



Brief Original Report

Do celebrity cancer diagnoses promote primary cancer prevention?

John W. Ayers^{a,*}, Benjamin M. Althouse^b, Seth M. Noar^{c,d}, Joanna E. Cohen^e^a Graduate School of Public Health, San Diego State University, San Diego, CA, USA^b Santa Fe Institute, Santa Fe, NM, USA^c School of Journalism and Mass Communication, University of North Carolina at Chapel Hill, NC, USA^d Lineberger Comprehensive Cancer Center, University of North Carolina at Chapel Hill, NC, USA^e Institute for Global Tobacco Control, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, USA

ARTICLE INFO

Available online 16 November 2013

Keywords:

Tobacco control
Health communication
Digital disease detection

ABSTRACT

Objective. Celebrity cancer diagnoses generate considerable media coverage of and increase interest in cancer screening, but do they also promote primary cancer prevention?**Methods.** Daily trends for smoking cessation-related media (information-availability) and Google queries (information-seeking) around Brazilian President and smoker Lula da Silva's laryngeal cancer diagnosis announcements were compared to a typical period and several cessation awareness events.**Results.** Cessation media coverage was 163% (95% confidence interval, 54–328) higher than expected the week after the announcement but returned to typical levels the second week. Cessation queries were 67% (95% confidence interval, 40–96) greater the week after Lula's announcement, remaining 153% (95% confidence interval, 121–188), 130% (95% confidence interval, 101–163) and 71% (95% confidence interval, 43–100) greater during the second, third, and fourth week after the announcement. There were 1.1 million excess cessation queries the month after Lula's announcement, eclipsing query volumes for the week around New Years Day, World No Tobacco Day, and Brazilian National No Smoking Day.**Conclusion.** Just as celebrity diagnoses promote cancer screening, they may also promote primary prevention. Discovery of this dynamic suggests the public should be further encouraged to consider primary (in addition to the usual secondary) cancer prevention around celebrity diagnoses, though more cases, cancers, and prevention behaviors must be explored.

© 2013 Elsevier Inc. All rights reserved.

Introduction

Celebrity cancer diagnoses spawn considerable attention and promote cancer screening (Noar et al., 2013). British television star Jade Goody's cervical cancer diagnosis corresponded with a 43% increase in Pap smear appointments (MacArthur et al., 2011; Metcalfe et al., 2010). Australian singer Kylie Minogue's breast cancer diagnosis stimulated a 40% increase in mammography appointments (Chapman et al., 2005). American President Ronald Reagan's colon cancer surgery was followed by a 400% increase in colon cancer inquiries to a national hotline (Brown and Potosky, 1990). But do public figures' cancer diagnoses also promote primary prevention, such as smoking cessation?

Celebrity diagnoses have not been linked to cancer prevention behaviors because of meager public health surveillance. Primary cancer prevention is usually assessed via annual telephone surveys reporting the proportion exposed to primary prevention messages or contemplating behavior change. However, these annual databases cannot be linked to external events occurring over a short timeframe, let alone a specific day (Ayers et al., 2011a,b, 2012b, 2013c). By monitoring daily media coverage of and Internet search queries for primary cancer

prevention, it is possible to assess both how population primary prevention behaviors are primed (information-availability) and how populations contemplate (information-seeking) behavior change in response to a discrete societal stimulus.

On 29 October 2011 former Brazilian President Lula da Silva announced he had been diagnosed with laryngeal cancer, an illness he attributed to smoking (Economist, 2011). Because of this specific link, Lula's announcement was an unusual prompt to quit for the 22% and 13% of Brazilian men and women who smoke (WHO, 2011). As a result, we used this case to explore the potential link between a public figure's diagnosis and population primary cancer prevention, aiming to discover if such a link is plausible.

Methods

Cessation media coverage (information-availability) was indicated by daily stories archived on Brazil's Google News that mentioned quitting smoking (news.google.com.br), capturing Portuguese language newspapers/magazines and broadcast/cable networks, including online and print content. Stories mentioning cessation were monitored relative to all stories (i.e., the number of articles containing "parar de fumar" ("stop smoking"), divided by the number of stories containing "o" ("the"), reported per 100,000 each day). Each story occurring on a separate web address was counted, which can include the same text presented in separate outlets.

* Corresponding author at: 9245 Sky Park Court, Suite 230, San Diego, CA 92123, USA.
E-mail address: ayers.john.w@gmail.com (J.W. Ayers).

Cessation queries (information-seeking) were indicated by daily trends for Google searches about cessation using *Google Trends* (google.com/trends). With this data it is possible to directly observe the thoughts of the searcher by the content of the query and that the searcher is taking some action toward behavior change. Queries that included the root phrase “parar de fumar” in Brazil (e.g., “como parar de fumar” – how to stop smoking) were monitored relative to all queries each day (i.e., relative search volume (RSV), where $RSV = 100$ is the day with the highest search proportion, and $RSV = 50$ is a day with 50% of that highest proportion). To demonstrate practical significance, the absolute number of unique cessation searches was estimated for the 50 most common queries that included “parar de fumar” obtained from *Google Adwords* (adwords.google.com).

An interrupted time series (Lewis-Beck, 1986) was used to estimate differences in the outcomes after Lula’s announcement compared to a typical period (the mean from 2008 through 2011) after removing the data from New Years Day, World No Tobacco Day and Brazil National No Smoking Day weeks (the day of and 3 days before or after). Media and search volume after the announcement were also compared to the 3 former events, by comparing search volume around Lula’s announcement to the week of each event from the same year (2011). For all four regressions, the difference between Lula and the comparison period was modeled as a percent increase ($(\beta_{\text{Diagnosis}} - \beta_{\text{Event}}) / \beta_{\text{Event}}$). Confidence intervals ($\alpha = 0.05$) were simulated using a bootstrap from the sampling distribution (King et al., 2000).

Results

Cessation media rose to 40 stories per 100,000 the day of Lula’s announcement, peaking at 90 stories per 100,000 the next day, compared to a typical daily trend ranging between 0 and 20 stories per 100,000 (Fig. 1). Cessation queries began deviating from pre-diagnosis

trends after cessation coverage spiked, increasing to their highest ever-observed (since 2004) volume 8 days after the announcement ($RSV = 100$).

Statistically, cessation media volume was 163% (95% CI, 54–328) higher than expected the week after Lula’s announcement, but returned to typical levels the second, third and fourth weeks after. This short-lived surge in cessation media translated into 67% (95% CI, 40–96) excess cessation queries the first and 153% (95% CI, 121–188) the second week after the announcement. Cessation queries also remained significantly higher the third (130%; 95% CI, 101–163) and fourth week (71%; 95% CI, 43–100) after the announcement. Aggregating over the entire month, queries were 107% (95% CI, 88–128) higher, amounting to roughly 1,100,000 more cessation queries for the 50 most common queries including the root terms “parar de fumar.”

Spikes in cessation media and cessation queries around Lula’s announcement were also larger than Brazil’s major cessation awareness events from the same year (Fig. 2). Descriptively, cessation media the day after Lula’s announcement (90/100,000) was 300% greater than New Years Day (28/100,000), and about 200% greater than National No Smoking Day (50/100,000) or World No Tobacco Day (46/100,000). Similarly, cessation search queries were also higher. On World No Tobacco Day cessation queries peaked at 71% (i.e., 71 RSV) of the peak relative volume around the announcement, followed by National No Smoking Day at 67% and New Years Day at 35%.

Cessation search queries the week after and the second week after Lula’s announcement were 77% (95% CI, –2 to 201) and 72% (95% CI, 39–106) greater than New Years Day week (the day of and 3 days before or after), and remained significantly higher for the third and fourth week after the announcement. Cessation queries were statistically

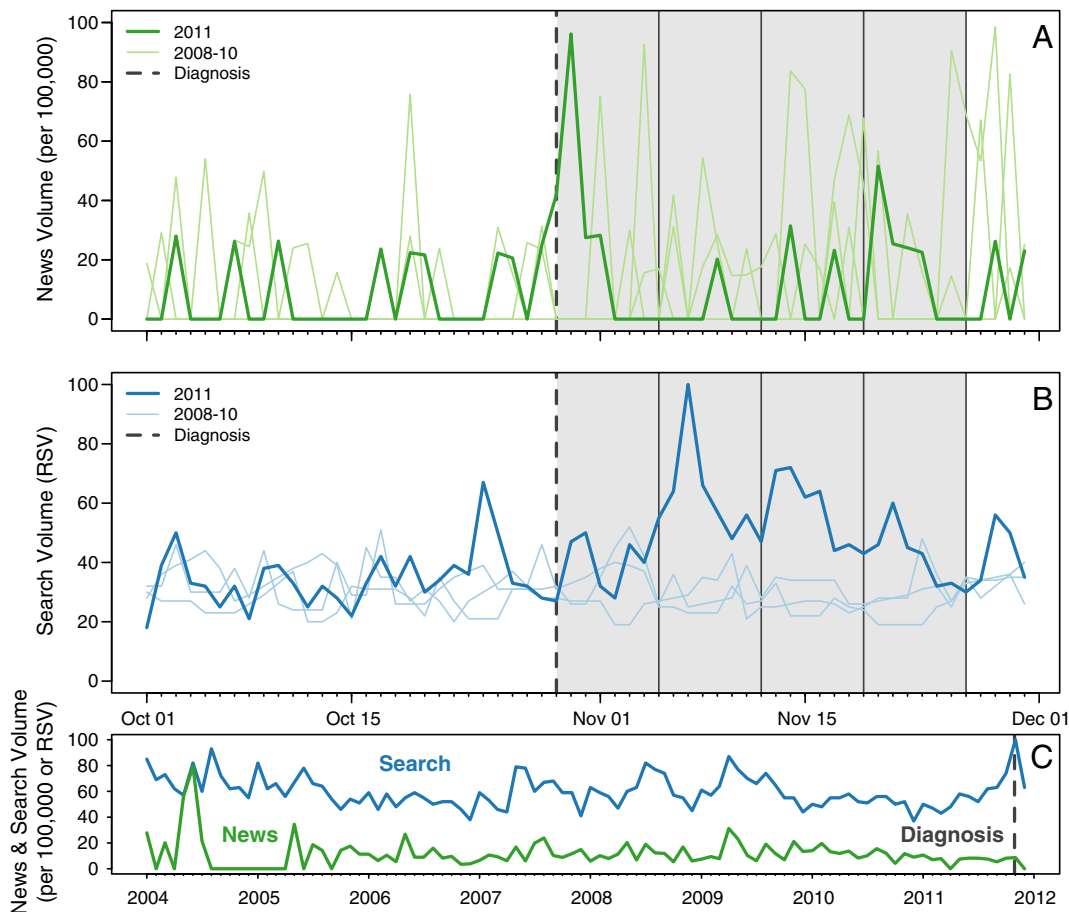


Fig. 1. Time-trends around President Lula’s cancer diagnosis and other years. Note: Each panel shows time-trends for cessation media and cessation search queries around Lula’s cancer diagnosis, including time trends for the same period from prior years. (A) Daily time series for media coverage of cessation by day, (B) daily time series for aggregate Internet search queries for cessation by day, (C) historic weekly aggregated time series for media and search since 2004. The shaded gray regions are 1, 2, 3 and 4 weeks after the diagnosis.

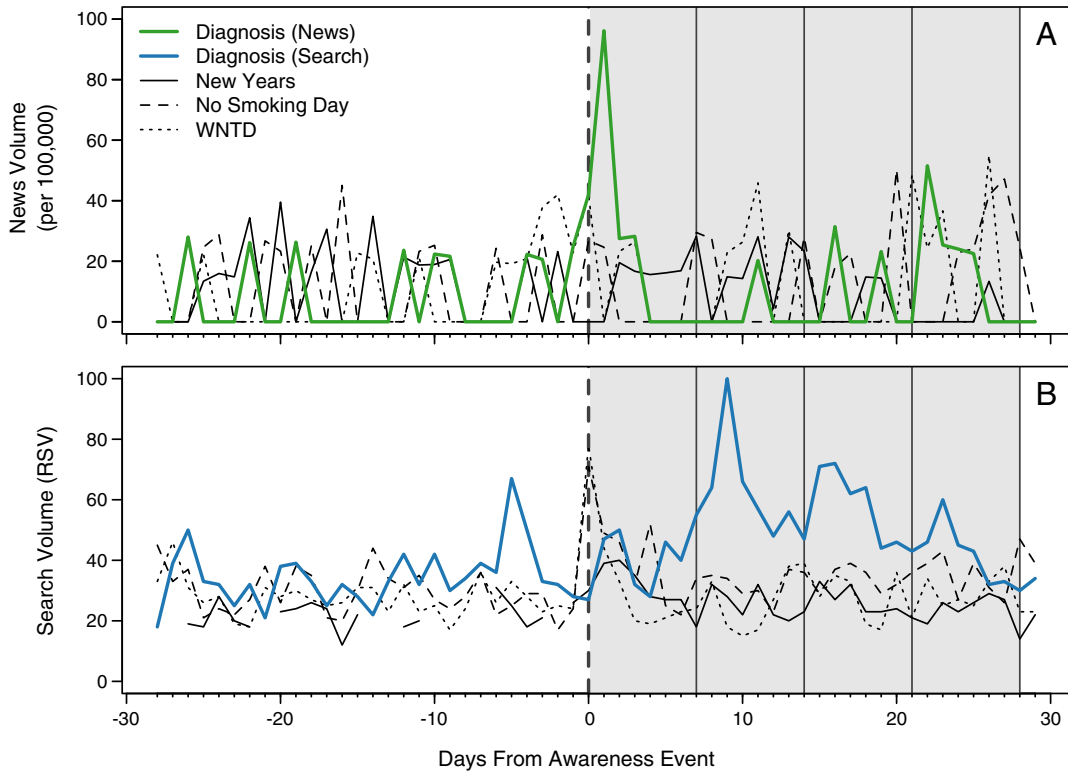


Fig. 2. 60-Day time-trends around President Lula's cancer diagnosis and other awareness events from 2011. Note: Each panel shows daily time-trends for cessation media and search queries centered on Lula's cancer diagnosis, New Years Day 2011, National No Smoking Day 2011 and World No Tobacco Day (WNTD) 2011 (all shown in various black lines). (A) 60-day series for media coverage of cessation by day, (B) 60-day series for aggregate Internet search queries for cessation by day. The shaded gray regions are 1, 2, 3 and 4 weeks after the diagnosis.

significantly greater than Brazil's National No Smoking Day or World No Tobacco Day week for the entire 4 week period after Lula's announcement. For instance, the second week after Lula's announcement cessation queries were 55% (95% CI, 29–81) and 65% (95% CI, 35–96) higher than cessation queries the week of Brazil's National No Smoking Day or World No Tobacco Day, respectively.

Discussion

Just as celebrity cancer diagnoses spur cancer screening, they also appear to promote primary prevention by priming cessation via more cessation media stories and encouraging cessation contemplations via more cessation queries in the population. For example, after Lula's cancer announcement cessation queries eclipsed all other times, including New Years Day, Brazil's National No Smoking Day and World No Tobacco Day. As a result, Lula's diagnosis may be one of the most significant cessation-promoting events in Brazil's history.

Implications for primary prevention

Prevention saves far more lives than screening (Evans and Foster, 2011), and focusing on prevention represents a major advance in how celebrity diagnoses are leveraged for public health impacts. For instance, there is no reliable early screening for laryngeal cancer, but by focusing on prevention via smoking cessation, numerous tobacco-related cancers can be potentially avoided including laryngeal and also bladder, colon, lung, leukemic, oral and pancreatic cancers (Ezzati et al., 2005). Moreover, some of the 6 million annual smoking deaths not attributable to cancer (Ezzati and Lopez, 2003) can also be avoided by promoting cessation.

Public health professionals might promote primary (in addition to the usual secondary) cancer prevention by buying advertised links on Google and other search engines in the wake of major diagnoses like Lula's to further increase awareness and drive those online to

professional evidenced-based cessation programs. Asking the celebrity to participate in a planned media campaign might also be effective, using strategies modeled after the *Center for Disease Control and Prevention's* "Tips from Former Smokers" campaign (Rigotti and Wakefield, 2012). Unless public health leaders take the initiative to manage the content of information-availability and guide cessation information-seeking, the large increases we have observed may not generate meaningful changes in actual smoking cessation.

A focus on primary prevention around celebrity diagnoses may also lead to salubrious public health benefits via health policy initiatives (Dorfman et al., 2005). As Lula's treatment unfolded, Brazilian policy makers considered an aggressive tobacco control agenda and on 15 December 2011, Brazil became the largest smoke-free nation. While Lula's high profile diagnosis may be an obvious case, other cases presently overlooked can be identified using web data. After such identification it may be possible to use these public narratives to motivate legislative action.

Study design strengths and weaknesses

Given the instantaneous availability of and cost-effective manner by which web data are aggregated and examined, web surveillance has strong potential to lead to overlooked discoveries in preventive medicine. For example, early detection of the popularity of electronic cigarettes using web data has been followed by a significant research effort (Ayers et al., 2011b). This study is yet another piece of evidence suggesting that web data has great potential for discovery in preventive medicine (Ayers et al., 2012a, 2013a,b).

Our novel approach has several important limitations, yet to be resolved. For information-availability, placement of stories, overall content, and audience size were not considered. For information-seeking only those online and then only Google searches were assessed. However, Brazil has the 5th highest global Internet use (Internet Steering

Committee in Brazil, n.d.), with 92% of those online using Google (International Digital Media, 2012). Although it is not possible to conclude that changes in information-availability and information-seeking correspond to smoking cessation behaviors, recent studies suggest digital data resources are valid proxies for behavioral (Goel et al., 2010) and health outcomes (Althouse et al., 2011). Moreover, our indicator of smoking cessation information-seeking may be more face valid than the commonly used survey questions where respondents artificially describe their contemplations (i.e., “are you thinking about quitting?”) with the potential for strong social desirability bias (Zaller and Feldman, 1992). Last, we focused on a single case to discover if celebrity cancer diagnoses are linked with primary cancer prevention. Others should explore additional cases, with variability in cancers, settings, and prevention outcomes.

Conclusion

Lula's case suggests that celebrity diagnoses can change media coverage and interest in smoking cessation, even eclipsing dedicated tobacco control campaigns or events. It seems likely that celebrity cancer diagnoses also impact other primary prevention behaviors, and more must be done to appreciate and harness their potential for cancer control.

Financial support

The Institute for Global Tobacco Control with funding from the Bloomberg Initiative to Reduce Tobacco Use. JWA was also supported by a grant from the National Cancer Institute (RCA173299A). The Bloomberg Initiative to Reduce Tobacco Use and NCI had no role in the design, conduct or implementation of the study.

Conflicts of interest

JWA and BMA share an equity stake in a consulting group, Directing Medicine LLC, that helps public health investigators implement some of the ideas embodied in this work. The data generation procedures, however, rely on public archives. There are no other conflicts of interest relevant to this study.

Acknowledgments

We thank Jon-Patrick Allem MA, Carl Latkin PhD, and Kurt Ribisl PhD for the helpful critiques on earlier versions of the manuscript.

References

Althouse, B.M., Ng, Y.Y., Cummings, D.A., 2011. Prediction of dengue incidence using search query surveillance. *PLoS Negl. Trop. Dis.* 5 (8), e1258.

- Ayers, J.W., Ribisl, K., Brownstein, J.S., 2011a. Using search query surveillance to monitor tax avoidance and smoking cessation following the United States' 2009 “SCHIP” cigarette tax increase. *PLoS One* 6 (3), e16777.
- Ayers, J.W., Ribisl, K.M., Brownstein, J.S., 2011b. Tracking the rise in popularity of electronic nicotine delivery systems (electronic cigarettes) using search query surveillance. *Am. J. Prev. Med.* 40 (4), 448–453.
- Ayers, J.W., Althouse, B.M., Allem, J.P., 2012a. Novel surveillance of psychological distress during the great recession. *J. Affect. Disord.* 142, 323–330.
- Ayers, J.W., Althouse, B.M., Allem, J.P., Ford, D.E., Ribisl, K.M., Cohen, J.E., 2012b. A novel evaluation of world no tobacco day in Latin America. *J. Med. Internet Res.* 14 (3), e77.
- Ayers, J.W., Althouse, B.M., Allem, J.P., Rosenquist, J.N., Ford, D.E., 2013a. Seasonality in seeking mental health information on Google. *Am. J. Prev. Med.* 44 (5), 520–525.
- Ayers, J.W., Althouse, B.M., Johnson, M., Cohen, J.E., 2013b. Circaseptan (weekly) rhythms in smoking cessation contemplations. *JAMA Intern. Med.* <http://dx.doi.org/10.1001/jamainternmed.2013.11933> (Electronic publication ahead of print).
- Ayers, J.W., Althouse, B.M., Ribisl, K.M., Emery, S., 2013c. Digital detection for tobacco control: online reactions to the United States' 2009 cigarette excise tax increase. *Nicotin Tob. Res.* <http://dx.doi.org/10.1093/ntr/ntt186> (Electronic publication ahead of print).
- Brown, M.L., Potosky, A.L., 1990. The presidential effect: the public health response to media coverage about Ronald Reagan's colon cancer episode. *Public Opin. Q.* 54 (3), 317–329.
- Chapman, S., McLeod, K., Wakefield, M., Holding, S., 2005. Impact of media of celebrity illness on breast cancer screening: Kylie Minogue's breast cancer diagnosis. *Med. J. Aust.* 183 (5), 247–250.
- Dorfman, L., Wallack, L., Woodruff, K., 2005. More than a message: framing public health advocacy to change corporate practices. *Health Educ. Behav.* 32 (3), 320–336.
- Economist, 2011. Brazil's former president Lula's cancer diagnosis. *Economist Mediaper Limited*, 8758 66.
- Evans, J.A., Foster, J.G., 2011. Metaknowledge. *Science* 331 (6018), 721–725.
- Ezzati, M., Lopez, A.D., 2003. Estimates of global mortality attributable to smoking in 2000. *Lancet* 362 (9387), 847–852.
- Ezzati, M., Henley, S.J., Lopez, A.D., Thun, M.J., 2005. Role of smoking in global and regional cancer epidemiology: current patterns and data needs. *Int. J. Cancer* 116 (6), 963–971.
- Goel, S., Hofman, J.M., Lahaie, S., Pennock, D.M., Watts, D.J., 2010. Predicting consumer behavior with Web search. *Proc. Natl. Acad. Sci.* 107 (41), 17486–17490.
- International Digital Media, 2012. Search engine market share by country Mar 2012. <http://www.idm.vn/search-engine-market-share-by-country-mar-2012/12-1/en> (Accessed 11 August 2012).
- Internet Steering Committee in Brazil, I. www.cg.org.br (Accessed 11 August 2012).
- King, G., Tomz, M., Wittenberg, J., 2000. Making the most of statistical analyses: improving interpretation and presentation. *Am. J. Polit. Sci.* 44 (2), 341–355.
- Lewis-Beck, M.S., 1986. *Interrupted Time Series*. Sage Publications, Beverly Hills.
- MacArthur, G.J., Wright, M., Beer, H., Paranjothy, S., 2011. Impact of media reporting of cervical cancer in a UK celebrity on a population-based cervical screening programme. *J. Med. Screen.* 18 (4), 204–209.
- Metcalfe, D., Price, C., Powell, J., 2010. Media coverage and public reaction to a celebrity cancer diagnosis. *J. Pub. Health* 33 (1), 80–85.
- Noar, S.M., Willoughby, J.F., Myrick, J.G., Brown, J., 2013. Public figure announcements about cancer and opportunities for cancer communication: a review and research agenda. *Health Commun.* <http://dx.doi.org/10.1080/10410236.2013.764781> (Electronic publication ahead of print).
- Rigotti, N.A., Wakefield, M., 2012. Real people, real stories: a new mass media campaign that could help smokers quit. *Ann. Intern. Med.* 157 (12), 907–909.
- World Health Organization, 2011. WHO Report on the Global Tobacco Epidemic. WHO, Switzerland.
- Zaller, J., Feldman, S., 1992. A simple theory of the survey response: Answering questions versus revealing preferences. *Am. J. Polit. Sci.* 44 (3), 579–616.