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Original Article

National trends and state-level variation in the duration of incoming quitline calls to 1-800-QUIT-NOW during 2012–2015

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Abstract

Introduction. The duration of incoming quitline calls may serve as a crude proxy for the potential amount of reactive counseling provided.
Aims. To explore whether call duration may be useful for monitoring quitline capacity and service delivery.
Methods. Using data on the duration of incoming quitline calls to 1-800-QUIT-NOW from 2012 through 2015, we examined national trends and state-level variation in average call duration. We estimated a regression model of average call duration as a function of total incoming calls, nationally and by state, controlling for confounders.
Results. From 2012 through 2015, average call duration was 11.4 min, nationally, and was 10 min or longer in 33 states. Average call duration was significantly correlated with quitline service provider. Higher incoming call volume was significantly associated with lower average call duration in 32 states and higher average call duration in five states (P-value <0.05). The relationship between call volume and call duration was not correlated with quitline service provider.
Conclusions. Variation in average call duration across states likely reflects different service delivery models. Average call duration was associated with call volume in many states. Significant changes in call duration may highlight potential quitline capacity issues that warrant further investigation.

Key words: 1-800-QUIT-NOW, call duration, cessation, counseling, quitline capacity, quitlines, tobacco control

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Introduction

Tobacco use remains the leading cause of preventable disease and death in the USA and worldwide (U.S. DHHS, 2014). Comprehensive state tobacco control programs, including telephone-based tobacco cessation services known as quitlines, have been shown to increase cessation and to be cost-effective (Fiore, 2008; U.S. DHHS, 2014). All 50 US states and the District of Columbia independently fund and contract with service providers to operate state quitlines that provide a variety of services, including cessation counseling, self-help materials, and, in many cases, cessation medications at no cost to tobacco users (Davis et al., 2015; Fiore, 2008; U.S. DHHS, 2014). State quitlines can be accessed through 1-800-QUIT-NOW, a national telephone portal which automatically connects callers with their state quitline based on the caller's area code.

State-level variation in quitline service offerings and service delivery is a result of the decentralized nature of quitlines in the USA (North American Quitline Consortium (NAQC), 2012b; Saul, Bonito, Provan, Ruppel, and Leischow, 2014). Most state quitlines offer multi-session counseling services through a combination of both incoming (e.g., reactive) and outgoing (e.g., proactive) calls. Many state quitlines begin the counseling process during the caller's first call (e.g., reactive counseling) and continue counseling over a series of subsequent proactive calls. Some state quitlines only register callers for counseling during their initial call and begin counseling during subsequent proactive calls (Saul et al., 2014). The number of counseling sessions offered to callers varies by state. Many state quitlines also offer certain subgroups of callers (such as uninsured and pregnant callers) more intensive counseling and a greater number of proactive counseling sessions (NAQC, 2012a).

According to the US Public Health Service Guidelines, there is a strong dose–response relationship between the amount of cessation counseling provided and successful treatment outcomes (Fiore, 2008). The Centers for Disease Control and Prevention's (CDC's) *Best Practices for Comprehensive Tobacco Control Programs* underscores the importance of ensuring that callers who want to talk to a quitline coach receive at least a 10-min reactive counseling call (CDC, 2014). Previous research has shown that most quit attempts are spontaneous and last less than 1 day (Hughes et al., 2014). Studies have also shown that quitline callers complete an average of two to three counseling

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sessions, which tends to be lower than the number of counseling sessions offered (NAQC, 2012a). The short-term and fleeting nature of quit attempts, combined with many callers not fully completing the counseling sessions they are offered, emphasize the importance on providing at least minimal reactive counseling when callers first contact the quitline.

The National Cancer Institute (NCI), which administers 1-800-QUIT-NOW, maintains data on all incoming (e.g., reactive) calls to 1-800-QUIT-NOW. These data include the duration of each incoming call (e.g., reactive calls) and are readily available on a daily basis. Detailed data on specific services and amount of counseling provided to callers from quitlines is collected and maintained by quitline service providers but is proprietary and not readily available. The measure of call duration for incoming calls to 1-800-QUIT-NOW represents total call length and does not indicate whether, or how much, reactive counseling was provided during each incoming call. Despite these limitations, in the absence of, or in advance of obtaining, more detailed data on quitline service provision, call duration for incoming (e.g., reactive) quitline calls may serve as a crude proxy measure of the amount of reactive counseling potentially delivered.

Few previous studies have examined quitline call duration. Two recent studies examined call duration as a secondary outcome or as an explanatory variable for cessation outcomes using clinical trials data (Bernstein, Weiss, Toll, & Zbikowski, 2016; Nemeth, Cooper, Wermert, Shoben, & Wewers, 2017). This is the first study to examine call duration as a primary outcome. In this study, we seek to understand whether call duration may be a useful measure for monitoring quitline capacity and service delivery. We summarized national trends in weekly average duration of incoming calls to 1-800-QUIT-NOW from 2012 through 2015. Because of differences in quitline services offered and service delivery models across states, we also examined state-level variation in average duration of incoming calls. To understand how periods of high call volume might influence call duration, we assessed the association between the number of incoming calls to 1-800-QUIT-NOW and average call duration, both nationally and by state.

Methods

Data and measures

We obtained data for all incoming calls to 1-800-QUIT-NOW from 2 January 2012 through 27 December 2015, for all 50 US states and the District of Columbia from the NCI. Data records are for each individual call received and do not represent unique callers. The data consist of all types of calls to 1-800-QUIT-NOW, including callers who are only being registered for quitline services; callers who are being registered for services and begin receiving counseling during the call; persons calling for general information; persons calling back for rescheduling or further counseling; and hang-ups, disconnects, wrong numbers, and prank calls. The data do not contain any information on call type, demographics or characteristics of callers, or service provided during each call. We assigned incoming calls to states based on the area code of callers. We calculated the duration of incoming calls (in min) based on the start and end times reported for each call in the 1-800-QUIT-NOW data.

Quitline hours of operation vary by state. Some states have live pick-up of calls available 24/7, while others have specific hours of operation. Of the 3,236,402 calls to 1-800-QUIT-NOW from 2012 through 2015, a total of 3,072,067 calls (94.9%) were received between 7 AM and 11 PM, local time. We restricted the data to times when the majority of incoming calls were received by omitting the 164,335 calls (5.1%) received before 7 AM or after 11 PM. To account for hang ups, wrong numbers, prank calls, or any potential system errors in tracking call length, we omitted outliers based on the distribution of incoming calls by duration. Of the 3,072,067 calls received between 7 AM and 11 PM, we omitted 46,361 calls (1.5%) that were less than 1 s and 45,329 calls (1.5%) that were 53 min or longer (Figure 1). The data used for this analysis includes 2,980,377 calls to 1-800-QUIT-NOW from 2 January 2012 through 27 December 2015 between the hours of 7 AM and 11 PM that were greater than 1 s and less than 53 min in length. Our analysis data include 92.1% of all incoming calls received by 1-800-QUIT-NOW during the study period.

We aggregated the data by state and week for each of the 50 states and the District of Columbia. Our analysis data set contains a total of 10,608 observations (51 states × 208 weeks). Our main outcome measure is average call duration (in min) per week. Our main explanatory variable is the number of incoming calls to 1-800-QUIT-NOW per week. To account for differences in the adult smoking population across states, we created a standardized measure of quitline call volume, which is the number of incoming calls per 100,000 adult smokers. Annual estimates of the number of adult smokers by state, for the years 2012 through 2015, were obtained from the CDC's Behavioral Risk Factor Surveillance System (CDC, 2019).

Analysis

First, we examined trends in average call duration and call volume by week, nationally, for 2012 through 2015. Next, we summarized average quitline call duration and call volume by week, nationally and by state, for the same period. Finally, to understand how much average call duration is influenced by the number of calls received, we estimated a multivariable linear regression model of average call duration as a function of weekly calls per 100,000 adult smokers. We estimated a pooled national model as well as separate state-specific models. Using the model results, we calculated the call volume elasticity of average call duration, which represents the percentage change in average call duration in a week associated with a given percentage change in incoming calls per 100,000 adult smokers during the week.

Our multivariable regression model includes control variables to account for state-level differences in tobacco control environments that are related to quit attempts and cessation, including per capita tobacco control program funding and state excise taxes on cigarettes. We also controlled for the percentage of the state population covered by comprehensive state or local smoke-free laws prohibiting smoking in workplaces, restaurants, and bars, which we calculated using US Census population data and comprehensive smoke-free air law coverage data from the US Tobacco Control Laws Database (American Nonsmokers' Rights Foundation (ANRF), 2017). We included a linear time trend variable to capture secular trends in call durations that may have occurred independent of other covariates in the model. The models incorporated indicator variables for each state to account for fixed differences in call durations across states and other unobserved potential state-level influences on call duration (e.g., other tobacco control policies and differences in quitline operations). When conducting descriptive analyses of the data,

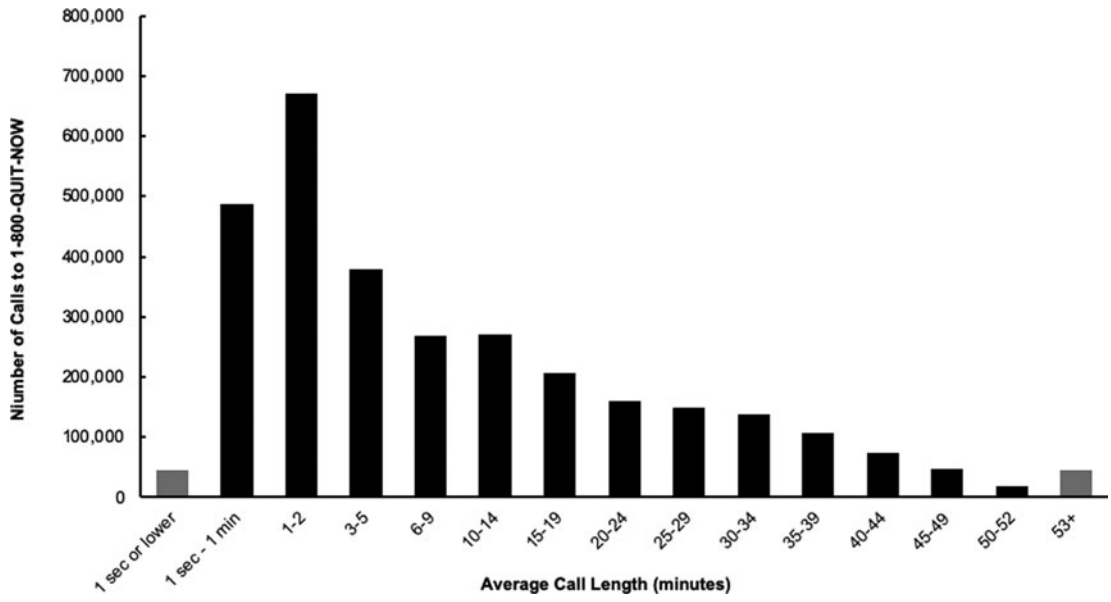

Fig. 1. Total incoming quitline calls to 1-800-QUIT-NOW by length of call, Monday–Sunday, 7 AM–11 PM, 2012–2015. *Notes*: Data are for all incoming quitline calls to 1-800-QUIT-NOW received during hours of 7 A.M. and 11 P.M. on any day of the week. Data include calls from individuals who are (1) only being registered for quitline services, (2) being registered for services and receive counseling during the call, (3) calling for general information, and (4) calling back for rescheduling or further counseling; hang-ups, disconnects, wrong numbers, and prank calls are also included. The data do not contain any information on call type, demographics or characteristics of callers, or service provided during each call.

we observed that state-level average call duration by week was significantly correlated with quitline service provider (χ^2 test for differences; P value <0.001). Among 13 states that changed quitline service providers during 2012 through 2015, nine experienced significant changes in average call duration after switching service providers. To control for the correlation between service provider and average call duration, we also included fixed effects for quitline service provider in our models. Based on our model results, we calculated call volume elasticity, which represents the estimated percentage change in average call duration per week that would be associated with a 1% change in total incoming calls per 100,000 adult smokers during a week. The elasticity estimates provide an indication of how sensitive average call duration is to short-term increases in quitline call volume.

Results

From 2012 through 2015, the average duration of incoming calls to 1-800-QUIT-NOW per week, nationally, was relatively stable and ranged from a low of 8.69 min during the week of 28 May 2012 to a high of 13.51 min during the week of 30 January 2012 (Figure 2). During the week of 28 May 2012, weekly calls to 1-800-QUIT-NOW peaked at 28,607, while average call duration was at its lowest level of 8.69 min per incoming call and was the only week when average call duration was less than 10 minutes. From 2012 through 2015, approximately 39% of the incoming quitline calls to 1-800-QUIT-NOW, nationally, that were included in our analysis were greater than 10 min.

Table 1 summarizes average call duration and number of incoming calls to 1-800-QUIT-NOW, nationally and by state. From 2012 through 2015, average call duration per week was 11.40 min (SD = 0.86), nationally. Average call duration varied widely by state, ranging from a low of 4.24 min in Arizona (SD = 1.27) to a high of 14.82 min in Delaware (SD = 3.10). Thirty-three states had an average call duration of 10 min or longer, three states had an average call duration per week between 9 and 9.99 min, and 13 states had an average call duration between 5 and 8.99 min. Only two states had an average call duration of fewer than 5 min. Average call duration by state was significantly correlated with quitline service provider (χ^2 test for differences; P-value <0.001).

Table 1 also presents the results from our multivariable linear regression model of average call duration as a function of incoming calls per 100,000 adult smokers. Model results indicate higher incoming calls per week were associated with lower average call duration, nationally (P-value <0.001). The relationship between call volume and average call duration was statistically significant (P-value <0.05) for 37 states. Higher incoming call volume per week was associated with lower average weekly call duration in 32 states and higher average weekly call duration in five states.

The estimated call volume elasticity of average call duration (calculated from our model results), nationally and by state, for the years 2012 through 2015, is also presented in Table 1. The call volume elasticity of average call duration was −0.05 nationally, which estimates that a doubling of incoming calls during a week was associated with a 5% reduction in the average call duration during the week. Of the 32 states with a statistically significant negative association between incoming call volume and average call duration (P-value <0.05), the associated call volume elasticities indicate that a doubling of incoming calls during a week would be associated with a decrease in average call duration ranging from 5% to 10% in 20 states, 12% to 20% in nine states, and 25% to 28% in the remaining three states. Only five states (District of Columbia, Idaho, North Carolina, Oregon, and South Carolina) had a statistically significant positive relationship between call volume and average call duration. In those states, a doubling of incoming calls per week would be associated with an average increase in call duration of 8%, ranging from 4% to 13%.

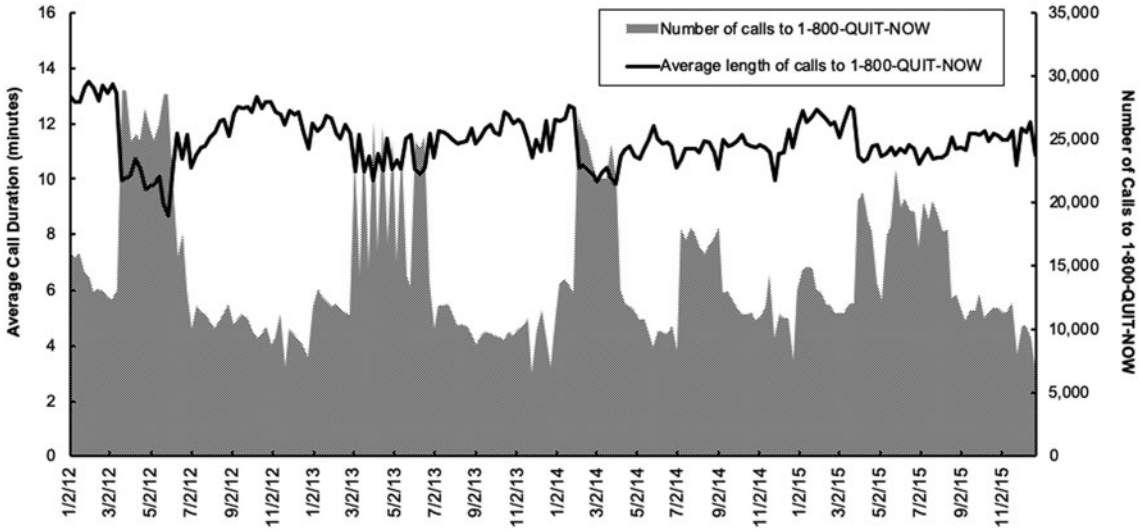

Fig. 2. National trends in quitline calls to 1-800-QUIT-NOW and quitline call duration (2 January 2012–27 December 2015). *Notes*: Data are for all incoming quitline calls to 1-800-QUIT-NOW received during hours of 7 A.M. and 11 P.M. on any day of the week. The data were further limited to calls with a duration of greater than 1 s and less than 53 min. Data include calls from individuals who are (1) only being registered for quitline services, (2) being registered for services and receive counseling during the call, (3) calling for general information, and (4) calling back for rescheduling or further counseling; hang-ups, disconnects, wrong numbers, and prank calls are also included. The data do not contain any information on call type, demographics or characteristics of callers, or service provided during each call.

Discussion

This is the first study to analyze quitline call duration as a primary outcome measure and to examine national trends and state-level variation in the duration of incoming quitline calls to 1-800-QUIT-NOW. CDC's *Best Practices for Comprehensive Tobacco Control Programs* recommends that callers who want to talk to a quitline coach should receive at least a 10-min reactive counseling call (CDC, 2014). Failure to connect quitline callers willing to participate in cessation counseling with a counselor immediately to begin the counseling process may result in missed opportunities to deliver an evidence-based intervention to tobacco users who are ready to make a quit attempt. Efforts to re-engage callers later to begin counseling may fail as previous research has shown that most quit attempts are spontaneous and last less than 1 day (Hughes et al., 2014). By the time those callers are reached at a later point, their openness to making a quit attempt may well have passed. This is also supported by previous research which shows that quitline callers tend to complete fewer counseling sessions than they are offered and that there is a fair amount of caller atrophy for multi-session quitline counseling services (NAQC, 2012a).

Call duration for incoming (e.g., reactive) quitline calls may serve as a crude proxy measure of the amount of reactive counseling potentially delivered. While the average duration of incoming (e.g., reactive) calls is not a direct measure of whether, or how much, reactive counseling was provided to quitline callers, it can still be used in analysis in the absence of or in advance of obtaining more detailed data on quitline service provision. From 2012 through 2015, national weekly trends in the average duration of incoming quitline calls were relatively stable at slightly more than 11 min per call and only fell below 10 min during 1 week (the week of 28 May 2012). Average call duration varied by state and was significantly correlated with quitline service provider, which likely reflects different quitline service delivery models. Quitlines could consider making sure that all quitline callers receive at least a minimal level of reactive counseling when they contact the quitline to address the importance of helping smokers at moments when they are ready to quit. The observed variation in average call duration across states should be explored further to determine whether cost-effective quitline service delivery models can be employed to ensure that each caller who is interested in receiving quitline counseling received at least 10 min of reactive counseling on the initial call to the quitline.

In this study, we also sought to better understand how average call duration might be influenced by periods of high call volume. Some state quitlines have previously employed strategies to handle large increases in call volume such as implementing an interactive voice response system or switching to registering callers for counseling during the initial call and beginning counseling services at a later time through a proactive call (NAQC, 2012b; Saul et al., 2014). These strategies may lead to shorter call durations and may also result in missed opportunities to provide callers with reactive counseling at a time when they are ready to make a quit attempt. From 2012 through 2015, increased quitline call volume was significantly associated with average call duration, both nationally (P-value <0.001) and in 37 states (P-value <0.05). Among the 37 states with statistically significant associations between incoming call volume and average call duration, increased call volume was associated with decreased average call duration in 32 states and increased call duration in the other five states. Unlike average call duration, the relationship between call volume and average call duration for states was not correlated with quitline service provider and was observed for all quitline service providers.

Our findings suggest that many state quitlines may have less capacity to engage in longer conversations with quitline callers during periods of high call volume. However, the magnitude of the association between incoming call volume and average call duration was relatively small. In the 32 states where increased call volume was significantly associated with decreased average call duration (P-value <0.05), a doubling of incoming calls in a given week was only estimated to be associated with a decrease in average

Table 1. Average duration and number of weekly incoming calls to 1-800-QUIT-NOW by state, 2012–2015

State	Duration of incoming calls to 1-800-QUIT-NOW (in min)		Incoming quitline calls to 1-800-QUIT-NOW			Model results: call volume elasticity of call duration (95% CI)[f]
	Average call duration per week (SD)[a]	Range: Min Max[b]	Average total calls per week[c]	Average weekly calls per 100,000 adult smokers (SD)[d]	Range: Min Max[e]	
National	11.40 (0.86)	8.69 13.51	14,341	2,543.33 (704.42)	1,255.42 4,481.82	−0.05*** (−0.06, −0.04)
Alabama	7.99 (3.65)	3.48 16.21	395	45.49 (23.87)	14.74 146.25	−0.20*** (−0.31, −0.09)
Alaska	14.43 (2.67)	1.03 23.16	97	88.20 (28.76)	38.27 246.01	−0.27*** (−0.34, −0.20)
Arizona	4.24 (1.27)	1.95 9.97	72	8.85 (7.61)	1.83 34.25	−0.07** (−0.12, −0.02)
Arkansas	13.87 (1.80)	9.32 20.00	465	84.52 (23.56)	30.73 157.65	−0.08** (−0.13, −0.02)
California	5.41 (1.53)	2.36 10.31	362	10.00 (7.85)	1.60 42.24	−0.03 (−0.08, 0.02)
Colorado	12.81 (1.19)	10.06 15.55	799	120.15 (25.50)	57.30 215.82	−0.09** (−0.14, −0.03)
Connecticut	12.53 (1.60)	8.21 16.66	292	66.84 (27.81)	25.91 265.05	−0.01 (−0.04, 0.03)
Delaware	14.82 (3.10)	7.55 25.27	34	24.54 (14.69)	6.45 63.08	−0.07** (−0.12, −0.02)
District of Columbia	10.75 (3.25)	3.81 16.89	98	97.76 (46.77)	27.93 259.33	0.12** (0.04, 0.20)
Florida	13.45 (1.56)	7.11 17.03	391	14.72 (10.75)	4.52 60.51	−0.10*** (−0.12, −0.08)
Georgia	13.00 (2.04)	8.49 19.80	227	15.44 (15.71)	1.43 58.45	−0.05*** (−0.08, −0.03)
Hawaii	14.11 (2.11)	8.81 19.70	131	84.40 (27.28)	39.85 203.76	−0.03 (−0.10, 0.03)
Idaho	13.15 (1.72)	7.56 17.66	138	72.64 (36.12)	26.87 261.84	0.04* (0.00, 0.07)
Illinois	5.88 (1.18)	2.52 8.99	313	17.35 (11.17)	5.43 51.96	−0.06** (−0.11, −0.02)
Indiana	11.95 (2.00)	6.86 17.72	431	36.88 (11.42)	15.76 63.90	−0.19*** (−0.24, −0.14)
Iowa	10.75 (0.93)	5.65 13.62	515	123.43 (30.34)	61.14 250.09	−0.01 (−0.07, 0.05)
Kansas	10.88 (2.13)	6.09 17.26	93	22.34 (10.98)	7.00 59.36	−0.10*** (−0.16, −0.05)
Kentucky	10.60 (1.79)	6.40 16.21	186	20.04 (13.70)	4.31 65.80	−0.07*** (−0.11, −0.04)
Louisiana	10.84 (1.53)	6.08 15.33	254	29.61 (16.56)	6.41 65.64	−0.01 (−0.05, 0.02)
Maine	9.50 (4.86)	0.95 22.46	19	9.04 (6.68)	0.94 45.14	−0.10* (−0.20, 0.00)
Maryland	13.42 (1.62)	9.29 18.69	425	59.97 (30.35)	20.17 210.05	−0.05*** (−0.08, −0.03)
Massachusetts	5.52 (2.80)	2.17 12.77	183	22.46 (12.42)	5.89 64.55	0.11 (−0.01, 0.23)
Michigan	10.55 (1.62)	4.81 14.53	393	22.54 (14.49)	6.14 111.14	−0.12*** (−0.15, −0.09)

(*Continued*)

Table 1. (*Continued.*)

State	Duration of incoming calls to 1-800-QUIT-NOW (in min)		Incoming quitline calls to 1-800-QUIT-NOW			Model results: call volume elasticity of call duration (95% CI)[f]
	Average call duration per week (SD)[a]	Range: Min Max[b]	Average total calls per week[c]	Average weekly calls per 100,000 adult smokers (SD)[d]	Range: Min Max[e]	
Minnesota	10.28 (2.68)	3.96 20.13	61	8.16 (5.52)	2.01 28.01	−0.10*** (−0.15, −0.05)
Mississippi	5.19 (0.68)	3.05 7.16	330	62.27 (20.09)	22.08 133.05	−0.12*** (−0.18, −0.07)
Missouri	11.88 (2.01)	6.62 18.02	254	23.32 (13.90)	6.53 73.54	−0.08*** (−0.12, −0.05)
Montana	14.19 (1.70)	9.18 18.21	220	145.18 (46.37)	63.22 284.49	−0.13*** (−0.20, −0.06)
Nebraska	10.36 (1.40)	7.57 14.58	128	47.20 (10.68)	24.31 78.47	−0.10* (−0.18, −0.02)
Nevada	6.15 (2.84)	0.94 13.80	105	28.48 (17.36)	3.51 73.81	0.06 (−0.01, 0.14)
New Hampshire	6.30 (3.80)	2.00 18.13	42	23.69 (13.80)	3.40 85.68	−0.07 (−0.20, 0.06)
New Jersey	7.41 (2.38)	2.62 16.99	115	10.18 (9.04)	1.86 41.68	−0.06* (−0.11, −0.01)
New Mexico	14.33 (1.98)	9.49 20.55	288	96.16 (24.49)	49.68 171.71	−0.12*** (−0.18, −0.07)
New York	5.61 (1.41)	2.55 9.48	217	9.00 (8.65)	1.49 37.58	−0.01 (−0.03, 0.02)
North Carolina	12.96 (2.09)	4.83 20.26	744	48.30 (27.10)	14.09 187.48	0.05** (0.02, 0.09)
North Dakota	8.96 (2.13)	4.16 15.19	82	72.95 (24.78)	31.03 203.02	−0.13* (−0.23, −0.03)
Ohio	9.93 (1.26)	6.54 13.48	491	24.49 (13.97)	6.93 76.91	−0.06*** (−0.09, −0.03)
Oklahoma	14.47 (1.84)	9.28 19.47	1,082	162.71 (36.39)	75.81 259.17	−0.09** (−0.14, −0.03)
Oregon	13.03 (1.42)	7.90 16.27	262	49.54 (19.70)	16.42 121.77	0.07*** (0.04, 0.11)
Pennsylvania	11.93 (1.51)	7.43 14.95	798	37.96 (16.17)	13.46 94.76	−0.09*** (−0.13, −0.05)
Rhode Island	5.80 (3.61)	1.26 18.58	31	21.60 (13.44)	3.51 68.79	−0.02 (−0.17, 0.13)
South Carolina	11.91 (2.37)	6.14 19.08	575	71.50 (50.35)	9.94 260.42	0.13*** (0.10, 0.16)
South Dakota	7.17 (3.22)	0.12 20.48	13	9.74 (6.84)	0.74 37.62	−0.08 (−0.18, 0.02)
Tennessee	4.30 (1.00)	2.42 9.69	237	19.88 (14.76)	4.53 63.55	−0.16*** (−0.20, −0.11)
Texas	12.41 (1.61)	7.30 17.64	391	11.51 (10.54)	2.18 49.00	−0.06*** (−0.08, −0.04)
Utah	11.53 (1.79)	7.00 16.24	244	118.47 (46.21)	49.61 302.03	−0.25*** (−0.30, −0.19)
Vermont	13.50 (1.96)	9.11 20.31	68	84.31 (26.68)	33.33 276.53	−0.07* (−0.14, 0.00)
Virginia	9.47 (1.51)	5.05 14.36	214	18.49 (12.97)	3.71 59.08	0.00 (−0.03, 0.03)

(*Continued*)

Table 1. (*Continued.*)

State	Duration of incoming calls to 1-800-QUIT-NOW (in min)		Incoming quitline calls to 1-800-QUIT-NOW			
	Average call duration per week (SD)[a]	Range: Min Max[b]	Average total calls per week[c]	Average weekly calls per 100,000 adult smokers (SD)[d]	Range: Min Max[e]	Model results: call volume elasticity of call duration (95% CI)[f]
Washington	13.80 (1.94)	8.66 18.53	386	42.56 (14.03)	15.77 76.75	0.01 (−0.07, 0.09)
West Virginia	6.57 (1.35)	3.15 9.78	195	47.11 (20.12)	14.53 96.39	−0.01 (−0.06, 0.03)
Wisconsin	15.23 (2.36)	9.06 21.94	352	40.53 (15.23)	13.47 102.66	−0.16*** (−0.19, −0.12)
Wyoming	11.14 (3.80)	3.92 20.19	103	110.81 (56.05)	30.17 380.33	−0.28*** (−0.37, −0.18)

Notes: Data are for all incoming quitline calls to 1-800-QUIT-NOW received between the hours of 7 AM and 11 PM any day of the week and lasted longer than 1 s (s for seconds) and less than 53 min. Data include calls from individuals who are (1) only being registered for quitline services, (2) being registered for services and receive counseling during the call, (3) calling for general information, and (4) calling back for rescheduling or further counseling; hang-ups, disconnects, wrong numbers, and prank calls are also included. The data do not contain any information on call type, demographics or characteristics of callers, or service provided during each call.

[a]We first calculated the average duration of incoming calls for each of the 208 weeks in our study (2012-2015). We then took the mean of average weekly call duration across the 208 weeks to come up with a single measure of average call duration per week. The standard deviation of average weekly call duration across the 208 weeks in our study is presented in parentheses.

[b]Represents the range in average weekly call duration across the 208 weeks in our study (2012-2015). Presents the average call duration during the week with the lowest average call duration (min) as well as the week with the highest average call duration (max).

[c]We first calculated the total number of incoming calls received during each of the 208 weeks in our study (2012-2015). We then took a mean of total weekly incoming calls across the 208 weeks to come up with a single measure of average total incoming calls per week.

[d]We first calculated the total number of incoming calls received per 100,000 adult smokers for each of the 208 weeks in our study (2012-2015). We then took a mean of the weekly total number incoming calls per 100,000 smokers across the 208 weeks to come up with a single measure of average total incoming calls per 100,000 adult smokers. The standard deviation of the weekly total number of incoming calls per 100,000 adult smokers across the 208 weeks in our study is presented in parentheses.

[e]Represents the range in the weekly total number of incoming calls received per 100,000 adult smokers across the 208 weeks in our study (2012-2015). Presents the weekly total number of incoming calls received per 100,000 adult smokers during the week with the lowest total number of incoming calls per 100,000 adult smokers (min) as well as the week with the highest total number of incoming calls per 100,000 adult smokers (max).

[f]This column presents estimates of the call volume elasticity of call duration calculated from our multivariable model results. This elasticity measure represents the percentage change in average call duration per week associated with a given percentage change in total incoming quitline calls per 100,000 adult smokers during that week. Our multivariable linear regression models include state fixed effects as well as well as fixed effects for quitline service provider to control for the effects of the different service delivery models utilized by quitline service providers on average call duration. * *P*-value <0.05; ** *P*-value <0.01; *** *P*-value <0.001. A 95% confidence interval for each elasticity estimate is presented in parentheses.

call duration of 25% or greater (with a max of 28%) in three states. Findings from our study also suggest that some of the changes in average call duration may also be driven by changes in the demand for quitline services. State and national cessation media campaigns that feature the 1-800-QUIT-NOW number or advertise quitline services may prompt a larger number of individuals to call the quitline who may not already be familiar with quitlines or what services they provide or who may be in the earlier stages of quitting. Increases in the number of callers asking general questions or seeking information, which tend to be shorter calls, will result in lower average call duration. Conversely, increased call volume was significantly associated with higher average call duration in five states (*P*-value <0.05) which suggests there may have been greater demand for counseling services, or more caller engagement, in those states during periods of higher call volume.

This study has four notable limitations. First, the data consist of records for each individual call received, not unique callers. Second, these data only include incoming calls to 1-800-QUIT-NOW received by the quitline (e.g., reactive calls) and do not contain any information about outgoing calls made by the quitline (e.g., proactive calls). As such, these data do not contain the full course of quitline services provided to callers who enrolled in multi-session counseling services, which are a combination of reactive and proactive calls that occur over time. Third, the data include all incoming calls to 1-800-QUIT-NOW and do not contain any information that would enable us to differentiate incoming calls by type of call. Our data include incoming calls from individuals who (a) registered for and received counseling during the call, (b) registered for counseling but did not receive it during the call, (c) were not interested in counseling and only received self-help materials from the quitline, (d) were calling to ask general questions, (e) were calling the quitline back to reschedule an upcoming counseling call, and (f) were calling on behalf of someone else; the data also include wrong numbers and potential prank callers. Fourth, these data do not provide any information on the specific service provided or amount of counseling delivered during the call.

Despite its limitations, call duration may serve as a useful crude proxy measure for monitoring quitline capacity and service delivery. Data on the duration of incoming quitline calls to 1-800-QUIT-NOW is measured consistently for all incoming calls across all states and over time and is readily available on a near real-time basis. Better understanding the relationship between quitline call volume and average call duration, both of which data are available for on a daily basis, may help quitline service providers determine how and when to increase staffing in response to increased quitline call volume. This information may also help states and quitline service providers to prepare for upcoming national or state promotion of quitlines, such as mass media campaigns or other interventions that are likely to boost calls over a known period of time. Significant changes in call duration may also provide an early indication or warning of potential problems with quitline capacity or service delivery and may also highlight areas that warrant attention and further investigation with more detailed data on quitline operations and service provision. Being able to observe and respond to significant changes in average call duration may provide states and quitline service providers with opportunities to make operational

adjustments or change service delivery models to ensure that state quitlines have adequate infrastructure and capacity to meet demand for services and customer needs.

Implications for policy and practice

From 2012 through 2015, average duration of incoming calls to 1-800-QUIT-NOW tended to be shorter during periods of higher incoming call volume, nationally and in 32 states. This may indicate that state quitlines have less capacity to engage with callers during periods of high call volume.

Call duration for incoming quitline calls may serve as a crude proxy for the amount of reactive counseling delivered to quitline callers. Significant changes in call duration may provide an early indication of potential problems with quitline capacity or service delivery and may highlight areas that warrant attention and further investigation with more detailed data on quitline operations and service provision.

Findings from this study may encourage states and quitline service providers to explore whether there are cost-effective quitline service delivery models for providing quitline callers who want to talk with a counselor receive at least 10 min of reactive cessation counseling and to ensure that state quitlines have adequate infrastructure and capacity to respond to customer needs, particularly during times of increased call volume.

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Conflict of interest. None.

Ethical standard. This study did not involve human and/or animal experimentation.

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References

American Nonsmokers' Rights Foundation (ANRF). (2017). Summary of 100% smokefree state laws and population protected by 100% U.S. Smokefree laws. Retrieved January 2, 2017, from http://www.no-smoke.org/pdf/SummaryUSPopList.pdf.

Bernstein, S. L., Weiss, J. M., Toll, B., & Zbikowski, S. M. (2016). Association between utilization of quitline services and probability of tobacco abstinence in low-income smokers. *Journal of Substance Abuse Treatment*, *71*, 58–62.

Centers for Disease Control and Prevention (CDC). (2014). *Best practices for comprehensive tobacco control programs – 2014*. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health.

Centers for Disease Control and Prevention (CDC), National Center for Chronic Disease Prevention and Health Promotion, Division of Population Health. (2019). BRFSS Prevalence and Trends Data [online]. 2012–2015 [accessed September 6, 2019]. https://www.cdc.gov/brfss/brfssprevalence/.

Davis, K. C., Alexander, R. L., Shafer, P., Mann, N., Malarcher, A., & Zhang, L. (2015). The dose–response relationship between tobacco education advertising and calls to quitlines in the United States, March–June, 2012. *Preventing Chronic Disease*, *12*, 150–157.

Fiore, M. C. (2008). *Treating tobacco use and dependence: 2008 update (2008 update ed.)*. Rockville, MD: U.S. Department of Health and Human Services, Public Health Service.

Hughes, J. R., Solomon, L. J., Naud, S., Fingar, J. R., Helzer, J. E., & Callas, P. W. (2014). Natural history of attempts to stop smoking. *Nicotine & Tobacco Research*, *16*(9), 1190–1198.

Nemeth, J. M., Cooper, S., Wermert, A., Shoben, A., & Wewers, M. E. (2017). The relationship between type of telephone service and smoking cessation among rural smokers enrolled in quitline tobacco dependence treatment. *Preventive Medicine Reports*, *8*, 226–231.

North American Quitline Consortium (NAQC). (2012a). Quitline service offering models: A review of the evidence and recommendations for practice in times of limited resources. Retrieved February 4, 2016, from http://www.naquitline.org/?qiiissuepapers.

North American Quitline Consortium (NAQC). (2012b). Results from the 2011 naqc annual survey of quitlines. Retrieved February 4, 2016, from http://www.naquitline.org/?page=2011Survey.

Saul, J. E., Bonito, J. A., Provan, K., Ruppel, E., & Leischow, S. J. (2014). Implementation of tobacco cessation quitline practices in the United States and Canada. *American Journal of Public Health*, *104*(10), e98–105.

U.S. DHHS. (2014). *The health consequences of smoking – 50 years of progress: A report of the surgeon general*. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health.