Preventive Medicine 129 (2019) 105830

Contents lists available at ScienceDirect

Preventive Medicine

journal homepage: www.elsevier.com/locate/ypmed

Assessing trends and healthy migrant paradox in cigarette smoking among U.S. immigrant adults

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ARTICLE INFO

Keywords:
Healthy migrant paradox
Cigarette
Smoking
Immigrants
Native born

ABSTRACT

The healthy migrant paradox suggests that immigrants to developed countries are, on average, healthier than the native born of the host country, with some finding that health advantages diminish after 10–20 years. This study examined trends in immigrant cigarette smoking trends, as well as smoking by the length of residence in the U.S. Data were drawn from the 1995–2015 Tobacco Use Supplement to the Current Population Survey (n = 140,254). Cochran–Armitage tests were used to assess changes in the prevalence of smoking over time in the population, as well by demographic characteristics. Multivariable logistic regression was used to compare cigarette smoking differences between immigrants' length of residence in the U.S. and the native-born population. The prevalence of immigrants' cigarette smoking significantly decreased from 15.0% in 1995/96 to 6.9% in 2014/15. Cigarette smoking rates for males and females significantly decreased from 20.8% and 9.1%% in 2007, respectively, to 10.4% and 3.6% in 2017. Differences in cigarette smoking appeared to have narrowed over time by the length of stay in the U.S. Multivariable analysis showed that immigrants had significantly lower odds of cigarette smoking (length of stay ≤5 years, Odds Ratio = 0.40, 95% Confidence Interval = 0.32–0.51; 6–10, OR = 0.39, CI =0.31–0.49; 11–20, OR = 0.39, CI =0.34–0.45; 20+, OR = 0.47, CI =0.43–0.53) compared to the native-born population. Findings show that immigrants consistently have lower smoking rates than native born, and this healthy behavior advantage did not appear to diminish based on years living in the U.S.

1. Introduction

Though there has been considerable progress in the reduction of smoking prevalence in the past two decades, smoking remains the leading cause of preventable death worldwide (Centers for Disease Control and Prevention, 2017; World Health Organization, n.d.). Smoking continues to present a significant public health problem that leads to a variety of health consequences, including cancer, heart disease, stroke, and diabetes (Centers for Disease Control and Prevention, n.d.). Research has shown that within the United States, some subpopulations (e.g., racial and ethnic groups and those with low socioeconomic background) have a higher smoking prevalence than the general population (American Lung Association, n.d.). However, little is known about cigarette smoking trends over time among the immigrant populations in the United States. Some evidence suggests that immigrants, especially females, have a lower prevalence of cigarette smoking than those born in the U.S. (Bosdriesz et al., 2013; Wilkinson et al., 2005; Acevedo-Garcia et al., 2005; Kuerban, 2016). For example, using data from the 2006–2007 Tobacco Use Supplement to the Current Population Survey (TUS-CPS), Bosdriesz et al. (Bosdriesz et al., 2013) found lower smoking rates among immigrants compared to both the U.S.-born group and the countries of origin.

The U.S. has experienced a large influx of immigrants in recent decades (Migration Policy Institute, 2013). As of 2015, the top source countries/regions of the U.S. immigrant population were South or East Asia (26.9% of immigrant population), Mexico (26.8%), Europe and Canada (13.5%), the Caribbean (9.6%), Central American (7.9%), South America (6.7%), the Middle East (4%), and sub-Saharan Africa (3.9%) (Migration Policy Institute, 2013; National Conference of State Legislatures, n.d.). The healthy migrant paradox (HMP) suggests that new voluntary immigrants to developed countries are healthier on average than the native born of the host country, especially within the earlier years of arrival (Singh and Siahpush, 2001; Markides and Rote, 2018). Different theories have been proposed about immigrants behavioral or health outcomes in their host communities. Segmented assimilation theory posits that immigrant groups experience different pathways of integration to the host society (Portes and Zhou, 1993; South et al., 2005). For example, South et al. found that among Latinos

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https://doi.org/10.1016/j.ypmed.2019.105830
Received 8 May 2019; Received in revised form 24 August 2019; Accepted 28 August 2019
Available online 12 September 2019
0091-7435/

that migrated to the U.S., certain subgroups were less likely to move into predominantly White neighborhoods (South et al., 2005). Another theory on immigrant adaptation patterns is acculturation, the dynamic process through which immigrants change behaviors to align with the cultural norms of the new community (Kirshner and Meng, 2012). Acculturation has been found to have varying effects on smoking behavior among immigrants (Pérez-Stable et al., 2001; Reiss et al., 2015). Likewise, stages of the smoking epidemic across countries could explain differences in smoking patterns between groups of immigrants (Reiss et al., 2015; Thun et al., 2012).

Several explanations for the HMP have been suggested in the extant literature. One such explanation is that immigrants undergo a self-selection process in which those individuals that are healthiest and have the greatest financial means are the most likely to migrate (Jasso et al., 2004). Another possible contributor was described in a study that found low smoking-related mortality may be partly responsible for the health advantages, specifically longevity (Blue and Fenelon, 2011). There is evidence that immigrants (especially younger, Black, or Hispanic immigrants) have a significantly lower risk of mortality from cardiovascular diseases, lung cancer, and chronic obstructive pulmonary disease (Singh and Siahpush, 2001; Markides and Rote, 2018), afflictions all associated with smoking (U.S. Department of Health and Human Services, 2014). Evidence suggests that the advantages of the HMP level off after 10–20 years of living in the developed country (Markides and Rote, 2018).

There is scant research investigating whether smoking behaviors follow the same temporal patterns as other health advantages described by the HMP (e.g., healthier diets and fewer sedentary hours); thus, it is unknown whether the lower prevalence of smoking that immigrants display within the first few years of arrival in their host countries changes over time. This raises a secondary question: Is there a point in time in which immigrant-smoking patterns become parallel with the smoking rates of the native-born population? It has been speculated that the HMP may be one of the mechanisms that influence smoking among migrants (Bosdriesz et al., 2013). A deeper understanding of tobacco use among immigrants is needed, especially trends in smoking by length of immigration in the host country. This study examined trends in cigarette smoking among immigrants in the U.S. In addition, we examined whether the length of residence in the U.S. is associated with cigarette smoking among immigrants in comparison to the native-born population and whether the association holds in both males and females.

2. Method

Data.

The TUS-CPS is a large household survey among the civilian non-institutionalized population 16 years of age and older in the United States. Administered by the U.S. Census Bureau and sponsored by the National Cancer Institute (NCI), the CPS is a monthly labor force interview survey conducted with > 50,000 households across the country. Since 1992, the TUS-CPS has been conducted periodically as a supplemental component to the CPS in order to assess many topics including smoking status, amount smoked, use of menthol cigarettes, smoking history, quit attempts, intention to quit, level of nicotine dependence, and other tobacco-related topics. In our study, we used data from 1995 through 2015 waves of TUS-CPS data, which were supplied by the NCI TUS team.

Study cohort.

Citizenship status questions were first included in the 1995–1996 questionnaire. The possible answers included: “Native, Born in the United States,” “Native, Born in Puerto Rico or U.S. Outlying Area,” “Native, Born Abroad of American Parent Or Parents,” “Foreign Born, U.S. Citizen by Naturalization,” and “Foreign Born, Not a Citizen of the United States.” In order to limit our analysis to the subpopulation of interest, we included only those who responded “Foreign Born, U.S. Citizen by Naturalization” and “Foreign Born, Not a Citizen of the United States” to the citizenship status question. For a comparison of smoking rates between native-born citizens and immigrants, people who responded “Native, Born in the United States” to the citizenship question were also included in our study. We further excluded subjects who had an invalid response to the question about the length of time spent living in the U.S., including those who responded that they had been living in the U.S. for a number of years that was higher than their age and those who refused to respond. The final analysis included 140,254 immigrants and 2,544,251 native-born citizens who met the inclusion criteria from survey circle 1995/96, 1998/99, 2000, 2001/02, 2003, 2006/07, 2010/11, and 2014/15.

Table 1
Sample characteristics of all selected immigrants in combined dataset (TUS-CPS 1995–2015).

n	Full sample	Smoker	Non-smoker	p-Value
	140,254	15,553	124,171	
Age				< 0.0001
18–24	11.00	10.44	11.07	
25–34	23.79	25.29	23.61	
35–54	41.70	46.39	41.14	
55+	23.51	17.88	24.18	
Sex				< 0.0001
Male	50.05	71.70	47.40	
Female	49.95	28.30	52.60	
Hispanic origin				< 0.0001
Hispanic	45.72	43.86	45.97	
Non-Hispanic	54.28	56.14	54.03	
Income[a]				< 0.0001
Low	47.30	50.79	46.85	
Lower median	14.30	14.77	14.24	
Median or higher	38.40	34.43	38.91	
Education				< 0.0001
Less than high school	30.52	31.92	30.34	
High school or some college	41.55	46.73	40.92	
Bachelor's degree or more	27.93	21.35	28.73	
Years in the U.S.				< 0.0001
≤5	15.44	17.42	15.22	
6–10	15.85	15.55	15.90	
11–20	29.32	29.54	29.29	
20+	39.39	37.49	39.59	
Metropolitan status				< 0.0001
Metropolitan	95.44	94.45	95.56	
Non-Metropolitan	4.56	5.55	4.45	

All variables were presented in weighted percentage.

[a] Income was categorized into low income (lower than 67% median income), lower median income (between 67% and 100% of median income), and median income or higher. Chi-square tests were used to compare sample characteristics between smokers and non-smokers.

Measures.

We defined a smoker as someone who have smoked at least 100 cigarettes in their life and currently smoked every day or some days at the time of the survey. We also obtained age, sex, Hispanic origin, family income, education level, metropolitan status, and immigrant's year of arrival in the U.S. from the harmonized data. We further categorized age as 18–24, 25–44, 45–64, and 65+; years in the U.S. as ≤5, 6–10, 11–20, and 20+. Education level was classified as less than high school, high school or some college, and bachelor's degree or more. For income classification, we obtained data for annual median household level from the Census Bureau (United States Census Bureau, n.d.) and used the definition of middle-class income as between 67% and 200% of the median income according to the Pew Research Center classification (Pew Research Center, 2016). We categorized income into low income (lower than 67% median income), lower median income (between 67% and 100% of median income), median income or higher.

Table 2
Trend of the prevalence (and 95% confidence interval) of smoking in immigrants since 1995.

	1995–1996	2000	2006–2007	2010–2011	2014–2015
n	15,852	12,620	18,755	20,589	19,124
Full sample	14.96	14.06	9.91	8.09	6.95
	(14.34, 15.59)	(13.40, 14.73)	(9.42, 10.41)	(7.66, 8.51)	(6.54, 7.36)
Sex					
Male	20.82	20.02	14.29	11.74	10.40
	(19.76, 21.87)	(18.92, 21.13)	(13.45, 15.14)	(11.02, 12.47)	(9.69, 11.12)
Female	9.09	8.08	5.46	4.37	3.64
	(8.46, 9.72)	(7.39, 8.77)	(4.98, 5.94)	(3.95, 4.78)	(3.23, 4.04)
Age					
18–24	12.57	13.42	10.09	6.71	6.25
	(10.76, 14.37)	(11.37, 15.48)	(8.43, 11.76)	(5.21, 8.21)	(4.56, 7.93)
25–34	16.51	14.68	10.14	8.20	7.02
	(15.22, 17.80)	(13.33, 16.03)	(9.10, 11.18)	(7.26, 9.14)	(6.07, 7.97)
35–54	16.85	15.93	10.93	9.15	7.42
	(15.82, 17.88)	(14.86, 17.01)	(10.15, 11.72)	(8.49, 9.81)	(6.80, 8.04)
55 +	11.25	10.18	7.67	6.67	6.40
	(10.15, 12.35)	(9.02, 11.35)	(6.81, 8.52)	(5.94, 7.40)	(5.72, 7.09)
Education					
Less than high school	15.43	13.99	10.87	8.58	8.07
	(14.30, 16.56)	(12.84, 15.15)	(9.95, 11.80)	(7.74, 9.41)	(7.20, 8.94)
High school or some college	16.41	15.63	11.05	9.24	7.94
	(15.43, 17.39)	(14.56, 16.70)	(10.24, 11.86)	(8.55, 9.93)	(7.28, 8.60)
Bachelor's degree or more	11.81	11.63	7.25	5.90	4.77
	(10.70, 12.93)	(10.42, 12.83)	(6.45, 8.05)	(5.25, 6.55)	(4.16, 5.38)
Income					
Low income	16.23	15.29	10.95	9.01	8.05
	(15.25, 17.21)	(14.23, 16.36)	(10.13, 11.78)	(8.30, 9.72)	(7.39, 8.72)
Lower median income	16.30	14.94	10.41	8.06	6.93
	(14.52, 18.08)	(12.98, 16.90)	(9.02, 11.80)	(6.89, 9.23)	(5.80, 8.05)
Median income or higher	13.27	12.49	9.13	6.87	5.78
	(12.27, 14.27)	(11.41, 13.56)	(8.32, 9.95)	(6.21, 7.53)	(5.09, 6.47)
Years in the U.S.					
≤5	17.15	17.24	11.44	7.94	6.82
	(15.49, 18.81)	(15.38, 19.11)	(9.98, 12.90)	(6.66, 9.22)	(5.55, 8.09)
6–10	14.41	13.00	10.29	7.67	6.56
	(12.94, 15.88)	(11.61, 14.38)	(9.12, 11.47)	(6.62, 8.73)	(5.33, 7.79)
11–20	15.54	13.76	9.74	8.55	7.10
	(14.40, 16.67)	(12.53, 14.99)	(8.80, 10.67)	(7.74, 9.35)	(6.34, 7.86)
20 +	13.60	13.54	9.30	7.97	6.98
	(12.61, 14.58)	(12.45, 14.62)	(8.56, 10.04)	(7.35, 8.60)	(6.41, 7.55)

Prevalence of smoking and its 95% confidence interval is presented for selected survey wave data and full data result is presented in Supplementary table 1. $P < .0001$ for each year among each subgroups.

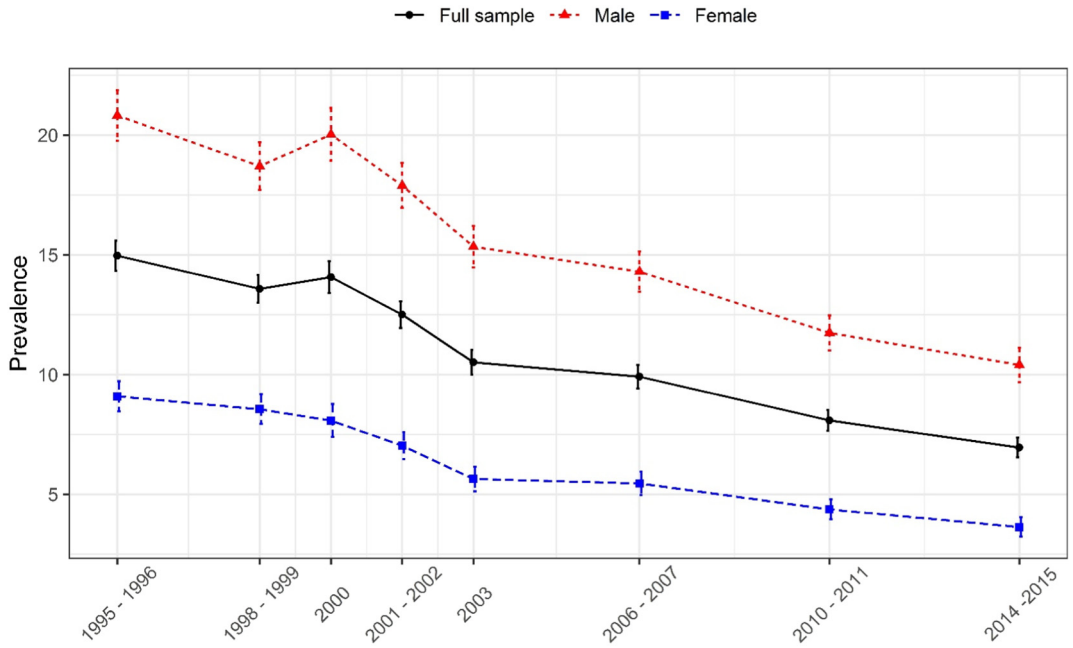

Fig. 1. Trends of smoking prevalence (and 95% Confidence Interval) in U.S. immigrants since 1995 by sex.

Table 3
Regression results of the association between years spent in the U.S. and smoking status for the 2014–2015 TUS-CPS.

Years in the U.S.	Full sample ref	Male ref	Female ref
Native-born citizen			
≤ 5	0.45(0.38, 0.53)	0.61(0.50, 0.74)	0.18(0.13, 0.26)
6–10	0.41(0.35, 0.47)	0.55(0.46, 0.65)	0.22(0.17, 0.27)
11–20	0.42(0.37, 0.47)	0.58(0.50, 0.68)	0.23(0.19, 0.29)
20+	0.52(0.47, 0.57)	0.62(0.54, 0.70)	0.41(0.35, 0.47)

Model adjusted for age group, Hispanic origin, income level, metropolitan status, and sex (though sex was excluded in the male/female subgroup analysis). ref. = reference category.

2.1. Statistical analysis

The weighted sample demographic characteristics were analyzed by smoking status. Rao-Scott Chi-Square tests were used to compare characteristics between two groups. We generated estimates of the prevalence of smoking for each year of data for the full sample as well as by sociodemographic characteristics (sex, income level, education level, age subgroups, and years in the U.S.). Rao-Scott Chi-square tests were performed for each survey wave data to test the difference of smoking prevalence by sociodemographic characteristics.

In the trend analyses, Cochran–Armitage tests were used to assess the statistical significance of changes in the prevalence of smoking over time and to examine the statistical significance of changes by sex, years in the U.S., income level, education level, and age subgroups. Additionally, multivariable logistic regressions were performed for the most recent data set (2014/2015) to examine whether immigrant cigarette smoking was following the HMP; that is, multivariable logistic regressions were performed to compare differences in cigarette smoking status between immigrants (by years in the U.S.) and native-born citizens. We also examined potential gender differences by stratifying analyses by sex. Analyses were adjusted for covariates, including age group, sex, Hispanic origin, income level, and metropolitan status. Sampling weights were included in all analyses to account for the complex survey design. All tests were two-sided, and a *P*-value of < 0.05 was considered significant. We performed all data analyses using SAS version 9.4 (SAS Institute, Inc., Cary, NC).

3. Results

The distribution of characteristics of all selected immigrants is shown in Table 1. Of the 140,254 immigrants included in the analysis, 41.7% were between 35 and 54 years old, 50% were male, and 45.7% were Hispanic. The majority of immigrants lived in a metropolitan area (95.4%) and had lived in the U.S. for > 10 years (68.7%). Around 47.3% of immigrants had a low income, and 30.5% did not graduate from high school. Significant differences were found in demographic characteristics between smokers and non-smokers. About 71.7% of smokers were male, 21.4% had a bachelor's degree, and 17.9% were aged at least 55 years. Among non-smokers, 47.4% were male, 28.7% had a bachelor's degree, and 24.2% were aged at least 55 years.

Table 2 reports the prevalence and characteristics of smoking in immigrants by survey year. Across the study period, smokers were more likely to be male and had a low or lower median income. Fig. 1 shows trends in the prevalence of smoking in all immigrants, as well as prevalence by sex. The prevalence of all smoking decreased significantly from 15.0% in the 1995/96 cycle to 7.0% in the 2014/15 cycle. In sex subgroups, the prevalence of smoking was significantly higher in males than in females (Supplementary Table 1). In both male and female immigrants, the prevalence of smoking decreased significantly from 20.8% and 9.1% in 1995/96, respectively, to 10.4% and 3.6% in 2014/15. Males showed a sharper decrease in prevalence than females. Although, odds ratios were smaller among females than males (Table 3).

Cigarette smoking trends by age in immigrants are shown in Fig. 2. In all subgroups, the prevalence of smoking decreased significantly. During the study period, the prevalence of smoking was highest in the 35–54 age group and lowest in the 55+ age group. In the 1995/96 cycle, the prevalence was higher in the 25–34 and 35–54 age groups than in the 18–24 and 55+ groups; this difference narrowed over time due to different rates of decreasing prevalence. The decrease in the prevalence was most significant for the 25–34 and 35–54 age groups, which both declined by approximately 9.4%, and the smallest in the 55+ age group at around 4.9%.

Fig. 3 shows cigarette smoking status by years living in the U.S. For immigrants that have lived in the U.S. < 5 years, the prevalence of smoking was statistically significantly higher than other groups in the

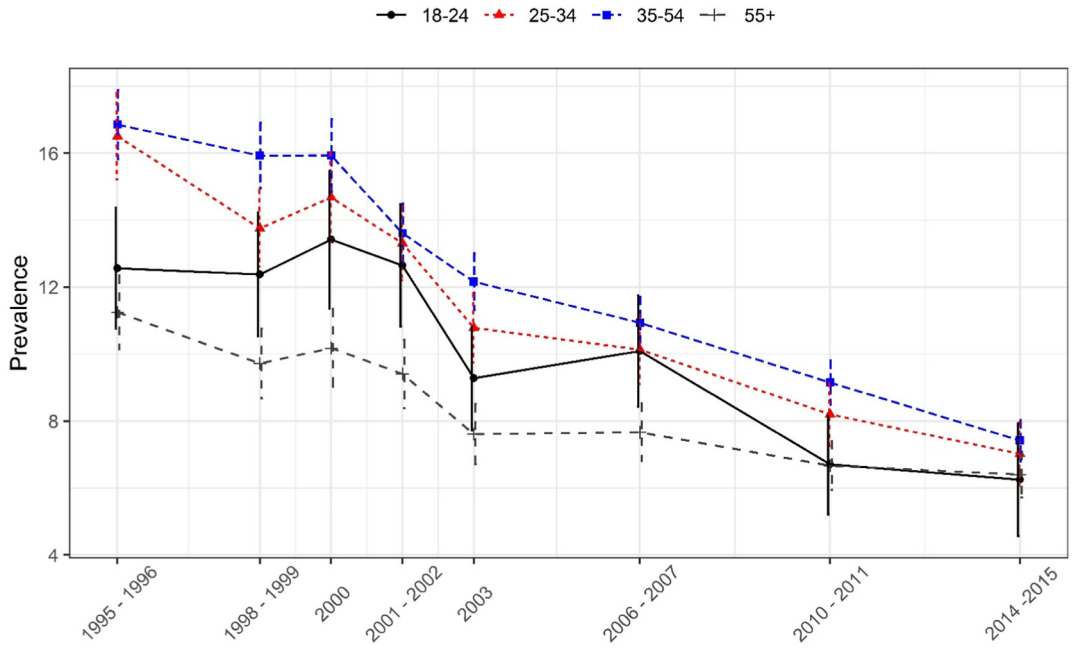

Fig. 2. Trends of smoking prevalence (and 95% Confidence Interval) in U.S. immigrants since 1995 by age.

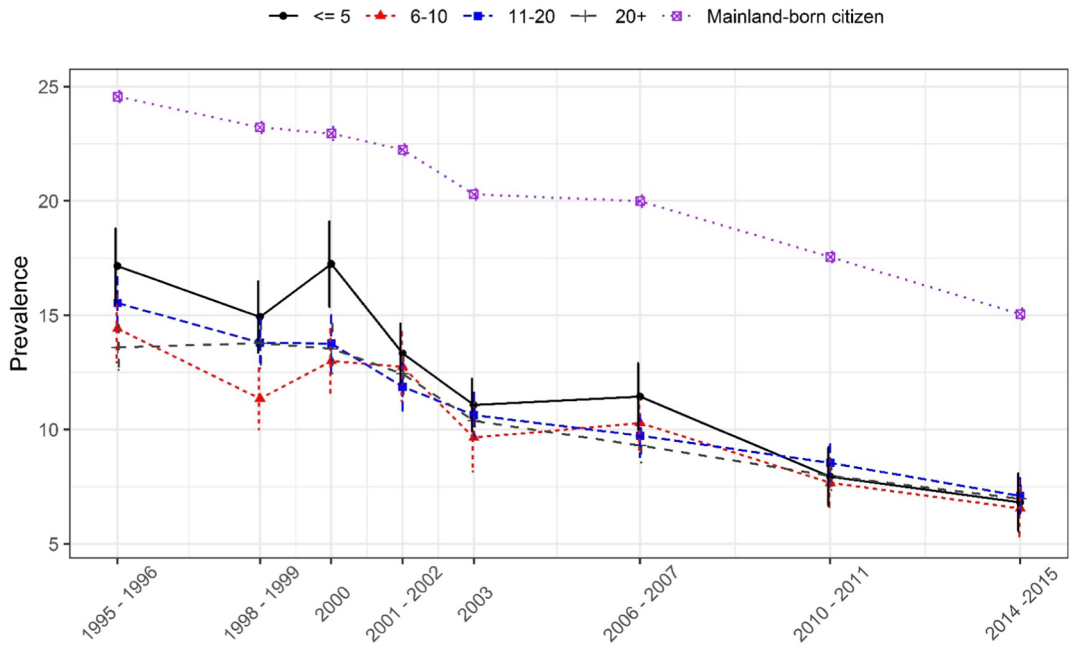

Fig. 3. Trends of smoking prevalence (and 95% Confidence Interval) in the native-born population and immigrants by year in the U.S since 1995.

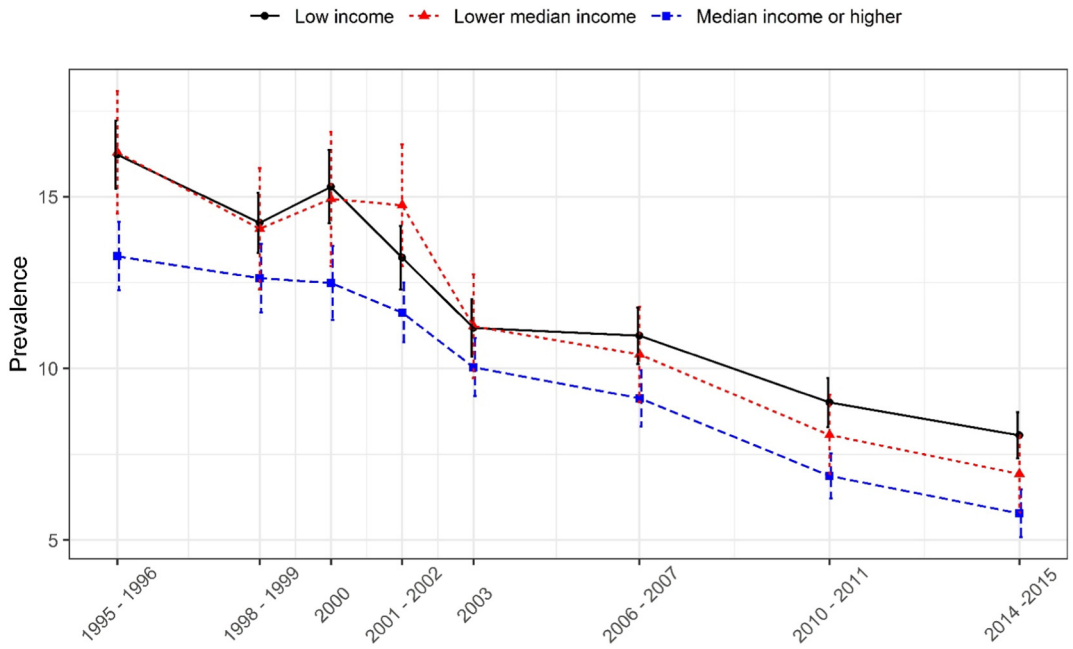

Fig. 4. Trends of smoking prevalence (and 95% Confidence Interval) in U.S. immigrants since 1995 by income.

1995/96 through 2000 survey cycles. In 2014/15, there was not much difference among subgroups. We also found that smoking rates in immigrants were lower than the native-born citizens throughout the study period. The results of the multivariable regression analysis comparing immigrants and native-born citizens are shown in Table 3. After adjusting for covariates, immigrants still had statistically significantly lower odds of cigarette smoking compared to the native-born citizen, regardless of years spent in the U.S.

Figs. 4 and 5 show trends in the prevalence of immigrant cigarette smoking by income and educational attainment. A significant decreasing trend was observed in all income and education-based subgroups. The prevalence was lowest in immigrants that had a median or higher family income over the study period. In the 1995/96 cycle, there was a negligible difference (less than a 0.1%) in the prevalence of smoking between low income and lower median income, but the difference increased to 1.1% in the 2014/15 cycle. In education-based subgroups, the prevalence was lowest in immigrants with a bachelor's degree or more.

4. Discussion

This study investigated trends in cigarette smoking among immigrants in the U.S., and whether the length of residence is associated with cigarette smoking. Across all immigrant subgroups, the prevalence of smoking decreased from the beginning of the study period to the end.

The prevalence of smoking was lowest in immigrants that had a median or higher family income over the study period, which is in keeping with findings in the general population that lower income is

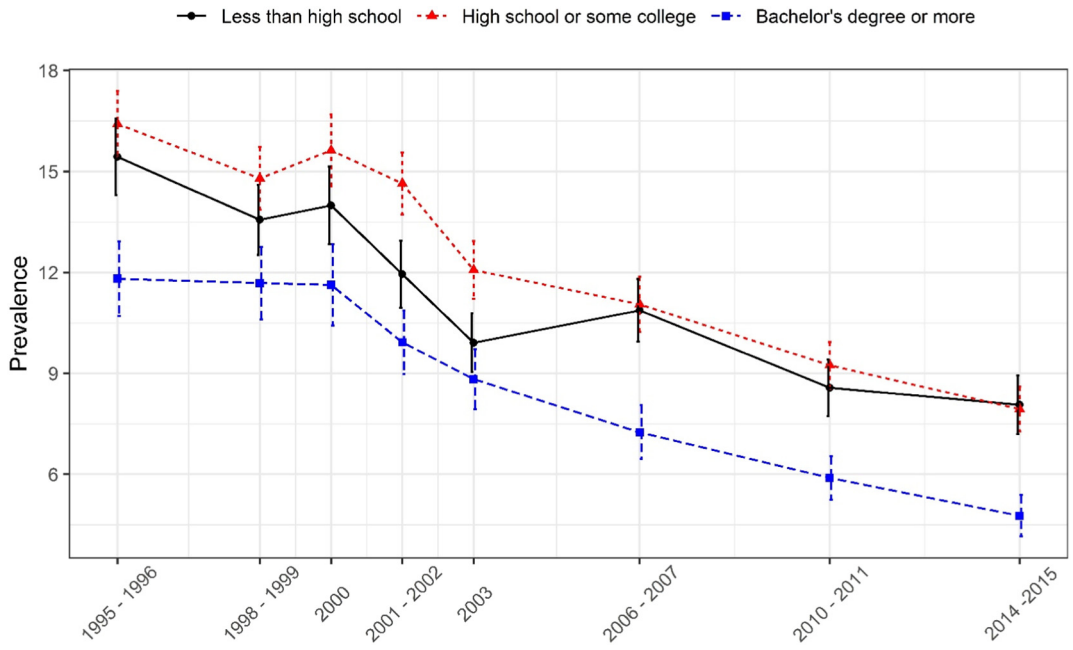

Fig. 5. Trends of smoking prevalence (and 95% Confidence Interval) in U.S. immigrants since 1995 by education level.

associated with higher smoking rates (U.S. Department of Health and Human Services, 2014). The prevalence was lowest in immigrants with a bachelor's degree or more compared with those who had less education. The gap in the prevalence of cigarette smoking between those with at least a bachelor's degree and those with less education is consistent with findings in the general population. The 2012 National Survey on Drug Use and Health found that in U.S. adults, college graduates had a 10.4% rate of current smoking while those with some college had a 23.4% current smoking prevalence (U.S. Department of Health and Human Services, 2014).

Regardless of the length of residence, we found that the smoking prevalence in the immigrant population was lower than that of the native-born population in the U.S. This finding lends support to a study that found low smoking-related mortality may be partly responsible for why immigrants display better health outcomes, specifically longevity (Blue and Fenelon, 2011). Using a similar definition to the one used in this study, the National Health Interview Survey found that smoking rates for all U.S. adults were around 15.1% in 2015 (Phillips et al., 2017). This is similar to the rate we found for native-born citizens in 2015 but much higher than the 7% smoking prevalence found for immigrants, which is partially in agreement with the HMP, in that immigrants may display better health outcomes. Although it has been suggested that HMP advantages level off after 10–20 years (Markides and Rote, 2018), this study's findings run contrary to the HMP theory: We found that smoking prevalence among all immigrants—regardless of years living in the U.S.—was similar across sex, age, and sociodemographic factors and was consistently lower than the native-born population. In addition, we found that immigrants who had been in the U.S. for a shorter period had higher smoking rates than those who had been in the U.S. for 6+ years or more.

Our results show that although the gap in the prevalence of smoking between male and female immigrants has narrowed over time, it was still large at the end of the study period. Throughout the study, males had a higher rate of smoking than females. This is consistent with findings in the general U.S. population, with males consistently displaying a higher prevalence of cigarette smoking than females (Phillips et al., 2017; The Henry J. Kaiser Family Foundation, n.d.). Compared to males and females in the general population in the U.S., immigrants had lower reported rates of smoking. Prior studies have found that approximately 16.7% of U.S. males and 13.6% of U.S. females were smokers in 2015 (Phillips et al., 2017), whereas 10.4% of male immigrants and 3.6% of female immigrants reported smoking. Evidence indicates that the smoking epidemic stages of the origin and host countries could explain differences in prevalence found between males and females, as origin countries that are in the early phases of the epidemic usually have higher rates of smoking in males than females (Reiss et al., 2015; Thun et al., 2012; Lopez et al., 1994). Furthermore, potential gender differences in the relationship between immigrants' assimilation in the host country and cigarette smoking have been documented elsewhere (Reiss et al., 2015). Among immigrants in western countries, Reiss et al. (Reiss et al., 2015) noted that more acculturated women had a higher likelihood of smoking with the opposite results found for men (Reiss et al., 2015).

The HMP has been documented in other countries. For example, in the United Kingdom, South Asians have been found to have lower mortality rates than Europeans (Hayes et al., 2017). A study conducted in France found that after migration, the prevalence of smoking increased over time among Maghrebin men to eventually surpass levels of the native-born, although it remained lower across the study among sub-Saharan African males (Khlat et al., 2019). Smoking rates among sub-Saharan Africa women eventually came close to the level of those native-born; however, Maghreb women had significantly lower smoking rates than native-born during the same time period (Khlat et al., 2019). It is important to note that comparing of findings across countries may be difficult given the potential country differences in the demographic characteristics of immigrants.

This study has a few limitations that are worth noting. The self-report nature of the survey may be subject to inaccurate recall of events and experiences. This study does not claim any temporal order of immigrants' years in the U.S. and smoking status. The TUS-CPS survey was conducted in two languages (English and Spanish), and it remains unclear how potential language barriers may have affected the survey. This study also had many strengths; for example, we were able to investigate a significant public health issue among a large sample of immigrants, a population that is historically understudied. In addition, the large sample size allowed for an analysis of trends in cigarette smoking by important sociodemographic characteristics. The operationalization of two categories, immigrant and non-immigrant, may omit potential inter-categorical differences across immigrant groups. The study did not capture heterogeneity among immigrant subgroups;

therefore, intra-inequalities are not reported or discussed. This study may not be generalizable to other countries as the immigrant characteristics may be different.

5. Conclusion

This study investigated trends in smoking among immigrants in the U.S., and whether the length of years spent living in the U.S., is associated with cigarette smoking. We found that immigrants consistently had a lower prevalence of smoking than the general U.S. population regardless of their length of residence. In terms of cigarette smoking, our findings run contrary to some aspects of the HMP, which suggests that health outcomes between immigrants and the native-born population tend to be similar with a longer length of stay in the host country. Future research may consider investigating whether the country of origin influences HMP.

Declaration of competing interest

The authors declare that they have no conflict of interest.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ypmed.2019.105830.

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