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BRIEF REPORT

Interest in Tobacco Treatment Delivered During Rideshare Travel

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Abstract

More than 37,000,000 US adults smoke cigarettes. Most are interested in quitting, but rates of successful cessation remain low. Developing more and better approaches to tobacco treatment is a public health priority. The evolution of vehicular travel may present an opportunity for tobacco treatment intervention. We recruited individuals who reported previous use of ridesharing services (eg, Uber or Lyft) at 10 sites in the Boston area. They completed an anonymous survey that collected sociodemographic and tobacco use information and assessed participants' interest in receiving various forms of tobacco treatment during their rideshare rides. Forty-nine adult smokers completed the survey. Mean age = 40.1, 61.2% male, 51.0% white, 16.3% African American/black, 14.3% Latino, and 8.2% Asian. Almost 70% were college graduates, 79.6% worked full time, and 40.8% used ridesharing services ≥ weekly. They smoked a mean of 8.7 cigarettes per day; 35.3% were moderately or highly nicotine dependent, 36.7% also smoked cigars, 34.7% also used e-cigarettes, and 41.7% were in the contemplation or preparation stage of quitting. More than 56% of participants expressed some level of interest in receiving quit-smoking messaging during their rideshare rides. On multivariate analysis, black or Latino race/ethnicity and rideshare frequency of at least once a week were associated with interest in receiving quit-smoking messaging during rideshare rides. The majority of rideshare users who smoke are amenable to the idea of quit-smoking messaging delivered to them during their rides, and interest rates were highest among black or Latino riders and those who used rideshare services most frequently.

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Despite the downward trend in cigarette smoking prevalence in the United States over the past half century, there are still almost 40 million American smokers, and more than 2000 individuals become new, established smokers every day.[1] Most smokers in the United States—68.0% in the most recent wave of the National Health Interview Survey—desire to quit, but only a small minority succeed.[2] The public health battle against tobacco use is fought on many fronts including the courts, the legislature, and regulatory bodies such as the Food and Drug Administration. It is also fought on an individual level, smoker by smoker, but busy clinicians, faced with long problem lists and short visit times, succeed at recognizing tobacco use in their patients but largely fail at delivering appropriate therapies.[3] The tobacco industry reaches the public through well-funded, clever, engaging marketing and advertising. The public health community, albeit less well-funded, tries to do the same with posters, billboards, brochures, and some high-profile initiatives such as the Centers for Disease Control's Tips From Former Smokers campaign, which produced more than 300,000 successful quitters.[4]

The automobile has not been neutral territory in the public health battle against tobacco use. The practice of smoking in automobiles is at least a century old, as evidenced by the first patent for an automobile cigarette lighter in 1919. Lighters and ashtrays were ubiquitous car features until the late 1990s. Cigarette smoking is associated with increased rates of traffic accidents and fatalities.[5] The enclosed space of a car makes it a particularly hazardous secondary smoke environment.[6] The tobacco industry has invested heavily in the creation of a mobile urban billboard system through their taxi advertising campaign.[7] Americans spend trillions of minutes in cars every year,[8] and we—as a society—cannot afford to cede

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this space to influences that promote tobacco use and are inimical to the public health. Ridesharing, an industry led by Uber and Lyft, has disrupted transportation in the United States and abroad, and rideshare customers spend hundreds of millions of minutes every year as passengers linked to the Internet and to the rideshare service provider via their cellphones.[9-11]

Herein, we describe a study of cigarette smokers who use rideshare services, such as Uber or Lyft, and their interest in receiving quit-smoking messaging during their rides.

METHODS

This was a substudy of a larger study assessing interest in health messaging during rideshares that has been published elsewhere.[12] The current study restricted its analyses to the subset of participants who affirmed current cigarette smoking (ie, they reported smoking at least 100 cigarettes in their lifetimes and having smoked a cigarette within the past 7 days).

Between July 24, 2017, and October 10, 2017, 2 research assistants set up temporary stands in high−foot-traffic areas in metropolitan Boston. Candidates either approached study staff in response to a sign offering a free Uber ride, or they were directly invited to participate by study staff. People who expressed interest completed the 2 screening questions on a tablet device to verify that they had ever used a ridesharing service before and that they had not yet participated in the study. Those persons who passed screening were presented an informed consent script, and, if still willing, proceeded to the next screen to answer the interview questions.

All responses were collected and then uploaded using a survey developed with the SoGoSurvey service (www.sogosurvey.com, GoSurvey, Herndon, VA). The final study database was maintained in Excel and then imported to SPSS V25.0 (IBM Corp., Chicago, IL) for analysis. Comparisons of proportions were performed with chi-square or Fisher's exact test. Comparisons of means were performed with Student's *t*-test. Multivariate logistic regression was completed by entering all covariates demonstrating univariate associations ($P<.10$) with the outcome variable of interest into the model and then using a stepwise, backward removal strategy until only those variables with a significant effect on the fit of the model remained.

Distribution of the study incentives, which did require the voluntary divulgence of identifying information, occurred only after the questionnaire was completed and responses were uploaded. Thus, the study dataset was fully anonymized. The study design and questionnaire were reviewed by the institutional review board (IRB) of the Albert Einstein College of Medicine and were granted exemption from IRB oversight.

RESULTS

In the parent study, we screened 209 candidates at 10 separate locations in Boston.[12] Of these, 170 were eligible, consented, and completed the questionnaire. Thirty-two (15.3%) of the 209 were disqualified because they had not ever used ridesharing services, and 7 (3.3%) were disqualified because they had completed the study previously. Forty-nine current smokers completed the survey. Compared with the 121 nonsmokers in the parent study, the smokers were significantly older (40.1±13.5 vs 31.6±12.1 years of age, $P<.001$), were more likely to be male (61.2% vs 33.9%, $P=.003$), nonwhite (69.4% vs 51.0%, $P=.02$), employed full-time (79.6% vs 61.2%, $P=.02$), and nonstudents (93.9% vs 76.9%, $P=.008$). Their sociodemographic characteristics are summarized in Table 1, and their tobacco- and nicotine-use behaviors are summarized in Table 2. Interest level in receiving free quit-smoking messaging and/or viewing a quit-smoking video from the rideshare provider was assessed on a 5-item Likert scale (from not at all interested to extremely interested), and 56.3% indicated some level of interest. Interest level was graded as slight in 48.2% of these, and moderate to extreme in 51.8%. We dichotomized this variable into "no interest" and "any interest," and we assessed all the variables in Tables 1 and 2 for association with "any interest." On univariate analysis (Table 3), factors that were associated with any interest in quit smoking messaging were working full time: odds ratio (OR)=4.00 (95% confidence interval [CI], 0.89-18.0, $P=.08$), black or Latino race/ethnicity: OR=4.80 (95% CI, 1.14-20.2, $P=.03$), and Uber use ≥ weekly: OR=8.73

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TABLE 1. Sociodemographic Characteristics of the Study Sample

Characteristic	N (%)
Age ± SD	40.1 ± 13.5
Gender	
Male	30 (61.2%)
Female	18 (36.7%)
Transgender	1 (2.0%)
Race/Ethnicity	
White	25 (51.0%)
African American/black	8 (16.3%)
Latino/Latina	7 (14.3%)
Asian	4 (8.2%)
Other	5 (10.2%)
Marital status	
Married/partnered	20 (40.8%)
Single	29 (59.2%)
Education	
≤High school graduate	4 (8.2%)
Some college	11 (22.4%)
College graduate	34 (69.4%)
Work status	
Unemployed/disabled	4 (8.2%)
Part-time employment	1 (2.0%)
Full-time employment	39 (79.6%)
Student	3 (6.1%)
Other	2 (4.1%)
Annual household income	
<$30,000	7 (14.3%)
$30,000-$49,999	10 (20.4%)
$50,000-$74,999	13 (26.5%)
$75,000-$99,999	5 (10.2%)
≥$100,000	14 (28.6%)
Frequency of rideshare usage	
<Once per month	17 (34.7%)
Monthly	12 (24.5%)
Weekly	13 (26.5%)
Almost daily or daily	7 (14.3%)

N = number of participants; SD = standard deviation.

TABLE 2. Tobacco- and Nicotine-Use Behaviors of the Study Sample[a]

Tobacco- and/or nicotine-use behavior	N (%)
Daily cigarette smoker	
Yes	33 (67.3%)
No	16 (32.7%)
Average number cigarettes/day ± SD	8.7 ± 6.8
Nicotine dependence[b]	
Low	31 (64.6%)
Medium	16 (33.3%)
High	1 (2.0%)
Other tobacco or nicotine use	
Cigar	18 (36.7%)
Pipe	6 (12.2%)
Cigarillo	4 (8.2%)
Chewing tobacco	5 (10.2%)
Hookah	7 (14.3%)
E-cigarette	17 (34.7%)
Number of quit attempts in the past 12 months ± SD	2.2 ± 4.7
Stage of readiness to quit[c]	
Precontemplation	28 (58.3%)
Contemplation	14 (29.2%)
Preparation	6 (12.5%)

[a]N = number of participants; SD = standard deviation.
[b]Derived from the Heaviness of Smoking Index. Data were missing from 1 participant.
[c]Data were missing from 1 participant.

(95% CI, 2.06-37.0, P=.003). On multivariate logistic regression (Table 3), black or Latino race/ethnicity: adjusted odds ratio (OR_{adj})=9.71 (95% CI, 1.80-52.5, P=.008) and rideshare use ≥ weekly: OR_{adj}=15.2 (95% CI, 2.94-78.1, P=.001) were associated with any interest in health messaging in the final adjusted model. Of the range of choices for different possible modes of tobacco treatment, interest was greatest, in order, for a quit-smoking app, quit-smoking videos, quit-smoking online social network, text-message–based tobacco treatment, and quit-smoking podcasts. Choices that evoked the least interest were links to telephone quitlines and self-help brochures.

DISCUSSION

Travel by automobile is evolving rapidly in the United States, with the dramatic growth in ridesharing that has already occurred, and the proliferation of autonomous, self-driving vehicles that is on the horizon. These phenomena are resulting in much more uncommitted passenger time, and popular culture is already considering best uses for this new-found resource,[13] including health-promoting activities such as vehicular gyms[13] and transformation of vehicles into mobile medical offices.[14] The 1 published study that explored the role

TABLE 3. Characteristics Associated With Any Interest in Smoking-Cessation Messaging Delivered During Rideshare Rides

	Univariate analysis			Multivariate logistic regression		
Characteristic	OR	95% CI	P	OR_{adj}	95% CI	P
Full-time employment	4.00	0.89-18.0	0.08	NA	NA	NA
Black or Latino race/ethnicity	4.80	1.14-20.2	0.03	9.71	1.80-52.5	0.008
Uber use at least weekly	8.73	2.06-37.0	0.003	15.2	2.94-78.1	0.001

CI = confidence interval; NA = not applicable; OR = odds ratio; OR_{adj} = adjusted odds ratio.

of modern vehicular travel as a public health instrument offered on-demand influenza vaccination in 4 urban centers via Uber.[15]

A fundamental tenet of tobacco treatment is that the more antismoking messaging that smokers receive, the better. Individuals who use rideshare services are generally tethered to the services by their smartphones, and these connections offer the opportunity for broad reach, low-cost interventions. Both Uber and Lyft already interact with the medical system as they provide federally funded transportation to clinic visits for Medicaid patients in centers throughout the United States.[16] Our previous work indicates that riders are open to the idea of health-promoting messaging delivered in the course of their rides,[12] and the current study suggests moderate levels of interest in receiving quit-smoking messaging among ridesharers who use tobacco.

The participant characteristics that were significantly associated with interest in tobacco treatment during rideshare rides were black or Latino race/ethnicity and higher frequency of rideshare use. The former observation is encouraging, given disparities in access to cessation resources that prevail in these minority groups.[17] Other larger studies have shown high levels of interest in quitting among black[2] and Latino[18] smokers. The literature also suggests higher use of eHealth resources[19] and of mobile smoking-cessation programs[20] among blacks and Hispanics compared with whites, although these findings did not achieve statistical significance. The observation that frequent rideshare users were more likely to be interested in quit-smoking messaging delivered during their rides may reflect their comfort level with ridesharing and willingness to use this uncommitted time for health-promoting purposes.

Interestingly, 15 of the 28 participants (53.6%) who were in the precontemplation stage of quitting expressed interest in quit-smoking messaging, suggesting a potential opportunity to increase the motivation to quit in this challenging subset of smokers.

Limitations

Our survey was limited by its small sample size, which contributed to the wide confidence intervals for all effect estimates and may have reduced our ability to detect important associations. The study design—that is, enrolling pedestrians in common thoroughfares for brief interviews—did not allow for the depth and breadth of questioning that would have been ideal. As such, we do not have information such as type of rideshare usage (ie, to work or recreation, individual or group, average duration of rides) that may be important in determining the types of tobacco treatment that are possible. The study was also limited to 1 urban center, which may not be representative of other geographic regions.

CONCLUSIONS

Uber and Lyft have built huge industries and disrupted vehicular travel in the United States and abroad by accessing an enormous resource (idle cars and licensed drivers) that had not before been tapped for this purpose. The hundreds of millions of minutes that passengers sit in these vehicles tethered to the rideshare provider by their smartphones represent another untapped resource with tremendous public health potential. We undertook this study, the first of its kind, to assess interest in quit-smoking messaging during rideshare rides, and it showed significant interest in the idea among rideshare users who smoke. We envision a time in which

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passengers can access smoking-cessation and other health-promoting messaging on their cellphones during uncommitted time and when clinicians can interface with rideshare computer platforms to "prescribe" and deliver web-based tobacco treatments at the times that their services are used. Future research should explore the feasibility and efficacy of intravehicular tobacco treatment for smokers during the time they spend as passengers.

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Abbreviations and Acronyms: **CI** = confidence interval; **OR** = odds ratio

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REFERENCES

1. Centers for Disease Control and Prevention. Smoking & Tobacco Use: Fast Facts. https://www.cdc.gov/tobacco/data_statistics/fact_sheets/fast_facts/index.htm. Accessed January 24, 2019.
2. Babb S, Malarcher A, Schauer G, Asman K, Jamal A. Quitting smoking among adults: United States, 2000-2015. *MMWR Morb Mortal Wkly Rep*. 2017;65(52):1457-1464.
3. Thorndike AN, Regan S, Rigotti NA. The treatment of smoking by US physicians during ambulatory visits: 1994-2003. *Am J Public Health*. 2007;97(10):1878-1883.
4. Frieden TR. Shattuck lecture: the future of public health. *N Engl J Med*. 2015;373(18):1748-1754.
5. Leistikow BN, Martin DC, Samuels SJ. Injury death excesses in smokers: a 1990-95 United States national cohort study. *Inj Prev*. 2000;6(4):277-280.
6. Northcross AL, Trinh M, Kim J, et al. Particulate mass and polycyclic aromatic hydrocarbons exposure from secondhand smoke in the back seat of a vehicle. *Tob Control*. 2014;23(1):14-20.
7. The University of Alabama Center for the Study of Tobacco and Society. Big tobacco in the Big Apple: how New York City became the heart of the tobacco industry...and anti-smoking activism. *In Transit*, https://csts.ua.edu/btba-welcome/essence/transit/. Accessed June 27, 2018.
8. The Washington Post. The astonishing human potential wasted on commutes. www.washingtonpost.com/news/wonk/wp/2016/02/25/how-much-of-your-life-youre-wasting-on-your-commute/?utm_term=.1447daf01d0a February 25, 2016. Accessed November 20, 2017.
9. eMarketer. How much more can ride-sharing services grow in the US? May 17, 2016. www.emarketer.com/Article/How-Much-More-Ride-Sharing-Services-Grow-US/1013963. Accessed November 28, 2017.
10. Sharespost. Uber & ridesharing: the $650 billion question. http://media.cygnus.com/files/base/MASS/document/2017/01/SharesPost-Ride-Sharing-Uber-Lyft-Research-Report.pdf 2017. Accessed November 28, 2017.
11. Sherpashare. Uber trips are becoming longer and faster, but are they more profitable?. http://www.sherpashareblog.com/2016/02/uber-trips-are-becoming-longer-and-faster-but-are-they-more-profitable/ February 2, 2016. Accessed November 28, 2017.
12. Shuter J, Rosander C, Kim RS, Brownstein JS. Passenger or patient? The automobile: a new frontier in health promotion. *Health Promot Pract*. 2019;20(3):328-332.
13. The New York Times Magazine. Life after driving: imagining a world of autonomous cars. *November*. 2017;12.
14. Carnegie Mellon University. Electrical & Computer Engineering. What would you do in a self-driving car? February 25, 2015. https://engineering.cmu.edu/news-events/news/2017/01/25-av-car-survey.html. Accessed February 4, 2019.
15. Brownstein JS, Huston JE, Steingold L, Joyce MV. On-demand delivery of influenza vaccination. *Ann Intern Med*. 2015;163(10):806-807.
16. USA Today. Uber, Lyft could fill void in health care transportation. Section B:1-2. *March*. 2018;6.
17. Cox LS, Okuyemi K, Choi WS, Ahluwalia JS. A review of tobacco use treatments in U.S. ethnic minority populations. *Am J Health Promot*. 2011;25(5 suppl):S11-30.
18. Cox LS, Cupertino AP, Tercyak KP. Interest in participating in smoking cessation treatment among Latino primary care patients. *J Clin Psychol Med Settings*. 2011;18(4):392-399.
19. Kontos E, Blake KD, Chou WY, Prestin A. Predictors of eHealth usage: insights on the digital divide from the Health Information National Trends Survey 2012. *J Med Internet Res*. 2014;16(7):e172.
20. Abroms LC, Boal AL, Simmens SJ, Mendel JA, Windsor RA. A randomized trial of Text2Quit: a text messaging program for smoking cessation. *Am J Prev Med*. 2014;47(3):242-250.