



The relationship between type of telephone service and smoking cessation among rural smokers enrolled in quitline tobacco dependence treatment

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ABSTRACT

Quitlines are successful tools for smoking cessation, but no known study has examined whether type of phone service (cell phone only (CPO) vs. landline (LL)) impacts quitline utilization, quit attempts, and sustained cessation. This report details an observational study examining the association between phone service and quitline utilization and cessation among Ohio Appalachian adults willing to quit smoking and enrolled in a cessation trial from 2010 to 2014. A secondary analysis was conducted with data obtained from smokers enrolled in the Ohio Tobacco Quitline arm of a group randomized trial ($n = 345$). The intermediate outcome variables included number of calls, cumulative total call length, average call length, verified shipments of NRT, and 24-hour quit attempt. The primary outcome measure was biologically confirmed 7-day point prevalence abstinence from tobacco at 3, 6, and 12 months post treatment. Participants with LL service, on average, made almost one more call to the quitline and spoke 17.2 min longer over the course of treatment than those with CPO service. Those with LL service were more likely to receive a second 4-week supply of NRT. Phone service status was not associated with average quitline call length, receiving at least one NRT shipment, having made one quit attempt at the end of treatment, or biochemically confirmed abstinence at 3, 6, or 12-month follow-up. Participants with LL services completed more counseling calls, accrued a longer cumulative length, and received more NRT when compared with CPO service participants. However, type of phone service did not deter abstinence outcomes.

1. Introduction

Tobacco use remains the leading cause of preventable disease and death in the United States (US Department of Health and Human Services, 2014). Though smoking prevalence has declined over the last fifty years, 16.8% of US adults continue to smoke cigarettes (Jamal et al., 2015). Cigarette smoking increases the risk of heart disease, respiratory disease, and cancer (US Department of Health and Human Services, 2014). Quitting smoking lowers these risks, and those who quit by the age of 35 years have similar long-term risks as never smokers (Doll et al., 2004). The majority of U.S. adult smokers want to quit, and in 2013, approximately two thirds of smokers had made a serious quit attempt in the past year (Lavinghouze et al., 2015).

Despite decreased use in the overall population, smoking prevalence disparity has increased between socially advantaged and disadvantaged populations (Jamal et al., 2015). Today, tobacco use is concentrated among historically marginalized populations within the United States (Jamal et al., 2015). The burden of tobacco related health disparity is felt more intensely among the most vulnerable, including lower

socioeconomic status populations, along with racial and ethnic minorities (US Department of Health and Human Services, 2014; Jamal et al., 2015; Jarvis and Wardle, 2011). This increase in tobacco attributable health disparity is fueled by the differential rate at which vulnerable sub-populations are able to access cessation intervention and successfully achieve tobacco abstinence (Jarvis and Wardle, 2011).

Tobacco telephone quitlines are successful tools for smoking cessation, especially in reaching broad populations of users (Lien et al., 2016; Giskes et al., 2007; Stead et al., 2013). Since the turn of the century, telephone quitlines have been advocated for widespread use due to the availability of telephones even among populations living in isolated areas where medical services, including access to trained cessation specialists, are limited and among those with low socioeconomic status (Fiore et al., 2004; Fiore et al., 2008). Quitlines that offer multiple proactive calls and nicotine replacement therapy (NRT) are the most effective (Stead et al., 2013). Increased number of calls and intensity of use relate to higher quit success; however, most individuals do not utilize the quitline to the full extent (Lien et al., 2016; Stead et al., 2013). As quitlines are positioned to deliver effective cessation

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treatment to marginalized populations, with potential to help curb further growth of tobacco attributable health disparities in these communities, it is important to understand barriers for utilizing quitline services in populations where access to other cessation services are limited.

The Centers for Disease Control and Prevention has highlighted the need to ensure free telephone quitline accessibility to vulnerable populations with higher concentrations of tobacco use (Centers for Disease Control and Prevention, 2004). One model, endorsed recently by the tobacco control community (Tobacco Control Research Priorities Working Group of the NCI Board of Scientific Advisors, 2016) for use to identify novel behavioral components to enhance smoking treatment engagement and effectiveness with vulnerable populations, is the Capability-Opportunity-Motivation Behavioral (COM-B) System (Michie et al., 2014; Michie et al., 2011). The COM-B System, as it would apply to tobacco cessation with vulnerable populations, posits that *capability* (psychological and physical capacity to engage in cessation) and *opportunity* (physical and social factors that make cessation possible or prompt it) impact 1) *behavior change, directly*, and 2) *behavior change through motivation* (both reflective and automatic processes) to maintain effective engagement with cessation treatment necessary to achieve and maintain cessation (Michie et al., 2014; Michie et al., 2011). Use of the COM-B System framework offers a unique opportunity to uncover the physical and social context of engagement in smoking cessation for members of populations where smoking prevalence remains high despite smokers' willingness and desire to stop smoking and engage effective treatment (Sorensen et al., 2004; Sorensen et al., 2003). This type of investigation allows us to uncover why, despite offering effective and free telephone-based cessation services, individuals from vulnerable populations motivated to quit, in particular, are still under-utilizing quitlines.

Limited research is available that explores the capability and opportunity for accessing quitline cessation services in low-income and rural communities. One exception is the work of Sheffer and colleagues who identified that access to a phone for quitline services impacted > 1/3 of their study participants in a community-based participatory project in the Arkansas' Mississippi Delta, a region with a high concentration of rural, poor, African-American residents (Sheffer et al., 2016; Sheffer et al., 2011).

Since telephones are the means by which quitline services are utilized, it is important to question if individuals from high tobacco prevalence populations have access to phone service which will allow them to fully utilize the effective treatment offered by quitlines. One issue that could impact quitline utilization is phone service access type. In 2009, 22.9% of US households had cell phone only service (Blumberg and Luke, 2012), while in 2015, it more than doubled to 48.3% (Blumberg and Luke, 2016). With this shift to cell phone only use, especially among low-income individuals (Blumberg and Luke, 2016), access to effective treatment offered by quitlines should be further examined. A recent study reported that among individuals with restricted calling plans (e.g. Medicaid-issued phones), a robust use of the quitline could consume 22%–34% of the 250 monthly minutes available (Bernstein et al., 2016).

No known study has examined whether type of phone service impacts quitline utilization, quit attempts, and sustained cessation. The aim of this study was to examine the association between phone services (cell phone only (CPO) vs. land line (LL)) and cessation outcomes among Ohio Appalachian adults willing to quit smoking and enrolled in a trial utilizing the Ohio Tobacco Quitline to deliver cessation treatment. Given that the Ohio Appalachian region is home to more Medicaid recipients than the rest of the state, and that poverty also impacts a higher concentration of residents in this region (Ohio Medicaid Assessment Survey, 2015), we believed that phone access could impact quitline utilization and, therefore, cessation outcomes, even among residents of the region interested in quitting smoking. It was hypothesized that participants with CPO service would have fewer

calls, lower cumulative total call length, and lower average call length with quitline cessation counselors and would receive fewer shipments of NRT. It was also hypothesized that participants with CPO service would be less likely to make a quit attempt by the end of cessation intervention, and would be less likely to be abstinent 3, 6, and 12 months post cessation intervention enrollment.

2. Methods

2.1. Study overview

To examine the association of CPO versus LL phone service and phone-based cessation treatment and outcomes, an observational study using secondary analysis was conducted with data obtained from participants enrolled in the Ohio Tobacco Quitline arm (called here forth the Quitline cohort) of a recently published group randomized cessation trial (Wewers et al., 2016). The study was approved by the Ohio State University Institutional Review Board.

2.2. Procedure

To establish the Quitline cohort, community health workers, hired and trained by research staff, recruited smokers at geographically and socioeconomically diverse sites in six Ohio Appalachian counties. Eligible participants: 1) were age 18 or older; 2) self-reported combustible tobacco daily use; 3) resided in a participating county; 4) had no NRT contraindication; 5) were non-pregnant, if female; 6) agreed to participate in study protocol; 7) wanted to quit smoking in the next 30 days and 8) provided written informed consent. Enrolled participants completed a baseline in-person interview with a county-specific interviewer, hired and trained by research staff. Next, and unique to the Quitline cohort, participants met with the community health worker who explained the study protocol, including how to access the Ohio Tobacco Quitline for cessation assistance. Quitline services were administered by National Jewish Health® through a contract with the Ohio Tobacco QuitLine. Treatment, based on evidence-based best practice guidelines for telephone cessation intervention, included up to five proactive cognitive-behavioral telephone counseling calls and unlimited reactive calls from a trained Quitline counselor and free NRT (Fiore et al., 2008). Twenty-one milligram patches for daily use were distributed by the Quitline in two 4-week shipments following study protocol—the first shipment was disbursed via surface mail following the first counseling call, and the second shipment 4 weeks later following at least a second counseling call. All NRT shipments were approved by research staff, after verifying continued study enrollment. Follow-up in-person interviews were conducted at 3, 6, and 12 month post baseline by the same county-specific interviewer who conducted the baseline survey. All cessation counseling and NRT was delivered between baseline and the 3-month follow-up interview. Participants received a gift card in the amount of \$25 at the completion of both the baseline and the 12 month follow-up interviews, and a \$10 gift card at the completion of both the 3 and 6 month follow-up interviews. Additional information about study procedures may be found in the paper detailing the parent group randomized trial findings (Wewers et al., 2016).

2.3. Measures

2.3.1. Sociodemographic and tobacco-related characteristics

Age, gender, race, marital status, poverty level, education, household size, health insurance and employment status were collected at baseline survey. Other measures included depressive symptoms as assessed by the Center for Epidemiologic Studies Depression 10-item Scale (CES-D-10) (Radloff, 1977; Zhang et al., 2012), Heaviness of Smoking Index (Heatherton et al., 1989), Fagerström Test for Nicotine Dependence (FTND) (Heatherton et al., 1991), and past use of NRT.

2.3.2. Exposure variable of interest: phone service at baseline

Initially, a four-category phone service variable was created and included: 1) *Limited Cell Phone Service Only*: those participants reporting they only had a cell phone and within the past 6 months they had a) asked people not to call to save cell minutes, b) avoided answering their phone because of concern over minutes, or c) turned off their phone because they had run out of minutes; 2) *Unlimited Cell Phone Service Only*: those participants reporting only having a cell phone but who reported no limitations as described above in category #1; 3) *Landline Service Only*; and 4) *Both Cell and Landline Phone Service*. Subsequently, the categories were collapsed to create two phone service variables classified as: 1) cell phone only (CPO) phone service (categories 1 and 2 above), and 2) landline (LL) phone service (categories 3 and 4 above).

2.3.3. Intermediate outcomes

National Jewish Health® provided the research team with the following participant information: dates of quitline counseling call, length of counseling calls, and date and quantity/dose of NRT shipped. Based on this information, the following variables were created to include number of calls, cumulative total call length (in minutes), and average call length (in minutes). In addition, the verified shipment of 1st and 2nd 4-week supply of daily NRT patches were documented. At 3-month follow-up survey, participants were asked if they made at least one serious quit attempt (i.e. a 24 hour period of not smoking) during cessation treatment.

2.3.4. Primary outcome

The primary outcome measure was biochemically confirmed 7-day point prevalence abstinence from tobacco at 3, 6 and 12 months post-treatment, defined as self-report of no tobacco use in the past 7 days, confirmed by a saliva cotinine concentration of < 15 ng/mL, or by expired air carbon monoxide level of < 8 ppm when saliva cotinine could not be tested (i.e. if participant was using NRT at the time of interview or if a sufficient quantity of saliva could not be collected) (SRNT Subcommittee on Biochemical Verification, 2002). Others may select alternative cut-points in distinguishing tobacco users and non-users—especially when the indoor smoking environment is relatively smoke-free (Benowitz et al., 2009). However, our sample was drawn from the Appalachian region of the state, where smoking practices contributing to secondary smoke exposure are still more prevalent, despite state enacted smoke free air policies (Ohio Colleges of Medicine Government Resource Center, 2008). Newer cut-points are based on the assertion that the secondary smoke exposure has decreased substantially (Benowitz et al., 2009)—and although it has in most populations, residents of the Appalachian region encounter indoor smoke more frequently, in particular in the home environment (Ohio Colleges of Medicine Government Resource Center, 2008).

2.4. Statistical analysis

Data were analyzed in SAS 9.4. Sociodemographic characteristics were calculated for the entire sample, and by phone service category. Continuous variable means were compared using ANOVA, and categorical variable distributions using Fisher's exact tests. No correction was made for multiple comparisons or potential correlation by county; however, p-values are provided because they served as the basis for variable selection in regression modeling.

For the association between our outcomes and phone service, unadjusted random effects mixed models were first run to determine if correlation by county (the unit of randomization) would impact analysis. If the variance of the random effect for county was estimated to be greater than zero, multivariable random effects mixed modeling was performed. However, if the variance of the random effect for county was estimated to be zero, a multivariable linear regression for continuous outcome variables and multivariable logistic regression for binary outcome variables were run instead. Final multivariable models,

adjusting for confounders, were built using backwards selection. The initial set of potential confounders was all sociodemographic characteristics variables found to have differences (using $\alpha = 0.20$) by phone service group. Variables were removed, one-by-one starting with the largest p-value, until all remaining predictor variables were significantly associated to the outcome variable (at $\alpha = 0.05$). To assess if limited service among the CPO users impacted findings, this process was repeated, and final models were built using both the two and four categorical level phone service variables. The mixed models were fit in SAS using PROC MIXED and PROC GLIMMIX; linear regression and logistic regression models were fit using PROC REG and PROC LOGISTIC, respectively.

3. Results

3.1. Participation & baseline characteristics

Recruitment occurred in three waves from November 2010 through October 2014. To establish the Quitline cohort whose data was used for this secondary analysis, 433 people were screened, with 412 (95.1%) eligible for participation. Of those, 85.9% enrolled ($n = 345$). Among the participants with CPO service, 18.6% reported *limited service*. Given similar findings for both 2 and 4 category phone service variables, concerns over model fit given small cell sizes, and for the sake of parsimony, only 2 category (cell phone only (CPO) vs. landline (LL)) phone service analyses are presented here. Baseline characteristics of the analytic sample by phone service category are summarized in Table 1. Compared to LL participants, CPO participants were younger, less likely to be married or living with a partner and to have health insurance, and more likely to be employed. There were also significant differences in household size between LL and CPO participants.

3.2. Retention & cessation outcome summary for entire sample

A summary of outcome findings for the total sample is presented in Table 2. Eighty percent of the Quitline cohort completed a 3 month follow-up interview, 78% at 6-months, and 85% at 12-months. During the course of cessation treatment, sample participants called the quitline on average 2.8 times, with an average call length of 17 min and an average cumulative call length of 46 min and 30 s. Sixty-eight percent of participants completed at least one call and received a 4-week supply of NRT; 36% completed at least two calls and subsequently received a second 4-week NRT shipment. Nearly 77% of participants made a quit attempt by the end of treatment. For the entire sample, biochemically confirmed abstinence increased slightly from 8.5% at both 3 and 6-month follow-ups, to 10.7% at 12-months. Among participants reporting no past 7 day tobacco use, abstinence was evaluated by saliva cotinine in 88.8% of all cases. Expired air carbon monoxide was only used for tobacco abstinence confirmation in 6.7% of all cases because the participant was unable to provide a sufficient amount of saliva, and in 4.5% of cases because the participant was using NRT at the time of interview and saliva collection.

3.3. Relationship of phone service to cessation outcomes

3.3.1. Intermediate outcomes

In adjusted models, those with LL service, on average, made almost one more call to the quitline ($\beta = 0.81$, $p < 0.01$) and spoke 17.2 min longer to a quitline counselor over the course of treatment ($p < 0.01$) than those with CPO service. In addition, those with LL service were more likely to receive a second 4-week supplies of NRT (aOR = 1.72, $p = 0.02$). Phone service status at baseline was not associated with average quitline call length, receiving at least 1 NRT shipment, or having made one quit attempt by the end of treatment.

Table 1
Sociodemographic characteristics for total sample^a and by phone access status.

	Total (N = 354)	Phone access		p-Value ^b
		Access to cell phone only (N = 164)	Access to landline (N = 190)	
Age in years				
<i>mean ± SD</i>	46.7 ± 12.5	43.0 ± 12.0	49.9 ± 12.0	< 0.0001
Gender <i>n (%)</i>				
Female	247 (69.8%)	108 (65.9%)	139 (73.2%)	0.16
Race <i>n (%)</i>				
White	328 (94.3%)	153 (95.0%)	175 (93.6%)	0.65
Marital status <i>n (%)</i>				
Married/living with partner	157 (44.4%)	58 (35.4%)	99 (52.1%)	0.0019
Poverty level ^c <i>n (%)</i>				
Living at or below 100% poverty	56 (16.1%)	27 (16.8%)	29 (15.5%)	0.77
Health insurance status <i>n (%)</i>				
Insured	254 (72.0%)	107 (65.2%)	147 (77.8%)	0.012
Employment status <i>n (%)</i>				
Employed fulltime/part-time	177 (50.1%)	99 (60.4%)	78 (41.3%)	0.00042
Education <i>n (%)</i>				0.40
Less than high school (HS)	37 (10.5%)	18 (11.0%)	19 (10.2%)	
HS diploma	92 (26.2%)	48 (29.3%)	44 (23.5%)	
GED	30 (8.6%)	16 (9.8%)	14 (7.5%)	
> HS diploma or GED	192 (54.7%)	82 (50.0%)	110 (58.8%)	
Household size <i>n (%)</i>				0.014
1 household member	60 (17.0%)	30 (18.3%)	30 (15.8%)	
2 household members	127 (35.9%)	45 (27.4%)	82 (43.2%)	
3 household members	77 (21.8%)	38 (23.2%)	38 (20.5%)	
4 or more household members	90 (25.4%)	51 (31.1%)	39 (20.5%)	
County <i>n (%)</i>				0.56
1	59 (16.7%)	24 (40.7%)	35 (59.3%)	
2	70 (19.8%)	29 (41.4%)	41 (58.6%)	
3	59 (16.7%)	28 (47.5%)	31 (52.5%)	
4	67 (18.9%)	30 (44.8%)	37 (55.2%)	
5	40 (11.3%)	20 (50.0%)	20 (50.0%)	
6	59 (16.7%)	33 (55.9%)	26 (44.1%)	
Depression ^d <i>n (%)</i>				0.25
Significant depressive symptoms	236 (67.8%)	106 (64.6%)	130 (70.7%)	
Past use of NRT <i>n (%)</i>				0.51
Yes	141 (39.8%)	62 (37.8%)	79 (41.6%)	
Fagerström Test for Nicotine Dependence (FTND) score ^e				0.17
<i>mean ± SD</i>	5.19 ± 2.16	5.01 ± 2.24	5.34 ± 2.08	
Heaviness of smoking ^f <i>n (%)</i>				0.75
High dependence	177 (50.4%)	84 (51.5%)	93 (49.5%)	

^a Sample comprised of Ohio Appalachian adults willing to quit smoking and enrolled in a cessation trial from 2010 to 2014.

^b Differential distributions of characteristics by phone access status were analyzed using Fisher's exact tests for categorical variables and ANOVA for continuous variables.

^c Poverty variables are based on 2009 poverty guideline set forth by the U.S. Government. Both household income and household size are used to determine a household's income-to-poverty ratio. Income-to-poverty ratios represent the ratio of family income to their appropriate poverty threshold based on household size. Ratios below 1.00 indicate that the income for the respective family is below the official definition of poverty. Here an individual was classified as living in poverty if their household's income-to-poverty ratio was at or below 1.00.

^d Depression was measured using the CES-D-10 scale score, range: 0–30. A CES-D-10 score ≥ 10 indicates depressive symptoms of clinical concern.

^e A six item summary score comprise the Fagerström Test for Nicotine Dependence (FTND), range: 0–10.

^f Heaviness of Smoking is defined using FTND cut points: a FTND score of 1–2 = low dependence, 3–4 = low to moderate dependence, 5–7 = moderate dependence, 8+ = high dependence.

3.3.2. Primary outcome

Phone service status was also not associated with biochemically confirmed abstinence at the 3, 6, or 12-month follow-up. After controlling for marital status, the odds of achieving biochemically confirmed abstinence at 12-months post quitline cessation treatment were similar between LL and CPO phone service groups (aOR = 0.91, 95% CI (0.45, 1.82), p = 0.91).

4. Discussion

This observational study examined the association of type of phone service and cessation among Ohio Appalachian adults willing to quit smoking who enrolled in a treatment trial utilizing the Ohio Tobacco Quitline. The first hypothesis was partially supported as participants with LL services completed more counseling calls and accrued a longer cumulative length, when compared to CPO service participants. There was no difference in average call length by phone service group. The second hypothesis stating that biochemically-confirmed abstinence at 3,

6 and 12 months would be greater among LL service participants was not supported. While quit rates were modest, it is encouraging that type of phone service did not deter abstinence outcomes. Of concern, only 36% of participants completed a sufficient number of calls to qualify for the second shipment of NRT. Smith and others (Smith et al., 2013) have recommended that counseling calls emphasize the importance of pharmacotherapy as a way to enhance sustained abstinence.

This study was not without limitation. First, our findings have limited generalizability given study participants lived in the Ohio Appalachian region. Although there may be other social and contextual factors unique to this rural region impacting utilization of quitlines, as there was in the Arkansas' Mississippi Delta (Sheffer et al., 2016; Sheffer et al., 2011), the proportion of wireless only households among our participants is similar to what is found in other rural regions of the United States. According to the National Health Interview Survey, in the calendar half-year of July–December 2015, 43.1% of adults living in a non-metropolitan statistical area reported residing in a wire-less only household—compared to the 46.3% we found in Ohio Appalachia

Table 2

Outcome distribution for total sample & unadjusted and adjusted regression models assessing cell phone only (CPO, referent group) vs. landline phone access (LL) on smoking cessation intermediate and ultimate outcomes.

Outcome variable	Total sample (N = 354)	Unadjusted regression model			Adjusted regression model			
	mean ± SD (n)	β (difference in means)	95% CI	p	β (difference in means)	95% CI	p	Variables included in adjusted model
Number of calls with QuitLine counselor ^a	2.82 ± 2.51 (n = 354)	1.12	(0.603, 1.63)	< 0.0001	0.807	(0.284, 1.33)	0.0026	Age
Cumulative total call length in minutes with QuitLine counselor ^a	46.5 ± 45.2 (n = 354)	22.6	(13.4, 31.8)	< 0.0001	17.2	(7.93, 26.5)	0.0003	Age, household size
Average call length in minutes with QuitLine counselor ^a	17.0 ± 6.31 (n = 286)	1.37	(− 0.107, 2.85)	0.069	–	–	–	–

Outcome variable	Total sample (N = 354)	Unadjusted regression model			Adjusted regression model			
	# (%) (n)	OR	95% CI	p	OR	95% CI	p	Variables included in adjusted model
Sent at least one NRT shipment ^b	240 (67.8%) (n = 354)	0.722	(0.455, 1.15)	0.17	–	–	–	–
Sent two NRT shipments ^c	129 (36.4%) (n = 354)	1.99	(1.28, 3.11)	0.0025	1.72	(1.08, 2.73)	0.022	Age
Made at least one quit attempt by end of intervention ^c	173 (76.9%) (n = 225)	0.635	(0.330, 1.22)	0.17	–	–	–	–
Biochemically confirmed abstinence at 3 months ^c	30 (8.5%) (n = 354)	1.81	(0.822, 3.99)	0.14	–	–	–	–
Biochemically confirmed abstinence at 6 months ^c	30 (8.5%) (n = 354)	1.14	(0.537, 2.43)	0.73	–	–	–	–
Biochemically confirmed abstinence at 12 months ^c	38 (10.7%) (n = 354)	1.07	(0.546, 2.11)	0.84	0.908	(0.453, 1.82)	0.78	Marital status

Sample comprised of Ohio Appalachian adults willing to quit smoking and enrolled in a cessation trial from 2010 to 2014.

^a Presentation of findings from linear regression model; correlation by county not present in mixed linear model.

^b Presentation of findings from generalized linear mixed model, accounting for the correlation by county. This comparison is between participants who were sent at least one NRT shipment (including those that received two NRT shipments) and those who received no NRT shipments.

^c Presentation of findings from logistic regression model; correlation by county not present in generalized linear mixed model.

(Blumberg and Luke, 2016). Although it warrants further investigation, it is plausible to believe that phone access status may function similarly in relationship to quitline utilization in other rural US regions as it did here. Second, we are unable to make causal inferences about the relationship between phone access and quitline use and cessation due to the study design.

Finally, when modeling using the 4-category phone service variable, we had a small number of participants in the ‘limited CPO’ group. As with the 2-category variable, in unadjusted regression models the relationship between the 4-category phone access variable was significant for the number of calls and cumulative call length, and was not significant for sent at least one NRT shipment, made at least one quit attempt and the 3 biochemically confirmed abstinence time points. However, only 8.2% of the overall Quitline cohort reported limited cell phone access, and as such we had small cell sizes and were underpowered to run adjusted regression models. Therefore, we decided to only model and report phone access using the 2-category variable here. However, future quitline studies should consider adding survey items that measure limited phone service characteristics in order to determine if limited phone access impacts telephone quitline services utilized and cessation achieved, even when services and pharmacotherapy are offered for free. As others have suggested (Bernstein et al., 2016), CPO service providers should explore supporting a form of quitline call exemption as one way to promote utilization among low-income smokers.

This study found that even among residents of Appalachia motivated to quit smoking, cell-phone only phone access may limit engagement in effective telephone cessation treatment. As such, it can be viewed as a measure of physical capacity, a type of capability (according to the COM-B System), limiting treatment access by phone. This

occurred by means of fewer calls and shorter cumulative call length with telephone cessation treatment counselors, and through reduced access to NRT (Stead et al., 2013). Other capabilities and opportunities impacting quitline service engagement among those living in the region, in particular those with limited phone service, deserve further investigation (e.g. lapse in cell phone coverage in certain geographic areas, lack of access to chargers, etc.). These modifiable conditions, if addressed in the course of treatment, may facilitate more intensive utilization of quitline services among this vulnerable population.

Declaration of interests

There are no competing interests.

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