

Media Reporting on Air Pollution: Health risk and precautionary measures in national and regional newspapers

Steven Ramondt (✉ s.ramondt@vu.nl)

Vrije Universiteit Amsterdam <https://orcid.org/0000-0001-6794-6894>

A. Susana Ramirez

University of California Merced

Research article

Keywords: Air pollution, Environment health, Public health, Newspapers, Environmental health literacy, Health promotion, Health communication, Efficacy, Risk communication, Advocacy

Posted Date: March 2nd, 2020

DOI: <https://doi.org/10.21203/rs.3.rs-15562/v1>

License:  This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

Version of Record: A version of this preprint was published at International Journal of Environmental Research and Public Health on September 7th, 2020. See the published version at <https://doi.org/10.3390/ijerph17186516>.

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23

Media reporting on air pollution:

Health risk and precautionary measures in national and regional newspapers

Steven Ramondt¹ and A. Susana Ramírez²

¹ Psychological Sciences, University of California, Merced, CA, USA

² Public Health, University of California, Merced, CA, USA

Corresponding author at:

University of California, Merced

SSHA, Psychological Sciences

5200 North Lake Road

Merced, CA 95343

United States of America

sramondt@ucmerced.edu

Abstract

24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46

Background

Exposure to air pollution is one of the primary global health risk factors, yet individuals lack the knowledge to engage in individual risk mitigation and the skills to mobilize for change necessary to reduce such risks. The news media are an important tool for influencing individual actions and support for public policies to reduce environmental threats; thus, a lack of news coverage of such issues may exacerbate knowledge deficits. This study examines the reporting of health risk and precautionary measures regarding air pollution in national and regional print news using an environmental health literacy perspective.

Methods

We conducted a content analysis of two national (*New York Times* and *Washington Post*) and two local newspapers (*Fresno Bee* and *Bakersfield Californian*) newspapers covering the country's most polluted region, California's San Joaquin Valley, during a 5-year period (2011-2015). Using a constructed week sampling approach, 276 newspaper articles were coded for information on threat, efficacy information, and information sources.

Results

News coverage of air pollution mostly failed to mention human health risks. Moreover, fewer than 10 percent of news stories about air pollution provided information on the precautionary measures necessary for individuals to take action to mitigate their risk. Despite being located in one of the most polluted areas in the US, local newspapers did not report significantly more threat and efficacy information. News coverage of air pollution consistently missed opportunities to raise environmental health literacy.

Conclusions

47 Although air pollution levels are high and continue to rise at alarming rates, our findings suggest
48 that news media reporting is not conducive to raising environmental health literacy. Public health
49 advocates and health promotion experts must develop more effective strategies for disseminating
50 information about the health risks of air pollution, balancing the need for recognizing the
51 structural causes of poor air quality and the actions individuals and communities can take to
52 reduce air pollution related morbidity and mortality. National and local news media may be
53 useful partners for such dissemination.

54

55 **Keywords:** Air pollution, Environment health, Public health, Newspapers, Environmental health
56 literacy, Health promotion, Health communication, Efficacy, Risk communication, Advocacy

57

58 **Background**

59 Air pollution is the single largest environmental health risk and one of the largest global risk
60 factors [1, 2], with outdoor air pollution estimated to be responsible for almost 8 percent of total
61 global deaths [3]. To manage individual risk from air pollution, individuals need to be aware
62 when air quality is poor [4–6]. The primary official forms of communication about air pollution
63 to achieve this goal are air quality advisories; however, the information environment is much
64 broader than targeted campaigns [7]. The broad public information environment is an important
65 determinant of knowledge, attitudes, and other cognitive and emotional determinants of behavior
66 [8–10] and should be investigated beyond air quality advisories. Especially since awareness of
67 air quality advisories often does not lead to behavior change, and air quality advisories are
68 among the least reported sources of information for air pollution [4, 11]. Research has found that
69 media, together with sensory and health cues, are the primary sources of information in air
70 polluted regions [11, 12]. Information found in the media can increase awareness environmental
71 risks, such as air pollution, and help individuals with processes that lead to risk reducing
72 behavior [13, 14]. Moreover, consistent with an ecological approach to health [2], recent
73 research in environmental health literacy argues that messaging must move beyond exclusively
74 focusing on individual behavior change to include strategies that empower individuals to
75 mobilize for the control of environmental exposures [15–17]. Media influence which issues the
76 public are exposed to and thereby set the public agenda [18]. Agenda-setting research has
77 furthermore shown that news coverage plays a role in shaping public opinion and the local policy
78 agenda, and that this role is more prominent for local level news [19].

79 The current research explores how air pollution is covered in news media. The extended
80 parallel process model (EPPM) [20] that is commonly used to explain how individuals process

81 health messages, proposes that for an individual to accept a message and change behavior, two
82 appraisal steps are necessary. First, an individual needs to perceive a threat to themselves that
83 warrants action, and second an individual needs to perceive themselves able to avert the threat
84 [20]. For an individual to take risk reducing action, they need to know both about the risk as well
85 as effective actions they can take to reduce risk We therefore conducted a content analysis of
86 newspapers and examined how individuals might process media messages by analyzing how
87 much health risk (threat) and information about precautionary measures (efficacy information)
88 air pollution coverage contains. Effective precautionary measures individuals can take are:
89 staying indoors, limiting physical activity, or using air filters to clean indoor air during severe air
90 pollution days [6]. In addition to examining health risk and information about precautionary
91 measures, we examined the potential influence of journalists' information sources on the framing
92 of air pollution. The manner in which issues are presented or framed in the media affects the
93 perceptions of the public [21]. Media coverage of environmental issues has been critiqued for
94 lacking substance, adequate coverage, and lack of potential solutions [22, 23]. The choice of
95 source for a story influences how a story is framed, the substance that is included, and which
96 solutions are provided [24].

97 National news was compared with local news from California's San Joaquin Valley
98 (SJV). The SJV is a rural and economically disadvantaged region that lacks resources and access
99 to address environmental and public health threats [25, 26]. Moreover, this region is one of the
100 worst air polluted areas in the US [27]. Latino, low-income, and less-educated populations -
101 which are overrepresented in the SJV- have less access to health information [28, 29]. For
102 minorities that suffer from this lack of access, news media are the primary and trusted sources of
103 health information [30]. News media, especially local news media, may be a particularly

104 important source of information for residents of the SJV, since the lack of resources and the
105 geographically-dispersed nature of rural areas such as the SJV make it hard to reach the
106 population through other channels.

107 By assessing which essential risk reducing information is missing in newspaper coverage,
108 and which messages individuals are exposed to, health promotion efforts can be tailored to take
109 the revealed information into account, creating more effective campaigns.

110

111 **Methods**

112 **Study sample**

113 Two national newspapers, the *New York Times* and the *Washington Post*, were selected to
114 represent the national-level discourse of air pollution in the media. Two newspapers from the
115 SJV, the *Fresno Bee* and the *Bakersfield Californian*, represented local news about air pollution.
116 The *New York Times* and the *Washington Post* have high circulation and influential status and
117 are considered to be agenda setters for other media in the US [18]. Both the *Fresno Bee* and the
118 *Bakersfield Californian* are among the highest circulating papers in California's air polluted San
119 Joaquin Valley and are the hometown papers of the two most polluted cities in the US [27].

120

121 **News coverage selection**

122 The data for this study were news stories about air pollution published in the four newspapers
123 during the five-year period 2011-2015. News stories were obtained from the Lexis-Nexis
124 database for the two national newspapers and the Newsbank World News database for the two
125 local newspapers. Following procedures described by Stryker and colleagues [31], a search term
126 was constructed. News stories about air pollution were operationalized as needing to include air

127 pollution content in the title and/or first three paragraphs. The following search term was used to
128 collect the sample: ATLEAST1(air quality or air pollution) AND (air pollution or air quality or
129 clean air or dirty air or polluted air or smok! or fume! or cloud or gas! or exhaust! or vapor or
130 inhale! or breathe! or respir! or emission! or smog or ozone) in any of the first three paragraphs
131 (HLEAD was used in Lexis-Nexis to automate this process). To keep our sample size
132 manageable while obtaining an accurate estimate of the population, a constructed week sampling
133 approach was used. Constructed week sampling is a stratified random sampling technique that is
134 preferred to simple random sampling as it accounts for variation of news content over a seven-
135 day news week [32]. The current study sampled 6 constructed weeks for each of the five years in
136 which news stories (both national as well as local) were collected for a total of 30 constructed
137 weeks, yielding a total of 276 articles.

138

139 **Measures**

140 We measured threat, efficacy information, and information sources. All measures were
141 dichotomous items. Stories were coded a threat if an article included any information about air
142 pollution being adverse to health. Efficacy was coded if the article included *any* information
143 about the precautionary measures an individual can take to reduce risk from air pollution. The
144 coding of efficacy information included an additional stage. If an article included efficacy
145 information, the nature of the efficacy information was investigated to see if the efficacy
146 information included any of the effective precautionary measures individuals can take: staying
147 indoors, limiting physical activity, or using air filters to clean indoor air during severe air
148 pollution days [6]. To examine which sources were utilized in the articles about air pollution, 5
149 types of sources were coded. The source typology was based on work by Brossard and

150 colleagues [33] and included: academics and scientists, non-expert/citizen , business/industry
151 groups, governmental sources and health, and environmental advocacy groups. All articles were
152 analyzed to see if any of these sources were utilized. It was possible to code for multiple sources
153 per article.

154 Once the coding instrument was developed, two coders were randomly assigned three
155 sections (N = 109, 39.5% of total sample) to code. Cohen’s kappa showed substantial agreement
156 (mean $k = .68$) [34]. Initial interrater reliability was below the threshold set a priori ($k < .7$) for
157 three codes classifying cited sources: “non-expert/citizen sources”, “business/industry groups”,
158 and “health and advocacy groups”. To achieve a higher level of reliability, the two coders double
159 coded all articles for these codes and conducted consensus meetings afterwards. As a result, the
160 final average Cohen’s kappa increased to high agreement (mean $k = .85$) [34]. The remaining
161 years of air pollution news articles were randomly distributed and coded independently by the
162 two coders.

163

164 **Data analysis**

165 To compare differences between local and national newspapers, chi-square independence tests
166 were conducted. Fisher’s exact test was used in case the expected cell count was less than 5. All
167 descriptive statistics, reliability, and chi-square tests and were performed with IBM SPSS
168 Statistics 24.0.

169

170 **Results**

171 A total of 276 articles met our selection criteria and were read and analyzed: 162 national
172 newspaper articles and 114 local newspaper articles. The *New York Times* (n = 98) accounted for

173 the majority of the coverage, followed by the *Washington Post* (n = 64), the *Bakersfield*
174 *Californian* (n = 61), and the *Fresno Bee* (n = 53). There was no significant difference in the
175 number of articles reporting about air pollution between local and national newspapers ($X^2 =$
176 3.732, P = .053).

177

178 **Threat and efficacy**

179 Threat information (39.9%) was reported more than efficacy information (7.6%) in the combined
180 sample ($X^2 = 34.626$, P = .001). Threat was reported more frequently compared to efficacy in
181 both local newspapers ($X^2 = 15.039$, P < .001) and national newspapers ($X^2 = 18.935$, P < .001).
182 No newspaper reported efficacy information without reporting threat information (Fig. 1). Table
183 1 compares threat and efficacy information for local and national newspapers. When comparing
184 local newspapers with national newspapers, local newspapers reported more threat information
185 (44.7%) compared to national newspapers (36.4%). However, this difference was not statistically
186 significant ($X^2 = 1.931$, P = .165). Similarly, no significant difference ($X^2 = 1.118$, P = .209) was
187 found for the reporting of efficacy information in local newspapers (13.0%) compared to national
188 newspapers (9.6%). When reporting recommended efficacy information, no significant
189 differences were found for the individual risk reducing behavior “stay indoors” ($X^2 = .885$, P =
190 .347), and “use of air filters” ($X^2 = .953$, P = .652). However, local newspapers did report more
191 on “limiting physical activity” compared to national newspapers ($X^2 = 5.105$, P = .036).

192 **Information sources**

193 Reporters primarily used governmental sources, followed by business/industry groups, health
194 and environmental advocacy groups, academics and scientist, and non-expert/citizen sources
195 (Fig. 2). A similar order was found for national newspapers. Local newspapers also used

196 governmental sources primarily, followed by business/industry sources, and health and
197 environmental advocacy groups. Although they used more non-expert citizen sources compared
198 to academic sources. National newspapers used disproportionately more information sources in
199 their articles compared to local newspapers. As can be seen in Table 2, national newspapers
200 utilized significantly more academic and scientist sources ($X^2 = 21.881$, $P < .001$),
201 business/industry groups ($X^2 = 28.189$, $P < .001$), governmental sources ($X^2 = 26.089$, $P < .001$),
202 and health and environmental advocacy groups ($X^2 = 16.680$, $P < .001$). No significant
203 differences were found in the use of non-expert/citizen as information sources for reporters ($X^2 =$
204 $.004$, $P = .950$).

205

206 **Discussion**

207 Although exposure to air pollution is one of the largest global risk factors [1], and rising at
208 alarming rates [2], it is often overlooked in health promotion research [35] and practice. The
209 present study is the first to look at the nature of air pollution reporting in the media, exploring
210 factors in news reporting about air pollution that might affect individual risk reducing behavior.
211 Similarly to other content analyses analyzing newspaper reporting of other health issues [36–39],
212 we found that air pollution stories contained more threat information than efficacy information. It
213 is important that newspapers report about the threat of air pollution on health, as this informs the
214 public on the need for action. However, by not providing any information on what to do to
215 reduce the introduced threat, undesirable side effects can happen. The EPPM [20] posits that
216 when threat information is high and efficacy information is low, individuals will manifest a
217 maladaptive coping response such as denial and avoidance of information [40]. While results can
218 differ for individuals, as individual differences including prior experiences, culture, and

219 personality influence appraisal of threat and efficacy [20], our results suggest that current
220 reporting about air pollution in newspapers is not conducive to promotion of risk reducing
221 behavior.

222 This study found that news reporting about air pollution lacked information about
223 effective precautionary measures that individuals can take. Local newspapers in the SJV did not
224 reported significantly more about air pollution, threat, and efficacy compared to national
225 newspapers, despite being located in one of the worst air polluted areas in the US, and despite
226 the fact that air pollution is a major concern for residents of the valley [41, 42]. The results are
227 not entirely surprising, as there is research suggesting that news stories about health are scarce
228 [43]. In addition, this relative absence of news stories about air pollution is in line with a recent
229 study analyzing local news reporting about health in the SJV, which also found limited coverage
230 of air pollution [28]. However, the lack of efficacy in local publications is alarming as public
231 information sources in the region have a similar deficiency [17], making it plausible that
232 residents in the SJV have insufficient information available necessary to protect themselves
233 from the adverse effects of air pollution. Public health advocates and health promotion experts
234 must recognize the need to balance the structural causes of poor air quality and the actions
235 individuals and communities can take to reduce air pollution related morbidity and mortality. It
236 is necessary to develop more effective strategies for disseminating information about the health
237 risks of air pollution. National and local news media may be useful partners for such
238 dissemination, as media play a vital role in public understanding of environmental risks [44].

239 Similar to content analyses of other environmental issues [23, 33], both local and national
240 newspapers over-relied on governmental sources. The high reliance on governmental sources is
241 concerning as they are likely to present established views [23]. Moreover, the high reliance on

242 governmental sources is particularly concerning in the current political climate as governmental
243 agencies are acting in conflict with their goals. For example, the agency in charge of mitigating
244 air pollution, is advocating for relaxation of the Clean Air Act legislation [45]. The relative lack
245 of sources that might present unconventional views limits the range of concerns and solutions
246 presented in the news. This has implications for the policy changes necessary to reduce air
247 pollution (health risk). For instance, changes in tobacco policy benefited from the voices of
248 diverse groups and organizations to established public perceptions necessary to mobilize change.
249 Collaboration in news media campaigns to increase media attention to diverse voices is therefore
250 recommended [46]. Non-governmental groups such as health and environmental groups and
251 academics and scientists should consider similar tactics to voice their concerns about air
252 pollution. Academics and scientist sources were present in less than a quarter of the articles. The
253 primary reliance of air pollution reporting on sources that might not be impartial and lack
254 expertise might not be conducive to the understanding of air pollution by the general audience.
255 Future studies should investigate if these sources cause environmental health literacy
256 misinformation and misperceptions.

257 Despite the strengths, this study suffers from some limitations. To begin, only a select
258 number of newspapers were included in the current study. It is possible that a selection of
259 different newspapers would reveal different patterns. Similarly, a selection of different news
260 sources (e.g., online news or broadcast) could show different results. However, we are
261 reasonably confident that this is unlikely because newspapers -and in particular widespread
262 national newspapers such as the national newspapers (i.e. *New York Times* and *Washington Post*)
263 utilized in this content analysis- are agenda setters for other media sources [9]. Additionally, our
264 coding for threat and efficacy information were simple binary codes. Coding therefore ignores

265 any nuanced tones and implications that potentially exist in the news story. Lastly, coverage
266 patterns could have changed since the time of the study (2011-2015), as developments such as
267 the WHO campaign [47] to mobilize people to bring air pollution to safe levels or the 2016
268 presidential election and resulting changes at the EPA could have influenced the coverage. For
269 example, the salient new efforts made by the WHO to convince the public and policy makers of
270 the disastrous effects of air pollution by branding it “the silent killer” might have increased the
271 amount of threat reporting in newspapers.

272

273 **Conclusions**

274 The findings of this study suggest that reporting about air pollution in newspapers is not
275 conducive to risk reducing behavior. Newspapers mostly fail to report on the health impacts air
276 pollution can have. Moreover, there needs to be a better balance between threat and efficacy
277 information -especially effective precautionary measures that individuals can take- in the
278 reporting about air pollution. Given the large impact air pollution has on the SJV and the
279 importance of local news on public opinion and the local policy agenda, more health promoting
280 news stories about air pollution would be beneficial. In addition, health promotion efforts should
281 consider the information in the media environment and develop strategies to enhance the air
282 pollution information environment. Health promotion efforts, such as the breath air campaign by
283 the WHO, might mobilize people into action by increasing the amount of threat information
284 available. However, to neutralize potential undesirable effects, campaigns would do well to
285 provide efficacy information on how to reduce individual risk from air pollution. The current
286 reliance on conventional sources of information by journalists might forestall the understanding
287 of complex issues such as air pollution. Air pollution reporting would benefit from more diverse,

288 expert, and impartial sources. News coverage of air pollution consistently missed opportunities
289 to raise environmental health literacy. Health promotion efforts should consider using news
290 media strategically to increase environmental health literacy.

291

292 **Abbreviations**
293 EPPM: Extended Parallel Process model
294 SJV: San Joaquin Valley
295

296 **Declarations**

297
298 **Acknowledgments**
299 We thank J. Wallander and A.V. Song for their expert advice. We thank Nadia Alazzeah, Jacqueline Diaz,
300 Kimberly Huynh, Natalie Pena Marquez, and Yesenia Villa for their coding efforts.
301

302 **Funding**

303 This project was supported by the US Agency for International Development through a grant from the UC
304 Berkeley Development Impact Lab.
305

306 **Availability of data and materials**

307 The datasets used and/or analyzed during the current study are available from the corresponding author on
308 reasonable request.
309

310 **Authors' contributions**

311 SR contributed to study design, data collection, analyses, and manuscript preparation. ASR contributed to
312 study design and manuscript preparation. All authors read and approved the final manuscript.
313

314 **Ethics approval and consent to participate**

315 Not applicable.
316

317 **Consent for publication**

318 Not applicable.
319

320 **Competing interests**

321 Not applicable.
322

323 **References**

- 324
- 325 1. Forouzanfar MH, Alexander L, Anderson HR, Bachman VF, Biryukov S, Brauer M, et al. Global,
326 regional, and national comparative risk assessment of 79 behavioural, environmental and occupational,
327 and metabolic risks or clusters of risks in 188 countries, 1990–2013: a systematic analysis for the Global
328 Burden of Disease Study 2013. *The Lancet*. 2015;386:2287–323.
- 329 2. Landrigan PJ, Fuller R, Acosta NJR, Adeyi O, Arnold R, Basu N (Nil), et al. The Lancet Commission
330 on pollution and health. *The Lancet*. 2017;0. doi:10.1016/S0140-6736(17)32345-0.
- 331 3. WHO. Mortality and burden of disease from ambient air pollution. Global Health Observatory (GHO)
332 data. 2019. https://www.who.int/gho/phe/outdoor_air_pollution/burden/en/.
- 333 4. Borbet TC, Gladson LA, Cromar KR. Assessing air quality index awareness and use in Mexico City.
334 *BMC Public Health*. 2018;18:538.
- 335 5. Cairncross EK, John J, Zunckel M. A novel air pollution index based on the relative risk of daily
336 mortality associated with short-term exposure to common air pollutants. *Atmos Environ*. 2007;41:8442–
337 54.
- 338 6. Laumbach R, Meng Q, Kipen H. What can individuals do to reduce personal health risks from air
339 pollution? *J Thorac Dis*. 2015;7:96–107.
- 340 7. Moldovan-Johnson M, Tan ASL, Hornik RC. Navigating the Cancer Information Environment: The
341 Reciprocal Relationship Between Patient–Clinician Information Engagement and Information Seeking
342 from Nonmedical Sources. *Health Commun*. 2014;29:974–83.
- 343 8. Leask J, Hooker C, King C. Media coverage of health issues and how to work more effectively with
344 journalists: a qualitative study. *BMC Public Health*. 2010;10:535.
- 345 9. Niederdeppe J, Froch DL, Hornik RC. Cancer News Coverage and Information Seeking. *J Health
346 Commun*. 2008;13:181–99.
- 347 10. Viswanath K. The communications revolution and cancer control. *Nat Rev Cancer*. 2005;5:828–35.
- 348 11. Brown P, Cameron L, Cisneros R, Cox R, Gaab E, Gonzalez M, et al. Latino and Non-Latino
349 Perceptions of the Air Quality in California’s San Joaquin Valley. *Int J Environ Res Public Health*.
350 2016;13:1242.
- 351 12. Johnson BB. Experience with Urban Air Pollution in Paterson, New Jersey and Implications for Air
352 Pollution Communication. *Risk Anal*. 2012;32:39–53.
- 353 13. Mello S. Media Coverage of Toxic Risks: A Content Analysis of Pediatric Environmental Health
354 Information Available to New and Expecting Mothers. *Health Commun*. 2015;30:1245–55.
- 355 14. Slovic P. Perception of risk. *Science*. 1987;236:280–5.
- 356 15. Finn S, O’Fallon L. The Emergence of Environmental Health Literacy—From Its Roots to Its Future
357 Potential. *Environ Health Perspect*. 2017;125:495–501.

- 358 16. Gray KM. From Content Knowledge to Community Change: A Review of Representations of
359 Environmental Health Literacy. *Int J Environ Res Public Health*. 2018;15. doi:10.3390/ijerph15030466.
- 360 17. Ramírez AS, Ramondt S, Bogart KV, Perez-Zuniga R. Public Awareness of Air Pollution and Health
361 Threats: Challenges and Opportunities for Communication Strategies To Improve Environmental Health
362 Literacy. *J Health Commun*. 2019;24:75–83.
- 363 18. McCombs ME. *Setting the agenda: The mass media and public opinion*. Malden, MA: Blackwell;
364 2004.
- 365 19. Nagler RH, Bigman CA, Ramanadhan S, Ramamurthi D, Viswanath K. Prevalence and Framing of
366 Health Disparities in Local Print News: Implications for Multilevel Interventions to Address Cancer
367 Inequalities. *Cancer Epidemiol Prev Biomark*. 2016;25:603–12.
- 368 20. Witte K. Putting the fear back into fear appeals: The extended parallel process model. *Commun*
369 *Monogr*. 1992;59:329–49.
- 370 21. Scheufele DA, Shanahan J, Kim S-H. Who Cares about Local Politics? Media Influences on Local
371 Political Involvement, Issue Awareness, and Attitude Strength: *Journal Mass Commun Q*. 2016.
372 doi:10.1177/107769900207900211.
- 373 22. Boykoff MT, Boykoff JM. Climate change and journalistic norms: A case-study of US mass-media
374 coverage. *Geoforum*. 2007;38:1190–204.
- 375 23. Zamith R, Pinto J, Villar ME. Constructing Climate Change in the Americas An Analysis of News
376 Coverage in U.S. and South American Newspapers. *Sci Commun*. 2013;35:334–57.
- 377 24. Liebler CM, Bendix J. Old-Growth Forests on Network News: News Sources and the Framing of An
378 Environmental Controversy. *Journal Mass Commun Q*. 1996;73:53–65.
- 379 25. Abood M. San Joaquin Valley Fair Housing and Equity Assessment. 2014.
380 <http://www.frbsf.org/community-development/files/SJV-Fair-Housing-and-Equity-Assessment.pdf>.
381 Accessed 12 Apr 2016.
- 382 26. Taylor JE, Martin PL. The new rural poverty: Central Valley evolving into patchwork of poverty and
383 prosperity. *Calif Agric*. 2000;54:26–32.
- 384 27. State of the air. *State of the Air 2019*. Chicago, IL.: American Lung Association; 2019.
385 <https://www.lung.org/assets/documents/healthy-air/state-of-the-air/sota-2019-full.pdf>.
- 386 28. Ramírez AS, Estrada E, Ruiz A. Mapping the Health Information Landscape in a Rural, Culturally
387 Diverse Region: Implications for Interventions to Reduce Information Inequality. *J Prim Prev*. 2017;:1–
388 18.
- 389 29. Viswanath K, Ackerson LK. Race, Ethnicity, Language, Social Class, and Health Communication
390 Inequalities: A Nationally-Representative Cross-Sectional Study. *PLoS ONE*. 2011;6:e14550.
- 391 30. Livingston G, Minushkin S, Cohn D. Hispanics and healthcare in the United States: Access,
392 information and knowledge. 2008. <http://pewhispanic.org/files/reports/91.pdf>.

- 393 31. Stryker JE, Wray RJ, Hornik RC, Yanovitzky I. Validation of Database Search Terms for Content
394 Analysis: The Case of Cancer News Coverage. *Journal Mass Commun Q.* 2006;83:413–30.
- 395 32. Luke DA, Caburnay CA, Cohen EL. How Much Is Enough? New Recommendations for Using
396 Constructed Week Sampling in Newspaper Content Analysis of Health Stories. *Commun Methods Meas.*
397 2011;5:76–91.
- 398 33. Brossard D, Shanahan J, McComas K. Are Issue-Cycles Culturally Constructed? A Comparison of
399 French and American Coverage of Global Climate Change. *Mass Commun Soc.* 2004;7:359–77.
- 400 34. Neuendorf KA. *The content analysis guidebook.* Thousand Oaks, CA: Sage; 2002.
- 401 35. Howze EH, Baldwin GT, Kegler MC. Environmental Health Promotion: Bridging Traditional
402 Environmental Health and Health Promotion. *Health Educ Behav.* 2004;31:429–40.
- 403 36. Hart PS, Feldman L. Threat Without Efficacy? Climate Change on U.S. Network News. *Sci Commun.*
404 2014;36:325–51.
- 405 37. He S, Shen Q, Yin X, Xu L, Lan X. Newspaper coverage of tobacco issues: an analysis of print news
406 in Chinese cities, 2008–2011. *Tob Control.* 2014;23:345–52.
- 407 38. Jensen JD, Moriarty CM, Hurley RJ, Stryker JE. Making Sense of Cancer News Coverage Trends: A
408 Comparison of Three Comprehensive Content Analyses. *J Health Commun.* 2010;15:136–51.
- 409 39. Shim M, Kim Y-C, Kye SY, Park K. News Portrayal of Cancer: Content Analysis of Threat and
410 Efficacy by Cancer Type and Comparison with Incidence and Mortality in Korea. *J Korean Med Sci.*
411 2016;31:1231–8.
- 412 40. Witte K, Allen M. A Meta-Analysis of Fear Appeals: Implications for Effective Public Health
413 Campaigns. *Health Educ Behav.* 2000;27:591–615.
- 414 41. Cisneros R, Brown P, Cameron L, Gaab E, Gonzalez M, Ramondt S, et al. Understanding Public
415 Views about Air Quality and Air Pollution Sources in the San Joaquin Valley, California. *J Environ*
416 *Public Health.* 2017;2017:e4535142.
- 417 42. Meng Y-Y, Rull RP, Wilhelm M, Lombardi C, Balmes J, Ritz B. Outdoor air pollution and
418 uncontrolled asthma in the San Joaquin Valley, California. *J Epidemiol Community Health.* 2010;64:142–
419 7.
- 420 43. Caburnay CA, Kreuter MW, Luke DA, Logan RA, Jacobsen HA, Reddy VC, et al. The News on
421 Health Behavior: Coverage of Diet, Activity, and Tobacco in Local Newspapers. *Health Educ Behav.*
422 2003;30:709–22.
- 423 44. Fitzpatrick-Lewis D, Yost J, Ciliska D, Krishnaratne S. Communication about environmental health
424 risks: A systematic review. *Environ Health.* 2010;9:67.
- 425 45. Tabuchi H. Calling Car Pollution Standards ‘Too High,’ E.P.A. Sets Up Fight With California. *The*
426 *New York Times.* 2018. <https://www.nytimes.com/2018/04/02/climate/trump-auto-emissions-rules.html>.
427 Accessed 3 May 2018.

428 46. Elliott J, Forster AJ, McDonough J, Bowd K, Crabb S. An examination of Australian newspaper
429 coverage of the link between alcohol and cancer 2005 to 2013. BMC Public Health. 2017;18:47.

430 47. BreatheLife. BreatheLife. 2018. <http://breathelife2030.org/>. Accessed 17 Apr 2018.

431

Figures

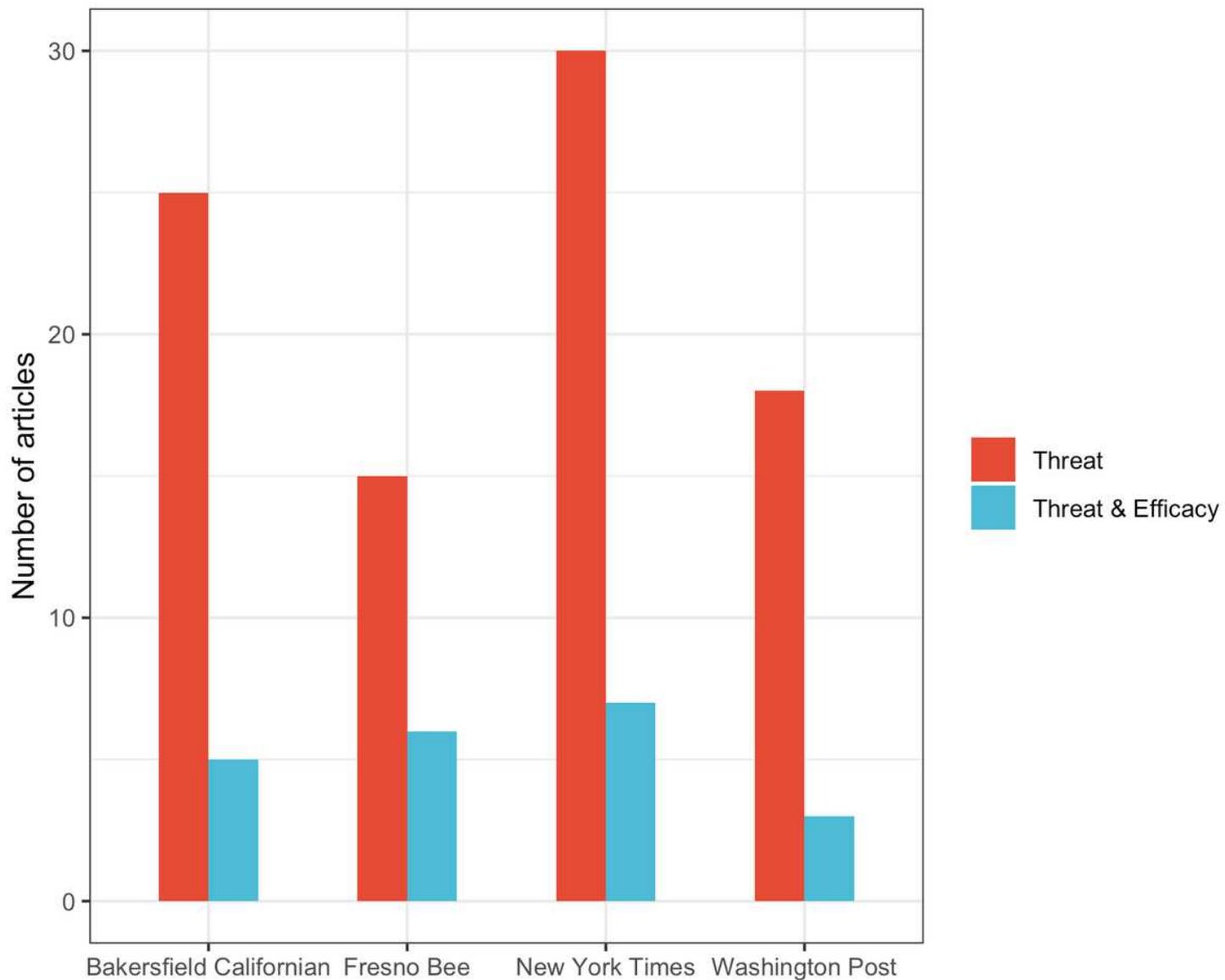


Figure 1

Threat information (39.9%) was reported more than efficacy information (7.6%) in the combined sample ($\chi^2 = 34.626, P = .001$). Threat was reported more frequently compared to efficacy in both local newspapers ($\chi^2 = 15.039, P < .001$) and national newspapers ($\chi^2 = 18.935, P < .001$). No newspaper reported efficacy information without reporting threat information.

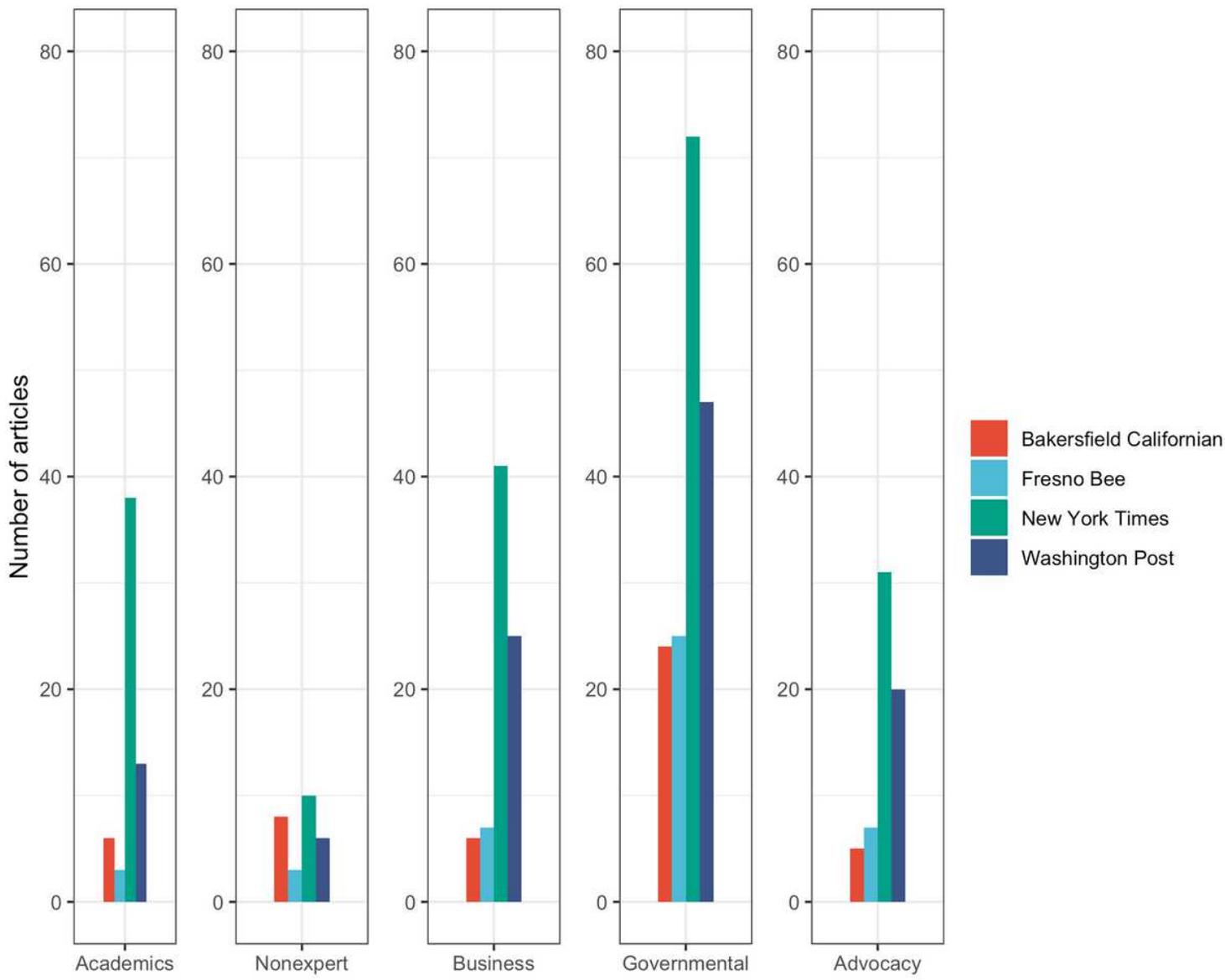


Figure 2

Reporters primarily used governmental sources, followed by business/industry groups, health and environmental advocacy groups, academics and scientist, and non-expert/citizen sources. A similar order was found for national newspapers. Local newspapers also used governmental sources primarily, followed by business/industry sources, and health and environmental advocacy groups. Although they used more non-expert citizen sources compared to academic sources. National newspapers used disproportionately more information sources in their articles compared to local newspapers.