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News coverage and online advertising effects on patient-led search for aspirin, heart health, and stroke prevention and educational tool use

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\textbf{Article Info}

\textbf{Abstract}

\textbf{Objective:} Using indicators of campaign effort and relevant news stories, we sought to predict two patterns of patient behavior regarding information about aspirin and heart health: patient use of a campaign web tool to determine whether they should talk with a physician about using aspirin and patient searches for information about aspirin and the heart. 

\textbf{Methods:} We used ARIMA modeling to predict two time series as a function of independent variables. 

\textbf{Results:} We found significant prediction of time series in both models, but campaign expenditure only predicted use of a campaign web tool whereas weekly news stories predicted online searches regarding aspirin and the heart originating from Minnesota. 

\textbf{Conclusion:} Patient information engagement is a function of information salience at least in part. Campaign advertising expenditure can prompt audience use of campaign tools but news coverage also operates as an important force on patient search behavior. 

\textbf{Practice Implications:} Health promotion professionals charged with reaching patients with heart health and stroke prevention messages should monitor news coverage as a potential complementary or rival force while at the same time promoting campaign-related information online.

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\textbf{1. Introduction}

The amount of information available to patients is staggering in comparison to earlier decades, yet we know people meaningfully process and act on only a fraction of that information. Although communication professionals can make content available online relatively easily, the effect of any health education effort relative to a patient’s everyday information exposure remains an open question [1]. At a moment when a small set of issues can dominate news cycles and draw patient attention, e.g., coverage of the COVID-19 pandemic or coverage of Zika virus outbreaks [2], we need to understand the relative (and potentially different) effects of patient exposure to health campaign promotion and patient exposure to health news stories by journalists.

In the case of heart health and stroke prevention, online promotion efforts can increase patient use of an educational tool [3]. Online campaigns nonetheless operate alongside forces that encourage patients to search for and find information not directly crafted by campaign staff. As Arendt and Scherr note [4], health news coverage can spark public attention and prompt action. We need information about how online campaign promotion fares against other sources such as news stories. To make such an assessment, we investigated effects of exposure to two information sources — advertising purchased by a heart health campaign and news coverage produced by journalists— on two distinct outcomes: patient use of a campaign-specific online tool and patient-led searches for information about aspirin and heart health online.

Our focus here is the Minnesota Heart Health Program’s \textit{Ask About Aspirin} campaign to promote USPSTF recommendations on aspirin use for prevention of cardiovascular disease [5]. Since 2015, the campaign has promoted a website-based tool that allows men (45- to 79-years-old) and women (55- to 79-years-old) to assess whether to discuss a daily aspirin regimen with a health care professional. The tool provides a recommendation as to whether a patient should talk with a physician about aspirin use.

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2. Methods

Time series analysis allows us to investigate relationships between longitudinal patterns of data [6]. We used ARIMA modeling to consider potential seasonality in time trends over time and to assess whether we could predict departure from trend in a dependent time series as a function of independent variables.

Using time series analysis of weekly data from September 2014 through December 2018, we used a count of news wire stories – stories published by an organization such as The Associated Press for republication and use by news outlets such as a local newspaper – as well as an indicator of campaign expenditures to predict patient activity. Specifically, we investigated the predictive ability of weekly newswire coverage about aspirin and heart health (i.e., articles published on The Associated Press general wire, The Associated Press State and Local Wire, or CNN Wire) relative to the predictive ability of sponsored online promotion (i.e., campaign advertising expenditures with Google, Yahoo, Facebook, and Twitter) to explain two distinct outcomes: patient engagements with an online tool and the relative search volume for “aspirin” and “heart” (together) in Minnesota.

We measured our dependent variables using two indicators. To measure audience engagement with a campaign web tool, we used a weekly campaign report of the number of visits to Ask About Aspirin’s web portal. For an indicator of audience search for information, we obtained the search index on a weekly basis from Google Trends for the period in question specifically for searches originating from the state of Minnesota (the focus of the campaign). For independent variables beyond time, we used campaign-reported expenditure for online advertising as well as a measure of news wire stories. For news story volume, we collected and coded major newswire stories mentioning “aspirin” and “heart.” A total of 83 stories appeared on the analyzed newswires during the 2014–2018 period in question; news wire story count in a week ranged from 0 to 7. To ensure intercoder reliability, two coders coded a sample of articles (n = 11) and achieved Krippendorff’s alpha of .80 or higher for coded variables, including reference to a relationship between aspirin use and heart health, reference to no effect or a negative effect of aspirin on heart health, and reference to potential aspirin use side effects. We also considered whether the news story had a Minnesota byline, which could indicate specific relevance of the story. We then created a weekly count of relevant stories published in a week (with and without the Minnesota byline).

Using those data, we modeled each dependent variable: the volume of patient initiations of the online advice tool and the relative search volume in the state of Minnesota for aspirin and heart. For our final ARIMA models, we assessed whether any adjustment was necessary to account for autocorrelation in the data and indicate that adjustment in the results, e.g., (1, 0, 0) indicates an autoregressive component has been included to control for autocorrelation.

3. Results

ARIMA model results told different stories for the effects of online promotion and news coverage. We were able to predict dependent time series in both instances. In the case of patient engagement with the campaign web tool, weekly patient engagement with the online tool was a function of online campaign promotion expenditure, p < .01, as well as weekly newswire appearance of a story on aspirin and heart with a Minnesota byline, p = .04, but not of weekly newswire story count for references to research on aspirin and heart health, ARIMA (1, 0, 0), R² = .76. We also separately modeled Minnesota-based searches for aspirin and heart as key words (via Google). Search for aspirin and heart was not a function of online campaign promotion, p > .05, but was a function of weekly newswire story count for references to aspirin and heart health research, p = .03, ARIMA (0, 0, 0), R² = .03.

We also assessed the actual focus of the news stories in question. Although 64% of stories mentioning aspirin and heart (53/83) referred to a potential relationship between aspirin use and heart health, almost a quarter (21%) of those stories mention research finding no effect of aspirin on heart health or a negative effect and 32% of those stories mention potential aspirin side effects.

4. Discussion and conclusion

4.1. Discussion

We found distinct spheres of influence for news stories and online campaign promotion on patient behavior. Results suggest important information forces beyond the immediate control of campaign efforts. In this case, as noted in the results, news stories did not universally champion aspirin use (which is not surprising given journalists’ tendency to cover conflicts and alternative viewpoints).

Our study has important limitations. As an effort to bring together streams of time series data, our inquiry sheds light on whether campaign expenditure affects patient use of a web-based tool and whether news stories prompt patient search. What we do not have are patients’ self-reported indicators of advertisement perceptions or news stories, per se; we are inferring relationships between indicators based on coincidence over time. Future work remains to understand what people think when they see online campaign ads like those from the Ask About Aspirin campaign or when they encounter news stories about aspirin and heart health.

We have assumed a model in which exposure prompts behavior; future work could assess possibilities such as message reactance and negative relationships. Google Trend data also offer an aggregated secondary source we cannot tease apart by demographics, e.g., behavior attributable specifically to the age group sought by the campaign. Future work also could look beyond this study to consider spillover effects on patients living in other areas. On a related plane, we do not know based solely on this data whether a pattern of news–prompted search operating distinctly from campaign efforts also describes what happens for topics beyond aspirin for heart health and stroke prevention. We also do not know whether the pattern observed here extends to other periods or if the relative novelty of recommended aspirin use might limit results generalizability. Nonetheless, as a cautionary tale for health promotion professionals, our results are relevant for professionals working to encourage consultation with clinicians to consider prevention recommendations.

4.2. Conclusion

Results suggest patient information engagement is a function of information salience at least in part, meaning efforts to affect environmental salience are key. Campaign advertising expenditure can prompt audience use of campaign tools but news coverage also operates independently as an important force on patient search behavior.

4.3. Practice implications

Heart health and stroke prevention professionals should heed the effects of news stories or patient information seeking in addition to effects of their own campaign efforts. Campaign promotion does not happen in a vacuum and news matters as a rival force in encouraging patient searches. Clearly, we see here evidence that online campaign promotion can prompt engagement
with campaign material. At the same time, efforts to monitor – and even to shape – relevant news coverage also will be important for future heart health and stroke prevention. Patient engagement outside of clinical settings poses substantial challenges as we help patients navigate complex information environments.

**CRediT authorship contribution statement**

**Brian G. Southwell:** Conceptualization, Formal analysis. **Milton Eder:** Conceptualization, Funding acquisition. **John Finnegan:** Conceptualization, Funding acquisition. **Russell V. Luepker:** Conceptualization, Funding acquisition. **Sue Duval:** Conceptualization, Funding acquisition. **Caroline Russell:** Conceptualization, Data curation. **Robert N. Graves:** Conceptualization, Data curation. **Adele Namboodri:** Conceptualization, Data curation.

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