

SENIOR HONORS THESIS

Household Smoking Bans in Ohio

A Study of Interregional Correlates

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Abstract

Background: Clean indoor air ordinances are being rapidly adopted across the United States to protect persons in public places from exposure to environmental tobacco smoke. The private sphere can be partially protected by adopting a household smoking ban.

Objective: To analyze the prevalence and adoption patterns of household smoking bans in Ohio.

Design: The 2008 Ohio Family Health Survey collected data using random-digit-dialing methodology and cell phone sampling from more than 50,000 Ohio households that provided sociodemographic and health behavior data for analysis. Respondent, household, neighborhood and regional level data were examined to determine the prevalence of adopting a total household smoking ban. Basic descriptive statistics and chi square analyses were used to determine if there were differences in ban adoption by select characteristics.

Results: The variables most closely associated with the adoption of household smoking bans included higher respondent education level, and the presence of children and other adults in a household. Being a current smoker was most negatively related to the adoption of a household smoking ban.

Conclusions: Public health officials have done an excellent job promoting the adoption of household smoking bans. It may now be necessary to refocus future campaigns to target those populations that have lower household smoking ban adoption rates, namely those in rural Appalachia, blacks, and smokers.

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INTRODUCTION

Environmental tobacco smoke (ETS) is classified as a class A carcinogen under the EPA's carcinogenic assessment guidelines, a classification reserved for compounds that, "have been shown to cause cancer in humans, based on studies in human populations" (USEPA, 2008). Researchers are trying to identify and disseminate any potential incentive to adopt smoking bans in public places via policy changes and in private places via attitude changes (Smith & Wakefield, 2005). Indoor smoking bans effectively reduce exposure to ETS when instituted in both the public sphere, via clean indoor air ordinance, and in the private sphere via, household smoking bans and other similar rules (Goodman, et al., 2007; Messer et al, 2008). The adoption of household smoking bans by current smokers has been noted to increase smoking cessation success rates and to decrease cigarette consumption among those who do not quit altogether (Messer et al., 2008). The route towards public policy changes is rough and it requires convincing a majority of residents to support clean indoor air initiatives or the action of a legislative or regulatory body, which although daunting is certainly achievable. The rewards of public education efforts are being met by the adoption of comprehensive smoking bans in public places for 70% of the American population (ANR, 2009). But, private households are not governed by majority rule of the neighborhood and thus, education efforts have to go even further than those that pass public place smoking bans to convince people to keep for themselves and their children, a healthy smoke-free environment.

Why should we examine household smoking ban adoption patterns? Largely, the act of exploring what tobacco control policies are enacted by individuals outside of the sphere of public policy is a reflection of the challenges that face the future leaders in the public health community. Strategies of the past have strived to change societal norms regarding the consumption of tobacco products (Smith & Wakefield, 2005). Efforts to take an image of glamour and sophistication that was embodied in the

cigarette and replace those positive connotations with largely negative images of addiction, disease, and willful ignorance have occupied the public health community for the last half century. These efforts have largely been a success in America where population wide smoking rates have declined by nearly half since 1965 (Centers for Disease Control and Prevention, 2010). But, as the decline in smoking rates in the population have begun to slow down in the last 20 years, the need to increase the policy efforts has intensified. Ad bans, clean indoor air ordinances, the Master Settlement Agreement, and FDA regulation of tobacco have all chipped away at the reputation and influence of the cigarette and tobacco industry on American society.

Much research on ETS has been performed over the last several decades leading to a broad and un-nuanced conclusion that ETS is harmful to the health of all persons exposed (Pirkle, 1996). Children are exposed to more ETS in the home than anywhere else in their daily lives (US Department of Health and Human Services, 2006). Research has shown that the adoption of household smoking bans benefit children by making them less likely to smoke as adults and decreasing occurrences of childhood asthma attacks (Goodwin, 2007). In addition, small scale qualitative research has been done to determine what sorts of aesthetic reasons inform families' decisions on the adoption of household smoking bans (Kegler, 2007). Namely, distaste for the odor and coloration of walls and décor of a household factor heavily into a family's decision to consider the adoption of a household smoking ban. Other research methodologies have contributed to the knowledge base like a multi-wave longitudinal study of Massachusetts adolescents that showed that youths aged 12 to 17 who lived in households without smoking bans were more likely to begin experimentation with smoking than their peers with a household smoking ban (Albers, 2008). Recent research has indicated that further association exists between those smokers who take residence in households with a total smoking ban and the reported intention of the smoker to quit (Seung-Kwon Myung, Kazinets, Seo, & Moskowitz, 2010).

A consistent rural-urban gap also exists in the adoption of household smoking bans (Pizacani, 2008). Part of this trend has been explained by racial and cultural differences in attitudes towards smoking in the home. Rural white and metropolitan African American smokers share opposing views on smoking in the home, with African Americans standing firmly against the practice (McMillan, 2004; Muilenberg, 2006). Moreover, when rural, as well as metropolitan smokers, are surveyed the presence of children in the home has been shown to be associated with the adoption of at least a partial household smoking ban (Berg, 2006; Wamboldt, 2008). The complexities of the relations between the rural and metropolitan gap are evidence of the further need to examine and define the relationships between variables.

Research in the area of household smoking bans was recently summarized in a review article that appeared in the October 2009 issue of *Nicotine & Tobacco Research* (Mills, Messer, Gilpin, & Pierce, 2009). The review article identified areas of research on household smoking bans that still must be addressed by future studies in the area, including fine-tuning large-scale population surveys to incorporate independent variables like age, race/ethnicity, education level and household composition into their analyses.

This thesis research is able to fill in certain gaps in the literature by studying in depth, the differences in household smoking ban adoption rates between understudied and underserved populations. The literature lacks a clear direction on where household smoking ban adoption promoting campaigns should be aimed. Other smoking cessation efforts have made a clear and concerted effort to focus their marketing efforts, to great effect (Vallone, et al., 2010). Modeling advertising efforts on the home smoking ban front to this focused paradigm may yield similar results. Previous studies into household smoking bans provide the evidentiary and motivational basis for continuing exploration with the 2008 Ohio Family Health Survey data. Each hypothesis derives from a need to know more about the

effect of a certain variable on the adoption of a household ban. This study asks a broad research question. What individual, household and neighborhood level characteristics are associated with a higher rate of adoption of household smoking bans? Also are these associations consistent between regions of Ohio? This study uses Ohio as the model to examine how public health officials can target their campaigns to effectively keep ETS out of the lungs of non-smokers.

Ohio will prove to be a good place to conduct research on interregional differences in household ETS, as the state is covered by a comprehensive public place smoking ban, leaving only households as one of the most significant places left to smoke indoors in the state. All communities share a baseline level on the legality of public smoking therefore normalizing the level of exposure each household has to Ohio's comprehensive smoking ban on public place. As living in an area with a public smoking ban has been associated with more frequent adoption of household smoking bans, Ohio will prove to be a good place to examine what further factors are holding people back from adopting their own household smoking ban (Bernat, Klein, Fabian, & Forster, 2009).

STUDY OBJECTIVES

This project will focus on two main research questions. First, which individual, household, and neighborhood-level characteristics are associated with the more frequent adoption of household smoking bans? Second, is there a relationship between adoption of a household smoking ban and geographic region in Ohio? Individual level variables such as the respondent's age, education level, race, smoking status, and marital status were examined. Household level variables such as family composition, poverty-line-to-income ratio were included in the study. A neighborhood level variable of school district performance was also analyzed.

The first hypothesis is that individual level characteristics, such as being a current or former smoker, will be associated with a lower rate of adopting household smoking bans. Racial differences

between respondents should be associated with smoking status and will reflect the rate of adopting smoking bans based on the respondent's smoking status.

The second hypothesis is that there will be a positive association between the household level variable of the presence of children in a household and the adoption of a household smoking ban. Previous research on a smaller scale has suggested such a trend exists (Pizacani, 2003) and this should hold true in the larger OHFS study.

The third hypothesis states that neighborhood level measures of school district performance will be related to the adoption of household smoking bans. Households located in higher performing school districts will adopt household smoking bans at greater rates than those in lower performing school districts. The rationale for this is that previous research has shown that other factors present in higher performing school districts have been associated with the adoption of household smoking bans (Wamboldt, 2008). For the purposes of this paper, only four representative test counties (Clinton, Guernsey, Licking, and Lucas) were examined at the neighborhood level, one from each region of Ohio (see Figure 1 in Appendix).

The fourth hypothesis is that there will be interregional differences between the four regions in Ohio in the rate of adoption of household smoking bans. These four regions divide Ohio's 88 counties in those that are Metropolitan, Suburban, Rural Non-Appalachian, and Rural Appalachian. Interregional differences also have been shown to exist in previous research, but trends have been found that indicate even the presence of children in a smoker's house is associated closely with the adoption of a smoking ban in rural areas (Berg et. al, 2006).

METHODS

Data Source

The data to be used in the analysis were collected as a part of the 2008 Ohio Family Health Survey (OFHS). The OFHS was commissioned to provide information to policy makers in Ohio who will gauge the status of health care in Ohio and guide policy to suit the needs of Ohioans during the volatile economic times of recent years. The 2008 OFHS was a stratified survey that used random digit dialing, list-assisted sampling, and cell phone sampling (Macro International Inc, 2009). In order to reach the sample size goals for select groups, sampling methods disproportionately stratified the population based on county, landline telephone bank, and minority race status. The telephone survey was conducted by operators working for Macro International who, upon calling a particular household, conducted an interview with an adult member of said household as well as a shorter interview with an adult proxy respondent for a child less than 18 years of age living in the household. The questions in the interview established the demographic, professional, and socioeconomic characteristics of respondents and inquired in detail into topics like health insurance coverage, access to care, domestic violence, and tobacco and alcohol usage. The response rate for the landline based survey was 35 percent and by the conclusion of the 5 month data collection period in January 2009, information from 50,944 completed interviews had been collected.

The survey data were weighted for analytical purposes at the respondent level and sampling weights were calculated to adjust for the unequal likelihood of an adult respondent being selected in the survey. Data were further divided into strata at the county level.

Study Variables

The primary outcome, or dependent variable, in this study was adoption of a total household smoking ban. In the OFHS, the question was the following, “Which of the following best describes the rules about smoking in your home.” The response options were, “Not allowed anywhere inside home,” “Some places at some times,” “Allowed anywhere,” “Do not know,” or “Refused.” For the purposes of this research, only the adoption of a total household ban (i.e. the response that, “Smoking is not allowed anywhere inside your home”) was counted as having adopted a ban in the process of data analysis. There is no proven safe level of ETS; therefore even a partial ban does not make a household free of ETS any more than a household with no ban at all (USEPA, 2008). Because we cannot measure the concentration of tobacco smoke in every house, we are best able to evaluate the safety of each household environment by creating a binary grouping system such as ours.

This study’s independent variables were divided into four large categories that describe the population they represent. Respondent-level variables describe the individual answering the telephone and responding to the questions in the OFHS. Household-level variables answer questions about every person in the respondent’s living quarters. Neighborhood-level variables use the ZIP code of a respondent to study larger groups of people. Regional variables study the four kinds of counties in Ohio. Table 1 in the Appendix lays out these variables according to variable type and variable level.

The respondent-level variable of smoking status is thought to be a significant correlate of household smoking ban adoption rates. Numerous studies have shown a strong link between being a smoker and lacking a household smoking ban when compared to non-smokers (McMillen, Winickoff, Klein, & Weitzman, 2003; Lund & Lindbak, 2007). This study included the variable to determine if households with smokers are adopting household smoking bans at a higher rate than the 22.3% of households the last time the measure was taken (Centers for Disease Control and Prevention, 2010).

The variable split respondents into three groups consisting of never smokers, former smokers and current smokers. Never smokers have not smoked 100 cigarettes in their life, while the former smokers have successfully quit smoking cigarettes.

The other respondent-level variables studied were race/ethnicity, age of respondent, marital status and level of education. Race/ethnicity was included in the study as a respondent level variable although it is known to be a close proxy for household racial and ethnic composition. But, in order to avoid extrapolation it is counted here as a respondent variable as respondents were asked to self identify their own race and ethnicity. The four categories of race and ethnicity used in this study are "White," "Black," "Hispanic," and "Asian." Previous studies that delved into the question of the effect of race/ethnicity on the adoption of household smoking bans have shown with great statistical difficulty that Black respondents least frequently adopt household smoking bans, followed by White respondents, then by Hispanics and Asians (Gilpin et al., 1999; Norman et al., 2000). Hispanics and Asians have not been shown to adopt bans at statistically significant rates yet because sample sizes have been too small. This study may be able to illuminate the finer effects that race may be playing especially as it relates to SES indicators.

The age of a respondent was a categorical variable because age groups were used to categorize respondents. The age of a respondent has an unclear effect on household smoking ban adoption patterns and this study attempts to fill in a gap in the literature. Respondents were split into six age groups which were, "18-24 years old," "25-34," "35-44," "45-54," "55-64," and "65 years old and higher". The use of age groups in this analysis changed a normally continuous variable, age, into a categorical variable.

Marital status is a respondent level variable that examines household composition. Marital status can be a close proxy to household level measures but, it is used here as a respondent level

variable as it only describes one person. For example, when there are two adults in a household and the respondent is married, all household adults are married. This analysis uses it as a respondent level variable to increase the precision of its results. Further, respondents who were widowed, separated, never married, and divorced have been found in previous OHFS 2008 analysis to be smoking at higher rates than married respondents (Ferketich, 2009). When this observation is cross-applied to the analysis on smoking status as it relates to the adoption of household smoking bans, it is expected that respondents who are married are less likely to smoke and therefore more likely to adopt a household smoking ban than their widowed, separated, never married, and divorced counterparts.

Education level was determined by the highest level of education received by a respondent. Respondents were grouped into four categories that ranked them from lowest to highest levels of attained education. The lowest level was “Less than High School Graduate”, next highest was “High School Graduate” followed by “Some College” and highest was “Four Year College Degree or Higher”.

The household-level variables examined covered income and household composition. Income level was examined as a categorical variable, splitting respondents by their household income as a percentage of the Federal Poverty Line. Households were grouped into one of six categories stratified by income level. Previous studies have indicated that a higher income level is correlated with a high rate of adopting household smoking bans among smokers (Pizacani et al., 2004; Shavers et al., 2006).

Family type was a categorical variable that split households into four groups based on the number of adults and children in the household. The categories were the following: 1 Adult & 0 Children, 1 Adult & 1 Child, 2 Adults & 0 Children, 2 Adults & 1 Child. In this context, households with “1 Child” included all households with 1 or more child and those households with “2 Adults” included all households with 2 or more adults. The presence of children in a household is expected to be associated with higher rates of ban adoption as previous studies into this question have indicated (Sheilds, 2007).

The number of adults in a household and the number of children in a household were also examined. These variables have not been extensively studied to determine if the presence of more children or more adults increases smoking ban adoption rates. It is expected that those households with 2 adults will adopt bans in the largest numbers as they are most likely to be married and least likely to smoke. Additionally if the presence of one child in household is associated with the adoption of a household smoking ban, it could be expected that additional children will provide additional rationales for the adoption of a household smoking bans, a positive association is expected to be seen when comparing adoption rates and the number of children in a household.

In order to measure a neighborhood level proxy of SES, school district performance data were collected from the Ohio Department of Education's website. Each household in the OFHS is associated with a ZIP Code and the likelihood of a certain ZIP Code falling in a school district was calculated using municipal tax records. Each ZIP Code was then given a weighted average Performance Index Score (PIS) composite value based on the percentage of homes in a ZIP Code that belong to each school district and the PIS of each school district. The Performance Index Score is a measure of a school district's academic success created and distributed by the Ohio Department of Education (Ohio Department of Education, 2009). This composite PIS score (redundancy intended) will be assigned to each respondent as a reflection of the likely academic performance of the immediate surrounding area.

To clarify, The Performance Index Score (PIS) is a measure that evaluates building-wide and district-wide standardized test achievement levels in Ohio. It is produced annually by the Ohio Department of Education which uses the results of the Ohio Graduation Test, (OGT) an examination distributed to Ohio pupils at the 3rd, 4th, 5th, 6th, 7th, 8th, and 10th grade levels, to produce a PIS. Students taking the OGT are determined to be achieving at a particular performance level; ranging from performing with limited proficiency, to being proficient, up to performing at an advanced level. The

percentage of students performing at each particular performance level within a building and within a district is then tabulated and each performance level is given a particular weight, with higher performing levels being given a larger weight. The percentage of students at each level is multiplied by the respective weight at that level and all weighted scores are added together to obtain the PIS. The maximum possible PIS is a 120 which would mean that 100% of students scored at the advanced level which has an associated weight of 1.2. This paper uses the PIS scores from 2008 as that time period is in line with when the 2008 OFHS data collection was undertaken.

The PIS has been used previously in other academic studies as a correlate to a lot of other measures. For example, the PIS was used to determine that those in their pre-elderly years do not tend to live in areas with high performing school districts while young parents cluster together in areas with higher performing schools. (Morrow-Jones & Moon, 2009). The only other citations that could be found in literature searches for finding use of the Performance Index Score was in Senior, Masters, and PhD theses from various universities around Ohio (Henry, 2007; Boyer, 2009; Francis, 2007).

Region was a measure of county types and four "regions" were included in the data set. The metropolitan region was made up of the counties holding Ohio's large cities. The suburban region was made of the counties with lower population density than the metropolitan counties. The counties that have even lower population densities than the suburban region were referred to as rural. The rural counties were further subdivided into the Rural Appalachian region and into the Rural Non-Appalachian region. Those counties in Appalachia were designated as belonging to that region by the Appalachian Regional Commission Act of 1965. Regions are being studied in order to find out if the different levels of urbanization and population density might have effects on smoking habits and household rules independently of other factors.

Data Analysis

The data to be analyzed in this report were categorical in nature, with the exception of the composite PIS score. Data on each adult respondent's age group, regional location, racial group, poverty-to-income ratio group, level of education, composition of household, household smoking ban presence and smoking status were analyzed using STATA 9.1 and 11.0. Appendix 1 indicates what variables have been chosen for analysis in this project. These independent variables were modeled against the binary outcome of whether or not the respondent reported a complete household smoking ban.

Analysis of the data took place in two main steps. First, simple descriptive statistics of each variable were calculated. This included determining the unadjusted prevalence estimates of adopting household smoking bans for each independent variable. Next, bivariate comparisons were performed to determine if there were significant factors associated with adopting a ban. Chi-square analysis was used to analyze the categorical and dichotomous variables from the OFHS. A linear regression was used on the continuous variable. The survey design features and sampling weights was accounted for in the analysis.

IRB approval was obtained for this project and listed as, "Household Smoking Bans in Ohio: A Study of Interregional Correlates" on March 25, 2009. A reference number for the project was not received from the ORRP because this project was exempted from further review because it did not involve human subjects as the object of research. This research was conducted using the hardware and software provided by the College of Public Health's Division of Epidemiology. Statistical analysis was performed on personal computers at the Division of Epidemiology. The nature of this project allowed the research to take place with little to no extra funding or equipment.

RESULTS

All relevant data tables are in the Appendix and should be referred to when reading through these results. The first observation recorded in the data was the household smoking ban adoption rate for the entire state of Ohio. A total of 73.6% of households in the state reported the adoption of a household smoking ban (95% confidence interval (CI) 73.0% - 74.2%).

Individual Level

Individual level characteristics show many significant trends upon examination of the data (Table 2). The most apparently, significant variable at the individual level was the smoking status of the respondent. Current smokers were the least likely of any subgroup found in the survey to have a household smoking ban, with only 38.6% adopting complete bans. Additionally, former smokers adopted bans at lower rates than did the never smokers in the OFHS.

Race/Ethnicity displayed a distinct rank order pattern, wherein Asian respondents most frequently adopted household smoking bans followed closely by Hispanics, then Whites, then Blacks. While whites adopted bans near the Ohio average, there is a significant gap between Blacks at 62.1% and the rest of the respondents in the study who adopted bans at significantly higher rates.

The age of respondent's yielded an interesting pattern in the data. Chi-square analyses support the finding that significant differences exist between age groups of respondents. Generally, household smoking ban adoption rates peak among respondents ages 25 to 34 and again in those above 65, while bottoming out in respondents in the 45 to 54 age group.

A distinct rank-order pattern emerged from analysis of marital status. The married respondent was the most likely adoptee of a household smoking ban while those who were divorced or never married were significantly less like to have a household smoking ban.

The level of education attained by the respondent turned out to be a highly significant variable that exhibited a clear pattern during analysis. If a respondent attained a higher level of education, they were more likely to adopt a household smoking ban. Additionally education appears to exhibit a slight dose response on the likelihood of adopting a household smoking ban, as more education continuously increased the likelihood of adopting a household smoking ban.

Household Level

The household level variables all yielded highly statistically significant results and will be analyzed in two groups, those dealing with economics, and those on familial composition (Table 3). Economics is largely covered by the variable of the household's poverty line to income ratio. A distinct trend that emerges from the descriptive statistics is that increasing levels of household income (and increasing poverty line to income ratio) was associated with an increased prevalence of having a household smoking ban.

Household composition was measured through the three variables of family type, number of children in the household, and the number of adults in the household. Family type examined the number of adults and the number of children in a given household and analysis of the data confirmed that the presence of children and the presence of other adults drives up household smoking ban adoption rates. The number of children and the number of adults in a household both initially increase the adoption prevalence. But, in adults, the adoption rate peaks at two adults per household while increasing numbers of children in a household increases the proportion of households adopting bans. There was not much of a difference between those households with three children compared to those with four or more children but both clearly had a higher rate of adoptions than those households with fewer children. Additionally, marital status appears to be closely linked to the number of adults in a household, perhaps informed by the observation that most married persons in the OFHS lived in a

household with two adults. This peak of household ban adoption rates at two adults per household is therefore, quite possibly linked to the respondent's marital status. The interrelated nature of the household composition variables is hard to work around, but their significance appears to have a strong overall effect on household smoking ban adoption rates.

Neighborhood Level

The neighborhood level variable of the PIS scores were examined using four test counties from each of the regions of Ohio (Table 4). After a comparison of mean PIS scores was conducted between those populations with a household smoking ban to those without a household smoking ban, the results were mixed. Only Lucas County, the sample metropolitan county, yielded a statistically significant difference of means, wherein the households with smoking bans had higher average PIS scores than those without bans. The other three counties showed no significant difference between groups. A comparison of means of all test counties at once yielded a statistically significant difference in the comparison of means, but this may have been due to the overwhelming influence of Lucas County in the analysis which had more respondents than the other three test counties combined.

Regional Level

Over all, The regions of Ohio adopted household smoking bans at distinctly different rates (Table 5). Suburban counties had the highest proportions of bans, followed by the Metropolitan and Rural (Non-Appalachian) counties which appear to adopt rates at the same basic rate. Appalachian counties trailed behind the rest of the state, but these counties are known to have high rates of tobacco usage, which as noted before, is strongly correlated to a lower proportion of household smoking bans. The differences between the regions was determined in a series of enlightening statistical and descriptive comparisons of the data.

Interregional Comparisons

Comparisons of the results, when the same tests were subdivided by region, yielded a few distinct patterns. The four regions of Ohio each exhibited unique characteristics while demonstrating common themes throughout their data. In Table 2, the respondent level variables of smoking status, marital status, and education level exhibited identical trends across all regions of Ohio, while race/ethnicity and age of respondents deviated from this pattern.

The race and ethnicity of the respondent was a highly significant variable in this study and for the most part, it remained so across regions. Further examination of Table 2 reveals that the sole exception to this occurred in the Appalachian counties (where racial and ethnic diversity is lowest in the state) that displayed a lower level of statistical significance at $P < 0.05$ than the other regions which were at $P < 0.001$. This could indicate that a certain level of cultural homogeneity exists within these contiguous and tightly clustered counties of Appalachia in Southeastern Ohio.

The age of respondents in the OFHS exhibited a stable trend across all regions except the Suburban counties where chi-square tests indicated that the variable was statistically insignificant at $P < 0.05$. This contrasts with the other regions which showed much more distinct patterns, but the most useful observation here, is that no age group in Suburban counties shows a distinct deficit in its adoption rates when compared to others. In other words, adoption rates are flat between age groups, and the explanation for why this occurred only in the Suburban counties is not immediately apparent, but further analysis on the data could uncover an answer.

In Table 3 the household level variables of poverty to income ratio, family type, and numbers of adults in a household appeared to show stable patterns of adoption rates across the four regions. The only household level variable that exhibited changes in the patterns of data between regions was the number of children in a household. Two changes from the whole dataset were observed in the regions.

The first change was that only in Appalachian and rural counties, did the presence of a single child in a household not increase the proportion of smoking bans adopted when compared to households with no children. The second change was in rural counties, where the presence of 4 or more children significantly increased the likelihood of adopting a household smoking ban when compared to those households with fewer children. This second change, while appearing to be statistically significant merits more analysis before conclusions are drawn because the sample size is fairly small (less than 300 rural households had 4 or more children) when compared to the larger dataset.

DISCUSSION

Place in the Literature

The well-documented increase in the adoption of household smoking bans in the last two decades reflects yet another success of the public health community's efforts to minimize ETS exposure in the U.S. (CDC, 2010). An interesting observation is made when comparing the 2008 OFHS results to the 2006-2007 Tobacco Use Supplement-Current Population Survey (TUS-CPS) wherein Ohio's statewide household smoking ban adoption rate showed a significant increase between 2006 and 2008. The TUS-CPS tracks household smoking ban adoption rates using a survey question that is comparable to the question used in the OFHS (See Figures 2 and 3 in the Appendix). In 2006, Ohio ranked 47th among the states in adoption rates with only 66.7% of households having complete bans. This measure carried a 95% CI of 64.2% - 69.2% (CDC, 2010). By 2008, Ohio households reported a significant increase in adoption rates to 73.2% with a narrow 95% CI of 73.0% to 74.2%. While it is unknown how much other states improved their adoption rates during this most recent time period, this significant increase could be a residual effect of Ohio's implementation of a comprehensive statewide clean indoor air ordinance in 2007 (McKinnon, 2007). Previous studies have demonstrated that the passage of public smoking bans influences the adoption of private sphere household smoking bans and this change in adoption rates

appears to support that conclusion (Mills, Messer, Gilpin, & Pierce, 2009). Between 2006 and 2010, the number of states with comprehensive bans increased from 14 to 34 (American Nonsmoker's Rights Foundation, 2010). Therefore, it is unknown if Ohio has risen in the nationwide rankings of household smoking ban adoption rates. But, tens of thousands of households appear to have adopted household smoking bans in the interim between 2006 and 2008, a certain public health victory.

We found that those who do not adopt a household smoking ban are different from those who do in many ways. Data on the respondent level variables used in this study were largely similar to results previously reported in the literature. No significant differences between the literature base and the OFHS data on race and ethnicity, education level, smoking status, or marital status were found. The results for respondent's age were different from the results in the literature, wherein previous studies indicated that being younger was associated with higher smoking ban adoption rates (Gilpin et al., 1999). Table 2 indicates that those in the youngest age groups often adopted bans at lower rates than the oldest age group and those age groups in between show no clear pattern of declining adoption rates in line with increasing age.

Analysis of household level economic variables and other respondent level SES proxy variables revealed that the OFHS results were similar to previous analyses that indicated high SES status is associated with increased adoption of household smoking bans. Household level variables that categorized the data by household composition largely agreed with previous findings which demonstrated that the presence of children or of other adults in a household increased the likelihood of household smoking ban adoption. Therefore on the whole, increased numbers of children, increased numbers of adults, being married (a respondent level variable that is a household level proxy), and having multiple adults with children in a household all significantly increased the proportion of

adoptions above the OFHS mean. Those who were unmarried, divorced, widowed or were single parents all notably had lower than average adoption rates.

When the OFHS data was split into regions, a noteworthy trend appeared that merits further study, as it seems to conflict with the aforementioned rural-urban gap in the household smoking ban adoption rates. Namely, those counties in Ohio that were Rural and non-Appalachian adopted bans at the same rates as Metropolitan counties (Table 5). Suburban counties adopted the highest proportion of bans and Rural Appalachian counties had the lowest proportion but, the lack of variability between the Rural and Metropolitan counties conflicts with the patterns found in the literature. Differences between the Rural and Appalachian counties need to be elucidated in order to determine if there are unique characteristics of Appalachia that depress adoption rates or if the proposed rural-urban gap is less substantial than previously thought.

Public Health Implications

Recognize Areas of Success

The actions of public health officials should continue to pursue goals that admirably seek to reduce the exposure of nonsmokers to ETS. There are many avenues open to achieve these goals and information derived from identifying exactly who has not yet adopted household smoking bans should be used to shape future efforts in reaching this goal. First, the OFHS data identifies areas of success in the tobacco control battle and second, it provides instructive information to officials on where to begin to target underserved populations in future ETS reduction efforts. These lessons should be taken into account as information is disseminated on the strategies to promote the adoption of more household smoking bans. OFHS data reflects a tremendous success of the public health community, wherein parents with children in the home are adopting smoking bans at a significantly greater rate than those households without children. Indeed, almost every paper on household smoking bans in the literature,

including this one, lists ETS's harm to children in the opening paragraphs of its introduction in order to make this plea for protection.

Target Areas of Weakness

The OFHS data has identified several distinct populations who adopt smoking bans at significantly lower rates than the general population. Namely, current smokers, Blacks, and those living in Ohio's rural Appalachian counties have the most room to improve their household smoking ban adoption rates. In recent years, more and more of the current smoking population are hardcore smokers who are unlikely to quit tobacco use regardless of societal pressure imposed through clean indoor air ordinances and excise taxes on tobacco (Burns & Warner, 2003). It is worth noting that being a current smoker was the variable most highly associated with the OFHS respondents who lacked a household smoking ban. Smokers are ideal beneficiaries of a new household smoking ban adoption campaign and their large numbers offer a prime opportunity to realize large scale population health benefits. The content of these new campaigns needs to be developed through future study and cannot be determined through further examination of OFHS data.

Strengths

The 2008 OFHS data are incredibly extensive and allow for the most comprehensive regression models to date to be created for modeling the patterns of adoption of household smoking bans. The size of the data set allows for extensive study of subgroups and creates very clear pictures of who is likely to adopt a smoking ban in Ohio. The data's specificity brings with it a clear strength of being the ideal guide for targeting household smoking ban adoption campaigns in Ohio, but this specificity brings with it a corollary weakness of limiting the scope of its application. Ohio does not accurately represent a cross-section of the nation, but it does contain a wide variety of people working in a wide variety of industry, representing all sides of politics, and lessons learned here can be applied elsewhere with at least a more

informed grounding in data from the OFHS. Ohio also serves as model proving ground for data collection because it has a comprehensive clean indoor air ordinance that evenly covers the entire state, creating a valuable control condition.

Limitations

The limits of this study derive from the study design of the 2008 OFHS dataset as it relies on self-reporting household smoking bans, omits important variables and collects mostly quantitative data. Additional limits were realized during statistical analysis and when examining the application of this research.

The OFHS data are mostly quantitative in nature and they capture variables that explain only what types of respondents adopt household smoking bans, effectively answering the journalist's basic question of "who" adopts these bans. In order to design effective campaigns to encourage the adoption of household smoking bans it will be necessary to know the "why" behind the adoptions of these bans. Additional limits to this study are that the OFHS only asked the main adult respondent in a household to answer questions. Previous studies have noted that discrepancies arise within households when reporting household smoking ban status, leading this study's use of self reported bans to be a limitation (Mumford, Levy, & Romano, 2004). The 2008 OFHS does not provide much information on tobacco usage beyond smoking status and household smoking ban status, leaving out other powerful variables including smokeless tobacco usage, the number of smokers in the household, age of initiation of smokers and former smokers and age of cessation of former smokers.

The descriptive and bivariate analysis conducted in the results leaves a certain degree of sophistication to be desired. These analyses do not create the comprehensive regression model required to determine what correlates are most significant in the adoption of household smoking bans. It will be necessary to control for more important variables to determine what subsets of the population truly

need to be focused upon when designing future public health efforts. This shortfall is being addressed, and regression analysis is expected to be performed in the near future on this dataset.

Finally, this OFHS data, as alluded to earlier, is solely extracted from Ohio. Household smoking ban patterns could be significantly different in other states or in other countries, but most research in this area points to the contrary as none of the studies on which my hypotheses are based provided data that significantly clashes with the conclusions reached through analyzing the OFHS data. These results need to be used to focus future campaigns to encourage household smoking ban adoptions and not to simply repeat statistics on adoption rates.

CONCLUSION

A sense of accomplishment is well deserved amongst the public health community as these data from the OHFS clearly indicate that adoption rates of household smoking bans are reasonably good in Ohio. Additionally, non-smokers and children are being protected, a fact that should not be taken lightly. Household smoking bans are doing a good job to prevent ETS exposure in the population in the status quo. But, significant portions of the population are still being exposed to ETS in their own homes and new campaigns to promote the household bans are still necessary. Current smokers, rural areas, and Blacks could all benefit from new campaigns that would increase household ban adoption rates in these underserved groups. Intervention strategies merit further study in order to determine what motivates the adoption of such bans and as long as these strategies are informed by lessons learned from studies like this thesis, then progress towards the effective implementation of more household smoking bans is being made.

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Appendix

Figure 1: Regions of Ohio Used in the 2008 OFHS (Health Policy Institute of Ohio, 2008)

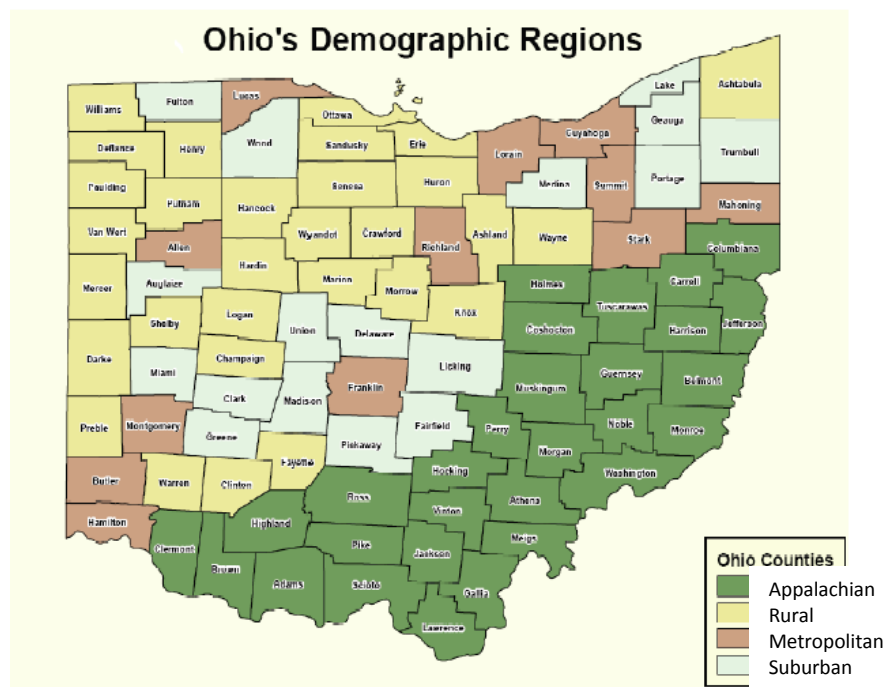


Table 1: Independent Variables by Data Type and Level

Variable Name	Variable Type	Variable Level
Smoking Status	Categorical	Respondent
Race/Ethnicity	Categorical	Respondent
Age of Respondent	Categorical	Respondent
Marital Status	Categorical	Respondent
Education Level	Categorical	Respondent
Family Type	Categorical	Household
Number of Adults	Categorical	Household
Number of Children	Categorical	Household
Performance Index Score	Continuous	Neighborhood
Region	Categorical	Regional

Table 2: Survey Proportions of Household Smoking Ban Adoption and 95% CI Levels for Respondent Level Variables

	Ohio	Appalachian	Metropolitan	Rural	Suburban
Smoking Status					
<i>Never Smoker</i>	0.870 (0.863-0.876)	0.844 (0.826-0.861)	0.867 (0.859-0.876)	0.874 (0.859-0.889)	0.890 (0.876-0.905)
<i>Former Smoker</i>	0.810 (0.800-0.821)	0.769 (0.743-0.795)	0.804 (0.790-0.818)	0.837 (0.816-0.857)	0.835 (0.810-0.859)
<i>Current Smoker</i>	0.386 (0.373-0.399)	0.359 (0.329-0.388)	0.383 (0.383-0.364)	0.390 (0.359-0.421)	0.418 (0.382-0.454)
	***	***	***	***	***
Race/Ethnicity					
<i>White</i>	0.745 (0.739-0.751)	0.677 (0.662-0.693)	0.757 (0.748-0.766)	0.740 (0.726-0.754)	0.769 (0.754-0.783)
<i>Black</i>	0.621 (0.602-0.640)	0.614 (0.491-0.737)	0.616 (0.596-0.636)	0.655 (0.534-0.775)	0.720 (0.634-0.805)
<i>Hispanic</i>	0.832 (0.809-0.854)	0.805 (0.726-0.884)	0.827 (0.798-0.856)	0.821 (0.763-0.879)	0.885 (0.838-0.932)
<i>Asian</i>	0.898 (0.871-0.924)	0.827 (0.664-0.990)	0.889 (0.857-0.922)	0.976 (0.946-1.007)	0.913 (0.856-0.970)
	***	*	***	***	***
Age					
18-24	0.718 (0.696-0.739)	0.666 (0.614-0.718)	0.719 (0.689-0.748)	0.732 (0.679-0.784)	0.770 (0.711-0.828)
25-34	0.764 (0.749-0.779)	0.694 (0.654-0.734)	0.773 (0.752-0.793)	0.744 (0.708-0.781)	0.807 (0.769-0.845)
35-44	0.746 (0.732-0.759)	0.662 (0.627-0.696)	0.746 (0.728-0.765)	0.762 (0.732-0.791)	0.783 (0.751-0.815)
45-54	0.694 (0.681-0.706)	0.620 (0.589-0.652)	0.689 (0.672-0.707)	0.709 (0.683-0.735)	0.736 (0.705-0.767)
55-64	0.720 (0.707-0.732)	0.676 (0.648-0.705)	0.717 (0.699-0.735)	0.712 (0.683-0.740)	0.760 (0.729-0.791)
65+	0.772 (0.761-0.782)	0.756 (0.733-0.779)	0.766 (0.751-0.782)	0.787 (0.765-0.809)	0.784 (0.756-0.812)
	***	***	***	**	
Marital Status					
<i>Married</i>	0.803 (0.796-0.810)	0.738 (0.720-0.755)	0.811 (0.801-0.821)	0.808 (0.794-0.822)	0.821 (0.805-0.837)
<i>Divorced/Separated</i>	0.590 (0.574-0.606)	0.542 (0.504-0.580)	0.611 (0.590-0.632)	0.548 (0.507-0.588)	0.579 (0.534-0.623)
<i>Widowed</i>	0.702 (0.685-0.720)	0.694 (0.662-0.725)	0.699 (0.675-0.723)	0.710 (0.671-0.748)	0.715 (0.667-0.763)
<i>Never Married</i>	0.674 (0.659-0.690)	0.619 (0.574-0.664)	0.671 (0.652-0.691)	0.679 (0.635-0.723)	0.745 (0.701-0.790)
<i>Unmarried Couple</i>	0.616 (0.579-0.653)	0.529 (0.428-0.629)	0.635 (0.588-0.682)	0.581 (0.480-0.683)	0.646 (0.541-0.750)
	***	***	***	***	***
Education Level					
<i>< HS Graduate</i>	0.561 (0.541-0.580)	0.537 (0.498-0.576)	0.562 (0.534-0.589)	0.577 (0.532-0.622)	0.575 (0.514-0.635)
<i>HS Graduate</i>	0.679 (0.669-0.689)	0.657 (0.635-0.678)	0.673 (0.659-0.688)	0.700 (0.680-0.721)	0.692 (0.667-0.716)
<i>Some College</i>	0.748 (0.736-0.759)	0.728 (0.696-0.759)	0.729 (0.714-0.745)	0.784 (0.758-0.810)	0.788 (0.762-0.814)
<i>4 Year Degree or More</i>	0.893 (0.886-0.900)	0.856 (0.830-0.881)	0.886 (0.876-0.895)	0.913 (0.896-0.930)	0.919 (0.903-0.935)
	***	***	***	***	***

P Values

< 0.001 = ***

< 0.01 = **

< 0.05 = *

Table 3: Survey Proportions of Household Smoking Ban Adoption and 95% CI Levels for Household Level Variables

	Ohio	Appalachian	Metropolitan	Rural	Suburban
Poverty to Income Ratio					
< 1.00	0.566 (0.554-0.589)	0.553 (0.518-0.588)	0.582 (0.560-0.604)	0.576 (0.533-0.618)	0.641 (0.594-0.688)
1.01-1.50	0.637 (0.618-0.656)	0.598 (0.556-0.641)	0.630 (0.604-0.657)	0.644 (0.600-0.689)	0.694 (0.644-0.745)
1.51-2.00	0.678 (0.658-0.698)	0.644 (0.597-0.691)	0.678 (0.648-0.708)	0.690 (0.647-0.733)	0.696 (0.644-0.748)
2.01-2.50	0.722 (0.704-0.741)	0.696 (0.649-0.742)	0.729 (0.703-0.755)	0.726 (0.686-0.766)	0.719 (0.671-0.768)
2.51-3.00	0.726 (0.707-0.746)	0.702 (0.656-0.749)	0.721 (0.693-0.749)	0.758 (0.719-0.797)	0.731 (0.683-0.779)
> 3.01	0.830 (0.823-0.837)	0.788 (0.767-0.810)	0.830 (0.821-0.840)	0.838 (0.822-0.854)	0.842 (0.826-0.859)
	***	***	***	***	***
Family Type					
1 Adult 0 Children	0.641 (0.629-0.653)	0.598 (0.567-0.629)	0.647 (0.631-0.663)	0.640 (0.610-0.670)	0.648 (0.615-0.681)
1 Adult 1 Child	0.659 (0.636-0.683)	0.578 (0.511-0.645)	0.666 (0.636-0.696)	0.651 (0.588-0.715)	0.706 (0.639-0.773)
2 Adults 0 Children	0.744 (0.735-0.753)	0.687 (0.665-0.710)	0.743 (0.730-0.755)	0.762 (0.743-0.781)	0.775 (0.754-0.796)
2 Adults 1 Child	0.805 (0.795-0.815)	0.732 (0.705-0.760)	0.817 (0.803-0.831)	0.782 (0.757-0.807)	0.840 (0.818-0.863)
	***	***	***	***	***
Number of Adults in Household					
1	0.645 (0.634-0.656)	0.592 (0.564-0.621)	0.651 (0.637-0.665)	0.643 (0.616-0.670)	0.659 (0.629-0.689)
2	0.784 (0.777-0.792)	0.719 (0.700-0.739)	0.790 (0.780-0.801)	0.789 (0.772-0.805)	0.808 (0.790-0.825)
3	0.733 (0.716-0.749)	0.660 (0.618-0.702)	0.735 (0.712-0.759)	0.736 (0.697-0.774)	0.783 (0.744-0.822)
4 or more	0.731 (0.705-0.758)	0.708 (0.643-0.774)	0.723 (0.686-0.760)	0.704 (0.640-0.767)	0.808 (0.748-0.868)
	***	***	***	***	***
Number of Children in Household					
0	0.710 (0.703-0.718)	0.662 (0.644-0.680)	0.708 (0.698-0.718)	0.729 (0.713-0.745)	0.739 (0.721-0.757)
1	0.752 (0.737-0.768)	0.663 (0.620-0.705)	0.766 (0.745-0.787)	0.728 (0.688-0.767)	0.798 (0.761-0.834)
2	0.798 (0.783-0.813)	0.739 (0.697-0.781)	0.804 (0.784-0.825)	0.772 (0.735-0.810)	0.839 (0.805-0.874)
3	0.810 (0.788-0.832)	0.774 (0.721-0.827)	0.819 (0.788-0.850)	0.778 (0.720-0.836)	0.833 (0.780-0.886)
4 or more	0.787 (0.752-0.822)	0.685 (0.585-0.784)	0.748 (0.696-0.800)	0.895 (0.843-0.947)	0.883 (0.818-0.948)
	***	***	***	***	***

P Values
 < 0.001 = ***
 < 0.01 = **
 < 0.05 = *

Table 4: Survey Means and 95% CI Levels of PIS Scores for 4 Test Counties

	Total Household Ban	Partial/ No Household Ban	
All Test Counties ***	91.496 (91.022-91.971)	87.634 (86.805-88.463)	
Clinton	94.809 (94.289-95.329)	95.521 (94.434-96.609)	
Guernsey	89.746 (89.152-90.339)	89.811 (88.900-90.722)	
Licking	95.466 (95.027-95.905)	94.921 (93.997-95.845)	
Lucas ***	89.727 (89.055-90.399)	84.803 (83.875-85.732)	
			P Values
			< 0.001 = ***
			< 0.01 = **
			< 0.05 = *

Table 5: Survey Proportions of Household Smoking Ban Adoption and 95% CI Levels for Regional Level Variables

	Total Household Ban
Ohio	0.736 (0.730-0.742)
Appalachian	0.679 (0.664-0.694)
Metropolitan	0.736 (0.728-0.744)
Rural	0.742 (0.729-0.755)
Suburban	0.771 (0.757-0.785)

Figure 2: CPS-TUS Survey Question on Household Smoking Ban Adoption

K4 Which statement best describes the rules about smoking INSIDE YOUR HOME?

READ ANSWER CATEGORIES

NOTE: "HOME" IS WHERE YOU LIVE. "RULES" INCLUDE ANY UNWRITTEN "RULES" AND PERTAIN TO ALL PEOPLE WHETHER OR NOT THEY RESIDE IN THE HOME OR ARE VISITORS, WORKMEN, ETC.

- (1) No one is allowed to smoke anywhere INSIDE YOUR HOME**
- (2) Smoking is allowed in some places or at some times INSIDE YOUR HOME**
- (3) Smoking is permitted anywhere INSIDE YOUR HOME**

Figure 3: OFHS Survey Question of Household Smoking Ban Adoption

D45b. Which statement best describes the rules about smoking inside your home? Do not include decks, garages, or porches. Would you say Smoking is NOT allowed anywhere inside your home, or Smoking is allowed in SOME places or at SOME times, or Smoking is allowed anywhere inside your home?

(Note: The data from this question is different for 1654 respondents as of 8/11. Now everyone is getting to this question instead of just smokers)

- | | |
|----|----------------------------------|
| 01 | NOT ALLOWED ANYWHERE INSIDE HOME |
| 02 | SOME PLACES OR AT SOME TIMES |
| 03 | ALLOWED ANYWHERE |
| 98 | DK |
| 99 | REFUSED |