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BACKGROUND: The news media facilitated the rapid dissemination of the findings from the estrogen plus progestin therapy arm of the Women's Health Initiative (EPT-WHI).

OBJECTIVE: To examine the relationship between the potential exposure to newspaper coverage and subsequent hormone therapy (HT) use.

DESIGN/POPULATION: Population-based cohort of women receiving mammography at 7 sites (327,144 postmenopausal women).

MEASUREMENTS: The outcome was the monthly prevalence of self-reported HT use. Circulation data for local, regional, and national newspapers was used to create zip-code level measures of the estimated average household exposure to newspaper coverage that reported the harmful effects of HT in July 2002.

RESULTS: Women had an average potential household exposure of 1.4 articles. There was substantial variation in the level of average household exposure to newspaper coverage; women from rural sites received less than women from urban sites. Use of HT declined for all average potential exposure groups after the publication of the EPT-WHI. HT prevalence among women who lived in areas where there was an average household exposure of at least 3 articles declined significantly more (45 to 27%) compared to women who lived in areas with <1 article (43 to 31%) during each of the subsequent 5 months (relative risks 0.86–0.92; $p<.006$ for all).

CONCLUSIONS: Greater average household exposure to newspaper coverage about the harms associated with HT was associated with a large population-based decline in HT use. Further studies should examine whether media coverage directly influences the health behavior of individual women.

KEY WORDS: newspaper coverage; women; mammography; hormone therapy; health behavior.
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INTRODUCTION

The release of the findings from the estrogen plus progestin therapy arm of the Women's Health Initiative (EPT-WHI) in July 2002[1] was accompanied by considerable coverage by the mass media and a rapid decline in the use of hormone therapy (HT).[2–4] The mass media are an important source of information about new medical developments for the public and health care providers[5,6] and may be an important source of information for women in their decisions about HT.[7,8] While the rapid decline of HT use after the release of EPT-WHI results suggests that the media played an important role in dissemination,[8,9] the association between the amount and framing of the coverage on the use of HT has not been explored. The level of news media coverage of a topic and the themes presented are referred to as "agenda setting" and "framing".[10] As these characteristics may vary by newspaper and region, differences in exposure could affect the dissemination of the findings to some groups of women. Despite the potential importance of the lay media in disseminating new medical evidence, few studies have examined the relation between exposure to coverage of a health topic and subsequent health behavior.[11–17] These studies also focused on national or statewide trends, and may therefore miss variation in coverage across smaller areas that may be important in understanding variation in dissemination. For example, news coverage of Nancy Reagan's choice of a

mastectomy was associated with a temporal decline in the use of breast conserving surgery (BCS) relative to mastectomy in the United States (US), although no information was presented about regional or local variation in coverage or procedure use.[14]

This study was designed to examine the relationship between potential exposure to newspaper coverage about the possible harm of HT and change in HT use after the release of the results of the EPT-WHI in July 2002. We hypothesized that women who lived in areas with more newspaper coverage about the harmful effects of HT would be more likely to discontinue use than women who lived in areas with less newspaper coverage.

METHODS

Data on Articles

We identified 22 newspapers with circulation in 7 areas of the United States that participate in the Breast Cancer Surveillance Consortium (BCSC): Western Washington (WA), San Francisco Bay Area (CA), Vermont (VT), New Hampshire (NH), New Mexico (NM), Denver (CO), and North Carolina (NC).[18] Local, regional, and national newspapers with circulation data for these areas were identified (*Albuquerque Journal*, (NM), *Santa Fe New Mexican* (NM), *Burlington Free Press* (VT), *Rutland Herald* (VT), *Times Argus* (VT), *Charlotte Observer* (NC), *Greensboro News and Record* (NC), *The News and Observer* (NC), *Star News Wilmington* (NC), *Winston-Salem Journal* (NC), *Denver Post* (CO), *Rocky Mountain News* (CO), *Oakland Tribune* (CA), *San Francisco Chronicle* (CA), *San Francisco Examiner* (CA), *San Jose Mercury News* (CA), *Seattle Post-Intelligencer* (WA), *Seattle Times* (WA), *Union Leader* (NH), *Boston Globe*, *New York Times*, and *USA Today*). We used LexisNexis (Dayton, OH) or the online archives of the paper to identify news articles, editorials, letters to the editor, advice columns, and news summaries published from July through October 2002.[19]

We conducted a content analysis of the newspaper articles, with trained individuals performing independent coding; the coding system developed for news story frames was based on the prior research literature.[20–22] For this study, we focused on articles that included coverage about the potential harmful effects of HT (defined as text that describes increased harmful effects, or adverse health results for women taking HT, or that which include scientific descriptions of harm such as increased risk of breast cancer or cardiovascular disease), as we hypothesized such information would be associated with the decline in HT use observed after the release of the EPT-WHI results. This "frame" or theme was identified in 83% of articles about HT in July 2002.[19]

Sample

Women between the ages of 50 and 74 without a personal history of breast cancer were included if they received a mammogram between July 2001 and December 2002 at 1 of the BCSC sites. We excluded women with missing information on HT use. For women who had more than 1 observation per year, we randomly selected a single observation from each year to include in the analysis.

Variables

The outcome for this analysis was the prevalence of prescription HT use during each month. Women receiving a mammogram at the BCSC sites are asked to report current use of HT at the time of each mammogram. Our principal independent variable was a woman's estimated potential exposure to newspaper articles conveying information about the potential harmful effects of HT. Because we could not ascertain whether any individual woman had seen a specific newspaper article, the average household exposure to a particular article was defined as the circulation of the newspaper in which the article appeared for her zip code of residence divided by the total number of households in that zip code. The Audit Bureau of Circulations and individual newspapers provided circulation data.[23]

For some national papers (*New York Times*, *USA Today*), only county or regional circulation information was available. For our primary analysis, we summed the average household exposure for each woman to the 162 articles in July 2002 to create an overall measure of average household exposure to articles that expressed the possible harmful effects of HT. We categorized average potential exposure as less than 1 article, 1.00–1.99 articles, 2.00–2.99 articles, and at least 3 articles. To evaluate the robustness of our findings, in a secondary analysis we also examined a continuous exposure variable. We also examined the association of the cumulative average potential exposure from July 2002 through the month of observation (e.g., for women who received a mammogram in October of 2002, we included the sum of articles from July through September 2002). The characteristics of individual women were available from the BCSC registry data including age, race/ethnicity (categorized as non-Hispanic white; non-Hispanic black; Hispanic; Asian, Hawaiian, or Pacific Islander; and other), family history of a first-degree relative with breast cancer, and educational attainment [less than high school; high school graduate, or general education diploma (GED); some college or technical school; college graduate or post-graduate].

Data Analysis

We calculated a "baseline" rate of HT use defined as the average utilization between July and December 2001, before the publication of the EPT-WHI. We did not include data from January to May 2002 in the baseline period because some of these sites also participated in the WHI, and women may have received information about the study findings before the publication in July 2002.[1] We examined the distribution of our household exposure variable by individual characteristics and site. For each of the 4 levels of average potential exposure to articles about the harmful effects of HT, we calculated the monthly prevalence of HT use and a monthly absolute change in HT use from the baseline prevalence. Log-binomial regression models were used to estimate the relative rate of HT use post-WHI compared to pre-WHI for each exposure group and to compare these relative rates for each of the 3 highest average potential exposure categories to the lowest average potential exposure group (the reference group).

These models were adjusted for the age, race/ethnicity, and family history of breast cancer of individual women and the interactions of these covariates with time period to control for other characteristics that may be associated with changes in

HT use. The models were fit using generalized estimating equations with an exchangeable correlation structure to account for clustering within zip code.[24,25] Each mammography registry received approval by their Institutional Review Board to collect the information about women in their registry. In addition, this analysis was reviewed and approved by the Institutional Review Board of Brigham and Women's Hospital.

RESULTS

Characteristics of the Sample

Our sample included 387,504 observations from 327,144 women who participated in the BCSC between July 2001 and December 2002 (Table 1). The majority of our sample was less than 60 years of age, white, and had at least some education beyond high school. There were differences in the demographic characteristics of the women across the participating sites. For example, San Francisco had a much larger percentage of women who described their race/ethnicity as Asian/Hawaiian/Pacific Islander than any other site (31%), North Carolina had the largest percentage of African Americans (17%), and New Mexico had the largest percentage of Hispanics (34%). San Francisco had the largest percentage of women who reported graduating from college or receiving post-graduate education (48%), and New Mexico had the highest percentage of women who reported not graduating from high school (17%).

Potential Exposure to Articles that Mention Harmful Effects of HT in July 2002

Overall, the majority of women in our sample were exposed to less than 1 article that reported the potential harmful effects of HT in July 2002 (Table 1). Average potential exposure to newspaper articles about the possible harmful effects of HT in July 2002 varied by individual characteristics. Older women had less exposure to newspaper coverage than younger women (median number of articles declined from 0.90 for women aged 50–54 years to 0.82 for women age 70–74). Asian/Hawaiian/Pacific Islander women had the highest level of average household exposure to newspaper coverage of this topic (median 2.99 articles), and Hispanic and African American

Table 1. Demographic characteristics of 387,504 observations on 327,144 women from July 2001 to December 2002 and level of average potential exposure to newspaper articles with iInformation about the harmful effects of HT in July 2002

	Women		Average potential exposure during July 2002 (number of articles)			
			<1.00	1.00–1.99	2.00–2.99	3.00+
	N	(Column %)	Row %			
Total observations	327,144		54.8	17.4	15.0	12.8
Use of hormone therapy at baseline[a]:						
No	71,270	56.2	56.3	16.7	15.0	12.0
Yes	55,523	43.8	54.0	18.8	14.7	12.5
Age (years)						
50–54	103,941	31.8	52.7	18.2	15.6	13.5
55–59	77,893	23.8	54.0	17.7	14.9	13.5
60–64	57,352	17.5	56.5	16.7	14.5	12.3
65–69	47,365	14.5	57.6	16.5	14.3	11.5
70–74	40,593	12.4	56.1	17.0	15.0	11.9
Race/ethnicity						
White, non Hispanic	243,558	77.6	56.1	18.7	136	11.6
Black, non Hispanic	20,378	6.5	63.0	12.7	14.5	9.8
Asian/Hawaiian/Pacific Islander	16,845	5.4	11.4	4.8	36.7	47.1
Other/Mixed (2+ races)	6,407	2.0	60.8	13.2	12.0	14.0
Hispanic	26,797	8.5	69.1	10.1	13.7	7.0
1st degree family history of breast cancer*						
No	264,097	86.0	55.3	17.3	15.0	12.5
Yes	43,097	14.0	54.0	18.5	13.3	14.1
Education*						
<High school graduate	27,232	10.4	64.0	10.7	14.7	10.6
High school graduate	72,295	27.6	63.9	16.7	11.5	7.9
Some college or technical school	71,491	27.3	50.4	18.6	15.9	15.1
College graduate or postgraduate	90,721	34.7	42.5	16.4	17.7	23.4
Site*						
North Carolina			65.7	15.9	14.6	3.8
New Hampshire			44.8	40.2	12.3	2.6
Vermont			95.5	4.3	0.2	0.0
San Francisco			3.3	1.9	39.1	55.6
Western Washington			30.1	12.5	11.3	46.1
New Mexico			88.3	8.6	3.1	0.0
Denver			7.8	58.2	33.2	0.8

Characteristics of the women at the time of the first observation. Data were missing for: education (n=13,159), family history (19,950), and education (65,405).

[a]*Baseline period refers to July–December 2001.*

**p<.001 for chi-square comparing level of average potential exposure across subgroups of women in each category.*

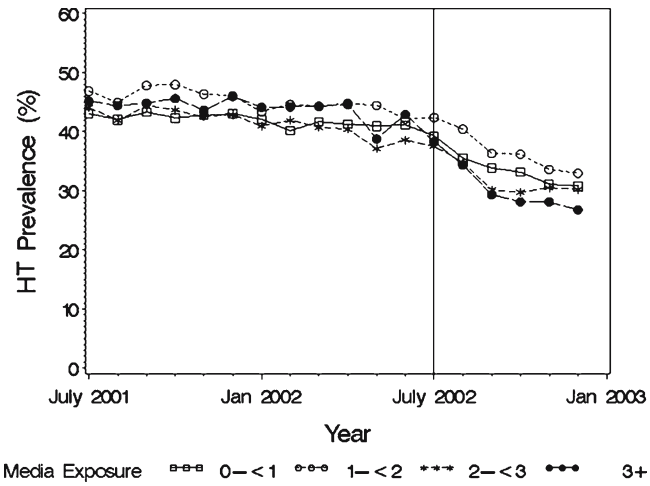

Figure 1. Hormone therapy prevalence by average potential exposure to newspaper coverage about the harmful effects of hormone therapy in July 2002. Each *line* represents the prevalence of hormone therapy (HT) use among women in each of the four groups that measure the average potential household exposure to newspaper coverage of the possible risks of HT during July 2002. The *square line* represents women who live in zip code with average potential exposure to <1.00 articles; the *open-circle line* represents women who live in a zip code with average potential exposure of 1.00–<2.00 articles; the *star line* represents women who live in a zip code with average potential exposure of 2.00–<3.00 articles; and the *shaded-circle* line represents women who live in a zip code with average potential exposure to at least three of these articles.

women had the lowest average potential exposure (medians of 0.70 and 0.59, respectively). Average potential exposure increased with education.

There was substantial variation in the average household exposure to articles about the potential harmful effects of HT across the BCSC sites. The majority of women from the San Francisco Bay area were exposed to at least 3 articles. In contrast, few women from North Carolina, New Hampshire, Denver, Vermont, or New Mexico had this level of average potential exposure.

Potential Exposure to Articles About the Harmful Effects of HT and HT Use

Before the publication of the EPT-WHI, 44% of these women reported HT use. HT use declined for all average household exposure groups after the publication of the EPT-WHI in July 2002 (Fig. 1). Women who were exposed to at least 3 articles about the potential harmful effects of HT experienced the greatest decline in HT use. Compared to a baseline rate of HT use of 45% for these women, HT use had declined to 34% by August 2002, to 29% by September, and to 27% by December 2002. In contrast, HT use among women in the lowest average potential exposure group only declined to 36% in August (from a baseline rate of 43%), to 34% in September, and to 31% by December. After adjustment for age, family history of breast cancer, and race/ethnicity (see Table 2), the prevalence of HT use among women exposed to at least 3 articles about the potential harmful effects of HT declined significantly more than the use among women with the lowest level of average potential exposure ($p<.006$ in each month post-WHI after adjustment for age, race, family history, and the interaction of these covariates with time period).

There was no consistent association between newspaper coverage and HT use at lower levels of average potential exposure, although there was a trend toward a greater decline in use among women who lived in areas with an average potential household exposure of 2.00–2.99 articles in the 3 months after the publication of the EPT-WHI. Women with a family history of breast cancer were less likely to use HT at baseline compared to women without a family history [relative risk (RR)=0.86, 95% confidence interval (CI)=0.85–0.88]; however, they were slightly less likely to decline in their use of HT by November 2002 (RR for HT use in November for women with a family history compared to women without, adjusting for baseline use and other covariates in the model: 1.07, CI 1.00–1.14). African Americans, Hispanics, and Asians were less likely to use HT at baseline compared with whites (African Americans: RR 0.66, CI 0.62–0.69; Asian: RR 0.69, CI 0.66–0.73; Hispanic: RR 0.84, CI 0.81–0.87). By October after the release of EPT-WHI, African Americans and Hispanics were less likely to decline in their use of HT compared to whites (African Americans: RR 1.17, CI 1.06–1.29; Hispanic: RR 1.09, CI 1.01–1.17). In contrast, by September, Asians were more likely to decline in their use of HT compared with whites (RR 0.86, CI 0.76–0.96).

In analyses using a continuous rather than categorical average potential exposure variable, greater exposure to coverage about the harmful effects of HT was associated with a significant decline in HT use in each of the subsequent 5 months ($p<.001$). The cumulative average potential exposure measure was not significantly associated with a decline in HT use, suggesting there may be a lag between media exposure

Table 2. Adjusted relative risk of hormone therapy use after the publication of the EP-WHI results by level of average potential newspaper exposure relative to the lowest average potential exposure group

Month (2002)	Level of average potential exposure to newspaper media in July 2002					
	1.00–<2.00	*p* value*	2.00–<3.00	*p* value*	3.00+	*p* value*
August	1.02 (0.97, 1.07)	.51	0.96 (0.91, 1.01)	.084	0.92 (0.87, 0.98)	.06
September	0.98 (0.93, 1.04)	.49	0.91 (0.85, 0.98)	.010	0.86 (0.79, 0.92)	<.0001
October	1.04 (0.98, 1.10)	.19	0.93 (0.86, 1.00)	.059	0.86 (0.80, 0.93)	<.0001
November	1.00 (0.94, 1.07)	.97	1.00 (0.92, 1.08)	.967	0.86 (0.80, 0.93)	<.0001
December	1.01 (0.93, 1.09)	.87	1.02 (0.93, 1.12)	.649	0.87 (0.80, 0.94)	.006

Model includes main effects of age, family history, race, and the baseline rate of hormone therapy use (defined as the average use between July and December 2001), and includes interactions of these variables with pre/post EP-WHI.

**p values compare each level of average potential exposure to referent group (exposed to <1 article in July 2002).*

and discontinuing HT for some women (i.e., women do not read an article and stop taking hormones the next day). For example, the highest average potential exposure group based on the cumulative average household exposure from July to August 2002 declined by 31% in September compared to a decline of 22% for the lowest average potential exposure group (p=.22); the highest average potential exposure group based on cumulative exposure from July to September 2002 declined by 35% in October compared to a decline of 23% in that period for the lowest average potential exposure group (p=.13).

DISCUSSION

This study demonstrates an association between average household exposure to newspaper coverage about new medical evidence in the area where a woman lives and population-based changes in medication use. While others have hypothesized that the rapid decline in HT use after the publication of the WHI was related to extensive media coverage,[9] these findings demonstrate that women who lived in areas with more newspaper coverage about the harmful effects of HT had greater declines in HT use. These findings suggest that a woman may need multiple exposures to the issues raised in newspaper reports before she changes her behavior. We also demonstrate substantial variation in average potential exposure to articles about the potential harmful effects of HT after the publication of the EPT-WHI by individual characteristics and region, which raises the concern that some women, particularly those who live in more rural areas, are African American or Hispanic, or have less education, may have less access to information about new medical findings through newspapers.

Our findings underscore the importance of newspapers in disseminating new medical findings to the public. The mass media research literature supports the ability of the news media to influence public opinion through the quantity and framing of stories about a specific topic.[10] The importance of the media in disseminating these findings is supported by a survey from a large health maintenance organization. Women who reported they had seen "good quality" media reports about the EPT-WHI were more likely to attempt to discontinue HT than women who had not seen these reports.[26] Our findings confirm that residents of rural areas have less access to news coverage than residents of more urban areas.[27] In an era when the National Institutes of Health is prioritizing the dissemination of research findings to the public, our findings suggest that the dissemination of this information by newspapers may be associated with changes in health behavior. Further research should examine whether lay media coverage of a medical study directly influences the health behavior of individuals, as well as the role of the timing and intensity of coverage on behavior.

Few studies have directly examined the relation between geographic differences in the level of exposure to news media coverage about a new research finding and subsequent health behavior. A 2002 Cochrane review of the effect of the mass media on health services utilization identified 5 studies evaluating the effect of media coverage outside the context of a planned intervention or public service campaign.[13–17,28] These studies generally showed a temporal change in use associated with media coverage in national or statewide samples, but did not examine the effect of variation in average potential exposure across smaller areas. Danovaro-Holliday *et al.* examined media coverage of new data about the risk of intussusception associated with rotavirus vaccine and found that states with more media coverage had more calls to the National Immunization Hotline with questions about the vaccine.[12] A temporal association between mammography-related newspaper reports and national patterns of mammography use has also been demonstrated.[29]

Extensive newspaper coverage of the presentation at a scientific meeting of the findings from a controversial study reporting an association between calcium channel blockers and myocardial infarction was associated with a significant temporal decline in pharmacy claims for calcium channel blockers relative to other classes of anti-hypertensives. The more modest newspaper coverage of the peer-reviewed publication of the same study[30] was not associated with a change in utilization.[31] In contrast, a study of media reports in combination with educational interventions related to prescribing practices for anti-hypertensives in British Columbia did not show an immediate decline in calcium channel blocker use associated with these reports.[17]

Our study has several limitations. First, we measured newspaper coverage but not other types of media. Although newspaper readership is declining, a substantial majority of older individuals, like the women in our study, report reading a newspaper.[32] Newspapers continue to be the leader of the media market, and likely influence coverage by television and other sources.[32] Second, we do not know whether any individual woman read a specific article. Our measure of average potential exposure is based on household circulation data and is intended to provide population-based estimates. Third, newspaper coverage is only 1 factor that may influence a woman's decision to use HT. We cannot address the importance of newspaper coverage relative to other sources of information, most notably direct communication with a health care professional.[29] Fourth, since our sample was derived from a mammography registry, our findings may not be generalizable to women who have not had a mammogram. National data, however, show that over 75% of postmenopausal women have received a mammogram in the prior 2 years.[33]

Finally, our data are observational; we cannot conclude that exposure to newspaper coverage caused the observed changes in HT use. Women who live in areas with greater exposure to newspaper articles may be different from women who live in areas with less exposure in ways that we cannot address (e.g., they may have better access to health providers, or better access to the Internet).

Greater average household exposure to newspaper coverage about the results of the EPT-WHI was associated with a larger population-based decline in HT use after the publication of the EPT-WHI. These results suggest the importance of the news media in the dissemination of new medical evidence and highlight the need to further study the role of media coverage of medical studies on the health behaviors of individuals.

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