Volume of Tobacco Advertising in African American Markets: Systematic Review and Meta-Analysis

Brian A. Primack, MD, EdM[a,b,c]
James E. Bost, PhD[a,b]
Stephanie R. Land, PhD[d]
Michael J. Fine, MD, MSc[a,b,e]

SYNOPSIS

Objective. African Americans currently bear the greatest burden of morbidity and mortality due to smoking, and exposure to pro-tobacco media messages predicts smoking. This study compared the concentration (proportion of media messages that are for tobacco) and density (pro-tobacco media messages per person) of pro-tobacco media messages between African American and Caucasian markets.

Methods. We searched Medline (1966 to June 2006), PsychINFO (1974 to June 2006), and CINAHL (1982 to June 2006) for studies from peer-reviewed journals directly comparing the volume of pro-tobacco media messages in African American and Caucasian markets. From each study, we extracted the number of total media messages, the number of tobacco-related messages, and the number of residents living in each market area. We calculated the concentration and density of tobacco advertising in each market.

Results. Out of 131 studies identified, 11 met eligibility criteria, including seven comparing billboard/signage in African American and Caucasian markets and four comparing magazine advertising in African American and Caucasian markets. Meta-analysis estimated a pooled odds ratio of 1.7 (95% confidence interval [CI] 1.1, 2.6) for a given billboard being smoking-related in African American vs. Caucasian market areas (i.e., concentration). The pooled rate ratio of the density of smoking-related billboards was 2.6 (95% CI 1.5, 4.7) in African American vs. Caucasian market areas. Magazine data were insufficient for meta-analysis.

Conclusion. Available data indicated that African Americans are exposed to a higher volume of pro-tobacco advertising in terms of both concentration and density. These findings have important implications for research, policy measures, and educational interventions involving racial disparities due to tobacco.

[a]Division of General Internal Medicine, Department of Medicine, University of Pittsburgh School of Medicine, Pittsburgh, PA
[b]Center for Research on Health Care, University of Pittsburgh School of Medicine, Pittsburgh, PA
[c]Division of Adolescent Medicine, Department of Pediatrics, University of Pittsburgh School of Medicine, Pittsburgh, PA
[d]University of Pittsburgh Graduate School of Public Health, Pittsburgh, PA
[e]Center for Health Equity Research and Promotion, VA Pittsburgh Health Care System, Pittsburgh, PA
Address correspondence to: Brian A. Primack, MD, EdM, Center for Research on Health Care, University of Pittsburgh School of Medicine, 230 McKee Pl., Ste. 600, Pittsburgh, PA 15213; tel. 412-586-9789; fax 412-692-4838; e-mail <bprimack@pitt.edu>.
©2007 Association of Schools of Public Health

Smoking remains the leading cause of preventable death and disease in the U.S., causing more than 440,000 deaths per year[1] and costing the U.S. more than $150 billion in direct and indirect costs annually.[2] African Americans currently bear the greatest burden of morbidity and mortality due to smoking.[3] For instance, total mortality from lung cancer is 21% higher among African Americans than among Caucasians,[4] and African American mortality from stomach cancer is 127% higher than that of Caucasians.[4] Epidemiological analyses have suggested that tobacco-related disparities between African Americans and Caucasians are so profound that reversing them could help eliminate all cancer disparities between these racial groups.[5]

Exposure to pro-tobacco media messages is now known to be a potent risk factor for tobacco use.[6–10] In fact, recent studies suggest that exposure to pro-tobacco media may have a more powerful influence on smoking than other factors more traditionally linked with smoking, such as parental smoking, sibling smoking, sensation seeking, and rebelliousness.[7,10,11] Furthermore, the most recent report of the U.S. Surgeon General focusing on racial/ethnic health disparities attributed to tobacco concluded that the top three factors influencing tobacco use among African Americans were all related to tobacco promotion: (*1*) the tobacco industry's marketing relationship with the African American community, (*2*) the targeting of minority members by the tobacco industry, and (*3*) the promotion of tobacco in minority neighborhoods and in publications geared toward African Americans.[3]

It is unclear, however, whether African Americans are indeed exposed to a higher volume of pro-tobacco advertising than are Caucasians. Although some researchers have found that there are more smoking advertisements in minority neighborhoods and publications,[12–15] other work has not confirmed these results.[16–19] Furthermore, prior studies have reported different results for the concentration (i.e., proportion of all advertisements per area for tobacco) and density (i.e., cigarette advertisements per resident) of advertising. For example, Hackbarth et al. found that African American neighborhoods in Chicago had a higher density of tobacco advertising per resident, but that Caucasian neighborhoods actually had a higher concentration of tobacco billboards.[16] Magazine studies also have reported conflicting results with regard to concentration and density.[14,19]

It will be useful and instructive to distinguish these different elements of volume of advertising (density vs. concentration). If African Americans are exposed only to a higher density of advertisements but not a higher concentration, then many different types of products, not only tobacco, vie for the attention of African Americans. If African Americans are exposed to both a higher density and a higher concentration of tobacco-related advertisements, however, this would imply that African Americans may be special targets of the tobacco industry. In this latter case, more aggressive policy and educational measures may be necessary to reduce the impact of such advertising exposure in these populations.

The purpose of this study was to conduct a systematic review and meta-analysis of peer-reviewed literature to determine if African Americans are exposed to a higher volume of pro-tobacco mass-media messages, both in terms of density and concentration, and to determine point estimates of any differences. Our *a priori* hypothesis was that pooled data would show that African Americans are exposed to both a higher density and a higher concentration of pro-smoking advertisements.

METHODS

Literature search

We searched Medline (1966 to June 2006), PsychINFO (1974 to June 2006), and CINAHL (1982 to June 2006) for all English-language journal articles involving mass communication, smoking, and African Americans. Articles involving mass communication were identified using expanded searches with subject headings related to media communications and marketing, and subheadings such as, but not limited to, communication, radio, television, mass media, and advertising.

We searched for pro-tobacco messages in all formats, including Internet, point-of-sale, promotions, sponsorships, billboards, magazines, movies, television programs, and newspapers. Articles involving smoking were identified using "smoking" and "tobacco" as expanded subject headings; those with "cigarette" in the title or abstract were also included. Finally, articles involving African Americans were included if the article had "African American" as a keyword anywhere in the title, abstract, or subject heading, or if "blacks" was listed as a subject heading. To identify additional relevant studies, we searched the reference lists of all articles obtained and consulted experts in public health, media research, and health disparities.

Study selection

Two investigators independently searched the titles, abstracts, and methods sections of the 131 studies identified with our search strategy. Manuscripts were selected for inclusion if they directly compared pro-tobacco media messages in African American and

Caucasian markets. Manuscripts were excluded if they did not specifically compare the two racial groups.

One study was eliminated, for example, because although it described in depth the cigarette advertising in three magazines geared toward African Americans (*Essence, Jet,* and *Ebony*), it did not provide data from magazines targeted toward Caucasians.[20] Articles were also excluded if they were opinion pieces, policy statements, or review articles. Articles were accepted only from peer-reviewed journals. Also, articles were selected only if they involved pro-tobacco messages, as anti-tobacco messages were not the focus of this study. When there was any discrepancy, consensus was easily achieved between the two researchers.

Data extraction

From each eligible manuscript identified, we extracted key information, including the year of data collection, the particular media studied, the geographic region of study, and a summary of the methods. We also extracted the number of total messages (e.g., billboards or magazine articles), the number of tobacco-related messages in that sample, and the number of residents living in each of the markets studied.

These data, which were collected separately in both African American and Caucasian markets, were then used to compute concentration and density. Concentration was defined as the number of tobacco messages divided by the number of total messages. Density was defined as the number of tobacco messages divided by the number of people residing in the market area, expressed as messages per 10,000 people. The extraction process was carried out by two investigators—working independently—who ultimately arrived at identical data.

ANALYSIS

Data were sufficient to pool two important outcomes available in multiple articles: concentration of tobacco-related billboards/signage in African American vs. Caucasian market areas and the density of tobacco-related billboards/signage in these areas. Data were imported into STATA version 9.0,[21] which was used to derive pooled estimates of African American and Caucasian concentrations and their odds ratios, as well as African American and Caucasian densities and their rate ratios. The pooled estimates were calculated using a random effects model with inverse-variance weighting using the DerSimonian and Laird method.[22] Prior to implementing the random-effects model, statistical heterogeneity between and within groups was measured using the Q statistic and assessed visually using the Galbraith plot of heterogeneity.[23] Because the Q test was statistically significant ($p<0.05$), we used the random effects method to analyze the data.[24]

We assessed publication bias for both concentration and density using the Begg rank correlation method and the Egger weighted regression method.[25] We also examined the cumulative effect on the pooled estimates by adding studies one at a time ordered by publication date.[25] To evaluate the weight of particular studies on the pooled estimate, we performed influence analysis. This method recalculates the pooled prevalence estimate, omitting one study at a time.[25] Meta-regression was also used to analyze the relationship between the pooled estimates and publication date.

We defined statistical significance *a priori* by calculating 95% confidence intervals (CIs) around all estimates. We log-tranformed density prior to conducting the meta-analyses and subsequently transformed density back to the original units for publication. This was done to conduct the meta-analyses using a closed-form expression of the variance.[25]

RESULTS

Of the 131 studies initially identified using the search strategy, 11 articles met all eligibility criteria. Seven of these studies investigated the medium of billboards and signage, including large point-of-sale advertisements and other placards,[12,13,15–17,26,27] and four compared pro-tobacco advertising in magazines[14,18,19,28] (Figure 1). Although we exhaustively searched for all types of pro-tobacco media and promotion, only studies involving billboards and magazines were represented in the findings.

Concentration and density of billboards and signage

Of the billboard/signage studies, six contained sufficient information to compute the concentration of tobacco advertisements (i.e., they measured both the number of tobacco advertisements and the number of total advertisements) and could be used to calculate a pooled estimate for this outcome[12,13,15–17,26] (Table, Figure 2). The remaining study counted only tobacco advertisements, not total advertisements.[27] The pooled concentration of tobacco advertisements was 22.0% (95% CI 17.9, 26.1) in African American markets and 15.5% (95% CI 8.8, 22.2) in Caucasian markets, with a pooled difference of 6.7% (95% CI 1.5, 11.8) higher in African American markets. The pooled odds ratio for a billboard being smoking-related in an African American area compared to a Caucasian area was 1.7 (95% CI 1.1, 2.6).

We detected no publication bias for either the

Figure 1. Studies identified comparing volume of tobacco advertising in African American vs. Caucasian markets

Source	*Year data collected*[a]	*Medium studied*	*Methods*
Altman,[b] 1991	1985–1987	Billboards/signage	901 San Francisco cigarette billboards were analyzed for tobacco advertising
Hackbarth,[c] 1995	1990–1991	Billboards/signage	5,924 Chicago billboards were analyzed for tobacco advertising
Hackbarth,[d] 2001	1997	Billboards/signage	2,421 Chicago billboards within 500 feet of a school, park, or playground were analyzed for tobacco advertising
Luke,[e] 2000	1998	Billboards/signage	1,239 St. Louis billboards were analyzed for tobacco advertising
Mayberry,[f] 1993	1989	Billboards/signage	155 Columbia, SC, billboards were analyzed for tobacco advertising
Pucci,[g] 1998	1996	Billboards/signage	580 Boston tobacco advertisements (billboards and other signage) were identified and analyzed
Stoddard,[h] 1998	1990–1994	Billboards/signage	4,376 Los Angeles billboards along highways were analyzed for tobacco advertising
Basil,[i] 1991	1924–1989	Magazines	1,171 magazine advertisements were analyzed from a set of African American and Caucasian publications
Cummings,[j] 1987	1984–1985	Magazines	7 magazines, 4 of which were geared toward African Americans and 3 of which were geared toward Caucasians, were analyzed for tobacco advertising
Landrine,[k] 2005	1998–2002	Magazines	4.5 years of magazine tobacco advertising were analyzed, comparing *Ebony* (African American publication) and *People* (Caucasian publication)
Pollay,[l] 1992	1950–1965	Magazines	16 years of tobacco advertisements were analyzed in *Ebony* (African American publication) and *Life* (Caucasian publication)

[a]In the case of magazines, year figures represent year of publication.

[b]Altman DG, Schooler C, Basil MD. Alcohol and cigarette advertising on billboards. Health Educ Res 1991;6:487-90.

[c]Hackbarth DP, Silvestri B, Cosper W. Tobacco and alcohol billboards in 50 Chicago neighborhoods: market segmentation to sell dangerous products to the poor. J Public Health Policy 1995;16:213-30.

[d]Hackbarth DP, Schnopp-Wyatt D, Katz D, Williams J, Silvestri B, Pfleger M. Collaborative research and action to control the geographic placement of outdoor advertising of alcohol and tobacco products in Chicago. Public Health Rep 2001;116:558-67.

[e]Luke D, Esmundo E, Bloom Y. Smoke signs: patterns of tobacco billboard advertising in a metropolitan region. Tob Control 2000;9:16-23.

[f]Mayberry RM, Price PA. Targeting blacks in cigarette billboard advertising: results from down South. Health Values 1993;17:28-35.

[g]Pucci LG, Joseph HM Jr., Siegel M. Outdoor tobacco advertising in six Boston neighborhoods: evaluating youth exposure. Am J Prev Med 1998;15:155-9.

[h]Stoddard JL, Johnson CA, Sussman S, Dent C, Boley-Cruz T. Tailoring outdoor tobacco advertising to minorities in Los Angeles County. J Health Commun 1998;3:137-46.

[i]Basil MD, Schooler C, Altman DG, Slater M, Albright CL, Maccoby N. How cigarettes are advertised in magazines: special messages for special markets. Health Communication 1991;3:75-91.

[j]Cummings KM, Giovino G, Mendicino AJ. Cigarette advertising and black-white differences in brand preference. Public Health Rep 1987;102:698-701.

[k]Landrine H, Klonoff EA, Fernandez S, Hickman N, Kashima K, Parekh B, et al. Cigarette advertising in black, Latino, and white magazines, 1998-2002: an exploratory investigation. Ethnic Dis 2005;15:63-7.

[l]Pollay RW, Lee JS, Carter-Whitney D. Separate, but not equal: racial segmentation in cigarette advertising. Journal of Advertising 1992;21:45-57.

African American or the Caucasian data on tobacco advertising concentration. Additionally, publication year had no effect on concentration for either race according to two methods (cumulative meta-analysis adding one study at a time ordered by publication date and meta-regression of year on concentration). Also, by removing one study at a time, the data showed that no particular study had undue influence on the pooled concentrations of tobacco-related billboards for either race.

A total of five billboard/signage studies reported sufficient data to compute the density of tobacco advertisements (how many tobacco advertisements were present per resident of the geographic study region)[15–17,26,27] (Table, Figure 3). The pooled density of tobacco advertisements was 11.8/10,000 African Ameri-

Table. Billboard/signage data extracted for meta-analysis

	African American					Caucasian				
Source	*Total number of signs*	*Number of tobacco signs*	*Number of residents in area studied*	*Percent of signs for tobacco*[a]	*Number of tobacco signs per 10,000 residents*[b]	*Total number of signs*	*Number of tobacco signs*	*Number of residents in area studied*	*Percent of signs for tobacco*[a]	*Number of tobacco signs per 10,000 residents*[b]
Altman,[i] 1991	190	46	86,414	24.2	5.3	446	76	395,081	17.0	1.9
Hackbarth,[j] 1995	5,100[c]	1,240	446,043[d]	24.3	27.8	800[c]	214	251,765[d]	26.8	8.5
Hackbarth,[k] 2001	1,210[e]	270	605,000[f]	22.3	4.5	295[e]	25	275,000[f]	8.5	0.9
Luke,[l] 2000	642	145	NA[g]	22.6	NA[g]	597	97	NA[g]	16.3	NA[g]
Mayberry,[m] 1993	127	32	35,500	25.2	9.0	126	23	66,600	18.3	3.5
Pucci,[n] 1998	NA	293	76,825	NA	38.1	NA	287	85,124	NA	33.7
Stoddard,[o] 1998	1,827	275	NA[h]	15.1	NA[h]	669	44	NA[h]	6.6	NA[h]

[a]Advertising concentration

[b]Advertising density

[c]Total billboards computed based on reported findings that there were 150 mean billboards in each African American ward and 50 mean billboards in each Caucasian ward.

[d]Population figures were computed based on reported finding that billboards were 27.8/10,000 population for the African American population and 8.5/10,000 population for Caucasians.

[e]Total billboards computed based on reported findings that there were 110 mean billboards in each African American ward and 59 mean billboards in each Caucasian ward.

[f]Population figures were computed by multiplying approximate ward population (55,000) by 11 for 11 African American wards and by 5 for five Caucasian wards. Only 11 African American wards and five white wards were included in this analysis; the other nine wards were Hispanic or other.

[g]Luke did not report number of residents in areas studied.

[h]Stoddard did not report number of residents in areas studied; instead, billboards/mile were reported.

[i]Altman DG, Schooler C, Basil MD. Alcohol and cigarette advertising on billboards. Health Educ Res 1991;6:487-90.

[j]Hackbarth DP, Silvestri B, Cosper W. Tobacco and alcohol billboards in 50 Chicago neighborhoods: market segmentation to sell dangerous products to the poor. J Public Health Policy 1995;16:213-30.

[k]Hackbarth DP, Schnopp-Wyatt D, Katz D, Williams J, Silvestri B, Pfleger M. Collaborative research and action to control the geographic placement of outdoor advertising of alcohol and tobacco products in Chicago. Public Health Rep 2001;116:558-67.

[l]Luke D, Esmundo E, Bloom Y. Smoke signs: patterns of tobacco billboard advertising in a metropolitan region. Tob Control 2000;9:16-23.

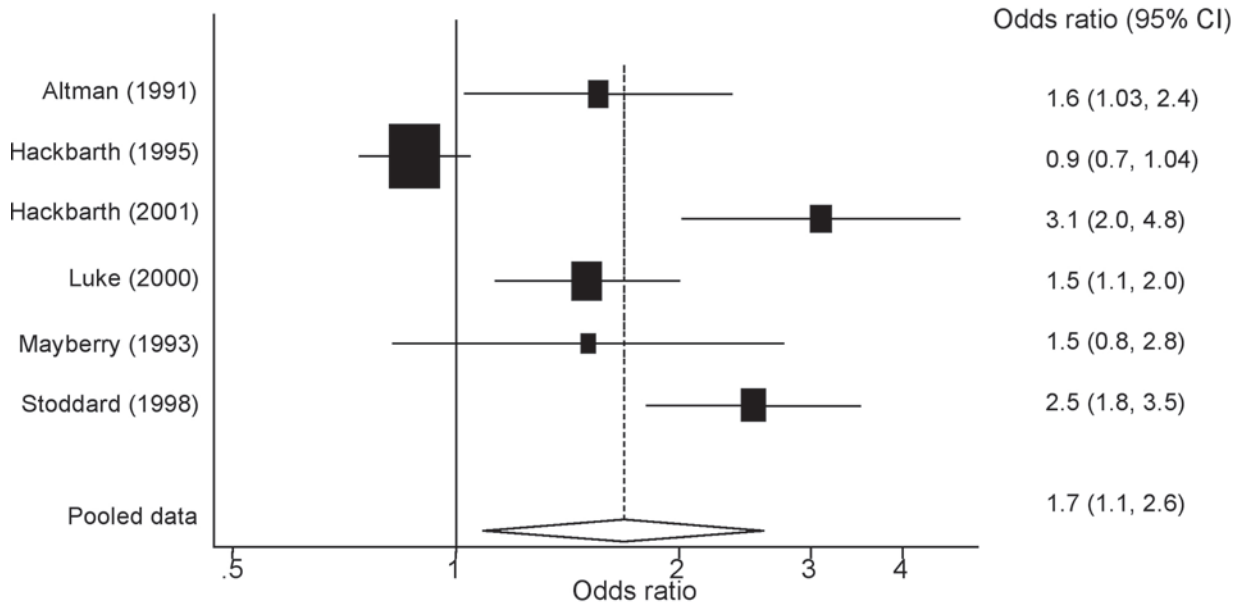
[m]Mayberry RM, Price PA. Targeting blacks in cigarette billboard advertising: results from down South. Health Values 1993;17:28-35.

[n]Pucci LG, Joseph HM Jr., Siegel M. Outdoor tobacco advertising in six Boston neighborhoods: evaluating youth exposure. Am J Prev Med 1998;15:155-9.

[o]Stoddard JL, Johnson CA, Sussman S, Dent C, Boley-Cruz T. Tailoring outdoor tobacco advertising to minorities in Los Angeles County. J Health Commun 1998;3:137-46.

NA = not applicable

Figure 2. Pooled odds of an advertisement being tobacco-related in an African American market area[a]



NOTE: Numerals represent the odds that an advertisement is tobacco-related in an African American market area vs. the odds that an advertisement is tobacco-related in a Caucasian market area. Thus, pooled data show that any given advertisement is 70% more likely to be for tobacco if it is in an African American market area. Box area is inversely proportional to the standard error for that study. Lines represent CIs. The diamond represents the pooled odds with CI. A random effects model was used.

[a]vs. a Caucasian market area

CI = confidence interval

can inhabitants (95% CI 5.0/10,000, 28.3/10,000) and 4.5/10,000 Caucasian inhabitants (95% CI 1.3/10,000, 15.2/10,000). The pooled rate ratio of African American to Caucasian tobacco-related billboard densities was 2.6 (95% CI 1.5, 4.7), indicating that there were 2.6 times as many tobacco advertisements per person in African American neighborhoods compared with Caucasian neighborhoods.

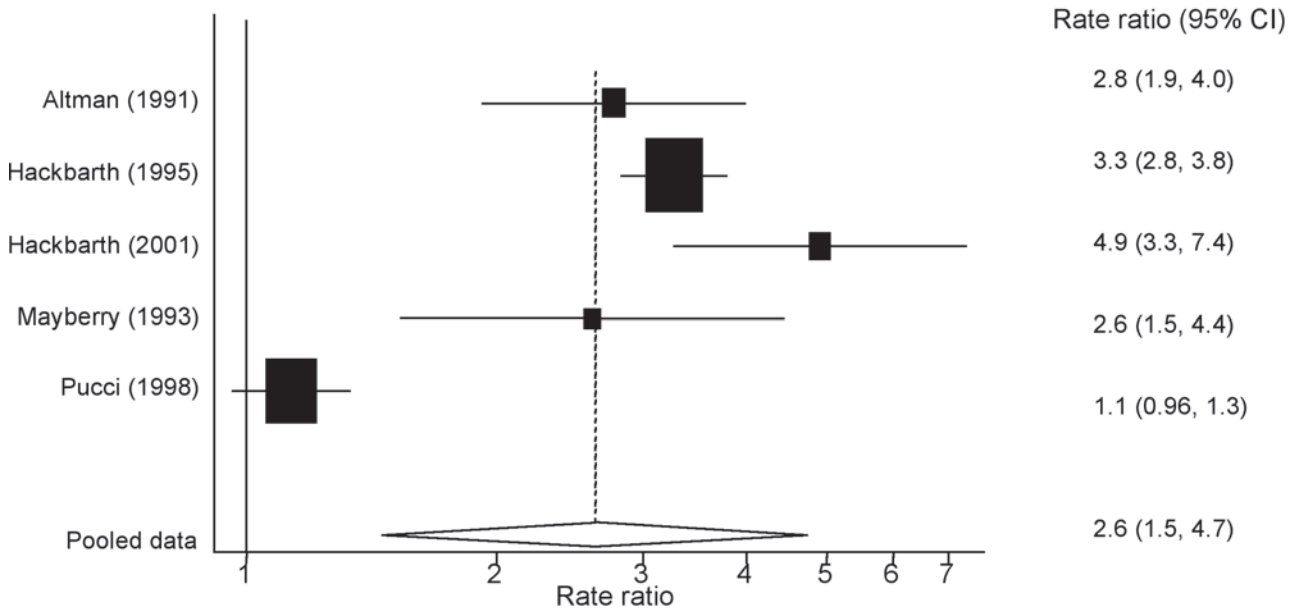
Again, we detected no publication bias for either the African American or the Caucasian density data. Influence plots showed that no one study had undue influence on the pooled density levels for either race area; however, Pucci reported lower densities for both races.[27] Finally, meta-regression showed that publication year was not a significant predictor of density for either race (p=0.87 for African American densities and p=0.97 for Caucasian densities).

Comparison of tobacco advertisements in magazines

Although four studies compared magazine advertisements between African American and Caucasian populations (Figure 1), their methods and outcomes were too varied for their results to be combined with meta-analysis. Only one study compared the concentration of advertisements between African American and Caucasian publications: Cummings et al. found that cigarette advertisements comprised 12.0% of all advertisements in African American magazines, whereas cigarette advertisements comprised only 9.9% of Caucasian magazines (p=0.04).[14]

Three studies investigated the number of pro-tobacco messages per issue, analogous to the density of advertising. Basil et al. coded 1,171 magazine advertisements and found that African American publications contained about twice as many cigarette advertisements per issue as did Caucasian publications (statistical significance not reported).[28] Landrine et al. found that *Ebony* had 2.25 cigarette ads per issue vs. *People*'s 1.87 ads per issue (p=0.06).[18] Finally, Pollay et al. found that *Ebony* and *Life* magazines had roughly the same density of cigarette advertisements during the years 1950–1965 (540 ads in *Ebony* vs. 526 in *Life*, p=1.0).[19]

Figure 3. Rate ratio comparing density of tobacco advertising in African American and Caucasian market areas



NOTE: Numerals represent the ratio between the number of tobacco advertisements per person in an African American neighborhood vs. a Caucasian neighborhood. Thus, pooled data show that there are 2.6 times as many tobacco-related advertisements per person in an African American market area vs. a Caucasian market area. Box area is inversely proportional to the standard error for that study. Lines represent CIs. The diamond represents the pooled odds with CI. A random effects model was used.

CI = confidence interval

DISCUSSION

This study comparing tobacco advertising in African American and Caucasian market areas demonstrated that, according to the available studies, tobacco signage was increased in African American markets in terms of both density and concentration. The odds that any given advertisement was smoking-related were 70% higher in African American areas vs. Caucasian areas, and there were 2.6 times as many tobacco advertisements per person in African American areas as compared with Caucasian areas.

The meta-analytic findings were consistent with relevant prior studies. For example, the two studies we identified that did not report sufficient data to be included in the density meta-analysis reported results consistent with our overall findings. Luke et al., who collected data on 1,239 billboards in St. Louis in early 1998, reported a statistically significant positive correlation between the percent of African American residents in a given geographic region and the proportion of tobacco billboards (r=0.15, p=0.004).[12] Stoddard et al., who examined signage along the roadsides of African American and Caucasian neighborhoods in Los Angeles from 1990 to 1994, reported a tobacco advertisement density of 2.41/mile in African American neighborhoods compared with 0.46/mile in Caucasian neighborhoods (p<0.001).[13]

Our findings imply that African Americans may be special targets of the tobacco industry. Policy makers may wish to keep this disproportionate advertising in mind when designing future policies involving tobacco-related media. They would have good reason, for instance, to seek universally applicable limits on the concentration and/or density of tobacco advertising.

Our findings also suggest that this population may require disproportionate public health interventions to counter the effect of the disproportionate pro-tobacco promotion. Programs involving analysis of media messages—also known as media literacy programs—may be particularly effective in this population.[29–31] Because this population is highly exposed to and familiar with media messages, techniques to analyze and evaluate these ubiquitous messages may be useful because of the direct relevance they provide. Finally, when addressing African Americans directly, medical practitioners (in both clinical and community settings) can emphasize the known disproportionate exposure of African

Americans to pro-tobacco mass media. This knowledge of being targeted may motivate African Americans to refuse to fall prey to industry tactics, helping them to avoid smoking.

Research is necessary to determine more precisely the cause of this disproportionate advertising so that it can be effectively curtailed. Are tobacco marketers more aggressive when approaching minority neighborhoods? Are point-of-sale venues in African American neighborhoods more likely to seek out tobacco advertisements from the industry? Are other social, economic, or political factors involved? Researchers will also need to increase efforts to study this population's susceptibility to advertising, which will be of particular concern as we now know their exposure is disproportionately high. Future research should also continue to characterize specific techniques tobacco makers use to attract African Americans to co-opt those techniques for use in anti-tobacco social marketing programs.

Another important finding of this study was that, although we did search for data involving other media such as films, music, radio, Internet, promotions, or sponsorships, most published data in this area focused on billboards/signage and magazines. Billboards and magazines, however, are not currently the most important carriers of pro-tobacco media.[32,33] The lessons these studies provide are still very relevant because the tobacco industry is remarkably adept at transitioning one type of advertising to another while still retaining its overall strategy.[32,34] In the future, however, research involving the impact of tobacco advertising on African Americans should focus more on the forms of promotion currently and increasingly utilized by the tobacco industry. In 2003, for instance, 71.4% of tobacco industry expenditures went directly into such promotional activities as the distribution of free cigarettes.[33] Future research should also address media such as smoking in movies, because it has now been established that as much as half of adolescent smoking initiation can be linked to watching smoking in movies.[9] Do these forms of tobacco promotion target and affect African Americans in particular and/or more frequently? If so, in what particular way do they affect African Americans? These questions will be essential to address in the future to most effectively reduce health disparities related to tobacco.

Limitations

This study had limitations worth noting. First, the only studies appropriate for meta-analysis involved billboards and signage. Although the tobacco industry is well-known to employ a consistent marketing strategy regardless of the specific medium used,[32,34] it should be considered that studies involving other media may have different findings. However, this is an important finding of the study in itself, as it elucidates the need for future research investigating these same issues while focusing on emerging forms of promotion.

Second, the studies identified were relatively heterogeneous according to statistical analysis with a Q statistic. However, we responded appropriately to this issue by conducting the meta-analysis using a random effects model.[23]

Third, to assure a certain level of quality, we excluded unpublished studies from the analysis. Although this exclusion introduced potential publication bias, we did not detect publication bias using two statistical methods.

A final potential limitation involved the population denominators used to determine advertisement density. It should be considered that these population figures may not accurately reflect the market of a billboard because billboards are often positioned to be viewed by those who live outside of their vicinity. However, we felt these figures were the most appropriate approximations of the market population available.

CONCLUSION

This systematic review and meta-analysis demonstrates that African Americans are disproportionately exposed to pro-tobacco mass-media messages in terms of both concentration and density. These findings suggest that important policy and intervention techniques should be considered in this population to appropriately reduce tobacco-related health disparities. Also, more research will be required that focuses on other important forms of media, such as tobacco promotions and smoking in films, to fully understand the impact of pro-tobacco promotion in African American communities.

Dr. Primack was supported by a Physician Faculty Scholars Award from the Robert Wood Johnson Foundation and by a career development grant from the National Cancer Institute (K07-CA114315). Dr. Fine was supported in part by a career development award from the National Institute of Allergy and Infectious Diseases (K24-AI01769). No funding agencies were involved in the design and conduct of the study; collection, management, analysis, and interpretation of the data; or preparation, review, or approval of the article.

REFERENCES

1. Mokdad AH, Marks JS, Stroup DF, Gerberding JL. Actual causes of death in the United States, 2000. JAMA 2004;291:1238-45.
2. Centers for Disease Control and Prevention (US). Smoking costs nation $150 billion each year in health costs, lost productivity [press release]; 2002 Apr 12.

3. Department of Health and Human Services (US). Tobacco use among U.S. racial/ethnic minority groups—African Americans, American Indians and Alaska Natives, Asian Americans and Pacific Islanders, and Hispanics: a report of the Surgeon General. Atlanta: Centers for Disease Control and Prevention (US); 1998.
4. Ries LAG, Eisner MP, Kosary CL, Hankey BF, Miller BA, Clegg L, et al. SEER cancer statistics review, 1975–2002. Bethesda (MD): National Cancer Institute; 2005.
5. Leistikow B. Lung cancer rates as an index of tobacco smoke exposures: validation against black male approximate non-lung cancer death rates, 1969–2000. Prev Med 2004;38:511-5.
6. DiFranza JR, Wellman RJ, Sargent JD, Weitzman M, Hipple BJ, Winickoff JP. Tobacco promotion and the initiation of tobacco use: assessing the evidence for causality. Pediatrics 2006;117:e1237-48.
7. Charlesworth A, Glantz SA. Smoking in the movies increases adolescent smoking: a review. Pediatrics 2005;116:1516-28.
8. Choi WS, Ahluwalia JS, Harris KJ, Okuyemi K. Progression to established smoking: the influence of tobacco marketing. Am J Prev Med 2002;22:228-33.
9. Sargent JD, Beach ML, Adachi-Mejia AM, Gibson JJ, Titus-Ernstoff LT, Carusi CP, et al. Exposure to movie smoking: its relation to smoking initiation among US adolescents. Pediatrics 2005;116:1183-91.
10. Gilpin EA, Pierce JP. Trends in adolescent smoking initiation in the United States: is tobacco marketing an influence? Tob Control 1997;6:122-7.
11. Carson NJ, Rodriguez D, Audrain-McGovern J. Investigation of mechanisms linking media exposure to smoking in high school students. Prev Med 2005;41:511-20.
12. Luke D, Esmundo E, Bloom Y. Smoke signs: patterns of tobacco billboard advertising in a metropolitan region. Tob Control 2000; 9:16-23.
13. Stoddard JL, Johnson CA, Sussman S, Dent C, Boley-Cruz T. Tailoring outdoor tobacco advertising to minorities in Los Angeles County. J Health Commun 1998;3:137-46.
14. Cummings KM, Giovino G, Mendicino AJ. Cigarette advertising and black-white differences in brand preference. Public Health Rep 1987;102:698-701.
15. Altman DG, Schooler C, Basil MD. Alcohol and cigarette advertising on billboards. Health Educ Res 1991;6:487-90.
16. Hackbarth DP, Silvestri B, Cosper W. Tobacco and alcohol billboards in 50 Chicago neighborhoods: market segmentation to sell dangerous products to the poor. J Public Health Policy 1995;16:213-30.
17. Mayberry RM, Price PA. Targeting blacks in cigarette billboard advertising: results from down South. Health Values 1993;17:28-35.
18. Landrine H, Klonoff EA, Fernandez S, Hickman N, Kashima K, Parekh B, et al. Cigarette advertising in black, Latino, and white magazines, 1998–2002: an exploratory investigation. Ethnic Dis 2005;15:63-7.
19. Pollay RW, Lee JS, Carter-Whitney D. Separate, but not equal: racial segmentation in cigarette advertising. Journal of Advertising 1992;21:45-57.
20. Hoffman-Goetz L, Gerlach KK, Marino C, Mills SL. Cancer coverage and tobacco advertising in African-American women's popular magazines. J Community Health 1997;22:261-70.
21. StataCorp. Stata: Version 9.0 for Windows. College Station (TX): StataCorp.; 2006.
22. DerSimonian R, Laird N. Meta-analysis in clinical trials. Control Clin Trials 1986;7:177-88.
23. Galbraith RF. A note on graphical presentation of estimated odds ratios from several clinical trials. Stat Med 1988;7:889-94.
24. Aitkin M. Meta-analysis by random effect modeling in generalized linear models. Stat Med 1999;18:2343-51.
25. Sutton AJ, Abrams KR, Jones DR, Sheldon TA, Song F. Methods for meta-analysis in medical research. New York: Wiley; 2000.
26. Hackbarth DP, Schnopp-Wyatt D, Katz D, Williams J, Silvestri B, Pfleger M. Collaborative research and action to control the geographic placement of outdoor advertising of alcohol and tobacco products in Chicago. Public Health Rep 2001;116:558-67.
27. Pucci LG, Joseph HM Jr., Siegel M. Outdoor tobacco advertising in six Boston neighborhoods: evaluating youth exposure. Am J Prev Med 1998;15:155-9.
28. Basil MD, Schooler C, Altman DG, Slater M, Albright CL, Maccoby N. How cigarettes are advertised in magazines: special messages for special markets. Health Communication 1991;3:75-91.
29. Primack BA, Gold MA, Land SR, Fine MJ. Association of cigarette smoking and media literacy about smoking among adolescents. J Adolesc Health 2006;39:465-72.
30. Primack BA, Gold MA, Switzer GE, Hobbs R, Land SR, Fine MJ. Development and validation of a smoking media literacy scale for adolescents. Arch Pediatr Adolesc Med 2006;160:369-74.
31. American Academy of Pediatrics Committee on Public Education. Media education. Pediatrics 1999;104(2 Pt 1):341-3.
32. Wakefield MA, Terry-McElrath YM, Chaloupka FJ, Barker DC, Slater SJ, Clark PI, et al. Tobacco industry marketing at point of purchase after the 1998 MSA billboard advertising ban. Am J Public Health 2002;92:937-40.
33. Federal Trade Commission. Cigarette report for 2003. Washington: Federal Trade Commission; 2005.
34. Balbach ED, Gasior RJ, Barbeau EM. R.J. Reynolds' targeting of African Americans: 1988–2000. Am J Public Health 2003;93:822-7.