying each value by 12 (months) and dividing by 52 (weeks). The study relied on publicly available data and was exempt from institutional review board approval.

RESULTS

We found evidence of significant search volume for WTS going back to the earliest possible date in *Google Trends* (January 2004) for the USA, Canada and the UK, and to mid-2006 for Australia (figure 1). For ENDS searches, significant volume can be tracked as far back as late 2006 in the USA, and 2008 in Australia, Canada and the UK. For our observation period, WTS had the highest weekly RSV (100%) in the USA and Australia in December 2013, and in Canada in August 2013, whereas ENDS had the highest weekly RSV in the UK in June 2013. When compared with ENDS, the mean weekly RSV for WTS-related searches was significantly higher for all countries across all years, with the exception of the UK (in 2012–2013). The mean weekly RSVs for 2013 were as follows: 82% for WTS vs 42% for ENDS in the USA, 72% for WTS vs 53% for ENDS in Australia and 71% for WTS vs 30% for ENDS in Canada. Since 2012, the mean weekly RSV for ENDS in the UK (63% in 2013) has significantly exceeded the mean RSV for WTS (56% in 2013).

When comparing the four countries, the online popularity of WTS was highest in the USA (100% RSV, December 2013), followed by the UK (48.2% mean weekly RSV for 2013), Canada (42.6%) and Australia (27.2%). Because it is unclear whether search queries indicate curiosity or shopping, we replicated prior models restricting the analysis to the *Google Shopping* category. In the USA, we found that WTS shopping searches increased by 291% between January 2004 and December 2013 compared with a 4% decrease for tobacco product searches in general. Growth rates in shopping searches over this time period were WTS=+300% vs tobacco=+4% in Australia, WTS= +142% vs tobacco=–25% in Canada and WTS=+186% vs tobacco=–7% in the UK.

Weekly estimates of crude volume for WTS-related searches are shown in figure 2. The most popular WTS terms were *hookah* at approximately 190 000 average weekly searches, followed by *shisha* at approximately 127 000 searches. The other relevant terms were distributed among information seeking queries (eg, *what is hookah* and *how to hookah*); product searches (eg, *hookah for sale* and *Starbuzz* (a popular brand of WTS tobacco and accessories)); and searches for WTS establishments (eg, *hookah lounge* and *shisha café*).

DISCUSSION

Our study suggests that the popularity of WTS, as evidenced by web-based search queries, has steadily increased over the past decade across all four countries. Our results are consistent with previous reports of increasing prevalence of WTS, especially among adolescents and university-aged smokers. However, our study is unique in estimating trends in demand for WTS information in four Western countries, independent of all age groups and spanning a 10-year period. It is also unique in analysing an unstudied, yet major medium for WTS-related information and transactions: the internet. Our results corroborate

the limited surveillance data about the increasing popularity of WTS, and provide a glimpse of how active the internet is in the promotion and marketing of WTS, even in comparison with ENDS.

Our study results suggest that interest in WTS is growing despite the increasing introduction of indoor smoking bans across jurisdictions within these four countries. Indeed, recent successes in regulating cigarettes may contribute to increased WTS use.³¹ For example, clean air laws may provide exemptions to tobacco retail establishments. Furthermore, more smokers may find WTS appealing because it promotes flavoured tobacco, which has been banned in some jurisdictions. In addition, the experience of WTS differs from cigarette smoking in many ways that make it difficult to apply proven methods in the regulation of cigarettes without understanding the idiosyncrasies of this product. For example, many users of WTS primarily smoke the product at cafés and are therefore not exposed to product packaging, including warning labels.

The strengths of this study include the use of search query monitoring to track the popularity of WTS over time; these data are otherwise unavailable. An added strength is the comparison with ENDS popularity. The finding that online popularity of WTS is competitive with ENDS argues that more attention is warranted to this issue, despite the current hype and debate around the benefits and harms of ENDS.³² Another issue that we did not address, but deserves further exploration, is one that is at the intersection of WTS and ENDS: *e-hookahs*. Electronic hookahs, also known as *hookah pens* or *vape pipes* have experienced exponential growth since 2013.³³

The World Wide Web is a critical health information resource and can be used to track the popularity of other nicotine delivery products.²⁸ This method of web-based search query surveillance, however, has its own limitations. First, the validity of this method in predicting actual purchase behaviour is uncertain; however, we found that the bulk of WTS search volume was categorised under *Google Shopping*—a strong indication that searches are related to purchase behaviour. Second, composite search terms may bias current estimates due to geographical variation; however, the terms used herein appear to be commonly used across countries. Third, young people who have been found to be the most common users of WTS in these countries, are over-represented online. This could also introduce bias to our results. Finally, Google does not provide absolute search volume data (outside of crude estimates from *Google AdWords*) and it is unclear how many searches for WTS occur in each country; however, given what we know about current ENDS sales volumes in these countries,³² it is alarming to learn that relative WTS popularity is comparable, if not higher.

To our knowledge, this is the first study to report long-term national longitudinal trends on the popularity of WTS. By applying search query surveillance technology, we were able to assess the popularity of WTS in the USA and three other English-speaking countries, where population-level prevalence data on WTS are unavailable through traditional means. Our findings from these four countries call for more research to inform policy development to more effectively regulate and curb this alarming trend.

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What this paper adds

- This paper provides long-term national trends showing the rise in online popularity of waterpipe tobacco smoking in the USA, Australia, Canada and the UK, and compares them with similar trends in electronic cigarettes. This information is not currently available through traditional surveillance methods.
- Surveillance of web-based searches suggests that popularity of waterpipe tobacco smoking has steadily increased over the past decade across all four countries.
- This paper finds that online popularity of waterpipe tobacco smoking is competitive with electronic cigarettes. This finding argues that more attention is warranted to studying waterpipe tobacco smoking, despite the current hype and debate around the benefits and harms of electronic cigarettes.

Figure 1.

National search trends of waterpipe tobacco smoking (WTS) relative to electronic nicotine delivery system (ENDS) (A–D) and across countries (E). The bold lines indicate the weekly running trend fitted using locally weighted scatterplot smoothing (lowess); the background trends are the raw relative search volume values. *WTS search terms*: hookah, shisha, chicha, hooka, narguile, hookah bar, nargile, sheesha, shisha bar, hookah lounge, hookah hookah and hookah shisha. *ENDS search terms*: electronic cigarette, electronic cigarettes, e-cigarette, review electronic cigarette, the electronic cigarette, njoy cigarette, njoy, njoy electronic cigarette, electric cigarette, blu electronic cigarette, blu cigarette and best electronic cigarette. In (A) and (D), *hookah* topic search was used for WTS, instead of the WTS search terms. The topic search is currently available in beta version in the USA and the UK.

Figure 2.

Ranking of absolute weekly search volume estimates of search terms related to waterpipe tobacco smoking (N=55). Unique search terms relevant to waterpipe tobacco smoking were identified using Google Trends. Weekly search volume estimates were derived from absolute monthly averages reported in Google AdWords.