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## Effectiveness of tobacco control among Chinese Americans: a comparative analysis of policy approaches versus community-based programs

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### Abstract

**Précis**—City wide tobacco control policies such as cigarette taxes and smoke free air policies are effective among Chinese immigrants. In addition, community-based tailored tobacco control interventions may increase the reduction in smoking prevalence rates beyond that achieved from public policies.

**Objective**—To estimate the effectiveness of a tailored multi component community-based smoking cessation intervention among Chinese immigrants living in NYC, implemented within the context of state and city-wide tobacco control policy initiatives for the general population.

**Methods**—A pre-post-test quasi-experimental design with representative samples from Chinese populations living in two communities in NYC: Flushing, Queens, the intervention community and Sunset Park, Brooklyn, the comparison community. From November 2002 to August 2003 baseline interviews were conducted with 2537 adults aged 18–74. In early 2006, 1,384 participants from the original cohort completed the follow-up interview. During the intervention period (October 2003 to September 2005), both communities were exposed to tobacco control public policy changes. However, only Flushing received additional linguistically and culturally-specific community-level tobacco control interventions.

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**Results**—From 2002 to 2006 overall smoking prevalence among Chinese immigrants declined from 17.7% to 13.6%, a relative 23% decrease. After controlling for sociodemographic characteristics, there was an absolute 3.3% decrease in smoking prevalence attributed to policy changes with an additional absolute decline in prevalence of 2.8% in the intervention community relative to the control community.

**Conclusion**—City wide tobacco control policies are effective among high-risk urban communities, such as Chinese immigrants. In addition, community-based tailored tobacco control interventions may increase the reduction in smoking prevalence rates beyond that achieved from public policies.

### Keywords

smoking prevalence; tobacco control; Chinese immigrants; community-based research; intervention effectiveness

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## INTRODUCTION

Smoking prevalence in the US has declined from a high of 42% in 1965 to 20.9% in 2005 (CDC, 2006). Yet tobacco use remains the most important cause of preventable death in the US and is rapidly becoming the leading cause of preventable death worldwide. (DHHS, 2004) Smoking prevalence in China is particularly alarming (Wright and Katz, 2007). In 2001 male smoking rates were 60.2%. (Gu et al., 2004) Excess risk from tobacco related morbidity and mortality persists among Chinese Americans and recent immigrants. Estimates of smoking rates among Chinese males living in the US range from 28–38% compared to 23.9% among US born males. (CDC, 2006; Yu et al., 2002; Ma et al., 2002; Shelley et al., 2004)

A comprehensive approach to tobacco control that couples programmatic components (e.g. counter advertising and cessation services) with policy interventions (e.g. increased cigarettes taxes) is the most effective strategy to promote cessation. (Hopkins et al 2001; Hyland et al., 2006) In addition, while the impact of large community-based health promotion interventions is inconsistent, there is preliminary evidence that tailoring community-level interventions to reach high-risk segments of the population may enhance outcomes. (Fisher et al., 1995; Robinson, 2005; Sorensen et al., 1998; Merzel and D'Afflitti, 2003) However, the effectiveness of these tobacco control interventions for immigrant populations is not known.

In 2002 the National Cancer Institute's (NCI) Tobacco Research Program on State and Community Initiatives funded a five-year project to study the effectiveness of a culturally and linguistically-specific community-based intervention to reduce smoking prevalence among Chinese Americans by increasing access to and demand for evidence-based services. The intervention period (October 2003 to September 2005) coincided with implementation of several new tobacco control initiatives by the New York City Department of Health and Mental Hygiene (NYCDOH). Between 2002 and 2003 NYC enacted the Smoke Free Air Act (SFAA) which eliminated smoking from all indoor workplaces including restaurants and bars, increased the cigarette tax to \$3.00, distributed free nicotine replacement therapy and expanded educational efforts. (Miller et al., 2005; Frieden et al., 2005; Cummings et al., 2006)

NYC's aggressive tobacco-related policy initiatives, together with the NCI study protocol, provided a unique opportunity to assess the impact of tobacco-related policies on adult smoking prevalence among Chinese Americans and to analyze the additional effect of a tailored community based intervention.

## METHODS

### Study Design and Research Setting

The study design is a pre-post-test quasi-experiment with representative cohorts from two large Chinese immigrant communities: Flushing, Queens, the intervention community; and Sunset Park, Brooklyn, the comparison community. A multi component community-based intervention, based in behavioral theory and evidence-based smoking cessation programs, was conducted with the NYCDOH and community-based partners, including the American Cancer Society, Chinese Branch (ACS), and Asian Americans for Equality (AAFE) (Hopkins et al., 2001; Azjen, 1991). The hypothesis tested was that tobacco-related policies (i.e. cigarette tax and SFAA) plus a linguistically and culturally-tailored intervention, delivered through several community-based channels and organizations, would result in a greater decline in smoking prevalence compared with policy initiatives alone.

### Baseline Survey

From November 2002 to August 2003, household-based interviews were conducted by Westat, an independent contractor, with 1,372 adults aged 18–74 from Sunset Park, Brooklyn and 1,165 from Flushing, Queens. Eligible households from both communities were obtained from the white pages using a list of 867 unique spellings from 622 native surnames identified in consultation with Chinese linguists. The Wade-Giles (e.g., Hsiao) and pinyin (e.g., Xiao) representations of the original Chinese characters were used as both are represented in the white page listings. The overall response rate was 46.3% computed as a product of the screener response rate (59%) and the extended interview response rate (76%). Trained bilingual interviewers from the community used a comprehensive questionnaire to conduct interviews in English, Mandarin, Cantonese, Fukinese and other dialects. Details of the instrument development and sampling procedures are provided in a previous article (Shelley et al., 2006).

### Comparison of the Communities

Sunset Park and Flushing are communities with predominantly immigrant populations located in two separate counties (Brooklyn and Queens respectively) in NYC. In 2000 there were 71,827 Chinese immigrants living in Sunset Park and 34,902 living in Flushing (Census, 2000). These communities were chosen for their generally similar characteristics at baseline (NYCHVS, 1999). The large majority were first generation immigrants, with over 80% in both communities born in China (NYCHVS, 1999). There were no significant differences in the age distribution or the distribution of educational attainment. Median annual income was similar (Sunset Park: \$10,000–15,000 vs Flushing: \$20,000–25,000;  $p=0.36$ ). However, a significantly higher proportion of Chinese households were living at or below the 100% poverty level in Sunset Park compared with Flushing (24.0% vs 9.4%;  $p<0.001$ ). Our baseline survey revealed no significant differences in level of addiction among smokers in the two communities, a key predictor of smoking cessation (Hyland et al., 2004).

### Intervention

The intervention period was from October 2003 to September 2005. The research team incorporated key principles of community-based participatory research in the final development of the intervention protocol (Israel et al., 1998; Schulz et al., 1998; Burton et al., 2004). A community advisory board (CAB) was established by the lead community-based organization (CBO), AAFE, and was comprised of members from a wide range of organizations in the intervention community. The intervention was funded by the NYCDOH and focused on two key areas: a community-level social marketing campaign to increase demand for services and design of new programs to increase access to smoking cessation

resources. Focus groups with Chinese living in the intervention community and the guidance of the CAB were used to achieve linguistic and cultural acceptability in the Chinese community.

Public education occurred through a social marketing campaign which included the distribution of 1228 bilingual posters and Chinese-language educational materials (35,764 brochures with four themes) placed in local businesses, CBOs and health care settings in Flushing. Materials were also distributed and new programs promoted during local events (e.g. health fairs, Chinese New Year parade, Great American Smoke Out). All posters and brochures included AAFE's contact information and a focus group derived tag line "Quitting is hard, but you can do it". Distribution sites, including health care settings, were located through a detailed community map created by block walking all four census tracts representing parts of Flushing where the majority of Chinese residents work and live. The community map included 1,045 organizations/businesses.

Access to language-specific smoking cessation resources was accomplished through implementing the following new programs and services: 1) Physician education and detailing which included the distribution of "Tool Kits" to 99 physicians in 42 practices; 2) distribution of 305 six-week courses of free nicotine patches through ACS and AAFE; 3) implementation of three free Chinese-language smoking cessation programs that included free pharmacotherapy (one hospital-based and two located in community-based health centers); 4) a quit and win contest (50 participants) and; 5) 13 smoking cessation workshops conducted by ACS (122 attendees). The physician tool kit included Chinese language brochures for patients, office posters promoting the Chinese language smoking cessation helpline and prescribing materials for physicians.

No intervention activities were directed specifically at individual cohort members. Possible contamination between the intervention and control community was minimized by the fact that each county (Queens and Brooklyn) has its own thriving self-contained Chinese community. Our analysis indicated that only 7% of respondents who lived in Flushing worked in Brooklyn, and similarly, 6% of respondents living in Brooklyn worked in Flushing. Additionally, despite coverage of the free nicotine patch program in Chinese newspapers in both communities, no smokers from Sunset Park enrolled in this program.

The study intervention coincided with the launch of city-wide tobacco control initiatives sponsored by the NYCDOH. These included a cigarette tax increase of \$1.50 per pack, that when combined with the NY State excise tax raised cigarette taxes to \$3.00 per pack, and the enactment of the SFAA. NYCDOH also launched a citywide media campaign in English and Spanish however, they did not distribute a Chinese-language educational campaign during the intervention period. Appendix A summarizes components of the study intervention and NYCDOH policies. Supplemental information regarding the intervention is available by request to the authors.

### Follow-up survey

Between January and June 2006, 1,384 participants in the original cohort completed the follow-up interview, with 617 from Flushing and 767 from Sunset Park. To minimize attrition various methods were used to obtain new telephone numbers for participants who could not be reached at their last known number. For example, names of persons likely to keep in touch with participants if their address changed were collected at baseline and contacted if the participant was not able to be reached. Prior to fielding the follow-up survey, the baseline database of addresses was compared to the National Change of Address (NCOA) database, and for any new addresses provided through the NCOA search, a search for new telephone numbers linked to the new address was undertaken. Additionally, advance letters alerting respondents to the follow-up survey were sent to each respondent. Letters returned to Westat as undeliverable,

address unknown were submitted to multiple internet search engines to attempt to locate a new address and telephone number. All telephone numbers were called a minimum of seven times at different times of the day, evening and weekends.

## Measures

**Main outcome measure**—The primary outcome measure was change in cigarette smoking prevalence. In both the baseline and final survey smoking status was assessed with two questions: “Have you smoked at least 100 cigarettes in your entire life?” and “Have you smoked even a puff in the past 7 days?” Current smokers were identified by a positive response to both questions. Smoking prevalence was estimated as the percentage of adults who were identified as current smokers.

**Intervention Receipt index**—During the final survey, after smoking status was ascertained, all respondents were asked questions to assess exposure to the intervention and program participation. We calculated three separate “receipt indices”, each associated with perceived receipt of a major component of the intervention: 1) Exposure to components of the community-level social marketing campaign including recollection of the poster tag line and brochures; 2) Participation in public education programs, events and contests and; 3) Utilization of cessation resources (e.g. enrollment in free NRT program and counseling programs). An overall assessment was obtained by summing the three indices. For this summary measure each index was standardized by subtracting its mean (based on individuals in the comparison community) and dividing the remainder by its within community standard deviation (obtained from analyses of variance). Standardization was done so that the separate indices would have equivalent weights in the summary measure (COMMIT, 1995a).

## ANALYSIS

Baseline and follow-up age-sex-specific prevalence rates were estimated using all data from pre and post surveys weighted to represent the population. Differences between time periods and communities were tested for significance with Student’s t-test. To test whether the community-based intervention had an independent effect on smoking, we estimated a multivariate logistic regression model:  $Y_{it=2} = \alpha + \beta_1 X_{1it} + \beta_2 X_{2it} + \beta_3 X_{3it} + \beta_{4-7} X_{4-7it} + \epsilon_{it}$ , where  $Y_{it=2}$  = smoking status (0,1) of individual  $i$  in the follow-up period ( $t=2$ );  $\alpha$  = constant;  $X_{it}$  = characteristics of individual  $i$  in time  $t$ , where 1 is pre intervention and 2 is post intervention;  $X_1$  = 0,1 variable indicating residency in Flushing (intervention = 1) or Sunset Park (control = 0);  $X_2$  = 0,1 variable indicating time period (pre = 0, post = 1 intervention);  $X_3$  = a constructed 0,1 interaction variable ( $X_1 * X_2$ ) between community and time period {control vs intervention community (0,1) multiplied by pre-post time period (0,1)} so that 1 = post intervention in Flushing, all else =0, indicating the independent effect of the intervention, controlling for community effects,  $\beta_1$ , and time period effects,  $\beta_2$ ). Thus  $\beta_2$  provides an estimate of the independent effect of NYC-wide tobacco program and policy changes across communities over time, and  $\beta_3$  is the estimated additional effect of the community based intervention.  $X_{4-7}$  = a series of categorical demographic variables indicating age group, income level, education level, and proportion of years of life lived in the US; and  $\epsilon_{it}$  = error term. Percent years in US are included rather than years in US to adjust for the age at which individuals immigrated. We estimated the model using only males because of the extremely small number of female smokers (N=21 at baseline) and low smoking rates. We conducted a pre-specification test of the model by first estimating two separate regressions, one for each community using the demographic predictors of smoking behavior. An F-test revealed non significant differences.

We adjusted for non-response bias due to attrition in two ways. First, person-level weights assigned to each individual at baseline were re-calculated using a sample-based non-response adjustment applied to the base weight. Variables from the baseline interviews were examined as potential predictors for follow-up response propensity, e.g. demographic, household characteristics, geographic and survey design. Follow-up non-response adjustment classes were developed using SPSS CHAID for Windows. Since the two types of non-respondents (eligible non-response and non-locatable) were likely to have different characteristics, separate CHAID runs were performed to form two sets of adjustment classes (Rizzo and Hao, 2004). Once the non response adjustment classes were formed, the non response adjustment factors were calculated and applied to the base weights to derive the non response adjusted follow-up weight. The method for computing response rates adheres to American Association for Public Opinion Research (AAPOR) guidelines (AAPOR, 2000).

Second, we adjusted for possible unobserved response bias from smokers (beyond what was controlled explicitly by non response-adjusted weights described above), using a 2-stage process. In the first stage, using baseline data, response to the follow-up survey (0,1) was fitted to the variables percent years in US, health insurance status, and for smokers, addiction level as measured by two questions: “How many cigarettes do you smoke per day”, and “How soon after waking up do smoke”. In the second stage, the predicted probability of response from the first stage was entered into the final regression model. This response propensity control variable did not affect the model results and thus was dropped.

The individual is the unit of analysis. As in a randomized trial, we treat individuals in both “treatment arms”, i.e. communities, as independent observations (after adjusting for household clustering). Intraclass correlation coefficients of 0.00000 (95% C.I. = 0.00000–0.00143) by community, and of 0.072 (95% C.I. = 0.004–0.141) by households, reveal a heterogeneous group of immigrants with little clustering of smoking behavior by community or household. Differences in prevalence (change in the probability of smoking) attributable to each predictor were estimated using STATA v.9. We separately calculated the marginal difference in prevalence independently attributable to the intervention, using appropriate procedures for interaction terms in logistic models (Ai and Norton, 2003; Norton, 2003; Norton and Wang, 2004).

## RESULTS

### Study population characteristics

Table 1 shows both the weighted baseline and re-weighted follow-up socio-demographic distributions of the sample. The final weighted response rates for the follow-up survey were 57.5% for Flushing and 57.6% for Sunset Park. Follow-up response propensity was found to be lower for those with less percentage of lifetime in the US (0–20%), the younger age group (18–34) and uninsured.

This was a low income population with only 23% at baseline reporting an income over \$40,000. Thirty five percent reported having more than a high school education. Over 60% of respondents lived 35% or less of their lifetime in the US. Using language spoken at home and language used to read newspapers to provide a composite indicator of acculturation levels about three-quarters of the population was defined as not acculturated (Shelley et al., 2004).

### Smoking Prevalence

Between 2002 and 2006 overall smoking prevalence declined from 17.7% to 13.6% (a 23.1% relative decline,  $p < .01$ ) as shown in Table 2. Smoking declined significantly among respondents with the highest and lowest education levels, among those with incomes less than

\$40,000, among those who had lived more than 35% of their lifetime in the US, and in all age groups except individuals 55 and older. Among all respondents who were current smokers at baseline and remained so at follow up, the mean number of cigarettes smoked declined significantly from 16.0 to 12.0 ( $p<.01$ ) on weekdays and 14.6 to 11.4 on weekends ( $p<.001$ ) (data not shown).

### Receipt index

Table 3 shows intervention receipt indices from the final survey computed for current and recent former smokers. Larger values of an index correspond to greater awareness and/or participation. All indices showed trends in differences in favor of the intervention community. Chinese-language community-level social marketing campaigns appeared to have the greatest penetration.

### Regression Analysis

Among the total male study population (i.e. Flushing and Sunset Park), the odds of being a smoker in the post-intervention time period declined by 23% ( $OR=0.77$ ,  $p<0.001$ ), as shown in Table 4. Using these results, we calculated the marginal change in the probability of being a smoker pre and post intervention to be an absolute 3.3% decline among males in the overall probability of being a smoker between 2002 and 2006. We attribute this decline in prevalence in both communities to the NYCDOH policy initiatives.

The results of our model estimation demonstrate an additional positive and significant marginal effect for the study intervention on the probability of smoking. In Flushing, the intervention community, there was an additional absolute 2.8% decline in the probability of smoking post intervention compared with Sunset Park ( $p<0.001$ ).

## DISCUSSION

From 2002 to 2006 overall smoking prevalence significantly declined from 17.7% to 13.6% among a representative sample of Chinese Americans living in NYC, with a decrease from 30.3% to 22.9% among men. Declines were observed among all age, education and income levels. We attribute the impressive declines in overall smoking prevalence to the large cigarette tax increase and SFAA which overlapped with the study period. Similarly, from 2002–2005 smoking prevalence in NYC declined from 21% to 18.9% among the general population and from 15.3% to 13.8% among Asian American Pacific Islanders (Frieden et al., 2005; NYCDOH, 2007). Cigarette tax increases and SFAA legislation are two of the most effective approaches to tobacco control (Levy et al., 2000; Siegel, 2002). In NYC, both policies impacted a broad spectrum of urban residents, penetrating even non-English-speaking immigrant enclaves. (Levy et al., 2000; Siegel, 2002; Messer et al., 2007)

The findings of our study are consistent with citywide data, and provide additional insight into the effect of tobacco control policy on Chinese immigrants. Our analysis indicated that a community-based tailored intervention may increase the impact of population approaches to tobacco control. We documented an additional absolute 2.8% decrease in prevalence over a two-year period in the intervention community beyond the overall 3.3% decrease across Chinese communities attributable to NYCDOH policies and programs. These findings are consistent with recent analyses of state-level tobacco control programs which demonstrate that combining multilevel community and population-based programmatic components, such as media and cessation resources, with strong policies is more effective in bringing about sustained declines in smoking than policy approaches alone. (Messer et al., 2007; Kegler et al., 1998; Pierce et al., 1998)

Results from the intervention receipt index suggest that persons in Flushing, the intervention community, were more likely than those in Sunset Park to recall exposure to the community-level social marketing activities and to engage in cessation services although overall exposure and the magnitudes of the differences between the two communities was small. Further analysis of the causal relationship between specific intervention components and smoker characteristics will be presented in a future publication.

The study builds on previous community-based research programs in two notable areas. First, most studies have not tailored interventions to reach different segments of the community (Sorensen et al., 1998; Merzel and D’Afflitti, 2003; COMMIT, 1995b; Goodman et al., 1995). Yet tailoring program content and delivery methods may enhance the effectiveness of these interventions when trying to engage non-English speaking immigrant populations that depend on local organizations to provide same language-based services (Sorensen et al 1998; Feinleib 1996; McPhee et al., 1995). Second, this study provided reassurance of the generalizability of effective citywide policy among an immigrant population.

The promising results of the current study point to the need to continue to develop and evaluate tailored approaches to address high risk segments of the population. The elimination of disparities requires a comprehensive approach that addresses both population risk and “pockets” of high prevalence groups (Fisher et al., 1995; Robinson, 2005; Sorensen et al., 1998; Merzel and D’Afflitti 2003).

## LIMITATIONS

Abstinence was based on self-report and not verified by biochemical analysis. However, verification would have increased the cost of the study without substantial evidence it would have been more accurate than self-report (Fisher et al., 1998; Chen, 2001; Resnicow et al., 1997). As is typical of cohort studies among vulnerable populations, there was a high drop out rate at follow-up. It is possible that baseline smokers lost to follow-up continued to smoke at higher rates than baseline smokers who remained in the study. Although we used several methods to correct for non response bias, we must use caution in stating the differences over time and between communities which may be less than appears.

The statistical phenomenon of regression to the mean may partially or completely explain the study's findings, since the intervention community had a higher initial smoking rate than the comparison community. In addition, it is possible that results are confounded by variables we did not include in the final model, such as immigration patterns, acculturation, and the influence of specific aspects of the NYCDOH campaign. We did examine the possibility that a differential impact of citywide interventions may have explained the additional declines in smoking prevalence in Flushing. For example, smokers in Sunset Park may have been more likely to purchase untaxed cigarettes compared with Flushing residents, or if more acculturated, Flushing residents may have been more exposed to and influenced by the NYCDOH English-language media campaign. However, there was no difference in tax avoidance behavior between the two communities (51.9% in Flushing and 56% in Sunset Park reported at least one tax avoidance strategy) (Cantrell et al., 2008), and levels of acculturation were similar in both communities as was self-reported exposure to the NYCDOH ad campaign.

Finally, we fit our regressions to non missing observations only, resulting in a 17% decrease in sample size from the full weighted sample. However, because the vast majority of missing values were due to income, we avoided potential bias resulting from income imputation.



## CONCLUSION

Large declines in smoking prevalence following an increase in the cigarette tax and the SFAA in NYC suggest that tobacco control policies and regulations are effective among non-English speaking immigrant populations. Policy approaches level the playing field by reaching entire populations and therefore are a key strategy for reducing disparities in tobacco use. Our findings suggest that additional targeted efforts in immigrant populations may enhance general population-based policy approaches. Research is needed to develop an evidence base of cost-effective approaches for reaching subgroups at greatest risk, which include Asian immigrant males and increasingly young Asian women (Kim et al., 2007). State and local tobacco control programs should consider funding demonstration projects and partnering with community organizations to test the feasibility and effectiveness of tailored interventions among other immigrant groups, and use existing surveillance mechanisms to track sustainability.

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**Table 1**  
 NYC Chinese American Tobacco Cessation Study Sample: Characteristics at  
 Baseline and Follow-up

	Baseline (N=2537)		Follow-up (N=1384)	
	Sample size*	Weighted Proportion	Sample size	Weighted Proportion
<i>Sex, (% Column)</i>				
Male	1581	55.1	826	56.1
Female	956	44.9	558	43.9
<i>Smoking Prevalence</i>				
Current	637	17.8	238	13.6
Former	324	12.4	315	21.5
Never	1576	70.0	821	64.9
<i>Age</i>				
18–34	629	30.8	271	27.9
35–44	699	25.1	374	25.6
45–54	685	24.8	387	25.8
≥ 55	517	19.3	349	20.7
<i>Education</i>				
< 12	1020	41.8	460	35.0
HS graduate	571	23.2	376	25.6
> 12	935	35.0	548	38.4
<i>Marital Status</i>				
Never married	2045	77.7	1162	79.1
Married/living together	487	22.3	207	20.9
<i>Income</i>				
< \$10,000	333	14.8	200	15.5
\$10,000–20,000	654	34.8	378	29.7
\$20,000–40,000	624	27.4	320	25.6
>\$40,000	503	23.0	384	29.2
<i>Percentage of lifetime spent in US</i>				
0 – 20%	845	32.7	306	22.1
20 – 35%	782	30.8	488	35.9
35 – 100%	781	36.5	534	42.0
<i>Acculturation</i>				
Not acculturated	1958	77.9	1013	74.1
Acculturated	565	22.1	360	25.9

\* Subtotals by subcategory do not add to the total sample due to missing values.

(NYC Chinese Health Study 2002–2006)

Table 2

Change in Smoking Prevalence by Community and Demographic Characteristics among Chinese Americans in New York City

	All Respondents			Flushing - Intervention			Sunset Park - Control		
	Baseline Prevalence (N=2537)	Follow-Up Prevalence (N=1374)	% Change	Baseline Prevalence (N=1165)	Follow-Up Prevalence (N=615)	% Change	Baseline Prevalence (N=1372)	Follow-Up Prevalence (N=759)	% Change
<b>All respondents</b>	17.6 (2537)	13.6 (1374)	-23.1**	19.5 (1165)	13.7 (615)	-29.5**	16.9 (1372)	13.5 (759)	-20**
<b>Gender</b>									
<b>Men</b>	30.3 (1581)	22.9 (816)	-24.3**	33.3 (721)	22.7 (365)	-31.7**	29.1 (860)	22.9 (451)	-20.9**
<b>Women</b>	2.2 (956)	1.7 (558)	-19.6	3.3 (444)	2.5 (250)	-23.3	1.7 (512)	1.5 (308)	-15.6
<b>Age Group</b>									
<b>18 to 34</b>	15.0 (629)	12.4 (270)	-17.2*	15.4 (247)	10.3 (99)	-32.9	14.8 (382)	12.9 (171)	-12.7
<b>35 to 44</b>	19.7 (699)	15.3 (370)	-22.2**	25.0 (327)	16.2 (155)	-35.1**	17.3 (372)	15.0 (215)	-13.5**
<b>45 to 54</b>	21.9 (685)	14.3 (385)	-34.6**	26.2 (340)	17.8 (181)	-32.0**	19.9 (345)	12.6 (204)	-36.6*
<b>55 &amp; above</b>	14.1 (517)	12.3 (346)	-13.0	9.1 (251)	9.1 (180)	0.1	16.6 (266)	13.9 (166)	-16.4
<b>Education</b>									
<b>Less Than HS</b>	19.6 (1020)	15.3 (457)	-21.7**	20.6 (370)	11.6 (158)	-43.4**	19.3 (650)	16.4 (299)	-15.1*
<b>High School</b>	18.1 (571)	17.6 (370)	-3.00	23.6 (235)	23.2 (132)	-1.6	16.2 (336)	15.8 (238)	-2.2
<b>More Than HS</b>	15.3 (935)	9.3 (547)	-38.9**	17.2 (556)	11.2 (325)	-35.0**	14.0 (379)	8.2 (222)	-41.7*
<b>Income</b>									
<b>0 to \$20K</b>	18.2 (987)	15.4 (574)	-15.8	23.4 (388)	15.6 (216)	-33.0*	16.7 (599)	15.3 (358)	-8.4
<b>\$20K to \$40K</b>	21.3 (624)	14.5 (318)	-32.1**	25.3 (330)	17.5 (148)	-31.0*	19.3 (294)	13.2 (170)	-31.6
<b>\$40K &amp; above</b>	12.8 (503)	9.9 (381)	-21.9	11.2 (294)	8.2 (210)	-26.6	14.0 (209)	11.1 (171)	-20.9
<b>Marital Status</b>									
<b>Married</b>	17.2 (2045)	12.6 (1152)	-26.7**	18.4 (968)	13.1 (513)	-28.9**	16.6 (1077)	12.4 (639)	-25.5**
<b>Not married</b>	19.6 (487)	16.4 (207)	-16.0*	25.2 (195)	17.1 (94)	-32.0	17.9 (292)	16.2 (113)	-9.5
<b>% Years in US</b>									
<b>0 to 20%</b>	19.1 (845)	16.1 (305)	-15.6	26.3 (457)	23.0 (144)	-12.4	15.0 (388)	13.1 (161)	-12.5
<b>20 to 35%</b>	19.9 (782)	15.6 (485)	-21.7	16.2 (355)	11.0 (226)	-31.7*	21.5 (427)	17.6 (259)	-18.1
<b>35% &amp; greater</b>	15.5 (781)	10.4 (529)	-33.1**	14.5 (307)	11.4 (227)	-21.6	15.9 (474)	10.0 (302)	-36.9**

\* = p&lt;0.05

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=  $p < 0.01$

(NYC Chinese Health Study 2002–2006)

**Table 3**Differences in receipt indices<sup>a</sup> for smokers and recent ex smokers, by intervention condition

Index	Flushing Mean (95%CI)	Sunset park Mean (95%CI)	Mean Difference	P-value
Exposure to Chinese media/ public education (0–6)	1.48 (1.15, 1.81)	0.97 (0.79, 1.14)	0.51	0.007
Utilization of cessation resources (0–8)	0.87 (0.57, 1.17)	0.54(0.41, 0.68)	0.33	0.05
Participation in program events and contests (0–7)	0.16 (0.07, 0.25)	0.04(0.01, .065)	0.12	0.01
Summary <sup>b</sup> (standardized)	0.49 (0.14, 0.83)	−0.44(−0.75, −0.13)	0.93	0.000

<sup>a</sup>To calculate each receipt index, responses to related questions from the final survey were recoded into dummy responses (Yes=1 and No=0) and then the responses were summed. For example, for utilization of cessation resources there were 8 questions which ranged from use of pharmacotherapy to enrollment in the free nicotine patch program. Answers to these questions were coded as 0 or 1 and then summed. (A list of survey questions contributing to specific receipt indices is available from the authors)

<sup>b</sup>To create the summary index each individual receipt index was “standardized” by subtracting its mean (based on individuals in the comparison community) and dividing the remainder by its within community standard deviation (obtained from analyses of variance. After standardization, the distribution of the receipt index is a normal distribution with Mean = 0 and SD = 1. The standardized summary index therefore could be negative or positive.

(NYC Chinese Health Study 2002–2006)

**Table 4**  
Regression analyses of intervention effects on smoking prevalence among Chinese Americans in New York City<sup>a</sup>

Independent variables	Odds ratio (95% CI)	P value	Marginal Effect <sup>b</sup> (95% CI)	P value
Intervention <sup>c</sup> = Interaction of Area * time				
Flushing post-intervention	NA <sup>d</sup>	–	–0.028 (–0.03–0.00)	0.001
Other			Referent	
Time period				
Post- intervention	0.77 (0.63–0.95)	0.015	–0.033 (–0.00–0.01)	0.013
Pre- intervention	1.00		Referent	
Site				
Flushing	1.33 (1.03–1.70)	0.028	0.037 (0.00–0.07)	0.032
Sunset Park	1.00		Referent	
Age				
18 to 34	1.22 (0.80–1.85)	0.358	0.026 (0.03–0.08)	0.37
35 to 54	1.38 (1.01–1.89)	0.041	0.041 (0.00–0.08)	0.04
≥55	1.00		Referent	
Income				
< \$20,000	1.51 (1.05–2.17)	0.024	0.05 (0.00–0.09)	0.024
\$20–40,000	1.74 (1.22–2.47)	0.002	0.08 (–0.02–0.13)	0.004
>\$40,000	1.00		Referent	
Education				
< HS	1.42 (1.03–1.95)	0.028	0.046 (–0.00–0.08)	0.034
= HS	1.42 (1.03–1.97)	0.034	0.048 (–0.00–0.09)	0.047
> HS	1.00		Referent	
% years in US				
<20%	1.31 (.95–1.82)	0.100	0.036 (0.00–0.08)	0.115
20–35%	1.32 (.96–1.82)	0.084	0.037 (0.00–0.08)	0.094
>35%	1.00		Referent	

(NYC Chinese Health Study 2002–2006)

Abbreviations: CI, confidence interval. Dependent variable: 0= never and former smokers and 1=current smokers.

<sup>a</sup>N = 2165 (total nonmissing observations, baseline and follow-up)

<sup>b</sup>Independent effects of predictors on smoking prevalence (marginal change in probability of smoking) were calculated using the STATA v9. However, the independent effect of the intervention on smoking prevalence was separately calculated following methods for calculating estimates of interaction terms in a nonlinear model. All values in the marginal effect column represent absolute percentages. (Ai and Norton 2001)

<sup>c</sup>The effect of the intervention, measured as the interaction between pre-post time period (0,1) and control vs intervention community (0,1) is interpreted as the additional decline of smoking prevalence by an absolute 2.8% in Flushing relative to Sunset Park.

<sup>d</sup>Odds ratio calculation algorithms do not apply to interaction terms (Ai and Norton, 2003).



**Appendix A**  
Overview of community-based tobacco control interventions

Study intervention components October 2003–September 2005	Flushing	Sunset Park
<i>Public Education:</i>		
Chinese language media campaign (e.g. posters, radio)	X	
Distribution of educational materials	X	
Unpaid media/media advocacy (e.g. newspaper coverage of events, new programs, press conferences and advisory board meetings)	X	X
Annual events (e.g. Great American Smoke Out, Chinese New Year Parade)	X	
<i>Cessation resources:</i>		
Physician training/detailing	X	
Free nicotine patch program (distribution through two community-based organizations)	X	
Free smoking cessation programs (one hospital based, 2 clinic based)	X	
Quit and win contest	X	
Helpline (800 number for information about smoking cessation resources administered by AAFE)	X	
<i>New York City Department of Health and Mental Hygiene Tobacco Control Policies</i>		
Cigarette excise tax increase (July 2002)	X	X
Smoke Free air legislation (March 2003)	X	X

(NYC Chinese Health Study 2002–2006)