Social context and smoking cessation:
A multilevel study of social norms and collective efficacy

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Abstract

Objectives. This study examines neighborhood level social norms and collective efficacy, a measure of social control and social cohesion, in association with individual cigarette smoking cessation.

Methods. We model the hazard of quitting over a 5 year period among 4000 participants in the 2005 New York Social Environment Study (NYSES).

Results. Multivariable analysis using Cox-Proportional Hazard models showed that neighborhood level prohibitive smoking norms were significantly associated with individual smoking cessation (HR= 1.93 (95% CI=1.16, 3.21). The analysis did not find a significant association for the neighborhood collective efficacy measure nor significant evidence of the joint effects of collective efficacy and smoking norms on cessation.

Conclusions. Neighborhood normative change may be an effective avenue for encouraging smoking cessation.

Introduction

Researchers have long noted substantial variations in the rates of disease by region, state, county and neighborhood [1-3]. There is growing evidence that variations in rates of disease are not only determined by different distributions of individual characteristics, but also by the social and physical environments in which people live [4, 5].

Cigarette smoking has been identified as one of the most important sources of preventable morbidity and premature mortality worldwide. While rates of smoking have declined in the US, an estimated 45.1 million (20.8%) adults smoke [6]. Each year, smoking-related diseases claim 438,000 American lives [6]. Given the continued high prevalence of smoking, and the reduction in risk of disease and premature mortality provided by quitting [7] there is a need to identify factors that support or impede smoking cessation that could be targeted by intervention. Studying environmental determinants of smoking cessation has the potential to inform environmental approaches to intervention to complement more traditional individual behavior change approaches [8].

Existing research suggests that characteristics of neighborhoods shape the distribution of smoking [9-11]. There is evidence that smoking is higher in neighborhoods with lower socioeconomic status[12, 13]. A small set of studies that have examined other neighborhood level social exposures suggest that smoking is higher in neighborhoods with lower levels of collective efficacy, and norms that are more accepting of smoking [10, 11, 14]. The only study that has examined the relations between the neighborhood environment and smoking cessation found that there was more quitting in areas with higher socioeconomic status [10]. Examining other social environment characteristics in relation to smoking cessation could increase our understanding of how the environment shapes smoking cessation, and suggest avenues for environmental intervention.

The social environment may influence individual smoking cessation by giving rise to social norms that define the boundaries of permissible or desirable behaviors. Community social norms

are acknowledged as a contextual influence in the smoking literature however, they are typically studied using individual perceptions of norms rather than a group level measure of norms. Group level attitudes about health behavior influence an individual's likelihood of adopting that behavior. Situational norms and attitudes have been linked to alcohol consumption [15], dietary intake [13], and smoking prevalence [13, 14, 16].

While there is no literature directly examining group level social norms with smoking cessation, there are studies on the perception of social norms and smoking, as well as some linking social processes to cessation. Previous research has found that social norms surrounding smoking contribute to smoking behavior, including cessation, among adolescents [17]. Greater quit ratios have also been observed in immigrant communities within the US, pointing to a possible role of acculturation influencing behavior [18].

Collective efficacy is another aspect of the social environment that may influence smoking cessation. Collective efficacy encompasses the capacity of residents to control group level processes and to respond to community stressors. Groups with higher efficacy have agency to produce desired effects and limit undesired ones through their collective action [19]. Based on this theory, it is hypothesized that high levels of collective efficacy may be protective against negative health outcomes. Lower levels of collective efficacy have been associated with higher levels of violent crime and homicide rates [20], obesity in youth [21], and heart disease mortality [22].

There is limited research on smoking and collective efficacy and no previous studies have examined quitting and neighborhood level constructs. Related constructs of individual perception of social capital and social participation have been associated with smoking cessation [23-25]. The literature has shown that individual perception of collective efficacy and related constructs is associated with smoking prevalence. A few studies have examined individual level measures of perception of increased social capital and social cohesion, finding lower likelihoods of smoking [26, 27].

Thus, the literature supports the potential importance of smoking norms and collective efficacy in shaping cessation, although the associations have not yet been examined. Existing research also suggests a potential convergence of these environmental characteristics. A qualitative study in a community in Glasgow found that high cohesion and strong pro-smoking norms combined not only to foster smoking but also to discourage or undermine cessation [28]. These findings were substantiated in a quantitative multilevel study which found that in neighborhoods where norms were strongly anti-smoking, higher collective efficacy was protective against smoking, and the individual odds of smoking were lower [14].

Informed by the existing literature and expanding from previous analyses, this analysis examines whether the social environment of the neighborhood, as characterized by smoking norms and collective efficacy, is associated with individual smoking cessation. We tested three specific hypotheses: 1.) neighborhood norms that are less accepting of smoking have a positive association with the incidence of individual cessation; 2.) higher levels of neighborhood collective efficacy have a positive association with the incidence of smoking cessation; 3.) neighborhood smoking norms and collective efficacy will interact such that smoking cessation will be highest where levels of collective efficacy are high and norms are less accepting of smoking.

Methods

The study sample is comprised of participants in the New York Social Environment Study (NYSES). Conducted between June and December of 2005, the NYSES was a multilevel study designed to examine the relations between neighborhood environment characteristics and individual substance use outcomes. The 4,000 participants were contacted using a random-digit-dial telephone survey to households in 59 community districts across New York City. In each household, one adult, 18 years or older, whose birthday was closest to the date of interview, was interviewed by telephone. Interviews were conducted in either English or Spanish. 54% of those contacted and eligible agreed to participate in the study. Respondents were offered $10 in compensation for their participation. The study protocol was approved by the institutional review boards of the New York Academy of Medicine, the University of Michigan, and the University of California, Berkeley.

Neighborhood-level social environment exposures

Each respondent's address or nearest cross streets were geo-coded and linked to a neighborhood unit. We define the neighborhoods in this analysis as New York City's 59 community districts. Community districts were initially delineated by a resident consultative process organized by the Office of City Planning to reflect residents' own descriptions of neighborhoods in the 1970s and, as a consequence, represent recognizable neighborhood areas with which residents identify, such as the Upper East Side, or the South Bronx. The community districts are not arbitrary spatial units; instead they each share a political and social organization. Previous studies have associated these neighborhood areas with resident health and health behaviors [5, 14, 29-33].

Neighborhood measures of collective efficacy and social norms were the average of the individual responses of participants within each community district. Collective efficacy was assessed for each individual based on responses to likert sub-scales for social cohesion (5 items) and informal social control (5 items) developed by Sampson et al. [20]. Similarly, neighborhood smoking norms were generated by averaging individual responses to questions about the acceptability of smoking, developed by the National Survey on Drug Use and Health (NSDUH). Norms were defined as the proportion of residents who believed it was unacceptable for adults to smoke regularly.

Smoking cessation outcome

Smoking behavior and cessation was assessed using the World Mental Health Comprehensive International Diagnostic Interview (WMH-CIDI) tobacco module [34]. Research suggests that self-report of smoking is comparable to bio-markers of smoking [35] and that self-assessments are equivalent in-person and by phone [36]. Measures in the tobacco module of the NYSES, including retrospectively recalled ages of smoking initiation and cessation, were used in this analysis to define the study population and the cessation outcome, effectively reconstructing the longitudinal course of smoking and quitting prior to the study. This analysis examines time to incidence of quitting among the sub-population of those at risk (those who smoked more than one pack a week) during the five year interval preceding the survey. The five year interval was selected by balancing the need to have an adequate number of smokers and quitting events so that there would be sufficient power, against the desire to maintain consistency in the neighborhood measurements. The neighborhood measurements were only made once, at the time of survey, and we did not want to assume measures were constant over an unreasonably long period. Based on power calculations the five year interval was the shortest that provided reasonable power; it provided 76% power to detect a HR of 1.75 and 91% power to detect a HR

of 2.0. Individuals were classified as part of the analysis population of smokers if they ever smoked at least once a week for at least two months during the five year interval prior to the survey, and only the time that they were smoking and residing in the same neighborhood was considered as time at risk. If a person initiated smoking after 2000 or moved to the neighborhood after 2000, only their years as a smoker, residing the neighborhood were included. Information on current age, age at first smoking, age at quitting smoking, and age moved to the neighborhood were used to construct the study population. As these variables provide precision to the level of year intervals, we included individuals who had resided in the neighborhood for at least one year out of necessity. The outcome was incidence of quitting smoking, assessed by reported quit age. If a person quit more than once, only the first quitting event was included.

Confounders

Confounders of concern based on the literature included age, race and ethnicity, gender, marital status, place of birth, education, income, employment, years lived in the current neighborhood, and interview language, and smoking prior to residence in the current neighborhood.

Analysis

To account for the probability of selection for interview, we weighted analyses by to the number of persons in the household divided by the number of telephone lines. All analyses also accounted for non-independence of residents of the same community district by calculating robust variance estimates. To examine incidence of quitting across the 5 year period of the analysis, we modeled the hazard of quitting with Cox-Proportional Hazard models. The model estimates the hazard relating the yearly risk of quitting smoking to a change in the exposures of interest. Additional analyses were conducted for a range of analysis time periods from 6 to 10 years to assess the sensitivity of results to the 5 year time window selected.

This analysis involved three steps: 1) we first analyzed the relations between collective efficacy and smoking cessation and between smoking norms and cessation, unadjusted for other variables. 2) We then added individual-level confounders to each model to asses the adjusted relations of collective efficacy and smoking norms with quitting. 3) Finally we included an interaction between neighborhood collective efficacy and smoking norms to assess the potential combined association with smoking cessation.

Results

Of the 1,755 ever smokers in the NYSES study population, 863 were eligible for this analysis because they were at risk of quitting smoking during some portion of the five year period from 2000-2005. The analysis population contributed 3317 person years of time at risk for quitting. There were 127 events of smoking cessation over the study period.

The weighted study population characteristics are listed in Table 1. The cumulative incidence of quitting over the 5 year study period was 15.5% and the incidence density was 3.8 per 100 person/years. 43.7% of the sample was White, 27.9% African American, 22.9% Hispanic, and 5.5% were of another race/ethnicity. A large portion, 41.6%, of the sample reported incomes of less than $40,000 a year. Additionally, 56.5% of the sample was male.

Initial graphical examination of the shape of the relations between neighborhood exposures and smoking cessation suggested a threshold shape for the relation between neighborhood smoking

norms on quitting. Therefore, we considered the neighborhood exposures primarily as dichotomous measures (above or below the neighborhood mean) to capture the possible threshold effects, however we also report associations for continuous neighborhood measures. The continuous measures were centered and standardized with change of two standard deviations.

Bivariable analysis of the demographic characteristics by cumulative incidence of smoking cessation is detailed in Table 2. The only statistically significant (p<0.05) difference in smoking cessation incidence was observed by birth place, with those foreign born reporting higher quitting incidence, compared with those born in New York or another US city (p=0.02). Although not significant, other notable patterns included higher smoking cessation incidence among those of higher income, those married or separated (versus divorced, widowed or never married), those employed (versus unemployed), and those with more years residing in their neighborhood.

Initial analysis of neighborhood social environment factors and smoking cessation found that those living in neighborhoods in which smoking was less acceptable had a hazard ratio of 1.73 for quitting versus those in neighborhoods in which smoking was more acceptable [95% CI (1.11, 2.69)]. Figure 1 displays the survival curves for neighborhoods more versus less accepting of smoking, depicting the higher quitting rate in neighborhoods in which smoking is less acceptable. The crude relation between collective efficacy and quitting was not statistically significant. The point estimate indicated that individuals living in neighborhoods with high collective efficacy had decreased hazard of quitting than those in a lower measured neighborhood [HR= 0.73, 95% CI (0.47, 1.14)]. Consistent with other analyses of these data, two neighborhoods with outlier values for norms were removed from the norms analyses [14].

Multivariable Model

The results of the adjusted models examining relations of collective efficacy and smoking norms with smoking cessation are presented in Tables 3 and 4. The relation between collective efficacy and smoking cessation remained null, (HR=0.69 [95% CI =0.42, 1.13]). Results of models with the continuous collective efficacy measure exposures had similar results (HR= .75 [95% CI=0.45, 1.25]). Neighborhood smoking norms remained significantly associated with individual smoking cessation, controlling for covariates. Hazard of quitting smoking in a neighborhood where smoking is unacceptable are 1.93 times the hazard of quitting in a neighborhood with acceptable smoking norms (95% CI=1.16, 3.21).   The model with a continuous measure of smoking norms resulted in a measure of association in the same direction however the confidence interval crossed the null value, likely because the continuous measure did not capture the threshold shape of the relation (HR=1.95 [95% CI= 0.97, 3.08). There was no significant interaction between collective efficacy and neighborhood smoking norms in this analysis (p=0.55), thus we have not included an interaction term in the final model.

Sensitivity analyses conducted for time periods of 6 to 10 years suggested consistent magnitude and significance of relations for the binary norms measure. For the continuous norms measure, the magnitude and significance was similar for 6 years. For the 7, 8, 9 and 10 year time windows in the relation was stronger and statistically significant.

Discussion

This analysis furthers evidence of the contribution of social context to individual smoking

cessation. Our results did not support our first hypothesis that more collective efficacy would be associated with increased smoking cessation. However, our results did support our second hypothesis, showing increased smoking cessation in neighborhoods where smoking was less acceptable. Individuals in neighborhoods where smoking is an unacceptable behavior have significantly higher rate of quitting. Finally, we did not find support for the hypothesized combined effects of collective efficacy and smoking norms on smoking cessation.

Our finding of no significant relation between collective efficacy does not confirm previous research suggesting that constructs related to collective efficacy (social capital and social participation) are related to increased smoking cessation [23]. However, the majority of previous literature examining social context and smoking does not assess incidence of quitting [11, 12, 37, 38]. Pathways for initiation, maintenance, and cessation may be different. This is the first study directly measuring group-level collective efficacy, thus other measures of social context even when closely related may measure different social processes. While Lindstrom found an association of smoking cessation and social participation, there may be a conceptual difference between that construct and collective efficacy. Collective efficacy does not measure an individual's involvement in the community, rather the aggregate feeling that a residents can rely on each other to maintain social order.

These results support and advance the previous literature linking situational norms to incidence of quitting. While previous studies have found that individual perception of social norms and self efficacy are associated to cessation among adolescents, none have examined cessation and group norms among adults [17]. This analysis expands work within adolescent groups to demonstrate that social norms are important predictors of smoking cessation for adults in the neighborhood setting. The findings provide support for the possibility that the social norms are part of the cessation pathway that has been implied by research on regulatory change and smoking cessation [39-41]. The relation between smoking norms and smoking cessation has a threshold shape, such that the slope of norms and probability of quitting smoking was reduced at the midpoint of the scale. This suggests that there may be something unique about people who remain smokers in neighborhoods with strong norms against smoking. They may be more resilient against community norms, perhaps more isolated from the social processes of the neighborhood.

The results did not support our hypothesis of a combined relation between collective efficacy and smoking norms. A collective efficacy and smoking norms interaction was found in a smoking prevalence analysis of this data set [14], thus this result suggests that neighborhood processes may operate differently for smoking cessation than for overall smoking. Perhaps neighborhoods with high collective efficacy and norms against smoking are effective in preventing smoking onset, but individuals who are already smokers might feel more isolated in these settings. Future analyses could consider these questions explicitly.

We focused this analysis on first cessation within the 5 year timeframe. Given that relapse is common among people who quit smoking, it would be useful to consider the role of the social context in quitting maintenance in future research. The study included individuals who had resided in the neighborhood for over a year. Young people may be more likely to move within a short timeframe, and thus underrepresented in the sample. Restricting young residents, who are most likely to initiate smoking, and others who lack residential stability may have limited the generalizability of the study results. This analysis did not include structural factors that may shape smoking norms such as tobacco availability and density of advertising which both may affect smoking norms and shape smoking behavior [41]. Future research considering the role of

these structural factors in addition to norms would be informative in terms of their potential role in the generation of social norms in a community. The 54% response rate for the survey is also a limitation if participants and non-participants were substantially different in terms of the relations of interest in this analysis. The demographic profile of the study population is similar to 2000 Census measures of New York City overall, thus increasing confidence that the smokers in our population represent the general population of smokers. However the participants may still differ from those in the city overall in ways that we were unable to capture.

In spite of these limitations, the present study has several important strengths. The WMH-CIDI tobacco module allowed us to reconstruct survival data from the survey responses. The inclusion of neighborhood level social environment variables is a strength of this analysis. Smoking norms and collective efficacy are not based on an individual perception of community characteristics, but rather a measure based on responses of the general population (both smokers and non-smokers) in each neighborhood. Additionally, this study used a multi-level design examining group level norms linked to individual smoking cessation, as opposed to an ecological analysis of overall rates [11, 42].

Conclusion

This study advances our understanding of the role of the social context in shaping smoking cessation, suggesting that norms in the general community are related to incident quitting among smokers. The results lend support to the notion that the normative environment strongly shapes health behavior and should be considered as part of intervention efforts[8].

Tables

TABLE 1: Population characteristics

Characteristic	N (weighted)	%	Characteristic	N (weighted)	%
Smoking			Education		
Current Smokers	729	84.5	Less than high school grad	128	14.8
Quit Smoking	134	15.5	High school grad	207	24
Age			Some college	241	27.9
<25	135	15.7	College grad	173	20.1
25-35	171	19.8	Graduate work	114	13.2
35-45	173	20.1	Birth place		
45-55	196	22.7	New York City	517	59.9
55-65	114	13.2	Other US	158	18.3
>65	68	7.9	Another country	183	21.2
Race			Employment		
White	377	43.7	working full-time	427	49.5
Black or African American	241	27.9	Working part time	97	11.2
Hispanic	198	22.9	Looking for work or unemployed	116	13.4
Other	47	5.5	Retired	97	11.2
Income			Homemaker	35	4
< $40,000	359	41.6	Student	31	3.6
$40,000-$80,000	270	31.3	On leave	62	7.2
>$80,000	165	19.1	Years lived in neighborhood		
missing	69	8	0-7	289	33.5
Marital Status			7-21	304	35.2
Married	327	37.9	>22	270	31.3
Divorced	98	11.3	Sex		
Separated	52	6	Male	488	56.5
Widowed	57	6.6	Female	375	43.5
Never married	330	38.2			

Table 2: Bivariable analysis of the cumulative incidence of smoking cessation by covariates (weighted)

Characteristic	Quit		p-value	Characteristic	Quit		p-value
	N	**%**			**N**	**%**	
Age				Education			
<25	135	15.6	0.87	Less than high school grad	140	16.2	0.97
25-35	149	17.3		High school grad	142	16.4	
35-45	113	13.1		Some college	123	14.3	
45-55	129	14.9		College grad	128	14.8	
55-65	129	15		Graduate work	148	17.2	
>65	171	19.8		Birth place			
Race				New York City	123	14.3	0.02
White	127	14.7		Other US	96	11.1	
Black or African American	124	14.4	0.84	Another country	195	22.6	
Asian	131	15.2		Employment			
Hispanic	161	18.7		Employed	140	16.2	0.17
Other	117	13.5		Unemployed	93	10.8	
Income				Years lived in neighborhood			
< $40,000	118	13.7	0.3	0-7	112	13	0.24
$40,000-$80,000	123	14.3		7-22	135	15.7	
>$80,000	157	18.2		>22	155	18	
missing	197	22.8		Sex			
Marital Status				Male	140	16.2	0.54
Married	160	18.5	0.18	Female	125	14.5	
Divorced	101	11.7					
Separated	192	22.2					
Widowed	87	10.1					
Never married	117	13.6					

Table 3: Cox proportional hazard model of Adjusted Hazard Ratios and 95% confidence intervals for Social norms and smoking cessation

	Haz. Ratio		(95% CI)		
Smoking norms					
Acceptable	1.00				
Unacceptable	1.93	(	1.16	,	3.21	)
Age					
<25	1.38	(	0.58	,	3.28	)
25-35	0.86	(	0.37	,	2.00	)
35-45	0.64	(	0.31	,	1.30	)
45-55	1.00				
55-65	0.96	(	0.44	,	2.09	)
>65	0.99	(	0.37	,	2.67	)
Race					
White	1.00				
Black or African American	0.83	(	0.46	,	1.48	)
Hispanic	0.98	(	0.52	,	1.87	)
Other & Asian	0.25	(	0.05	,	1.19	)
Income					
>$80,000	1.00				
< $40,000	0.63	(	0.34	,	1.17	)
$40,000-$80,000	0.68	(	0.34	,	1.35	)
Sex					
Female	1.00				
Male	0.86	(	0.53	,	1.38	)
Marital Status					
Married	1.00				
Divorced	0.62	(	0.28	,	1.37	)
Separated	1.99	(	0.85	,	4.63	)
Widowed	0.39	(	0.12	,	1.31	)
Never married	0.84	(	0.45	,	1.57	)
Education					
College or graduate school	1.00				
Less than high school grad	0.96	(	0.50	,	1.83	)
High school grad	1.35	(	0.67	,	2.74	)
Some college	1.23	(	0.54	,	2.83	)
Birth place					
New York	1.00				
Other US	0.96	(	0.49	,	1.88	)
Another country	1.86	(	1.03	,	3.36	)
Employment					
Employed, student or retired	1.00				
Looking for work or unemployed (3)	0.87	(	0.46	,	1.66	)
Years lived in neighborhood					
0-7	1.00				
2-21	0.96	(	0.52	,	1.78	)
>22	1.37	(	0.69	,	2.74	)

Table 4: Cox proportional hazard model of Adjusted Hazard Ratios and 95% confidence intervals for collective efficacy and smoking cessation

|	Haz. Ratio		(95% CI)		
Collective efficacy					
Low	1.00				
High	0.69	(	0.42	,	1.13	)
Age					
<25	1.35	(	0.56	,	3.28	)
25-35	0.75	(	0.32	,	1.75	)
35-45	0.67	(	0.34	,	1.32	)
45-55	1.00				
55-65	0.98	(	0.47	,	2.04	)
>65	1.60	(	0.63	,	4.06	)
Race					
White	1.00				
Black or African American	0.97	(	0.54	,	1.73	)
Hispanic	1.12	(	0.61	,	2.04	)
Other & Asian	0.25	(	0.05	,	1.27	)
Income					
>$80,000	1.00				
< $40,000	0.66	(	0.37	,	1.18	)
$40,000-$80,000	0.65	(	0.35	,	1.24	)
Sex					
Female	1.00				
Male	0.90	(	0.57	,	1.44	)
Marital Status					
Married	1.00				
Divorced	0.61	(	0.28	,	1.31	)
Separated	1.84	(	0.79	,	4.26	)
Widowed	0.33	(	0.09	,	1.17	)
Never married	0.85	(	0.47	,	1.54	)
Education					
College or graduate school	1.00				
Less than high school grad	0.89	(	0.48	,	1.68	)
High school grad	1.10	(	0.56	,	2.17	)
Some college	0.98	(	0.44	,	2.17	)
Birth place					
New York	1.00				
Other US	0.91	(	0.46	,	1.77	)
Another country	1.70	(	0.92	,	3.12	)
Employment					
Employed, student or retired	1.00				
Looking for work or unemployed (3)	0.89	(	0.45	,	1.74	)
Years lived in neighborhood					
0-7	1.00				
2-21	0.94	(	0.51	,	1.73	)
>22	1.21	(	0.61	,	2.40	)
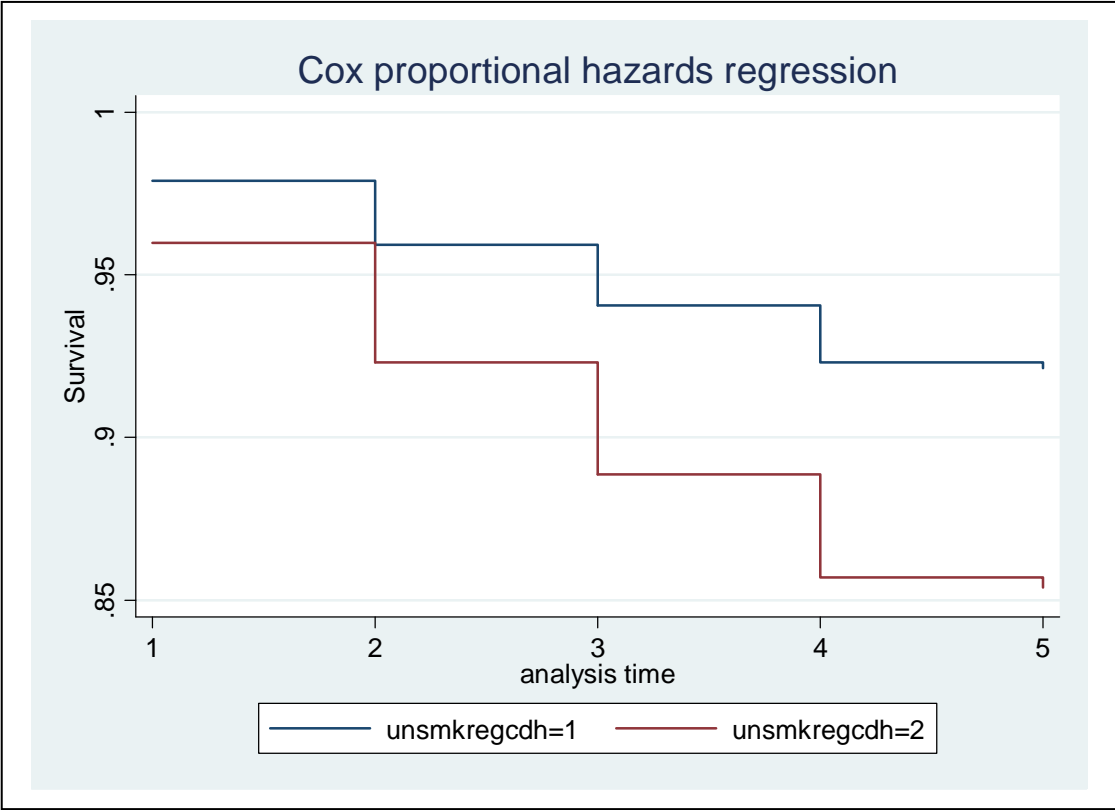
Figure 1

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