Adult smoking trends in Mexico: An analysis of the Mexican National Addiction Surveys

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Abstract

Objective. To describe and explain the recent trends of four smoking indicators in Mexico. **Materials and Methods.** Comparable data from four national probabilistic household surveys (1988-1992) were analyzed using statistical techniques for survey data. The analysis was restricted to persons aged 18 to 65 years. Changes in indicators compare 2002 to 1988. **Results.** The overall prevalence of never smokers increased by 10% and increased more in men. The prevalence of daily smokers shows a 16% reduction in men and reductions are concentrated in persons 45 and older. The average number of cigarettes smoked daily shows a 31% decrease in men and no decrease in women. The prevalence of heavy smokers (one pack or more) is 60% higher in women in 2002. **Conclusions.** Mexico does not closely follow the WHO model for the evolving tobacco epidemic. Nevertheless, the tobacco epidemic is in an advanced stage, with a decreasing prevalence in men and a rising one in women and the young. The improvement in the smoking situation was mainly due to the country's economic stagnation during the analyzed period and to public awareness of the dangers of tobacco exposure rather than to a sound control policy on the part of the state.

Keywords: Smoking epidemic stages; Smoking trends; Never smokers; Daily smokers; smoking intensity; smoking economic determinants; Mexico

Resumen

Objetivo. Describir y explicar las tendencias recientes de cuatro indicadores de tabaquismo en México. **Material y métodos.** Se analizan datos comparables de las cuatro Encuestas Nacionales de Adicciones (1988-1992) mediante técnicas estadísticas adecuadas para datos muestrales. En el análisis se incluye a personas entre 18 y 65 años de edad. Los cambios en indicadores comparan 2002 con respecto a 1988. **Resultados.** La prevalencia en ambos sexos de nunca fumadores aumentó 10% pero dicho aumento ocurrió solo en hombres. La prevalencia de fumadores diarios se redujo un 16% en hombres y en ambos sexos las reducciones más importantes ocurrieron en las personas de 45 y más años. El promedio de cigarrillos diarios se redujo en 31% en hombres exclusivamente. La prevalencia de fumadores de una cajetilla o más fue 60% mayor en mujeres en 2002. **Conclusiones.** México no sigue completamente el modelo de la OMS de la epidemia de tabaquismo. En todo caso, se encuentra en una etapa avanzada de la epidemia con reducciones en la prevalencia en hombres y aumento en las mujeres y los jóvenes. La mejoría observada se debió principalmente al estancamiento económico observado en el país y al mayor conocimiento de la población de los efectos dañinos del tabaquismo, más que a una sólida política estatal de control.

Palabras claves: Etapas de la epidemia de tabaquismo; Tendencias en el tabaquismo; Nunca fumadores; fumadores diarios; intensidad del tabaquismo; determinantes económicos del tabaquismo; México

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Lopez *et al.* introduced a descriptive model of the tobacco epidemic in developed countries based on nearly 100 years of observations of countries with a long history of widespread cigarette use.[1] Such a model divides the smoking epidemic into four stages, characterized by different smoking prevalences in men and women and subsequent attributable mortality. Although it was originally proposed to explain apparent paradoxes, like an increase in attributable mortality concurrent with decreasing smoking prevalence, it has become a standard reference for classifying the status of the smoking epidemic within the context of the global pandemic.[2] The model seems to be appropriate for describing the rising tobacco epidemic in most Asian emerging economies.[3-6] However, when the model is applied to Latin American countries, including Mexico, it seems to place these countries at an earlier stage[7,2] than what is suggested by other data. One possible explanation for this inadequate fit is that the Lopez *et al.* model is based on the observation of growing economies at a time when very little was known about the deleterious effects of tobacco consumption.

Like other Latin American countries, Mexico has suffered at least 25 years of economic stagnation, increasing inequalities and decreasing wages. This economic context has undoubtedly shaped the course of the smoking epidemic. Public awareness of the health risks of smoking should also have had some effect on the trends of the smoking epidemic in Mexico. To examine these hypotheses, this paper presents an analysis of smoking information for adults aged 18 to 65 included in the Mexican National Addiction Surveys (MNAS) conducted in 1988, 1993, 1998 and 2002. Most of the period covered by these surveys was characterized by very low economic growth and the virtual absence of effective smoking control policies. MNAS data were obtained through a probabilistic sampling design with face-to-face interviews of the respondents. Although methodological differences exist among the four MNAS waves, an attempt has been made to make the information comparable.

Materials and Methods

Data sources and data preparation

Information analyzed in this paper comes from the four MNAS. The basic sampling design used in all survey years consisted of a stratified multistage cluster-sampling scheme. Within state regions, census tracts (AGEBs, per its initials in spanish) were randomly selected and blocks and subsequently households were randomly sampled. The last stage of sampling consisted of the random selection of a person of the appropriate age range within the households.

Although all MNAS waves used a similar sampling scheme, important differences occurred over time in terms of the target population. Thus, the first three waves, designed and conducted by the Ministry of Health, focused more on urban populations, whereas the last wave, designed and conducted by the National Institute of Statistics Geography and Informatics of Mexico (INEGI, per its initials in spanish), focused on the entire Mexican population. Smoking prevalence and intensity is lower in Mexican rural populations. Therefore, to increase the comparability of the target population in all MNAS years for trend analysis, only information pertaining to municipalities with a similar level of urban development as that observed in most MNAS waves was selected for analysis. Urban development in the municipalities was evaluated using the marginality index, a standardized socioeconomic deprivation index developed by the Mexican Population Council (CONAPO, per its acronym in spanish) based on census data, which includes housing and socioeconomic indicators of the population as well as information on the proportion of the population living in towns with less than 15 000 persons.[8] For the present analysis, the marginality index developed with data from the 1990 census was used, which included only the observations in the 2002 MNAS obtained from municipalities with a 1990 marginality index ≤ 1.425. This excluded from the analysis 0.96% of the observations from the 2002 MNAS corresponding to highly rural municipalities.

All MNAS waves used standardized questionnaires, administered face-to-face by trained interviewers. However, smoking questions on the questionnaires have changed with each wave and this, coupled with the limited exploration in most waves with regard to former smoking, has limited the type of smoking indicators whose trends over time could be analyzed. Thus, for instance, current smoking ascertainment is not directly comparable between years since the direct question, "*¿Fuma usted actualmente? / Do you currently smoke?*" that was included in the first two MNAS years, was deleted in the subsequent ones and substituted by questions such as: "*En (el) los último(s) __ (días, semanas, mes) ¿ha fumado tabaco? / Have you smoked during the last __ days/weeks/month?*" In addition, the generally asked question, "*¿Durante su vida ha fumado más de 100 cigarrillos (5 cajetillas)? / During your lifetime have you smoked more than 100 cigarrettes (5 packs)?*" was only included in the last three MNAS waves.

Given the mentioned changes in the questionnaires, it was decided to analyze the trends of four

smoking indicators that were directly comparable in all MNAS waves:

a) Never smokers: Persons who answered "no" to the question "*¿Ha fumado tabaco alguna vez en su vida?/ During your lifetime, have you ever smoked tobacco?*" All MNAS waves included this question.

b) Daily smokers: Persons who smoked daily. The question used to determine daily smoking the first year was "*¿Usted fuma a diario?/ Do you smoke daily?*" Years two and three included the question "*¿Cuántos cigarros fuma y con qué frecuencia (diario, semanal, etc.)?/ How many cigarettes do you smoke and how often (daily, per week, etc)?*" Finally, year four included the question "*¿Aproximadamente, cuántos cigarrillos ha fumado diariamente en los últimos 30 días?/ Approximately, how many cigarettes have you smoked daily during the last 30 days?*"

c) Smoking intensity in daily smokers: All waves included questions on the approximate number of cigarettes smoked daily, as indicated above. Waves one through three had open answers to these questions. Wave four had closed answers with the following intervals: 1-5, 6-10, 11-20, 21 or more. In order to make data comparable among the survey waves, the number of cigarettes smoked in wave one to year three was categorized as in wave four. Then the average number of cigarettes smoked within wave four in each category was obtained by combining the information from waves one to three. The average number of cigarettes smoked in the intervals used in wave four, according to the information from waves one to three, were 3.2, 8.4, 14.5 and 23.6. These averages allowed for the computing of the number of cigarettes smoked daily for each person in waves one through four using the same categorization in all waves for cigarettes smoked daily as in wave four. The trends of the percentage of heavy daily smokers (persons who smoked 21 or more cigarettes daily) were also assessed.

d) Daily smokers who had ever attempted to quit: Persons who answered "yes" to the question "*¿Alguna vez ha intentado dejar de fumar? / Have you ever attempted to quit smoking?*" All MNAS waves used the same question.

Statistical analysis

All statistical procedures employed in this report made allowances for the selection probabilities of each observation. The observations' expansion factors were available in each MNAS database and their inverse was used

as the selection probability. Additional information on the primary sampling units and survey strata were available but were not used because the expansion factors that were used were produced using such information and national data were the focus of this report. Statistical survey procedures available in STATA version 9 were used throughout this analysis.[9]

Information was analyzed for persons between 18 and 65 years of age. Either proportions or means were used as appropriate smoking indicator summaries. Statistical models with the following general form assessed time trends for these indicators:

$$\emptyset = \beta_o + \sum \beta_k a_k + \sum \beta_i \lambda_i + \sum \beta_1 \mu + \sum \beta_2 \lambda + \varepsilon$$

Where $\emptyset$ is the response variable, the log odds for proportions or the mean value for the number of cigarettes smoked, β_o is the intercept, $\beta_k a_k$ is a vector of k slopes (β_k) for dummy variables indicating a particular 5-year age group (a_k), $\beta_i \lambda_i$ is a vector of i slopes (β_i) for dummy variables indicating a particular survey year (λ_i), β_l is the slope for male gender (μ), $\beta2$ is the slope for the marginality index (λ) and ε is the random error. Fitting logistic or multiple regression models as just described was carried out for obtaining indicator summaries (proportions or means) for the entire Mexican population, adjusted for age, sex and marginality. Indicator summaries were obtained specifically for a population resembling the 2005 age and sex distribution in Mexico[10] and for the country's 1990 marginality index in 2005 (-1.09). Thus, the smoking indicators estimated could be directly compared with other national surveys carried out in 2005. Additionally, similar statistical techniques were applied to the MNAS databases to obtain smoking indicators for both genders and for broad age groups. Percent changes in 1993, 1998 and 2002 in the adjusted smoking indicators were also calculated using 1988 as the reference year. Statistical significance of the changes in smoking indicators was assessed from the fitted multivariate models described above using the Wald test.

Results

The four MNAS databases had a total 43 914 observations. However, only 38 841 observations (88.4% of the original number) had complete information on the analysis variables. The 1993 MNAS had the largest proportion of missing information in one or more of the analysis variables (16.2%). The number of observations analyzed was 10 396, 13 654, 5 308 and 9 483 for MNAS waves 1988, 1993, 1998 and 2002, respectively. Mean age, weighted by selection probabilities, ranged from 32.0 years in the 1988 survey to 34.4 in the 2002 survey.

The weighted proportion of females was 54% in the first two waves, 58% in the third and 56% in the fourth wave. The average marginality index of sampled municipalities was -1.56, -1.51, -1.44 and -1.31 in years one through four, respectively. As explained in the statistical analysis section, all results presented in the following sections have been projected according to the characteristics of the entire Mexican population in 2005.

Never smokers

Table I presents the adjusted prevalence of never smoker adults estimated in the four MNAS waves. Compared to 1988, the three more recent surveys show a statistically significant 10 to 18% increase in the proportion of never smokers in the whole population. During the same period, males show increases close to 30% in this category, whereas females show lower and more erratic increases of between 2 and 8% compared to 1988. According to the 2002 MNAS, the adjusted proportion of Mexican adults between the ages of 18 and 65 years that had never smoked was 52%, a figure much larger in females (74%) than in males (30%). Interestingly, the last three MNAS waves show a similar adjusted prevalence of never smokers in both genders.

Table II presents the changes in the adjusted prevalence of never smokers over the study period, according to broad age groups and each gender. Men below the age of 45 present consistent increases over time in the adjusted proportion of never smokers, which are more intense in the 30 to 44 age group. In contrast, older men present a statistically significant increase in the proportion of never smokers in the 1993 survey and then a non-significant

Table I

Estimated percentage of the adult Mexican population who were never smokers* between 1988 and 2002, according to gender

Gender	% never smokers				% change with respect to 1988		
	1988	1993	1998	2002	1993	1998	2002
Both	47.1	52.2	55.5	51.7	10.8‡	17.8‡	9.8‡
Males	23.5	30.6	30.1	29.7	30.2‡	27.8‡	26.4‡
Females	72.2	73.9	78.5	73.8	2.4	8.7‡	2.2

* Percentage adjusted, through logistic regression for survey data, to represent the entire Mexican population in 2005 in terms of age groups, gender distribution and average marginality index

‡ % change with respect to 1988, statistically significant (p <.05), according to Wald's test in the logistic regression model

Table II

Changes in the percentage of the adult Mexican population who were never smokers* between 1988 and 2002, according to age group and gender

	Males				Females			
	% Never smokers	% change with respect to 1988			% Never smokers	% change with respect to 1988		
Age group	(1988)	1993	1998	2002	(1998)	1993	1998	2002
18-29	28.3	22.4‡	20.3‡	26.4‡	76.1	0.3	7.0‡	-2.5
30-44	22.1	36.4‡	38.8‡	34.1‡	69.1	4.5	8.8‡	5.9
45-65	20.7	35.7‡	22.3	13.9	70.7	3.6	11.1‡	5.0

* Percentage adjusted, through logistic regression for survey data, to represent the entire Mexican population in 2005 in terms of the marginality index

‡ % change with respect to 1988, statistically significant (p <.05), according to Wald's test in the logistic regression model

increase in the subsequent survey years. On the other hand, only women show statistically significant increases in the adjusted proportion of never smokers in the 1998 survey, although less intense than those observed in men. During 1988, females across all age groups show roughly three times the observed prevalence of never smokers than males. However, this ratio is smaller in younger age groups.

Daily smokers

The adjusted prevalence of daily smokers in 2002 was 22.7% in males and 5.4% in females (Table III). Overall, this prevalence has significantly decreased, around 20%, in the latter MNAS waves with respect to the 1988 survey. In the second and third waves, the reduction in the prevalence of daily smokers with respect to the first survey year was close to 30% in women and slightly lower than 20% in men. Nevertheless, the last MNAS wave shows a reverse in the declining trend in women, whereas men show almost the same reduction during the latter three years with respect to 1988.

Table IV presents the adjusted prevalence of daily smokers by gender and broad age groups. The proportion of daily smokers during 1988 was lower in younger persons, a pattern seen in both males and females. Compared to 1988, the adjusted proportion of daily smokers shows reductions in almost all age groups and in both genders. Statistically significant reductions in this indicator tend to concentrate in the second and third MNAS waves and are seen in all age groups. These reductions are more marked in women.

Table III

Estimated percentage of the adult Mexican population who were daily smokers* between 1988 and 2002, according to gender

Gender	% Daily smokers				% change with respect to 1988		
	1988	1993	1998	2002	1993	1998	2002
Both	14.7	11.5	11.2	12.1	-21.5‡	-23.8‡	-17.3‡
Males	26.9	22.6	22.4	22.7	-16.1‡	-16.8‡	-15.7‡
Females	6.4	4.6	4.3	5.4	-27.8‡	-32.7‡	-15.8

* Percentage adjusted, through logistic regression for survey data, to represent the entire Mexican population in 2005 in terms of age groups, gender distribution and average marginality index

‡ % change with respect to 1988, statistically significant (p <.05), according to Wald's test in the logistic regression model

Table IV

Changes in the percentage of the adult Mexican population who were daily smokers* between 1988 and 2002, according to age group and gender

	Males				Females			
	% Daily smokers	% change with respect to 1988			% Never smokers	% change with respect to 1988		
Age group	(1988)	1993	1998	2002	(1988)	1993	1998	2002
18-29	22.9	-21.8‡	-17.5‡	-8.3	3.6	-28.2‡	-27.0	20.7
30-44	29.9	-15.2	-18.5‡	-16.5	7.3	-17.1	-29.2‡	-26.6
45-65	28.2	-8.4	-12.0	-24.9‡	9.8	-40.6‡	-41.2‡	-31.9‡

* Percentage adjusted, through logistic regression for survey data, to represent the entire Mexican population in 2005 in terms of the marginality index

‡ % change with respect to 1988, statistically significant (p <.05), according to Wald's test in the logistic regression model

In the 2002 survey, the reductions are more pronounced in both genders in the 45 to 65 age group. Additionally, women between 18 and 29 years of age show a 20% rise in the prevalence of daily smokers.

Smoking intensity in daily smokers

Trends in smoking intensity indicators in daily smokers are presented in Table V. Considering the entire population, the adjusted average number of cigarettes smoked daily was 6.4 in the 2002 MNAS, with women smoking on average 0.5 cigarettes more than men. During that year, the overall reduction in the average number of cigarettes was 24.6% from 1988 and reached statistical significance only in men, who showed a 31.2% reduction in 2002 with respect to 1988. Similar findings are observed with regard to the proportion of heavy cigarette smokers among daily smokers (21 or more cigarettes daily). In 2002, the adjusted percentage of heavy smokers among daily smokers was 5.5, considering the entire population, a figure 62% lower then that observed in 1988. In that same year, women showed a higher percentage of heavy smokers among daily smokers than men (7.8% vs. 4.9%). In men, the percent reduction observed between 1998 and 2002 was again higher than in females (72% vs. 10.6%).

Table VI shows the observed changes in adjusted smoking intensity indicators in daily smokers according to broad age groups and gender. With regard to the average number of daily cigarettes smoked, important reductions between 1988 and 2002 are seen in all age groups in males, but not in females. Decreases in the average number of cigarettes smoked are also higher in persons below age 45. Additionally, although not statistically significant, in most age groups females show an increase in the average number of cigarettes smoked between 1988 and 2002. The percentage of daily heavy smokers shows similar trends as those just described. Statistically significant reductions in the adjusted proportion of heavy smokers, between 63 and 75%, are observed only in men. Women under 45 years of age present a 16 to 33% reduction in this indicator but show an increase in the 45 to 65 age group. None of these last changes is statistically significant. Table VI also suggests that in 1988 smoking was more intense in the older birth cohorts of daily smokers.

Daily smokers who had ever attempted to quit

Trends in the adjusted percentage of daily smokers who had ever attempted to quit are shown in Table VII, according to gender. Regardless of gender, the majority of daily smokers over the study period had attempted to quit at some point in their life. In 2002, the adjusted percentage of ever attempters is somewhat larger in females than in males (60.9 *vs*. 52.4). This is because women show more significant and consistent increases with respect to 1988 for this indicator than men (28.8 *vs*. 4.5% increase in 2002, respectively).

Table VIII shows the changes in the percentage of daily smokers who had ever attempted to quit in the latter three MNAS years with respect to 1988 for broad age groups and each gender. Significant increases in this indicator over the study period are almost confined to women, especially in the age groups 18 to 29 and 30 to

Table V
**SMOKING INTENSITY INDICATORS OF DAILY MEXICAN ADULT SMOKERS[*] BETWEEN 1988 AND 2002,
ACCORDING TO GENDER**

Smoking intensity indicator and gender	% Daily smokers				% change with respect to 1988		
	1988	1993	1998	2002	1993	1998	2002
Number of cigarettes smoked per day							
Both	8.5	8.1	7.8	6.4	-4.8	-8.6[‡]	-24.6[‡]
Males	9.4	8.5	8.3	6.5	-10.2[‡]	-12.1[‡]	-31.2[‡]
Females	7.2	8.1	7.3	7.0	11.5	1.2	-2.7
Percent smoking 21 or more cigarettes per day							
Both	14.3	12.0	9.4	5.5	-16.0	-34.2[‡]	-61.9[‡]
Males	17.7	12.9	9.7	4.9	-26.8[‡]	-45.2[‡]	-72.0[‡]
Females	8.7	11.4	10.1	7.8	31.5	16.6	-10.6

[*] Smoking indicator adjusted, through either logistic regression or multiple regression for survey data, to represent the entire Mexican population in 2005 in terms of age groups, gender distribution and average marginality index
[‡] % change with respect to 1988, statistically significant (p <.05), according to Wald's test in the logistic regression model

Table VI
**CHANGES IN SMOKING INTENSITY INDICATORS OF DAILY MEXICAN ADULT SMOKERS[*] BETWEEN 1988 AND 2002,
ACCORDING TO AGE GROUP AND GENDER**

Smoking intensity indicator and age group	Males				Females			
		% change with respect to 1988				% change with respect to 1988		
	1988 figure	1993	1998	2002	1988 figure	1993	1998	2002
Number of cigarettes smoked per day								
18-29	8.0	-10.8	-8.2	-32.5[‡]	5.3	37.9[‡]	24.4	6.7
30-44	9.6	-6.2	-12.4	-33.3[‡]	8.3	-4.2	-10.7	-14.9
45-65	11.5	-12.6	-15.2	-24.8[‡]	8.1	10.5	0.7	9.6
Percent smoking 21 or more cigarettes per day								
18-29	10.8	-24.6	-13.6	-71.7[‡]	5.2	72.8	81.2	-33.2
30-44	21.4	-18.6	-55.2[‡]	-75.4[‡]	14.0	-3.1	-18.6	-16.5
45-65	27.0	-31.3	-46.8[‡]	-63.1[‡]	11.1	50.1	42.4	19.8

[*] Smoking indicator adjusted, through either logistic regression or multiple regression for survey data, to represent the entire Mexican population in 2005 in terms of the marginality index
[‡] % change with respect to 1988, statistically significant (p <.05), according to Wald's test in the logistic regression model

44. For instance, in the 2002 MNAS, women between the ages 18 and 29 show a 56.5% increase in the percentage of daily smokers who had ever attempted to quit, whereas those aged 30 to 44 show a 39.6% increase. In 1988, the percentage of ever attempters is very similar in both genders and in each age group. Also noticeable is an increase in the adjusted percentage of ever attempters with age, a finding seen in the 1988 survey in both males and females.

Discussion

Smoking data in Mexico prior to the late eighties are scarce and limited to specific populations. The four National Addictions Surveys conducted in Mexico between 1988 and 2002 represent one of the first serious attempts to derive national smoking data from representative samples and direct interviews. Unfortunately, as has been described in the methods section, smoking

Table VII

ESTIMATED PERCENTAGE OF DAILY MEXICAN ADULT SMOKERS* WHO HAD EVER ATTEMPTED TO QUIT BETWEEN 1988 AND 2002, ACCORDING TO GENDER

Gender	% Daily smokers who had ever attempted to quit				% change with respect to 1988		
	1988	1993	1998	2002	1993	1998	2002
Both	50.7	58.1	63.2	56.2	14.5‡	24.7‡	10.9
Males	50.1	53.6	59.4	52.4	7.0	18.5‡	4.5
Females	47.2	63.0	67.4	60.9	33.3‡	42.7‡	28.8‡

* Percentage adjusted, through logistic regression for survey data, to represent the entire Mexican population in 2005 in terms of age groups, gender distribution and average marginality index

‡ % change with respect to 1988, statistically significant (p <.05), according to Wald's test in the logistic regression model

questions included in each MNAS year are not homogeneous and a consistent estimate of the prevalence of current smokers could not be directly obtained. Additionally, most survey years did not include enough information on former smokers. Given these limitations, the present analysis focused on never smokers and current daily cigarette smokers. The proportion of never smokers provides information about general exposure to tobacco addiction in the population. Current daily cigarette smokers is group that is most exposed to the deleterious effects of tobacco. The first two MNAS waves, which used the standard question "¿Fuma usted actualmente? / *do you currently smoke*?" show

that current daily Mexican smokers represented 64% of all current smokers in 1988 and 55% of all current smokers in 1993. Therefore, even though the MNAS information on smoking does not provide a complete picture of this health problem, it does provide useful information on the trends of smoking in never smokers and the most frequent and exposed type of smokers, namely, daily smokers.

Another MNAS problem has to do with the target population. The first three MNAS waves focused on urban populations[11,12] while the last one focused on the entire Mexican population [Medina-Mora ME, personal communication, March 2007]. There was interest in obtaining estimates for the smoking indicators over time that could refer to the entire Mexican population and, therefore, the smoking summary measures needed to be adjusted. The adjustment procedure consisted of two steps. First, the highly rural populations that were sampled in the 2002 MNAS were excluded from the analysis using the municipality's marginality index, from which observations came. Second, the data was analyzed using appropriate survey techniques and an adjusted proportion or mean was obtained for a population closely resembling the 2005 Mexican population in terms of age and gender distribution as well as average marginality. The correlation between both smoking prevalence and smoking intensity and marginality was negative, indicating a better smoking situation in the rural regions of Mexico (data not shown). Average marginality for the whole country in 2005 was within one standard deviation from the sampled average in each MNAS wave. Therefore, analyzed data were suitable for national estimation in terms of marginality. Additionally, overall adjusted summary measures by gender, estimated using the

Table VIII

CHANGES IN THE PERCENTAGE OF DAILY MEXICAN ADULT SMOKERS* WHO HAD EVER ATTEMPTED TO QUIT BETWEEN 1988 AND 2002, ACCORDING TO AGE GROUP AND GENDER

Age group	Males				Females			
	% Daily smokers who had attempted to quit (1988)	% change with respect to 1988			% Daily smokers who had attempted to quit (1988)	% change with respect to 1988		
		1993	1998	2002		1993	1998	2002
18-29	47.9	19.9	7.8	9.3	40.1	46.8‡	27.5	56.5‡
30-44	49.0	1.2	30.5‡	-4.2	47.9	41.8‡	47.8‡	36.9‡
45-65	56.5	-2.3	11.6	8.2	56.2	8.1	46.3‡	-10.6

* Percentage adjusted, through logistic regression for survey data, to represent the entire Mexican population in 2005 in terms of the marginality index

‡ % change with respect to 1988, statistically significant (p <.05), according to Wald's test in the logistic regression model

same age structure in each gender, allowed for direct comparisons to be made between genders.

Findings from this analysis generally indicate that over the study period, tobacco use in Mexico shows both positive and negative trends. On the positive side, the overall percentage of Mexicans between 18 and 65 years of age who have never smoked has increased between 1988 and 2002. In addition, the prevalence of daily smokers shows a 17% reduction over the same period and the proportion of daily heavy smokers in 2002 is 62% lower than in 1988. Furthermore, the average number of cigarettes smoked by daily smokers in 2002 is 6.4, representing a 25% reduction with respect to the 1988 corresponding figure. However, some of these indicators show the greatest improvements between 1998 and 1993 with some reversal of the trend in the most recent MNAS year. Nevertheless, these positive trends are consistent with an economical analysis of the Mexican Income and Expenses Survey in Households.[13] Such analysis shows that between 1992 and 1998 there was a significant reduction in the prevalence of household tobacco spending and a reduction in household monetary spending on tobacco. In addition, the per capita annual number of packs shows a 10 to 20% reduction between 1988 and 1996.[14]

On the negative side, trends in smoking indicators over the study period are mixed when analyzing data by gender and age group. Although the adjusted proportion of never smokers is about 2.5 times greater in women, it shows a more rapid increase in men. This is more evident in younger men for whom the entire increase in never smokers occurs, whereas younger women show no change or even some decrease in the proportion of never smokers between 1988 and 2002. Trends in the adjusted proportion of daily smokers, for their part, also show differential improvements by gender and age. Over the study period, the proportion of daily Mexican smokers is approximately four times greater in men than in women; whereas men show a 16% reduction in 2002 with respect to 1988, women show more significant reductions than men in 1993 and 2002, although there was an increase in 2002. This increase is observed in women under 30 years of age. On the other hand, the reduction in the prevalence of daily smokers is more consistently observed in persons 45 years or older in both genders. Smoking intensity indicators in daily smokers also show that their overall reductions are concentrated in men, whereas women show almost no change with regard to the average number smoked daily and the percentage of heavy smokers. As a result, in 2002, Mexican women who were daily smokers smoked on average 0.5 cigarettes more than men did and represent a 60% higher proportion of heavy smokers than men.

In summary, the present analysis shows a reduction during the last decade of the twentieth century in smoking exposure, daily smoking prevalence and smoking intensity in Mexico. This reduction has either been more intense or occurred exclusively in men, depending on the analyzed indicator. Additionally, the most significant reduction both in the prevalence of daily active smokers and in smoking intensity occurred in older age groups in both genders. Women, for their part, during the latter part of the analyzed period present a reversal in the downward trend in these smoking indicators, and in 2002, daily female smokers smoked a greater amount of cigarettes than men. Nevertheless, men still present a worse smoking situation than women in terms of both prevalence of daily smokers and percentage of daily smokers.

A downward smoking trend in men and the beginning of an upward trend in women is, therefore, one of the salient features of the tobacco epidemic in Mexico between 1988 and 2002. Other surveys conducted in Mexico during the analyzed period provide similar findings. For instance, a survey conducted in Mexican physicians in the early 1990s found a greater prevalence in female physicians.[15] Another survey of university students also found a rising smoking prevalence in females between 1989 and 1998.[16]

The pattern of a declining prevalence in men and a rising prevalence in women observed in Mexico is similar to that observed a few decades ago in the United States, Canada and most European countries.[17-23] In this sense, the cigarette epidemic in Mexico over the analyzed period is thus similar to that described as the end of stage III by Lopez et al.[1] In addition, lung cancer mortality in Mexico is consistent with stage IV of the lung cancer epidemic. Mortality from this disease reached a peak in Mexico in cohorts born around 1930, with subsequent cohorts showing consistently lower mortality rates at the same age in both genders.[24,25] The local tobacco industry in Mexico was well established in the early twentieth century, with over 700 factories in 1900.[14]

However, the Mexican tobacco epidemic shows important differences with the general pattern observed by Lopez et al.[1] in developed countries. In other surveys conducted during the 1990s, as in those analyzed here, smoking prevalence is high but smoking intensity is generally low, with about 70% of current smokers smoking less than 10 cigarettes per day.[26,27] In the present analysis, an average of 6.4 cigarettes per day in 2002 was shown for daily smokers, the most exposed group.

Furthermore, only 5.5% of daily smokers consumed 20 or more cigarettes during that year. Another salient feature of the epidemic in Mexico is that smoking preva-

lence and intensity is generally higher in more educated and wealthier persons. Two of three surveys conducted of Mexican health care workers during the 1990s found a higher smoking prevalence than in the general population.[15,28,29] The inverse relationship observed by the MNAS between marginality and smoking prevalence and intensity lends additional support to this assertion. In addition, a survey conducted in Latin men in the United States has found a direct association between smoking and educational attainment in that population.[30] These counterintuitive findings underscore the need for health education programs specially tailored for our population.

Other data also suggest that economic factors are important determinants of the smoking patterns of the Mexican population observed over the analyzed period. The economic analysis of the Mexican Income and Expenses Survey in Households referred to above shows that, in the Mexican population, the two main determinants of cigarette spending are price and income.[13] Over the study period, cigarette prices in Mexico increased in real terms and wages decreased, especially during the 1995 economic crisis.[31,32] It is well known that a 10 percent price increase may decrease cigarette consumption between 2 and 7%.[33,31] Therefore, it is likely that the harsh economic context explains a significant proportion of the reduction in prevalence and intensity observed in Mexico during the 1990s. During this decade, tobacco control measures in Mexico were focused on legislation banning smoking in public places, but with inadequate enforcement.[34] More effective control measures were only implemented in the early 2000s, including mass media advertising bans, enforcement legislation to ban smoking in federal buildings and other public places and successive taxation increases.[35-37] Consequently, in the absence of a strong state policy, the other reason for the decrease in smoking prevalence and intensity over the study period is public awareness possibly acquired by informal means or by contact with health personnel. The finding in the present analysis that, in 2002, about 52% of male daily smokers and 61% of female daily smokers had attempted to quit lends support to this hypothesis.

Since the most recent tobacco control measures implemented in Mexico, especially through taxation, are expected to be effective in reducing the prevalence and intensity of tobacco exposure,[38,39,40] a further improvement in the situation is expected, at least in the short term. However, the rising smoking trends in women and the young already present are likely to continue and worsen in the future, especially if the Mexican economy returns to a path of solid economic growth not seen since the late 1960s. As with other

health matters, such as alcohol consumption or obesity, there is a need for an effective state policy that promotes healthier life styles.

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