

News coverage about aspirin as a countervailing force against low-dose aspirin campaign promotion

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Abstract

Organized health promotion efforts sometimes compete with news media, social media, and other sources when providing recommendations for healthy behavior. In recent years, patients have faced a complicated information environment regarding aspirin use as a prevention tool for heart health. We explored the possibility that campaign promotion of low-dose aspirin use might have been undermined by news coverage in the USA detailing controversies regarding aspirin use. Using time series data on low-dose aspirin sales in Minnesota, USA, we assessed whether news coverage of aspirin or audience engagement with the Ask About Aspirin campaign website predicted subsequent changes in low-dose aspirin sales, over and above any secular trend. News coverage predicted actual low-dose aspirin purchases whereas exposure to a state-level campaign did not. While a campaign effort to encourage people at risk to discuss low-dose aspirin use with their health care providers did not generate substantive changes in low-dose aspirin tablet sales in the areas of Minnesota monitored for this study, past news coverage about aspirin use, including news about negative side effects, may have suppressed low-dose aspirin sales during this same period. The extent of news coverage about aspirin and heart health had a negative effect on tablet sales recorded in greater Minnesota approximately a month later in an ARIMA time series model, coefficient = $-.014$, $t = -2.33$, $p = .02$. Presented evidence of news coverage effect suggests health campaign assessment should consider trends in the public information environment as potential countervailing forces.

Keywords

Cardiovascular disease, Health promotion, News coverage, Time series

Although many organized health promotion efforts focus on addressing people with simple and coherent recommendations for behavior, patients live every day amidst considerable amount of information related to their health, at least some of which offers conflicting perspectives [1]. Community events and local news outlets, for example, offer important alternative sources of health information relative to peer-reviewed literature [2]. Despite that aspect of patients' everyday lives, we sometimes consider communication interventions as forces for change that somehow reside outside of this cacophony, and yet

Implications

Practice: Media-based prevention campaigns should heed the news environment as a key source of information that may affect patient behavior.

Policy: Evaluators of communication campaign efforts should account for potential countervailing trends before making judgments about patterns in behavior over time.

Research: Future research can employ time-based methods to understand longitudinal processes related to communication interventions and the ways in which information environments beyond controlled campaign messages interact with campaign efforts to affect behavior.

to best understand patient behavior we likely need to understand all of that noise.

Previous work has suggested that concerted efforts to promote health information online can encourage people to view and consider such content. Southwell and colleagues [3], for example, demonstrated that campaign efforts to draw people to an online assessment tool related to heart health and stroke prevention were successful in doing so over a period of several years. What we do not yet know sufficiently is how such efforts operate alongside community-level information patterns outside of those specific campaign efforts. How might efforts to engage audiences with web-based information to encourage physician-patient dialog, for example, result in discernible patient behavior beyond information engagement?

Efforts such as the Ask About Aspirin campaign in Minnesota encourage patients to consider information that would in turn affect their product consumption patterns, which means that effects of such campaigns should be discernible in commercial sales data. Do efforts to promote low-dose aspirin as a prevention strategy, for example, result in greater consumption of low-dose aspirin in the future? Research on advertising

for commercial products suggests promotion can affect sales, but we have relatively less information regarding evidence for a public health campaign resulting in preventive behavior that could be indicated by product sales, as is the case with the promotion of physician-patient discussion of aspirin use.

We also do not know about how campaign promotion efforts involving low-dose aspirin promotion might interact with relevant news coverage not directly linked to the campaign. We do know that news coverage can prompt online searches for health information [4]. What is the relative role of news coverage about aspirin use as a potential force influencing actual low-dose aspirin sales? Might health organization promotion of low-dose aspirin use be undermined, instead of bolstered, by news coverage detailing controversies regarding aspirin use? We explored that possibility using time series data from the state of Minnesota. We predict two potentially offsetting relations during a period from mid-2015 through mid-2017 for which we have data: Engagement with a web-based campaign to encourage people to talk with their clinician about aspirin use will be associated with increased aspirin sales in Minnesota and exposure to news coverage about aspirin use and heart health will be associated with a decrease in aspirin sales.

METHODS

Site for Research

The Minnesota Heart Health Program launched the Ask About Aspirin campaign in 2012 to promote United States Preventive Services Task Force (USPSTF) recommendations on aspirin use for primary prevention of cardiovascular disease [5]. As part of the campaign effort, staff developed a website-based tool to allow people to assess whether they should discuss a daily aspirin regimen with a health care professional. After reporting their characteristics in the web tool, users received a tailored assessment. Intended web tool audiences included men 45–79 years and women 55–79 years. In 2015, the campaign began substantive online promotion with paid campaign ads on Google, Yahoo, Facebook, and Twitter. That means the effects of the online campaign

might have occurred beginning in 2015. Although the campaign was focused on promoting interaction between patients and physicians regarding the potential use of low-dose aspirin as a primary goal, here we can ask whether the promotion and use of that website are associated with substantive changes in low-dose aspirin sales in greater Minnesota, the area on which the Ask About Aspirin campaign focused.

Procedure

We brought together three sets of time series data in order to consider whether indications of audience engagement with the Ask About Aspirin campaign website are associated with changes in low-dose aspirin sales in Minnesota, USA, over and above any secular trend during the time in question and relevant news coverage. For the purposes of this paper, we will refer to the addressed areas—all of Minnesota except the seven-county Minneapolis–St. Paul metropolitan area and the city of Rochester—as greater Minnesota. Our study design assessed the same geographic area over time. The logic of the Ask About Aspirin media campaign constrained that geographic focus. Campaign staff excluded the population-dense Twin Cities (Minneapolis and Saint Paul) metropolitan area (including Anoka, Carver, Dakota, Hennepin, Ramsey, Scott, and Washington counties) to minimize potential measurement contamination in comparisons between areas where the campaign operated and where it did not, because patients in such regions often cross geographic boundaries and receive care in multiple clinics. Similarly, campaign staff excluded Rochester, Minnesota, home of the Mayo Clinic, given the substantial healthcare industry presence in the city.

We used website audience engagement data and news coverage data to create time series that could predict subsequent aspirin sales in greater Minnesota. In aligning time series for prediction, we used lags to theoretically allow for time for audience members to discuss possibilities with a health care professional and then to purchase low-dose aspirin.

Measures

In this analysis, we intended to assess whether low-dose aspirin sales were affected by exposure to the

Table 1 | ARIMA Model (1, 0, 1) Predicting Greater Minnesota Weekly Low-Dose Aspirin Tablet Sales (Natural Log)

Series	Coefficient	SE	Significance
Constant	1.36	1.07	.21
Autoregressive component	.96	.06	<.001*
Moving average component	.80	.11	<.001*
lowa low-dose aspirin tablet sales	.84	.09	<.001*
News coverage volume (1- to 3-week lag)	<.001	.01	.95
News coverage volume (4- to 6-week lag)	-.01	.01	.02*
Candidates identified by website (1- to 3-week lag)	-.000003	.00003	.91
Candidates identified by website (4- to 6-week lag)	.00004	.00003	.21

Note. * $p < .05$. $R^2 = .54$. Ljung–Box statistic = 22.44, $df = 16$, $p = .13$.

self-assessment tool promoted by the Ask About Aspirin campaign or by news stories about aspirin and health in general. Our main dependent variable was an indicator of low-dose aspirin sold and our main independent variables were indicators of how much people interacted with the campaign web tool and of how much relevant news coverage was in the information environment.

Our dependent variable for analysis was the number of units of low-dose aspirin sold, as measured in Nielsen Retail Scanner Data generated through scanning of the Universal Product Code at retail outlets. (Our analysis is based in part on data from Nielsen Consumer LLC and marketing databases provided through the NielsenIQ Datasets at the Kilts Center for Marketing Data Center at The University of Chicago Booth School of Business. In using the data, we agreed to note that the conclusions drawn from the NielsenIQ data are those of the researchers and do not reflect the views of Nielsen. Nielsen is not responsible for, had no role in, and was not involved in analyzing and preparing the results reported herein.)

We obtained Nielsen sales data for greater Minnesota for a 109-week period (from the week of June 7, 2015, which corresponds to the approximate launch of the campaign, through the week of July 2, 2017) by aggregating low-dose aspirin tablet sales data by week and by the first three digits of the zip code in which the medication was sold during the time in question.

One of our independent variables for analysis was an indicator of engagement with the self-assessment tool created by the Ask About Aspirin campaign: specifically, the extent to which people had been identified as candidates to consider regular aspirin use using the tool. Drawing on weekly records generated by website traffic, our measure of tool engagement was the number of candidates for aspirin use—patients recommended to talk with their physician about potential aspirin use—identified in a week. For our model, we aggregated the number of identified candidates into two lagged predictors: the number of candidates identified in the 3 weeks prior and the number of candidates identified 4–6 weeks prior to the week of dependent variable assessment. Given the likely time between recognition as a potential candidate, potential consultation with a clinician, and eventual aspirin purchase at a retail outlet we wanted to capture both immediate and slightly delayed effect possibilities.

Another independent predictor in our model was the number of recent news stories mentioning a link between aspirin and heart health. As previously reported, a considerable amount of news coverage of aspirin as a heart health treatment since 2015 has raised questions about efficacy and side effects [4]. To measure news story volume, we collected major news wire stories mentioning “aspirin” and “heart,”

that is, articles published on The Associated Press general wire, The Associated Press State and Local Wire, or the CNN Wire and then specifically coded for stories mentioning any link between aspirin use and heart health (achieving a Krippendorff's alpha of 1.0 between two coders). For our model, we aggregated the number of news stories into two lagged predictors: the number of articles in the 3 weeks prior and the number of stories appearing 4–6 weeks prior to the week of dependent variable measurement.

We also included an indicator of regional secular variation in aspirin sales. We used low-dose tablet sales in Iowa (adjacent to Minnesota but not the focus of the Ask About Aspirin campaign) as a proxy for secular variation. That measure paralleled our sales indicator for greater Minnesota and was available for the same period of 109 weeks from mid-2015 through mid-2017. By including Iowa sales in our model, we attempted to control for regional weather anomalies and any cultural forces that might have invited spikes or declines in aspirin sales.

Analysis

Using a week as our unit of analysis (meaning $n = 109$ for all analysis), we used time series analysis to assess the relation of community engagement with the online tool (as measured by identified candidates for aspirin use consideration) and subsequent aspirin sales (tablets sold in the geographic areas in question in a given week). In using a time series approach, we avoided a potential pitfall—spuriousness resulting from trend autocorrelation—that correlational analysis alone would not have avoided. Because time series data can reflect autocorrelation that makes observed relations spurious, interpretation of bivariate correlations alone to link time series data is not advisable [6].

To assess the relationship between independent variables and low-dose tablet sales, we used time series analysis to predict aspirin sales as function of other observed trends. To do that, we fit an Autoregressive Integrated Moving Average (ARIMA) model that allowed adjustment to rule out the influence of autocorrelation in the original trend. We first looked at the simple 109-week time series of web tool engagements without any adjustment for secular trend, a model that generated a Ljung–Box statistic to indicate whether significant autocorrelation resided in the dependent time series. As described in the Results section, we added as needed an autoregressive, differencing, or moving average component to our base model to transform the time series to white noise that we then could predict with independent variables.

RESULTS

Over the roughly 2-year period observed, each of the variables in our analysis demonstrated

substantive variation. Low-dose aspirin tablet sales in greater Minnesota in a week ranged from 63,402 to 96,003. In Iowa, low-dose aspirin sales in a week ranged from 112,422 to 153,459. (The larger numbers in Iowa compared to Minnesota reflect our focus on greater Minnesota in this study, without the Twin Cities/Rochester area included, as opposed to using whole-state numbers for Iowa.) To ensure variance stability, we used the natural log for tablet sales, which ranged from 11.06 to 11.47 in greater Minnesota and 11.63 to 11.94 in Iowa. The number of candidates for aspirin use consideration generated by the Ask About Aspirin web tool ranged from 15 to 1254 in the 3 weeks prior to a given week and from 0 to 1254, 4–6 weeks prior to a given week. (The campaign did not set an absolute goal for number of patients to be reached but staff did intend the web tool to reach an age-appropriate audience in which roughly half of the respondents would be identified as candidates to consider aspirin use, which in practice was the approximate proportion identified during this time period.) News wire stories mentioning the link between aspirin and heart health, each of which could be republished and amplified by numerous other news outlets, ranged from 0 to 4 for both the 3 weeks prior and the period 4–6 weeks earlier. Our analysis focused on how all of those trends related to one another.

Greater Minnesota Low-Dose Sales as a Function of Campaign Web Activity and News Coverage

We initially fit an ARIMA (0, 0, 0) model with no predictors to predict the natural log of tablet sales in greater Minnesota to assess the nature of our dependent time series. That model produced a statistically significant Ljung–Box statistic, 40.79, $df = 18$, $p = .002$, meaning the modeled time series could not yet be considered white noise with no autocorrelation in residuals. Fitting a model with autoregressive and moving average components reduced the trend to white noise: for an ARIMA (1, 0, 1), the Ljung–Box statistic was 12.02, $df = 16$, $p = .74$.

We then fit a full model with all predictors to test our two hypothesized relations (between engagement with the campaign website and aspirin sales and between news coverage and aspirin sales). See [Table 1](#). In that ARIMA (1, 0, 1) model, the Ljung–Box statistic was not significant, 22.44, $df = 16$, $p = .13$. Both autoregressive and moving average components were significant predictors of the natural log of greater Minnesota tablet sales, $p < .01$ in both cases. The natural log of Iowa tablet sales positively predicted the natural log of Minnesota tablet sales, coefficient = .84, $t = 9.21$, $p < .01$. Increases in tablet sales in Iowa corresponded to increases in tablet sales in greater Minnesota. Neither lagged indicator of the number of campaign-identified candidates (neither 3 weeks prior nor 4–6 weeks prior) significantly predicted overall greater Minnesota

tablet sales, $p > .10$ in both cases. News stories in the 3 weeks prior also did not significantly predict greater Minnesota tablet sales, $p > .10$. News stories appearing 4–6 weeks prior did significantly, and negatively, predict logged Minnesota tablet sales, coefficient = $-.014$, $t = -2.33$, $p = .02$. In other words, news coverage about aspirin had a negative effect on tablet sales recorded in greater Minnesota approximately a month later.

DISCUSSION

Although previous work has suggested that promotional efforts such as the Ask About Aspirin campaign can encourage patient interest in information about low-dose aspirin as a heart health aid, here we did not find that the number of candidates identified by the Ask About Aspirin web tool predicted subsequent sales of low-dose aspirin in greater Minnesota. What did predict low-dose aspirin sales in greater Minnesota was the volume of sales in an adjacent state, which suggests regional or national secular trend patterns are important to note. Moreover, past news coverage (approximately a month prior) negatively predicted low-dose aspirin tablet sales. Relatively more news coverage appearing on major news wires about aspirin and the heart—wire stories that likely were widely republished by various newspaper, television, and radio news outlets used by residents in the state—was associated with relatively fewer low-dose aspirin tablets being sold 4–6 weeks later. That relation held after controlling for autocorrelation in the aspirin sales time series and occurred over and above whatever regional trend is evident in the sales of a neighboring state.

The notion that news coverage might have run counter to efforts such as the Ask About Aspirin campaign offers important context. The possibility that news coverage might suppress or undermine consumer interest in low-dose aspirin is underscored by the focus on controversy and debate often highlighted in such stories. Approximately 27% (7/26) of Associated Press or CNN News Wire stories mentioning a link between aspirin use and heart health during this period explicitly mentioned negative side effects of aspirin use, for example. Consider this example headline published in a 2015 Associated Press story: “Panel backs aspirin for heart health in only certain adults” [7]. In December 2015, this claim appeared in a story on the CNN Wire: “The decades long push to use aspirin to prevent heart attacks came to an end in May of this year, when the Food and Drug Administration warned against anyone using aspirin as a preventative measure” [8]. In 2016, a CNN story opened with this line: “New recommendations on daily aspirin use will likely stir the pot in the ongoing aspirin debate” [9]. A quick read of such reporting on debate and controversy regarding aspirin use as a heart health tool likely offered a sense of uncertainty, even if a closer look

at peer-reviewed literature on heart health suggests nuanced evidence. Even if such news coverage does not offer a definitive recommendation to patients regarding prevention strategies for heart health, salient uncertainty in a public information environment may well be sufficient in many instances to at least temporarily dissuade consumers from proactively purchasing low-dose aspirin, especially in light of the fact that regular low-dose aspirin use has not been a common habit among most consumers historically.

Campaigns do not appear in a vacuum. We know that factors such as weather, seasonal variation, and popular culture can affect health behavior [10]. Campaign staff might carefully craft specific messages and make plans to generate exposure but often cannot control the larger public information environment. At the same time, much of our public health communication research focuses on unipolar possibilities for effect rather than considering the potential interplay of conflicting information [11].

What this means is that we should consider public health promotion in a longitudinal context. Effort to promote recommended behavior likely needs to be judged relative to existing or predicted trends that reflect a complex array of public information environment dynamics, which is different than assuming a default control scenario that simply lacks any competing information. In this light, serving patients will require us to have a keen sense of the information landscape they are facing alongside the promotional messages we offer.

Limitations

Although our time series analysis assessed the relation between trends that were subsequent in time, it is possible that a larger system of factors beyond what we measured in this study could have been driving all observed trends. We also should note that if the Ask About Aspirin campaign had encouraged consumption among those for whom aspirin use is recommended and discouraged it among those for whom it is not recommended and those two groups of patients were roughly equal in size—an unlikely but possible scenario given the formal goal of the campaign to encourage discussion of appropriate use—we also would have seen no net effect of the campaign. Nonetheless, the empirical evidence from the period in question, in which campaign-associated website activity did not predict overall low-dose aspirin sales and news coverage did significantly predict such sales, is consistent with a conclusion that news coverage is relatively more important in understanding the overall pattern of low-dose aspirin use in greater Minnesota during this period than campaign efforts are.

Our model only found a negative coefficient for news coverage occurring 4–6 weeks prior to a week in question. We did not find a significant coefficient

for news coverage aggregated during the 3 weeks immediately prior to a given week. Given the amount of time likely necessary for a person to encounter a news story—either directly or indirectly through referral from another person—and then possibly to discuss the topic with a clinician and also to incorporate relevant consideration into a trip to a retail outlet, it is not surprising that news coverage has a delayed effect. The absence of such effect immediately prior to news story appearance nonetheless is notable. It might reflect the secular trend control captured by Iowa sales data (which would have restricted any immediate effect relevant to both Iowa and Minnesota). Future research might further discern possibilities for delayed effects.

We also should note that our analysis is limited to the period for which we had available continuous data on low-dose aspirin sales. The 109-week period available overlaps with a time of campaign activity and so is useful for analysis. (We ended our analysis at a point when available data became discontinuous due to an apparent data collection anomaly in the 110th week.) It is possible that the relationship observed here does not generalize to other time periods or to other geographical areas.

Importantly, this direct comparison of Ask About Aspirin web tool engagement and news coverage is almost certainly not a fair comparison of the content of either, per se, as the differential effects likely stem in part from exposure differences. The fact that the web tool identified on average hundreds of candidates a week across greater Minnesota suggests that fewer people likely engaged with the campaign web tool than read the news wire stories included in this analysis. That imbalance in exposure is not an inherent problem for analysis and in fact might be an important consideration in accounting for these results: prominent news coverage may overwhelm campaign activity in terms of sheer exposure in many instances, particularly for state-level activity. In light of that, we should view these results not as a direct comparison of the relative efficacy of campaign promotion of low-dose aspirin consideration and news coverage about aspirin and heart health, but rather as a potentially telling naturalistic assessment of what seems to have occurred over a 2-year period when the Ask About Aspirin campaign attempted to reach Minnesotans and when there was prominent news coverage focused in some instances on debate about the scientific literature on aspirin (and not always low-dose aspirin, per se) as a preventive tool.

CONCLUSION

In assessing possibilities for public communication effects on health behavior, we need to move out of the laboratory to also include assessment of the public information environment as it unfolds outside of the control of public health and medical organization efforts. In this study, we provide evidence that a state-level campaign effort to identify candidates for low-dose

aspirin use consideration did not generate substantive differences in low-dose aspirin tablet sales in the state in which the campaign was operating. Generally, low-dose aspirin sales patterns observed in this study reflected the secular trend as it is measured in sales in a nearby state. Moreover, we presented some evidence to suggest that news coverage may have suppressed low-dose aspirin sales during this same period. Such evidence of news coverage effect suggests any assessment of heart health campaign promotion during this period or others like it should also consider trends in the public information environment as potential countervailing forces.

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Compliance with Ethical Standards

Conflict of Interest: The authors declare that they have no conflicts of interest. This article does not contain any studies with human participants performed by any of the authors. This study does not involve human participants and informed consent was therefore not required. This article does not contain any studies with animals performed by any of the authors.

Authors' Contributions: Southwell conceptualized the study and led analysis and writing efforts. Duval and Van't Hof organized aspirin sales data and contributed to analysis and writing. Luepker, Oldenburg, Eder, Russell, Graves, and Finnegan supported data collection and advised manuscript writing.

Ethical Approval and Informed Consent: This study employed archived administrative data generated by the Ask About Aspirin campaign directed by the University of Minnesota and did not involve primary data collection.

Transparency Statement: This study assesses secondary data. This study was not formally registered nor was an analysis plan formally pre-registered. De-identified data, materials used to conduct this study, and analytic code from this study are not available in a public archive and may be available (as allowable according to institutional IRB standards) by emailing the corresponding author.

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