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## Geographic and Longitudinal Trends in the Media Framing of Obesity in the US

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### Abstract

**Objective:** The media’s framing of public health issues is closely linked to public opinion on these issues and support for interventions to address these issues. We characterized geographic and temporal variation in the US media’s framing of obesity across states during 2006-2015.

**Methods:** Newspaper articles that mentioned the term “obesity” were drawn from Access World News, a comprehensive online database (N=364,288). We employed automated content analysis, a machine learning technique, to categorize articles as attributing obesity to (1) individual-level causes (e.g., lifestyle behaviors), (2) environmental/systemic causes (e.g., neighborhood walkability), (3) both, or (4) articles without any such attribution framework.

**Results:** Nationwide across all years, a higher proportion of articles focused on individual-level attribution of obesity than environmental-level or both attributes. Missouri and Idaho had the highest proportions of articles with an individual framework, and Nevada, Arkansas, and Wisconsin had the highest proportions of articles with an environmental framework.

**Conclusions:** This analysis demonstrates that US media sources heavily focus on an individual framing of obesity, which may be informing public perceptions of obesity. By highlighting

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**Author contributions**

JLP, AS, and RH conceived and supervised the study and contributed to data collection. JC completed the analyses and produced the figures. AA led the writing, contributed to analysis, and produced the figures. All authors contributed to interpretation of the data, revising the manuscript critically for intellectual content, and approval of the final version of the manuscript.

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differences in obesity media portrayal, this study could inform research to understand why particular states represent outliers and how this may affect obesity policymaking.

### Keywords

behavior modifications; biostatistics; cultural issues; environmental factors; public health

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## Introduction

Obesity is a major driver of chronic disease in the US, with recent national figures showing 39% of US adults and 18% of US youth affected (1, 2). Public health advocates and governmental organizations have long recognized that targeting social and environmental factors is critical to addressing the obesity epidemic (3). Yet they also acknowledge that the implementation of policies to address such systemic factors is challenging (4). Prior research has documented the obstacles in convincing policymakers and the general public to enact such policies (5). For example, proposals by health advocates to levy taxes on sugar-sweetened beverages have been repeatedly defeated by legislators and voters, with studies suggesting that the general public views consumption of these beverages as a matter of “personal choice” (6). Lobbying by the fast food and soda industries to focus policymakers and the public’s attention on these individual-level attribution frames rather than a systemic frame emphasizing environmental determinants of obesity presents a major challenge to enacting policy (7).

Not only do local media sources often reflect the prevailing views in their local geography, but the media is also an important actor in setting the framework of how public health issues are viewed by the public. A rich body of research has demonstrated that newspapers and other media reflect public opinion, influence public opinion, and more generally reinforce the status quo (8, 9, 10, 11, 12). Studies have demonstrated that an individual’s understanding of the causes of obesity affects his or her beliefs about whether solutions to the epidemic should focus on individual or systemic factors (9, 13, 14). This framing of obesity as either an individual behavioral problem versus an environmental problem mirrors the debate around tobacco several decades ago, in which the shift in focus from personal responsibility to a broader focus on addiction and “innocent victims” was paralleled by a rise in successful anti-tobacco litigation and legislation (7, 15, 16, 17). For health advocates seeking to advance policies that target the environmental determinants of obesity, it is critical to understand how obesity is framed in the media—and how this varies geographically and over time—in order to best target advocacy efforts.

Multiple studies have examined how obesity is framed by mass media by providing a snapshot of local (or occasionally national) attitudes at a single point in time from a subset of media outlets (6, 8, 18, 19, 20). A limited number of studies tracked trends in media framing of obesity over time (21, 22, 23). Very few studies evaluate geographic variation in the framing of obesity (24); these include one study comparing the US and France (20) and a single pilot study of four states that examined state-level variation (25). Such a comparative analysis of variation by place would allow for a deeper understanding of the drivers behind obesity framing and could be leveraged to understand obesity-related policymaking. Prior

studies have been limited by the burdensome process of hand-coding a sufficient number of media articles to represent media coverage in several states over several years.

In this study, we employ a novel analytic method that addresses this major challenge in the field, which has previously limited the ability to conduct large-scale studies across space and time. Our study aim was to fill this gap by applying automated content analysis to the largest US database of media articles. We hypothesized that the media's framing of obesity would differ among states and over a ten-year period. Understanding differences in the way that obesity is portrayed by the media across states and how these trends have changed over time can give public health advocates insight into strategies to inform public opinion and policymaking.

## Methods

### Data

To evaluate media coverage of obesity, we gathered articles from the Access World News database, an online database of international, national, and local news sources, maintained by Newsbank, Inc (26). This database contains a greater number and diversity of sources compared to others such as LexisNexis, including print and online-only newspapers, blogs, newswires, journals, broadcast transcripts, and videos. We included documents that included the word "obesity" in the title or full text and published from 2006 (the earliest year that comprehensive data were available nationwide) to 2015 (the latest year that was available when analysis began in 2017). We excluded international and national sources, as we were interested in variation at the state level, resulting in a total sample of 364,288 articles. Newsbank tags each article with the state and date of publication.

### Automated Content Analysis Method

We employed an analytic method based on automated content analysis. This method is a form of supervised machine learning in which an algorithm is "trained" using a small subset of documents that have been hand-coded by the research team into predetermined categories, after which it applies the categorization scheme to a larger body of documents. By examining vast quantities of media coverage, it enables researchers to efficiently perform cross-state and longitudinal analyses.

The automated content analysis algorithm we used was ReadMe, developed by researchers at Harvard University (27). ReadMe is publicly available as a free open-source package for the statistical program R. For a given body of documents, the algorithm determines what proportion of the documents fall into each of the predetermined categories, rather than categorizing individual articles. In prior work, we have found that the results of this technique are similar to the proportions obtained from hand-coding a smaller set of articles (25). Further details on this technique are available in the Supplemental Methods and in Hopkins and King (2010). This method has been previously validated and used in the social science literature to examine censorship patterns in Chinese media (28), to investigate patterns in political spending (29), to forecast election results based on political sentiments in the media (30), and to explore how racial ancestry is framed in the media (31). To our

knowledge, it has not been used in the study of health or obesity outside of one small prior pilot study (25).

### **Categorization Scheme**

Because media framing can affect individual beliefs about the causes of obesity, we examined three frames that correspond to three different belief orientations. The frames were: (1) those in which the attribution of or solutions to the obesity epidemic are solely at the individual level, e.g., suggesting that obesity is due to an individual choosing to eat more or be sedentary, or suggesting a solution that involves educating individuals about exercising more; (2) those focusing on etiologies or solutions exclusively at the environmental or systemic level, e.g., suggesting that poor urban development like few sidewalks may contribute to physical inactivity, that the lack of grocery stores contributes to few healthy food options, or suggesting a solution that involves restricting marketing of unhealthy food or improving food options in restaurants and school cafeterias; (3) those mentioning both of these frames. In order to ensure that the list of categories was exhaustive, we also included a final category: (4) those mentioning the word “obesity” but that were not relevant to this study, e.g. mentioning that a politician’s campaign platform addresses obesity but giving no further details about any obesity attribution framework.

We developed a coding instrument through an iterative process. After defining the categories above, we reviewed a small sample of articles to refine the instrument. We repeated this process until we achieved an inter-class correlation coefficient of at least 0.75, indicating an acceptable level of inter-rater reliability (32).

To construct the training set, hand-coding was performed by the research team on a randomly selected subset of approximately 350 articles. Two individuals coded each article, with a third individual resolving any disagreements.

### **Analytic Strategy**

We conducted our analyses at the state level, which is the smallest geographic level at which Access World News allows searches to be conducted, and the level at which many obesity-related policies are enacted.

First, we examined the distribution of articles in each of the categories by state during the study period. Next, we conducted a longitudinal analysis in which we examined the distribution of articles in each category by year. More granular time periods—e.g., monthly—were not possible as the number of articles per cell was small. Finally, we examined the distribution by state and year, creating annual state-level maps of the US to assess changes over time and space.

ReadMe allows for the estimation of confidence intervals to establish the precision of estimates, a unique feature of this approach that has not been possible in prior studies. We computed bootstrapped standard errors using 300 replications, as recommended in prior literature (33).

## Ethics approval

Ethical approval was not required since no human subjects were involved in this research.

## Results

### Sample Characteristics

Our search process resulted in a total of 364,288 articles containing the word “obesity” during the years 2006-2015, of which 65.8% used some kind of attribution framework to characterize the etiology of obesity. Of these, 46.0% used an individual framework, 22.8% used an environmental framework, and 31.2% mentioned both. These were similar to the proportions established in the hand-coded training set (Supplemental Figure 1). This included a median of 36,582 articles per year (ranging from 25,498 in 2015 to 46,738 in 2010), and a median of 4,954 articles per state (ranging from 647 in Wyoming to 37,014 in California).

### Longitudinal variation in media framing of obesity

In all years, the highest proportion of articles employed an individual framework to characterize the etiology or solutions to obesity (range: 42.9-47.2%) (Figure 1). The lowest proportion of articles employed an environmental framework to characterize the etiology or solutions to obesity (range: 21.8%-24.8%), with articles mentioning both individual and environmental factors falling in between (range: 30.9-32.3%). This trend remained stable over the years examined, with no statistically significant differences in trends over time.

### Geographic variation in media framing of obesity

Figure 2 shows the proportion of articles with an individual framework by state. Missouri and Idaho stood out as having statistically significantly higher proportions of articles in this category, and Tennessee, Wisconsin, Minnesota, Arkansas, and Nevada had lower proportions than other states. The remaining states were similar to one another.

Figure 3 shows the proportions of articles with an environmental framework by state. Nevada, Arkansas, and Wisconsin had statistically significantly higher proportions of articles in this category, and Missouri and Idaho had lower proportions than other states. All remaining states were similar to one another.

Figure 4 shows the proportions of articles that mentioned both frameworks, by state. Alaska had a higher proportion of these articles than other states, and other states had similar proportions of articles in this category.

### Joint longitudinal and geographic variation in media framing of obesity

Finally, we analyzed the proportion of article categories by both state and year, developing a series of maps for each year and article category (Supplemental Figures 2–4).

For individual attribution (Supplemental Figure 2), the states that stood out for consistently having the lowest proportion of articles in this category included Nevada (2007-2015), Arkansas (2007-2012), Minnesota (all years except 2006 and 2011), and Wisconsin

(2006-2008). States that stood out in one or two years included New Mexico, Oklahoma, Tennessee, Florida, and Colorado. No states stood out as outliers with a higher proportion of articles in this category.

For environmental attribution (Supplemental Figure 3), the states that stood out for having the highest proportion of articles in this category included Nevada (all years except 2006 and 2010), Wisconsin (2006-2008), Arkansas (2007-2009, 2012), and Minnesota (2009 and 2012-2015). States that stood out in one or two years included Alabama, Florida, Nebraska and New Mexico. Nationwide, the years with the most states having a high proportion of environmental articles were 2007, 2008, and 2010.

For articles including both individual and environmental attribution frameworks (Supplemental Figure 4), the states that stood out for having the highest proportion in this category included Alaska (2006, 2009, 2011, 2013-2015), Arkansas (2007-2009, 2012), Minnesota (2007-2009, 2012-2015), New Mexico (2007, 2008, 2010), Nevada (2008, 2009, 2011-2015), Tennessee (2007-2009, 2011), and Wisconsin (2006-2008). States that stood out in one or two years included Alabama, Oklahoma, and Washington. Nationwide, the years 2007-2009 had the most states with high proportions of this category of articles.

## Discussion

To our knowledge, this study is the first to characterize the media's framing of obesity (or any other public health issue) across all 50 states across time, providing the most granular description of this important characteristic of the public discourse around obesity. Using a novel application of a machine learning algorithm, we find that most media framing of obesity focuses on individual attribution and solutions. We found that nationwide, the highest proportion of articles employed an individual framework, while a subset of states stood out in multiple years for having more or less of a focus on an individual or environmental framework of obesity attribution than the rest of the nation. These findings point to several new directions for future research, discussed below.

Our analysis is consistent with prior studies that have used more limited geographic areas, shorter timeframes, and smaller numbers of articles (22, 34, 35). It may be that this individual framing of obesity reflects a perception among the general public that the causes of obesity are at the individual level; future studies should attempt to correlate these findings to surveys of public opinion. Alternately, articles with individual frameworks may be overrepresented, since journalists specialize in storytelling with a focus on human stories (36).

The place-based analysis also found that none of the outlier states had a higher than average proportion of articles taking both an individual and environmental framing approach. That is, states with fewer environmental articles had more individual articles, but not more "both" articles, and vice versa. This suggests that media outlets tend to take an either/or approach, that is, switching from an individual to an environmental framework, rather than employing a framework inclusive of both perspectives.

Building on previous research, our longitudinal analysis included ten years of data and we found that this trend towards individual attributions was stable over time, suggesting that there has not been a large shift in the media framing of obesity during this period. This is contrary to a prior study that found increasing proportions of articles with environmental attributions compared with individual attributions in the *New York Times* during 1985-2002 (23), and another study in six national and regional newspapers during 1995-2004 (22). These prior studies examined earlier time frames and smaller sets of newspapers than the current study. Thus, a shift in media focus may have occurred in that timeframe and geography but not in more recent years, and the substantially broader representation of news sources and geography in our study may indicate that the trends in prior studies were driven by regional or publication-specific changes, but not reflective of the nation as a whole. Our finding is consistent with one study using more recent data showing no overarching trend in media focus but increases and decreases in mentions of specific subcategories of individual and environmental causes and solutions over time; that study focused specifically on childhood obesity from 2000-2009, in 18 news sources including national and regional newspapers (21). Notably, similar studies in several European countries have found a shift over time from individual to environmental frameworks, suggesting cross-national differences in media narratives around obesity (37, 38, 39).

By using automated content analysis to include a much larger sample size, this study was among the first to also examine variation in the media's framing of obesity across states. The analysis of article categories by state revealed a few outlier states, namely Nevada, Arkansas, and Wisconsin, which consistently had the highest proportion of articles with an environmental framework, and the lowest proportion of articles with an individual framework. Interestingly, these are three very different states in terms of obesity rates (national ranks from lowest to highest obesity rates Nevada 22<sup>nd</sup>, Wisconsin 32<sup>nd</sup>, and Arkansas 48<sup>th</sup>), racial/ethnic diversity (national ranks from highest to lowest percentage of non-white residents Nevada 5<sup>th</sup>, Arkansas 27<sup>th</sup>, Wisconsin 39<sup>th</sup>), income (national ranks highest to lowest of median income Wisconsin 22<sup>nd</sup>, Nevada 26<sup>th</sup>, Arkansas 48<sup>th</sup>), and politics (currently Arkansas governor and state houses all Republican, Nevada all Democratic, and Wisconsin mixed) (40). Several other states including Minnesota, Tennessee, and New Mexico, reflected similar trends to these three states, although not as consistently across all study years. On the other hand, Missouri and Idaho stood out as having the most individual and fewest environmental articles, a more extreme version of the national trend. Future studies could conduct a more focused qualitative analysis of this handful of states to examine whether particular obesity-related topics were consistently discussed in the media or reflected in local policymaking, or quantitative analyses of how obesity-related media coverage contributes to (or reflects) obesity-related policymaking. This type of research could provide valuable insights to public health advocates hoping to help reframe media coverage toward more systemically focused problem statements and policy solutions.

This study has several strengths. The size of the data set that we employed and the automated content analysis method that we used enabled us to provide more granular estimates of geographic and temporal variation in the media's framing of obesity. This opens the door to future research possibilities that go beyond describing overall averages, to

describing more comprehensive trends to help inform public health advocacy and policymaking approaches. For example, future work could examine state-specific factors that may influence media framing of obesity, as well as whether this media framing is associated with public health policy passage and obesity outcomes in different states. In addition, future studies could more closely examine regions within states or outlier states, for example with qualitative analysis, to better understand the influences driving their media framing. It may also be possible that examining media characterization of obesity attribution may reflect public opinion; future studies should examine whether our findings correlate to survey responses, to demonstrate whether this form of automated content analysis can serve as an alternative method to assess public opinion.

This study also has several limitations. First, the automated content analysis method provides overall proportions of articles in each category, at the expense of the ability to classify individual articles or to examine a broad array of article sub-themes within the “environmental” and “individual” categories. Also, the method may produce biased results if particular state-year combinations did not employ language similar to the subset of articles that were hand-coded as part of the training set. Finally, our study makes no causal claims regarding whether the media’s characterization of obesity etiology affects public opinion or policymaking, or vice versa; future studies could examine this question by exploiting natural experiments in which an exogenous shock to public opinion (or policymaking) would allow for a more causal analysis (41).

## Conclusions

Given the history of media influence on public health issues such as smoking, public health action on obesity will likely be facilitated by a more prevalent view of obesity as an environmental rather than an individual problem. This analysis suggests that the public’s view of obesity is currently being informed and reflected by a media heavily focused on individual-level, rather than environmental-level, attributions and solutions. It opens the door to new research that can help public health advocates better understand the driving forces behind obesity media framing and policymaking.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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**What is already known about this subject?**

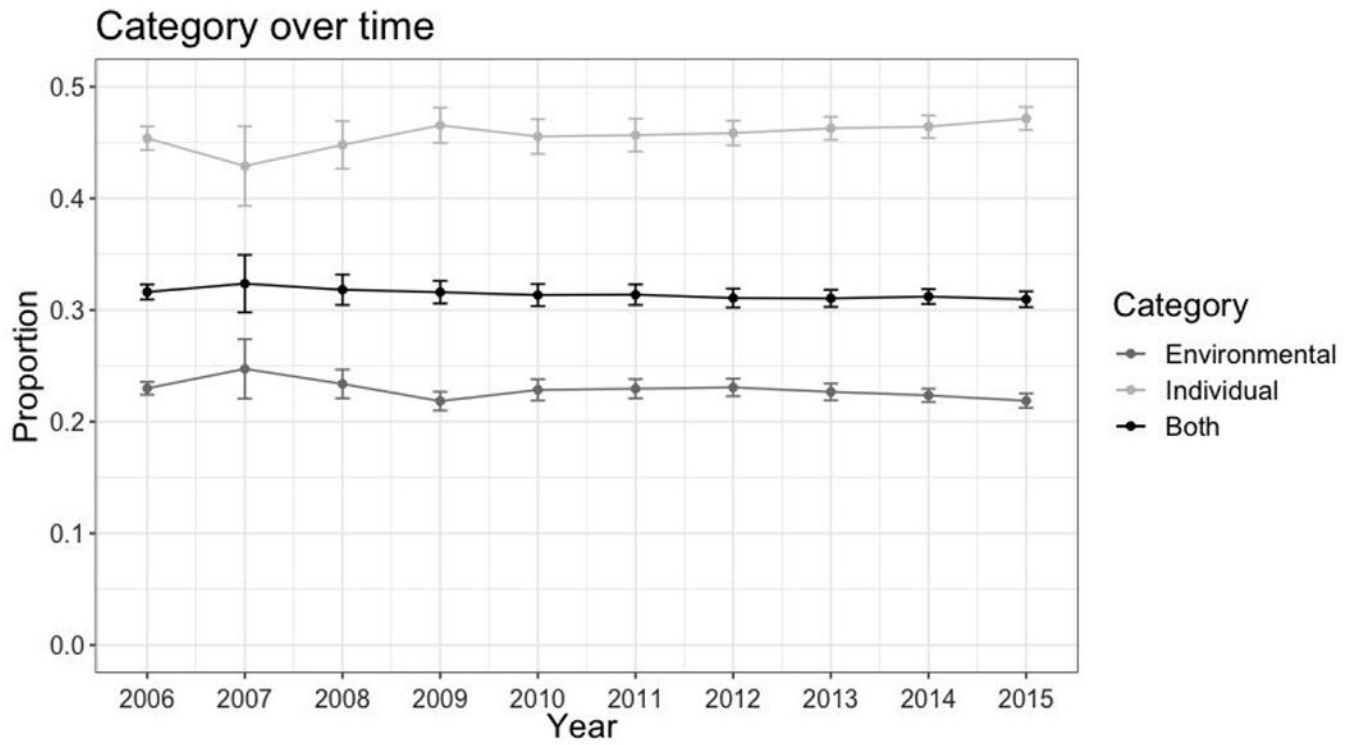
- Local media sources reflect local public opinion, and the media is an important actor in setting the framework of how public health issues are viewed by the public.
- An individual's understanding of the causes of obesity—e.g., behavioral or environmental determinants—affects his or her beliefs about whether solutions to the epidemic should focus on individual or systemic factors.

**What are the new findings in your manuscript?**

- Using automated content analysis of nationwide longitudinal data, we find that the majority of US media coverage across states focuses on obesity as driven by individual behaviors rather than environmental or structural etiologies.
- Yet, there are several states that consistently stand out as outliers.

**How might your results change the direction of research?**

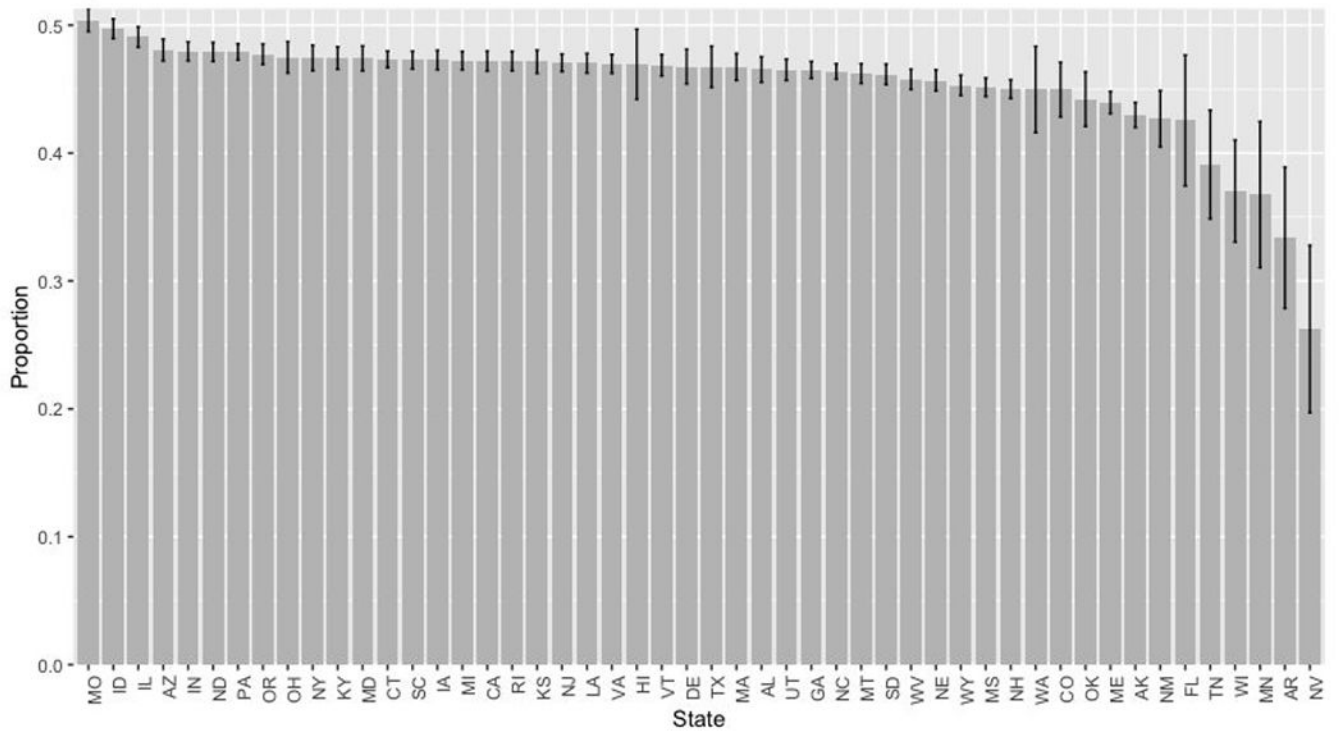
- This study opens the door to new research that can help public health advocates better understand the driving forces behind obesity media framing and policymaking.
- Future work informed by these results could enable a more targeted approach by health advocates attempting to influence public opinion and promote policy aims to address the obesity epidemic.



**Figure 1.**

Proportion of articles utilizing different frameworks of obesity attribution, by year

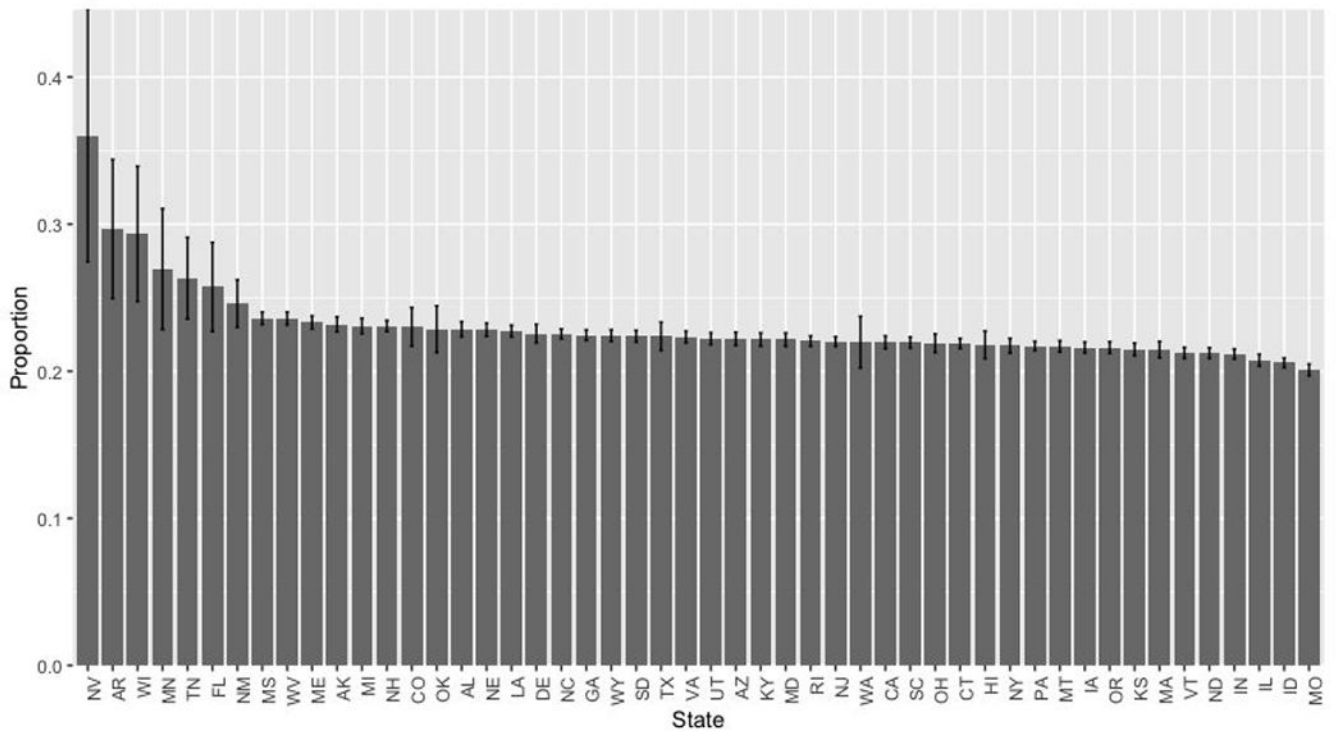
Note: N = 364,288 articles drawn from Access World News. Whiskers represent 95% confidence intervals.



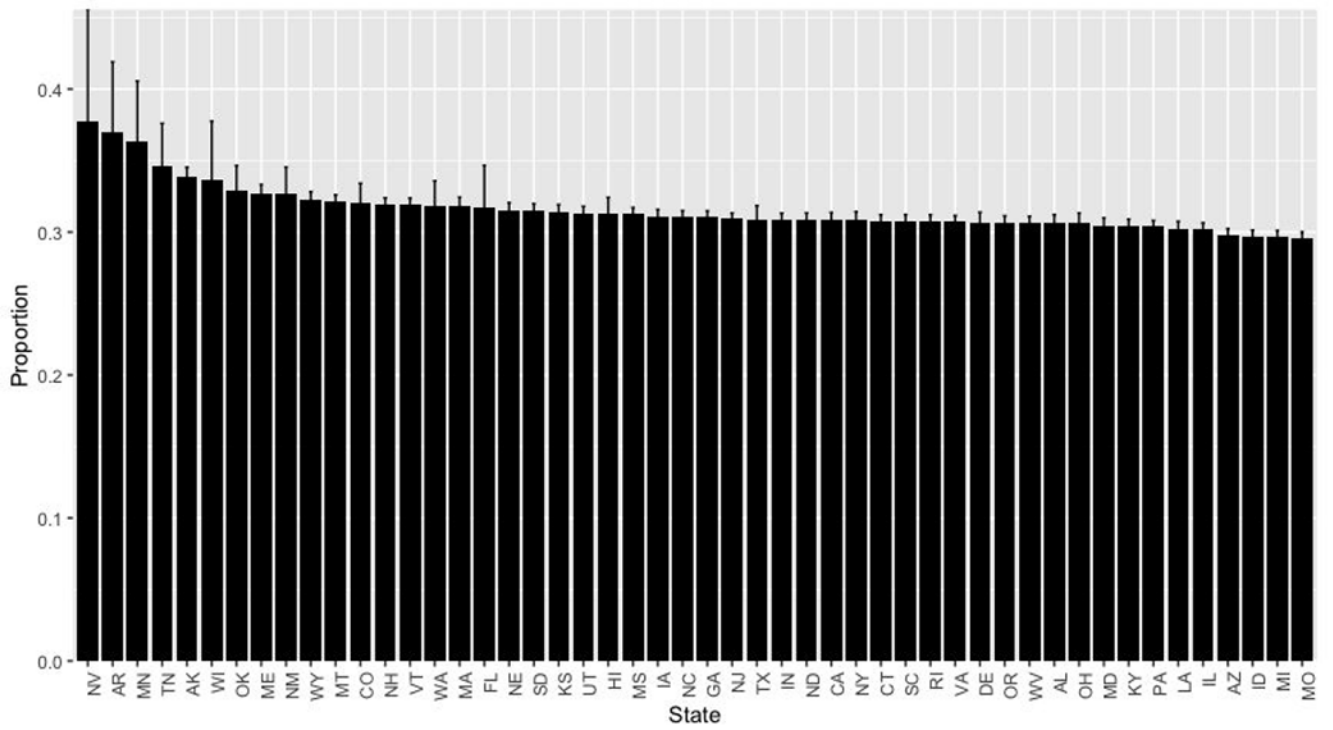
**Figure 2.**

Proportion of articles using an individual framework of obesity attribution, by state

Note: N = 364,288 articles drawn from Access World News. Whiskers represent 95% confidence intervals.



**Figure 3.** Proportion of articles using an environmental framework of obesity attribution, by state  
Note: N = 364,288 articles drawn from Access World News. Whiskers represent 95% confidence intervals.



**Figure 4.** Proportion of articles using both frameworks of obesity attribution, by state  
Note: N = 364,288 articles drawn from Access World News. Whiskers represent 95% confidence intervals.