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ORIGINAL ARTICLE

Examining the significance of urban–rural context in tobacco quitline use: does rurality matter?

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Abstract
Objectives The purpose of this study was to examine the importance of urban–rural context as a determinant of call rates to smoking cessation lines.
Methods This study used individual level New Zealand Quitline call data from 2005 to 2009, and 2006 New Zealand Census data on smoking to calculate Quitline call rates for smokers. Negative binomial regression examined the relationship between call rates and a sevenfold urban–rural classification, controlling for age, sex, ethnicity and deprivation.
Results We found a significant urban–rural gradient in the rate of smokers calling Quitline. Rates were highest among smokers in main-urban areas [0.09 (95 % confidence interval (CI) = 0.089, 0.091)] decreasing with successive urban–rural classifications to the lowest rate in rural/remote areas [0.036 (95 % CI = 0.03, 0.04)]. This association was not confounded by age, sex, ethnicity or deprivation.
Conclusions Smokers in rural areas are less likely to use the New Zealand Quitline, even after controlling for confounding factors. This suggests that the national quitline is less effective in reaching rural smokers and more attention to the promotion of smoking cessation in rural communities is needed.

Keywords Quitline · Smoking cessation · Urban–rural · Geographical information systems

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Introduction

Telephone-based tobacco cessation programmes (quitlines) have been a prominent development in many countries over the last 30 years (Anderson and Zhu 2007; McAfee 2007; Ossip-Klein and McIntosh 2003). The last decade has seen quitlines becoming prevalent in nearly all richer countries and also in much of Latin America and parts of Asia (Anderson and Zhu 2007).

Quitlines are the important policy interventions. They are a cost effective means of reaching a large number of smokers and they can easily be promoted through advertising (Farrelly et al. 2007; Sheffer et al. 2010; Wilson et al. 2005). Meta-analyses suggest that they are effective in reducing the incidence of smoking—depending upon the extent to which the programmes provide additional support in terms of different therapies and counselling for those wishing to give up quit (Lichtenstein et al. 2010). For example, one randomized trial conducted for the California's Smokers Helpline showed that the rate of abstinence over a 12-month period for a group who received helpline counselling was 3.4 times higher than another group who did not receive counseling (Zhu et al. 2002).

There has been a huge growth in research on quitlines and their use in recent years. Much of this research has emanated from the US. However, there are also a significant number of European studies, as well as studies from Australasia, which provide insights into variations in

patterns of use and the effectiveness of quitlines in different national contexts.

This research falls into three main groups. One group of studies has concentrated on the effectiveness of quitlines as a method for smoking cessation, and has led to extensive evidence that smokers who attempt to quit using quitlines have a better chance of success (Borland and Segan 2006; Campbell et al. 2008; Li and Grigg 2007). A second group of studies has focused on temporal patterns of use and the factors that lead to increased utilization (Delnevo et al. 2006; Harwell et al. 2007; Li and Chen 2008; Wilson et al. 2007). Lastly, a group of studies has increasingly focused on group differences in patterns of quitline use, with most of the emphasis on socio-economic and ethnic differences in use and, to a much lesser extent, on geographical variations (Ortiz et al. 2008; Wilson et al. 2010; Zhu et al. 2011).

Few studies have examined urban–rural differences in quitline uptake. The majority of studies report higher call rates from urban areas. With few exceptions (Zhu et al. 1995), most studies tend to use simple binary urban–rural measures (Ortiz et al. 2008) rather than investigating more complex urban–rural differences. Furthermore, with the exceptions of one study from America (Sood et al. 2008), data for analysis are usually sought via questionnaires or small subsets of administrative data and covers local areas rather than whole countries.

This study examines the impact of urban–rural context on Quitline call rates in New Zealand using a much finer urban–rural classification than employed in most other studies. The study also explores the reasons for urban–rural differences in Quitline uptake. We use a national dataset, at a fine spatial level (Census Area Unit), which allows us to link in additional geographic and demographic information.

Methods

Data

This study used individual-level Quitline call data from 2005 to 2009. Quitline, run by the Quit Group and funded by the New Zealand Ministry of Health, was launched in 1999 after a successful pilot the previous year. It is a 6-day-week phone counselling service involving quit coaches. Awareness of Quitline is raised through mass media campaigns. The data period was chosen specifically as one where three groups, in particular, were targeted to enhance their participation in Quitline: younger people, the indigenous Māori population, and Pacific Peoples.

Data were obtained with permission from the Quit Group and provided caller sex, age, ethnicity and address. We focused on new callers to ensure an emphasis on the initiation of contact with the service and also to ensure that there was no bias between areas where higher rates of repeat callers may be observed. All addresses were geocoded to Census Area Unit (CAU), the second smallest level of aggregated data release in the New Zealand Census. Acceptable geocoding was possible with 84 % of our data. Calls from prisons, hospitals and callers with an address of a post office box were omitted because the usual place of residence of such callers is unknown—the small numbers involved (<1,000 callers) implied that their omission would not effect our analysis. Geocoding allowed us to link our administrative data to information on the deprivation level and urban–rural classification of a caller's CAU of residence. For this, we used New Zealand Deprivation Index 2006 (NZDep) quintiles and the 2006 New Zealand Census Urban–Rural Classification (NZURC) (Salmond et al. 2007; Statistics New Zealand 2009). The Urban–Rural classification aims to explore the diversity of the social and economic characteristics of people living in all areas of the urban–rural spectrum. As opposed to traditional methods which define urban and rural by population numbers, this classification re-categorises rural areas on the basis of the significance of urban areas as a source of employment. It identifies seven categories: three urban (Main Urban, Satellite Urban, Independent Urban) and four rural (Rural with High Urban Influence, Rural Area Moderate Urban Influence Rural with Low Urban Influence and Highly Rural/Remote).

To examine the penetration of Quitline between geographical areas and between different population groups, we further enhanced our dataset by linking information on regular smokers, taken from the 2006 New Zealand Census, the census closest in time to our Quitline dataset. Census data disclosure provisions protecting confidentiality dictated the process of this linkage. Callers aged under 15 were excluded as the census only asked about smoking among adults. Age was then categorized into four classes (15–29, 30–44, 45–59, 60+). Ethnicity was categorised as European, Māori and Other. Sex, NZDep and the NZURC remained as two, five and seven categories, respectively. Unpublished census data counts of people considering themselves as regular smokers were obtained for each of the 840 cells of the resultant five-way cross-tabulation for comparison with a similar cross-tabulation of the Quitline data.

Analysis

Analysis sought to assess the effect of urban–rural place of residence on the penetration of Quitline among smokers, controlling for confounding and mediation by age, sex,

ethnicity and (area) deprivation. We worked with the five-way data cross-tabulations introduced above. 'Other' ethnicity was excluded from the analysis as a chaotic construct artificially bringing together groups (Asian and Pacific Peoples) with very different smoking behaviours. Analytical units were, thus, 560 cells of the cross-tabulated Quitline and census data. For each cell, data were available on callers and smokers.

Two analytical strategies were considered: negative binomial regression and binomial outcomes-as-proportions regression. The former is reported with the choice of negative binomial regression reflecting the over-dispersed nature of the data with significant skew evident in the data on both callers and smokers. The outcome variable in our analyses was the count of callers with an offset reflecting the expected count proportional to the smoker population. Age, sex, ethnicity, NZDep and NZURC were categorical predictor variables. A sequential model-building process was followed beginning with demographic predictors and then adding deprivation and the NZURC separately and finally deprivation and the NZURC together. Interactions between predictors were explored. All analyses were conducted in SPSS v20.

Results

Table 1 sets out initial descriptive data on Quitline calls and their association with the denominator smoker population for each predictor variable. There were a total of 42,286 new calls to Quitline during the study period in the analytical dataset. The total smoker population was 514,065.

Women are substantially more likely to call Quitline than men. Calls fall off with increasing age, being some 3 % higher among the youngest group compared to the oldest. Māori are very marginally more likely to be callers. There is no clear relationship between deprivation and Quitline calling, although calling appears a little higher from CAUs in the three highest NZDep quintiles. Significantly for the concerns of this paper, there are clearer variations between call rates over the various categories of the NZURC, with call rates varying from over 90 per 1,000 smokers in main urban areas to 36 per 1,000 in the most remote rural localities. These variations indicate the possibility that smokers are much less likely to use Quitline, if they live in remote rural areas and, moreover, suggest that calling declines monotonically with increasing rurality and

Table 1 Basic descriptive statistics: New Zealand Quitline uptake 2005–2009

	Callers	Smokers	Call rate	Confidence Intervals
Sex				
Female	24,013	269,946	0.089	0.088–0.090
Male	18,273	244,119	0.075	0.074–0.076
Age				
15–29	15,719	169,185	0.093	0.091–0.094
30–44	14,913	174,894	0.085	0.084–0.087
45–59	8,534	120,114	0.071	0.070–0.073
60 and over	3,120	49,872	0.063	0.060–0.065
Ethnicity				
European	30,292	377,496	0.080	0.079–0.081
Māori	11,994	136,569	0.088	0.086–0.089
NZDep				
1 (low)	4,426	58,191	0.076	0.074–0.078
2	5,780	76,116	0.076	0.074–0.078
3	8,382	100,869	0.083	0.081–0.085
4	11,584	132,822	0.087	0.086–0.089
5 (high)	12,114	146,067	0.083	0.081–0.084
NZURC				
Highly rural/remote area	287	7,950	0.036	0.032–0.040
Rural area with low urban influence	1,810	38,139	0.047	0.045–0.050
Rural area with moderate urban influence	996	16,737	0.060	0.056–0.063
Rural area with high urban influence	743	11,967	0.062	0.058–0.067
Independent urban community	5,997	78,153	0.077	0.075–0.079
Satellite urban community	1,535	19,182	0.080	0.076–0.084
Main urban	30,918	341,937	0.090	0.089–0.091

Table 2 Independent effects on call numbers (new callers) to New Zealand Quitline 2005–2009 (incident rate ratios (IRR) and 95 % CIs; bold denotes significance)

	IRR	Lower CI	Upper CI
Intercept	0.64	0.42	0.97
Ethnicity			
Māori	**1.24**	**1.03**	**1.49**
European	1.00		
Gender			
Men	**0.79**	**0.65**	**0.95**
Women	1.00		
Age (years)			
60 and over	0.82	0.62	1.08
45–59	**0.75**	**0.58**	**0.97**
30–44	0.86	0.67	1.11
15–29	1.00		
Deprivation quintile			
5 (high)	0.77	0.57	1.05
4	0.92	0.68	1.24
3	0.90	0.67	1.22
2	1.05	0.77	1.43
1 (low)	1.00		
Urban–rural classification			
Main urban area	**2.23**	**1.53**	**3.23**
Satellite urban community	**2.21**	**1.50**	**3.27**
Independent urban community	**1.98**	**1.36**	**2.90**
Rural area with high urban influence	**1.52**	**1.01**	**2.28**
Rural area with moderate urban influence	**1.62**	**1.10**	**2.39**
Rural area with low urban influence	1.19	0.82	1.74
Highly rural/remote area	1.00		

is much more likely to occur from people living in CAUs in the main urban areas.

To explore this finding further, we report the results of our negative binomial regression controlling for factors that may influence the independent effect of urban–rural location (Table 2). Incidence Rate Ratios and their associated 95 % confidence intervals are reported as contrasts against a stereotypical young European woman caller living in a low deprivation CAU in a remote rural area. The results were consistent throughout the sequential model-building process, so we display only the final selected model. There is a clear independent association between calls to Quitline and Māori ethnicity with call levels from Māori being higher. Male smokers call the service less often. The age effects apparent in univariate analysis are not clear when other factors are taken into account. Smokers aged 45–59 make consistently fewer calls to Quitline in comparison to the reference group of the youngest smokers but other age groups' use of the service is statistically indistinguishable from that of young smokers. In contrast, the univariate suggestion that there is little association between calling and NZDep is borne out in multivariate analysis: the call levels from high deprivation areas are statistically similar to that from low deprivation areas.

Our key exposure variable was NZURC. The results of the negative binomial regression suggest that the association between calls to Quitline and NZURC is robust to the confounding and mediating effects of demographic variables and CAU level deprivation. The picture is generally one of an increasing use of Quitline as urbanisation increases although wider confidence intervals suggest a greater variance in uptake in the most urban areas. Smokers in the main urban areas of New Zealand are over twice as likely to use Quitline in comparison to the smokers in remote rural areas. Only in rural areas with low urban influence is the effect of increasing urbanisation not evident with confidence intervals suggesting that call levels are statistically similar to those in the most rural areas.

Further modelling, not reported here, did not identify significant interaction effects; confirming the main effects model reported in Table 2 as an appropriate summary of the impact of our chosen variables on Quitline uptake.

Table 3 explores the implications for the uptake of Quitline by different demographic groups across the range of urban and rural settings. It indicates the differences between the modelled and actual prevalence of calling by smoker population groups for each cell in the data cross-tabulation. We can interpret this table as showing the effectiveness of Quitline in terms of reaching different sorts of people in different sorts of places in that the table shows the gap between the expected uptake given age, sex, ethnicity, urban rural status and deprivation status, and the actual prevalence recorded in the administrative data. Positive values represent a higher proportion of callers than expected; negative values denote the opposite. The table shows how age, sex, ethnicity and NZURC work together to influence Quitline performance taking into account the relative size of the calling and smoking populations in each cell.

In general, Quitline outcomes reflected expectations; however, two cells stood out. We observed 6 % fewer Māori women Quitline callers aged over 60 than expected in Satellite Urban Communities. Paradoxically, the same group also achieves a call rate over 5 % above expectations in Rural Arexpected. More broadly, it appears thateas with High Urban Influence. Less marked evidence points to fewer calls than expected for Māori men aged over 60 in Satellite Urban Communities and Remote Rural Areas. Māori men and Māori women aged 15–29 and Māori women aged 30–44 in Satellite Urban Communities and Māori women aged over 60 in Independent Urban Communities also use Quitline less than expected. More

Table 3 New Zealand Quitline performance, 2005–2009: above or below predicted prevalence (%)

	Main urban	Satellite urban community	Independent urban community	Rural area with high urban influence	Rural area with moderate urban influence	Rural area with low urban influence	Highly rural/ remote area
European							
Female							
15–29	−0.35	−0.74	0.22	−0.92	0.63	2.11	1.09
30–44	0.38	−0.43	−0.07	0.33	−0.78	0.20	−0.81
45–59	0.30	0.84	0.27	1.98	−1.09	0.04	0.96
60 and over	−2.03	−1.77	−2.16	−1.29	−0.57	1.24	0.97
Male							
15–29	0.81	0.16	1.14	1.14	−0.34	0.54	−0.39
30–44	1.68	1.81	0.55	0.20	−0.58	0.12	0.31
45–59	0.22	−1.09	0.05	−0.12	−0.27	−0.17	−1.41
60 and over	−0.76	−1.03	−0.88	0.42	−0.02	0.08	−0.02
Māori							
Female							
15–29	−2.65	−3.24	−2.09	−2.06	−0.38	−1.78	1.52
30–44	−1.20	−3.09	−2.00	0.30	−2.23	−1.48	−1.68
45–59	0.11	−2.08	−0.63	−2.08	0.40	−0.84	0.99
60 and over	−2.02	−6.24	−3.25	5.29	1.68	−1.16	1.38
Male							
15–29	−2.17	−3.59	−1.82	−2.53	−0.50	−1.44	−2.19
30–44	0.70	−1.84	−2.01	−0.90	−0.99	−1.54	−2.58
45–59	0.38	−2.59	−0.58	−0.40	−0.67	−0.48	−0.85
60 and over	0.82	−3.83	−1.20	0.17	NA	0.18	−3.82

NA no data available

broadly, it appears that Quitline may be generally less successful in targeting Māori in Satellite Urban Communities and Independent Urban Communities, and Māori men in more rural locations. Conversely, call levels by Māori women aged over 60 in rural areas are generally above expected levels. Among Europeans, call rates are generally above expected levels for the youngest and the oldest groups of women in more rural areas and for men aged 30–44 in more urban areas. Older Europeans of both sexes call Quitline less often than expected.

Discussion

This study examined variations in call rates to the New Zealand Quitline from 2005 to 2009 with a particular focus on the extent to which the call rates varied by urban–rural location. As opposed to many other studies that use simple binary measures to define urban and rural, we used the seven-category Statistics New Zealand Urban–Rural Classification.

Three main findings can be highlighted. First, there is a distinct urban–rural gradient in the rate of smokers calling Quitline; with the highest call rates coming from main urban areas and call rates decreasing in each successive urban–rural classification down to the lowest rate in highly rural/remote areas. These differences are consistent with one North American study that found a significant over-representation of urban and metropolitan callers using telephone helplines for quitting smoking (Sood et al. 2008).

Second, after examining the call rates using negative binomial regression and controlling for age, sex, ethnicity and deprivation, there is still evidence of a significant urban–rural gradient in the rate of smokers calling Quitline. Smokers from main urban areas are over twice as likely to call Quitline than those living in highly remote and rural areas. While individual demographic factors were important predictors of calls to Quitline, these, in themselves, did not reduce the marked urban–rural gradient in the pattern of calls. This finding is similar to one UK study, which found after controlling for confounding factors, that there were significant differences in the intention to quit, with rural smokers more likely to continue smoking than their urban counterparts; in essence, urbanisation matters but deprivation does not. (Twigg et al. 2009).

Third, ethnicity proved to be more important than deprivation in predicting call rates. Māori call rates were higher than Europeans, which may reflect the impact of advertising targeted at Māori. A similar pattern has been observed in South Australia where rates of indigenous and non-indigenous callers were comparable (Cosh et al. 2013). Quitline could be attractive for Māori who are widely reported to be mistrusting of mainstream health systems (Harris et al. 2006). Quitline provides an 'arms-length' method to receive help quitting smoking without face to face contact—removing any opportunity for cultural humiliation, embarrassment or perceived racism. Even so, our analysis of Quitline performance (Table 3) shows that, for some sub-groups of Māori, Quitline use is less than expected particularly in Satellite Urban Communities.

Research, from the US, where rural smoking rates are higher, has emphasised the particular barriers facing rural smokers wishing to cease smoking (Hutcheson et al. 2008). These barriers include lack of cessation programmes, difficulties of access to health providers, rural poverty and fewer smoking restrictions and a higher volume of billboard advertising in densely populated urban areas. The extent to which the barriers are an important cause of lower rural call rates to the national quitline in New Zealand is difficult to ascertain. For example, In New Zealand, telephone ownership varies little by rurality (Statistics New Zealand 2008), nor are there rural–urban differences in access to information sources about Quitline, such as TV advertising. Furthermore, urban–rural differences in population composition do not appear to dictate variations in call rates in New Zealand as call rate variations persisted after controls for age, deprivation and ethnicity. It would appear that, in the context of the present study, there are clear differences in Quitline uptake between urban and rural areas; however more in-depth research needs to be undertaken to investigate why this is the case.

Limitations

Our study has limitations. First, we use Census 2006 data to represent smoking populations, rural–urban status and to determine deprivation among callers. This may be problematic in that smoking and deprivation levels among the population and within particular groups could have changed over our study period. In mitigation, using data from the most recent available census and approximately contemporaneous with our Quitline data has enabled us to base our analysis on the best possible national estimate of the denominator smoker population.

Second, in our study we have had to trust the accuracy of administrative Quitline data recorded over the telephone by customer representatives. Data recorded this way are unlikely to be completely accurate. In particular, it is likely to be problematic in its ethnicity recording, as many New Zealanders have mixed ethnicity yet our data ascribe each individual to a single ethnicity. The limitations of secondary administrative data are partially countered by the large size of our dataset. Moreover, our study contributes to the emerging academic interest in the utility of administrative data for research purposes.

Implications

We have shown that smokers residing in more rural areas are less likely to use the New Zealand Quitline, even after confounding factors have been considered. Our results point to the need to improve the delivery effectiveness of Quitline services in such areas. They also suggest a need to understand more clearly the contextual factors underlying geographic differences in the pattern of Quitline calls and develop nuanced explanations for why significant urban–rural differences exist in rates of engagement with Quitline services. More attention needs to be placed on rural smoker environments and how such settings impact on the desire to quit and the availability of different sources of support for quitting (Pearce et al. 2012).

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Conflict of interest None.

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