Trends in E-cigarette Use in Callers to the Wisconsin Tobacco Quit Line

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ABSTRACT

Introduction: E-cigarette use has been increasing for years with a limited understanding of how to help users quit. Quit lines are a potential resource for e-cigarette cessation. Our objective was to characterize e-cigarette users who call state quit lines and to examine trends in e-cigarette use by callers.

Methods: This retrospective study examined data from adult callers to the Wisconsin Tobacco Quit Line from July 2016 through November 2020, including demographics, tobacco product use, motivations for use, and intentions to quit. Descriptive analyses were performed by age group with pairwise comparisons.

Results: A total of 26,705 encounters were handled by the Wisconsin Tobacco Quit Line during the study period. E-cigarettes were used by 11% of callers. Young adults aged 18-24 had the highest rates of use at 30%, and their use rose significantly from 19.6% in 2016 to 39.6% in 2020. E-cigarette use among young adult callers peaked at 49.7% in 2019, coinciding with an outbreak of e-cigarette-related lung injury. Only 53.5% of young adult callers used e-cigarettes to "cut down on other tobacco," compared to 76.3% of adult callers aged 45-64 ($P < 0.05$). Of all callers using e-cigarettes, 80% were interested in quitting.

Conclusion: E-cigarette use among callers to the Wisconsin Tobacco Quit Line has increased, driven largely by young adults. Most e-cigarette users who call the quit line want to quit. Thus, quit lines can serve an important role in e-cigarette cessation. A better understanding of strategies to help e-cigarette users quit is needed, particularly in young adult callers.

INTRODUCTION

Cigarette smoking has been on the decline for decades among all age groups in Wisconsin and the United States.[1-3] However, e-cigarette use—or vaping—has increased markedly since its introduction over 10 years ago. As of 2019, 4.5% of all adults (18 and older) in the US reported current e-cigarette use.[4] Among all age groups, young adults aged 18-24 reported the highest rates of e-cigarette use, with 9.3% reporting that they used e-cigarettes in 2019.[4]

E-cigarettes represent a potential public health benefit if used exclusively to help people quit combustible tobacco cigarette use.[5] However, most young adult e-cigarette users report that they never previously smoked cigarettes,[4,6] thus they are not using e-cigarettes for combustible tobacco cessation. Given the risks of negative health consequences with e-cigarette use among young adults,[7-10] the rising rates of e-cigarette use among this population[4] mandates a better understanding of how to help e-cigarette users to quit.

State tobacco quit lines serve as an important resource to connect tobacco users with free, evidence-based treatment for nicotine addiction.[11] Given their established infrastructure and broad reach, quit lines are poised to play a major role in helping e-cigarette users quit vaping. Studies examining e-cigarette use among quit line callers have focused largely on how e-cigarettes impact cigarette smoking cessation[12-14] rather than on e-cigarette cessation. One recent study evaluating e-cigarette use in callers across 24 public quit lines noted a rise in e-cigarette use in quit line callers from 12.3% in 2016 to 14.7% in 2018, with highest rates of use among young adult callers at 25.2% reported in 2018.[15] As e-cigarette use increases, more information is needed regarding use patterns (exclusive vaping vs dual use with cigarettes), trends by age group, motivations for use, and interest in quitting e-cigarettes among callers to quit lines, with a particular focus on young adults given

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their higher rates of use. Such information can help quit lines to better develop treatment services for e-cigarette users and help clinicians better understand the potential of quit lines to assist their patients who use e-cigarettes.

The Wisconsin Tobacco Quit Line (WTQL) receives approximately 5,000 to 10,000 calls per year. Its core program provides a single counseling session and 2 weeks of over-the-counter nicotine replacement therapy. The goal of this study is 2-fold: to characterize e-cigarette users who call state quit lines and to examine the trends, by age, in quit line use among people who vape. The current study used data from calls to the WTQL from July 2016 through November 2020 to characterize callers' demographics, use patterns of e-cigarettes and other tobacco products, and desire to quit e-cigarettes, overall and by age groups. Trends over time in call volume and e-cigarette use among callers also were examined. Given the rise in e-cigarette use overall during this period, we expected reports of e-cigarette use among WTQL callers to have increased substantially, especially among young adult callers. The late portion of 2019 was a period of particular interest, as a nationwide, highly publicized outbreak of e-cigarette or vaping product use associated lung injury (EVALI) occurred during this time,[16] potentially driving increased interest in e-cigarette cessation.

METHODS

This study was a retrospective analysis of data from the WTQL from July 2016 through November 2020. July 2016 was chosen as the starting point as this was when the WTQL updated its intake call screening language to ask, "Have you used an e-cigarette or other electronic vaping product in the past 30 days?" During this time period, there were 26,705 treatment encounters. Treatment encounters were identified by the intake assessment call, and data from these intake assessment calls were used in the current analyses, regardless of how many additional calls occurred during the treatment encounter. It should be noted that 92% of the 26,705 calls were from unique individuals and that among individuals with repeated treatment encounters, most (89%, n = 1791) had 2 unique encounters (range = 2-14; mean = 2.16; SD = 0.62). We opted to include all treatment encounters in our analysis, even if they were from someone who had more than 1 treatment encounter, in order to capture who is using WTQL services. Results were very similar when analyses were limited to the first treatment encounter from unique individuals (see Appendix). We hereto refer to treatment encounters as calls.

Measures

During intake calls, the WTQL collected month and year of call, demographic information, method of entry (phone, fax, e-referral, web enroll, other), and tobacco-specific questions (tobacco type[s] used, age at first use). For approximately 1 month twice each year when callers reported e-cigarette use, they were asked (1) "How many days did you use an e-cigarette or e-vaping product in the last 30 days?"; (2) "Are you using e-cigarette/e-vaping products to quit smoking?"; (3) "Do you intend to completely quit using e-cigarettes/e-vaping products within the next 30 days?'

Statistical Analyses

Descriptive analyses and pairwise comparisons were performed to examine demographic characteristics of the sample overall and by age group (18-24 years, 25-44 years, 45-64 years, and 65+ years). These age groups were chosen as they represent the standard age groups defined by the Centers for Disease Control and Prevention in reporting smoking prevalence.[3,4]

To characterize WTQL callers, they were classified according to patterns of product use: e-cigarette only, combustible cigarette only, dual use of e-cigarettes and combustible cigarettes, or neither e-cigarette nor combustible cigarette use (eg, smokeless tobacco). Rates of each use pattern were calculated overall, and the proportions of each use pattern were compared across age groups. The frequency of vaping, use of e-cigarettes to quit smoking, and motivation to quit vaping were analyzed similarly and followed by pairwise comparisons between age groups.

To examine trends over time, descriptive analyses examined the total call volume and investigated how the age structure of the callers varied over time. Pairwise tests were performed to identify changes in quit line utilization over time within each age group. Next, we examined the proportion of callers in each age group reporting e-cigarette use in each year. Trends were tested using a logistic regression analysis predicting e-cigarette use from year (coded linearly from 2016 = 0 to 2020 = 4), a categorical age group variable, and their interaction. To permit a closer look at a potential influence of the 2019 EVALI outbreak, we plotted e-cigarette use over time by quarter-years for the whole set of calls and within each age group.

This study was approved by the University of Wisconsin-Madison Health Sciences Institutional Review Board.

RESULTS

Characterizing WTQL Callers

From July 2016 through November 2020, there were 26,705 calls to the WTQL. Table 1 describes demographic and tobacco use characteristics of the callers. The majority of callers were >44 years old (67.9%), female (59.9%), White (73.9%), first used tobacco prior to age 18 (62.8%), and used cigarettes (95.8%). E-cigarettes were used by approximately 11% of all callers during the study period. Most of contacts with WQTL were initiated by tobacco users calling the WTQL (71.5%).

Tobacco product use patterns and assessments of e-cigarette use characteristics are given in Table 2. Of the 2,969 callers reporting e-cigarette use, 93.2% (n = 2,768) reported being "dual users" (using both e-cigarettes and cigarettes), while the remaining 6.8% used e-cigarettes alone. E-cigarette use was most common among young adults aged 18-24 (30.1%). The proportion of dual users

Table 1. Demographics of Wisconsin Tobacco Quit Line Callers by Age Group, 2016-2020

	Total N (%)	18-24 years N (%)	25-44 years N (%)	55-64 years N (%)	65+ years N (%)
Total Callers	26,705 (100)	730 (2.7)	7,848 (29.4)	13,276 (49.7)	4,851 (18.2)
Sex					
Male	10,694 (40.0)	301 (41.2)[a,b]	3,193 (40.7)[a]	5,317 (40.0)[a,b]	1,883 (38.8)[b]
Female	15,979 (59.8)	427 (58.5)[a,b]	4,644 (59.3)[a]	7,944 (59.8)[a,b]	2,964 (61.1)[b]
Race					
American Indian/Alaska Native	400 (1.5)	19 (2.6)[a]	146 (1.9)[a]	191 (1.4)[b]	44 (0.9)[c]
Arab/Arab American	31 (0.1)	3 (0.4)[a]	18 (0.2)[a]	8 (0.1)[b]	2 (0.04)[b]
Asian	104 (0.4)	4 (0.5)[a,b]	68 (0.9)[a]	28 (0.2)[b,c]	4 (0.1)[c]
Black/African American	4514 (16.9)	99 (13.6)[a,c]	1,232 (15.7)[a]	2,523 (19.0)[b]	660 (13.6)[c]
Native Hawaiian/Pacific Islander	21 (0.1)	2 (0.3)[a]	9 (0.1)[a,b]	8 (0.1)[b]	2 (0.04)[b,c]
White	19,738 (73.9)	543 (74.4)[a]	5,725 (72.9)[a]	9,609 (72.4)[a]	3,861 (79.6)[b]
Other	1,008 (3.8)	44 (6.0)[a]	388 (4.9)[a]	468 (3.5)[b]	108 (2.2)[c]
Ethnicity					
Hispanic or Latino	1,041 (3.9)	44 (6.0)[a]	457 (5.8)[a]	461 (3.5)[b]	79 (1.6)[c]
Non-Hispanic or Latino	24,738 (92.6)	664 (91.0)[a]	7,138 (91.0)[a]	12,358 (93.1)[b]	4,578 (94.4)[c]
Education					
<High school	3,741 (14.0)	121 (16.6)[a]	826 (10.5)[b]	2,152 (16.2)[a]	642 (13.2)[c]
High school/GED	9,737 (36.5)	367 (50.3)[a]	2,837 (36.1)[b,c]	4,728 (35.6)[b]	1,805 (37.2)[c]
Some college or technical/trade school	7,927 (29.7)	184 (25.2)[a]	2,469 (31.5)[b]	3,812 (28.7)[c]	1,462 (30.1)[b,c]
College or university degree	4,451 (16.7)	36 (4.9)[a]	1,474 (18.8)[b]	2,157 (16.2)[c]	784 (16.2)[c]
Entry method					
Phone	19,098 (71.5)	539 (73.8)[a,c]	5,363 (68.3)[b]	9,475 (71.4)[a]	3,721 (76.7)[c]
Fax referral	2,901 (10.9)	91 (12.5)[a]	892 (11.4)[a]	1,559 (11.7)[a]	359 (7.4)[b]
E-referral	2,471 (9.3)	64 (8.8)	696 (8.9)	1,232 (9.3)	479 (9.9)
Web enroll	1,189 (4.5)	32 (4.4)[a]	693 (8.8)[b]	393 (3.0)[c]	71 (1.5)[d]
Other	1,046 (3.9)	4 (0.5)[a]	204 (2.6)[b]	617 (4.6)[c]	221 (4.6)[c]
Tobacco used (not mutually exclusive)					
Cigarette	25,584 (95.8)	684 (93.7)[a]	7498 (95.5)[b]	12,749 (96.0)[b]	4,653 (95.9)[b]
E-cigarette	2,969 (11.1)	220 (30.1)[a]	1,260 (16.1)[b]	1,152 (8.7)[c]	337 (6.9)[d]
Cigar	1,476 (5.5)	73 (10.0)[a]	474 (6.0)[b]	690 (5.2)[c]	239 (4.9)[c]
Smokeless tobacco	843 (3.2)	63 (8.6)[a]	453 (5.8)[b]	268 (2.0)[c]	59 (1.2)[d]
Pipe	196 (0.7)	13 (1.8)[a]	71 (0.9)[b]	66 (0.5)[c]	46 (0.9)[b]
Other	544 (2.0)	42 (5.8)[a]	197 (2.5)[b]	240 (1.8)[c]	65 (1.3)[d]
Age at first tobacco use					
5-12 years	3,098 (11.6)	86 (11.8)[a,b]	898 (11.4)[a]	1,714 (12.9)[b]	400 (8.2)[c]
13-17 years	13,671 (51.2)	457 (62.6)[a]	4,273 (54.4)[b]	6,822 (51.4)[c]	2,119 (43.7)[d]
18-20 years	5,229 (19.6)	154 (21.1)[a]	1,565 (19.9)[a]	2,292 (17.3)[b]	1,218 (25.1)[c]
21-24 years	1,675 (6.3)	17 (2.3)[a]	532 (6.8)[b]	757 (5.7)[c]	370 (7.6)[b]
25+ years[†]	2,212 (8.3)	0 (0.0)	345 (4.4)[a]	1,281 (9.6)[b]	586 (12.1)[c]

Note: Within-category counts do not always sum to corresponding caller total owing to missing data on some measures. Proportions in the same row not sharing the same subscript ([a,b,c,d]) differ significantly at $P < 0.05$. Subscripts omitted for rows with no significant pairwise comparisons.

[†]The 18-24-year-old age group not included in pairwise columns comparisons owing to the structural zero in this group.

was similar across age groups. Young adults were significantly less likely to report using e-cigarettes "to cut down on other tobacco" compared to older adults aged 45-64 (53.5% vs 76.3%, OR = 0.36; 95% CI, 0.18-0.70; $P = 0.003$). Most callers in all age groups (79.6% of total sample) reported a "desire to quit e-cigarettes" in the next 30 days.

Trends Over Time

Call volume data over time are summarized in the top portion of Table 3. Calls to the WTQL peaked in 2018, with an average of 579 per month. There was a marked decrease in callers in 2020, with an average of 352 per month. Calls from young adults represented less than 5% of the total call volume in each study year and decreased over time.

Rates of reported e-cigarette use by year and age group are reported in bottom section of Table 3. The Figure depicts trends in reported use of e-cigarettes over quarter-years during the study period by age groups. E-cigarette use in young adult callers increased from approximately 20% in 2016 and 2017 to a peak of 49.7% in 2019, then fell somewhat to 39.6% in 2020. A logistic regression analysis revealed a significant linear increase with year (OR = 1.48; 95% CI, 1.30-1.68; $P < 0.001$) and an effect of age group, such that, compared to 18- to 24-year-old callers, odds of reported e-cigarette use were marginally lower in those 25-44 years old (OR = 0.72; 95% CI, 0.52-1.01; $P = 0.053$) and significantly lower in those 45-64 years old (OR = 0.53; 95% CI, 0.38-0.73; $P < 0.001$) and those 65 and older (OR = 0.44; 95% CI, 0.30-0.65; $P < 0.001$). Additionally, there was a year × age group interaction (Wald = 60.65; df = 3; $P < 0.001$). Specific interaction contrasts indicated that, relative to the increase in reported e-cigarette use among 18–24 year olds, increases over time were less pronounced among the other age groups (interaction ORs = 0.62 - 0.76; $Ps < 0.001$). Interestingly, the Figure indicates that the peak period in which young adult e-cigarette users called WQTL occurred in the third quarter of 2019, coinciding with the EVALI outbreak that began in July of 2019.[16]

DISCUSSION

The goals of this study were to better characterize e-cigarette use among callers to the WTQL from June 2016 through November 2020 and examine trends, by age, over time. We were especially interested in understanding young adult use patterns. Reported e-cigarette use during the study period increased in WTQL call-

ers overall. This is consistent with prior data[15] and likely reflects the increasing rates of e-cigarette use nationally—largely among younger adults.[3,4] This is consistent with our finding that e-cigarette use varied markedly by age, with young adults having the highest rate of e-cigarette use. Young adults, when compared to older callers, less frequently reported using e-cigarettes to "cut down on tobacco use" and more frequently reported being "e-cigarette only" users. These patterns are consistent with national population-level studies showing higher rates of dual use in older adults.[17] These differences in both use patterns and reasons for vaping based on age suggest that different approaches may be warranted for older versus young adult WTQL callers, as motivations may affect expected use duration and expectations for quitting.

Our data show that approximately 80% of callers to the WTQL who use e-cigarettes intend to quit vaping in the next 30 days. These rates did not differ markedly between age groups and were higher than prior studies that reported between 50% and 65% of adult e-cigarette users intending to quit.[18] Although callers to the WTQL aren't specifically asked if they are calling for assistance to quit e-cigarettes, their intentions to quit suggest they may view the WTQL as a quit resource. Given the lack of data on how to help e-cigarette users quit, these results highlight the importance of identifying how quit lines can best support e-cigarette cessation attempts. It is also important to understand how best to help dual users quit both cigarettes and e-cigarettes.

Finally, this study shows that tobacco product use is dynamic and requires continued monitoring to identify and respond to changes in use patterns over time. E-cigarette use in callers to the WTQL peaked in the 3rd quarter of 2019, which coincided with the EVALI outbreak during which e-cigarette users were becoming ill and occasionally died.[16] While this was ultimately determined to be related to vitamin E acetate used in counterfeit tetrahydrocannabinol (THC) vape devices,[19] the initial concern was that the disease was the result of vaping e-cigarettes, and the media extensively highlighted this possible connection. The peak in young adults calling the WTQL during this timeframe was dramatic and provides additional support to the notion that young adults identified the WTQL as a valuable resource for quitting e-cigarettes.

This study has limitations. First, we examined quit line data from a single state, thus the findings may not be generalizable to other states or regions of the country. Second, detailed e-cigarette use questions were asked only for approximately 2 months per year, resulting in a smaller number of responses for those detailed

Table 2. Tobacco Product Use Patterns and Characteristics of E-cigarette Use Among Wisconsin Tobacco Quitline Callers, 2016-2020

	Total Sample	18-24 years	25-44 years	45-64 years	65+ years
Tobacco Product Use Pattern					
E-cigarette only, N (%)	201 (0.8)	28 (3.8)[a]	77 (1.0)b	79 (0.6)[c]	17 (0.4)[d]
Dual user, N (%)	2,768(10.4)	192 (26.3)[a]	1,183 (15.1)[b]	1,073 (8.1)[c]	320 (6.6)[d]
Cigarette only, N (%)	22,816 (85.4)	492 (67.4)[a]	6,315 (80.5)[b]	11,676 (87.9)[c]	4,333 (89.3)[d]
Other tobacco, N (%)	920 (3.4)	18 (2.5)	273 (3.5)	448 (3.4)	181 (3.7)
Total	26,705	730	7,848	13,276	4,851
E-cigarette assessments					
E-cigarette frequency (days/mos), M (SD)†	11.9 (11.1)	17.1 (13.8)[a]	11.9 (11.2)[b]	11.2 (10.7)[b]	11.6 (10.0)[a,b]
E-cig used to cut down other tobacco, N (%)††	367 (68.6)	23 (53.5)[a]	132 (62.0)[a,c]	167 (76.3)[b]	45 (75.0)[b,c]
Want to quit e-cigarette, N (%)‡	401 (79.6)	32 (78.0)	168 (81.6)	158 (77.1)	43 (82.7)
E-cigarette nicotine, N (%)‡‡	452 (76.4)	39 (90.7)[a]	184 (80.3)[a]	182 (70.3)[b]	47 (77.0)[a,b]

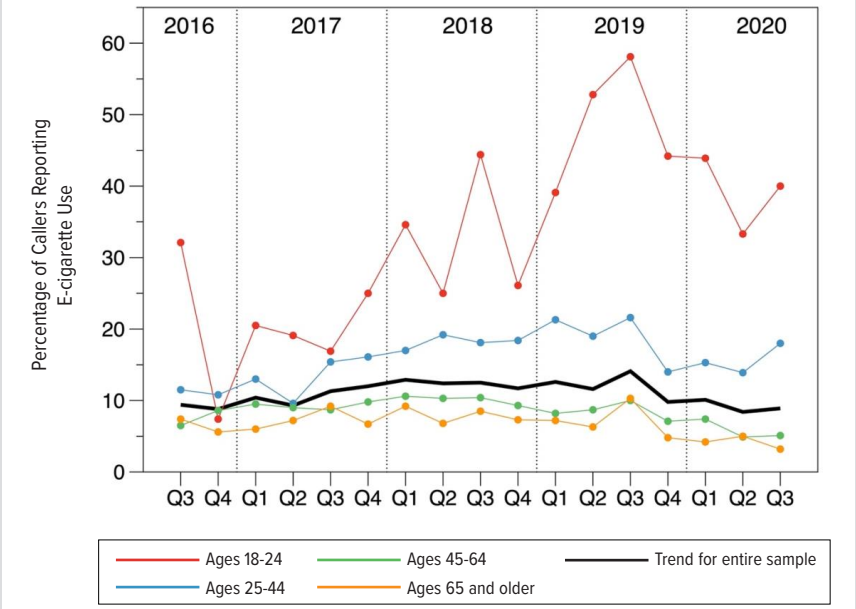
Note: Values in the same row not sharing the same subscript ([a,b,c,d]) differ significantly at $P < 0.05$. Subscripts omitted for rows with no significant pairwise comparisons.
†Limited to 313 callers administered the assessment (18-24 years, n = 21; 25-44 years, n = 118; 45-64 years, n = 132; 65+ years, n = 2).
††Limited to 535 callers administered the assessment and providing a valid response (18-24 years, n = 43; 25-44 years, n = 213; 45-64 years, n = 219; 65+ years, n = 60).
‡Limited to 504 callers administered the assessment and providing a valid response (18-24 years, n = 41; 25-44 years, n = 206; 45-64 years, n = 205; 65+ years, n = 52).
‡‡Limited to 592 callers administered the assessment and providing a valid response (18-24 years, n = 43; 25-44 years, n = 229; 45-64 years, n = 259; 65+ years, n = 61).

Table 3. Wisconsin Tobacco Quit Line Call Volume and Reported E-Cigarette Use by Year and Age Group

	2016†	2017	2018	2019	2020‡
Call Volume	**Calls**	**Calls**	**Calls**	**Calls**	**Calls**
Total (calls/month)	2,321 (387)	6,848 (571)	6,944 (579)	6,719 (560)	3,873 (352)
18-24 years (%)	107 (4.6)[a]	275 (4.0)[a]	112 (1.6)[b]	145 (2.2)[c]	91 (2.3)[c]
25-44 years (%)	776 (33.4)[a]	2,066 (30.2)[b]	2,012 (29.0)[b,c]	1,852 (27.6)[c]	1,142 (29.5)[b]
45-64 years (%)	1,159 (49.9)[a,b]	3,509 (51.2)[a]	3,406 (49.0)[b]	3,322 (49.4)[b,c]	1,880 (48.5)[b,d]
65+ years (%)	279 (12.0)[a]	998 (14.6)[b]	1,414 (20.4)[c]	1,400 (20.8)[c]	760 (19.6)[c]
Callers Reporting E-Cig Use	**N (%)**	**N (%)**	**N (%)**	**N (%)**	**N (%)**
Total	212 (9.1)[a]	724 (10.6)[b]	860 (12.4)[c]	815 (12.1)[c]	358 (9.2)[a]
18-24 years	21 (19.6)[a]	55 (20.0)[a]	36 (32.1)[b]	72 (49.7)[c]	36 (39.6)[b,c]
25-44 years	87 (11.2)[a]	274 (13.3)[a,b]	366 (18.2)[c,d]	354 (19.1)[d]	179 (15.7)[b,c]
45-64 years	86 (7.4)[a,b]	323 (9.2)[b,c]	346 (10.2)[c]	285 (8.6)[b]	112 (6.0)[a]
65+ years	18 (6.5)[a,b]	72 (7.2)[b]	112 (7.9)[b]	104 (7.4)[b]	31 (4.1)[a]

†Based on 6 months of data from 2016.
‡Based on 11 months of data from 2020.
Proportions in the same row not sharing the same subscript ([a,b,c,d]) differ significantly at $P < 0.05$.

Figure. Trends in Callers to the Wisconsin Tobacco Quit Line Reporting E-cigarette Use



questions. This illustrates the importance of collecting additional data on e-cigarette users who call the WTQL. Third, there was a very small number of young adult callers, highlighting need to increase cessation motivation and quit line appeal among young adults. The WTQL added a texting option as part of its services in 2021, and this may increase engagement with young adult e-cigarette users.[20] Finally, the smaller number of "e-cigarette only" users (7% of total e-cigarettes users and <1% of all callers) limited our ability to perform meaningful comparisons of this group to "dual users" or "cigarette only" users.

CONCLUSIONS

E-cigarette use increased in callers to the WTQL over the period 2016- 2020 and was highest among young adult callers. Quit lines likely can play an important role in helping e-cigarette users—particularly young adults—quit, but additional research is needed to clarify how to achieve this outcome.

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