Protocols, Instrument, Reliability Analyses for Content Analysis

Our sample consists of news stories that refer to research on opioid-related disorders, published by *BBC*, *Breitbart*, *CBC*, *CNN*, *Fox News*, *Global News*, the *New York Times*, *Vice*, and the *Washington Post* between 2017 and 2019. The final dataset contained 223 mentions of 164 unique studies across 151 news stories.

A coder used a detailed coding instrument (see the "Codebook for Content Analysis," page 3 of this Appendix) to assess how each news mention of scientific research in the sample was framed, first coding for the individual frame elements, then for the overarching frame This strategy allowed us to uncover how individual news mentions were framed in the news coverage, as well as the distinct characteristics of each frame, enabling us to provide a more nuanced analysis than would be possible with an analysis of the overarching frames alone. Importantly, while the uncertain and controversial science frames could convey certain elements of the valid science frame (e.g., scientific credibility), the valid science frame could not include any uncertain or controversial aspects. As such, any mentions containing elements of the valid science frame as well as of either the uncertain and/or controversial science frames were coded as uncertain or controversial, not as valid.

Table 1 presents an overview of the observed frames and their related codes. Note that in the coding instrument itself, codes are not grouped by frame but instead organized into conceptual groups. This conceptual and physical proximity helped us to gain a clearer understanding of these closely related variables and to minimize uncertainties during the coding process.

Table 1. Frame definitions and code classification

	Valid Science	Uncertain Science	Controversial Science
Major Theme	Trust	Doubt	Conflict
Previous Research	Antilla (2005: 344) Guenther et al. (2019: 50) Ruhrmann et al. (2013: 10)	Guenther et al. (2019: 50) Zehr (2000: 92)	Atilla (2005: 347) Guenther et al. (2019: 50) Ruhrmann (2013: 10) Zehr (2000: 90)
Conceptual Definition	The valid science frame portrays scientific research as sound and trustworthy. It omits any potential uncertainties and controversies surrounding the research, such as poor methodological quality or contrasting research findings. Instead, research findings are presented as trusted facts and certain, often without further discussion or evaluation, or by implying broad scientific agreement.	The uncertain science frame portrays scientific results as tentative or pending additional research. It cautions against seeing research findings as trusted facts and may indicate flaws in the study, errors in the data, or replicability issues.	The controversial science frame injects and/or emphasizes controversy or disagreement surrounding the reported research. This is done by contrasting research findings or presenting conflicting viewpoints. This frame does not portray scientific research as trusted or certain; neither does it just invoke doubt and uncertainty. Instead, it clearly highlights two diverging perspectives.
Relevant Codes	• Trusted facts • Positive credibility	• Preliminary findings • Questionable credibility	• Contrasting research findings • Conflicting viewpoints

All coding was completed by a single coder. To minimize bias and ensure consistency in the coding, the research team also met continuously throughout the coding process to ensure the coder was on the right track and to discuss any questions that they raised. A 20% random draw of all mentions (n = 45) was independently coded by both our primary coder and a reliability coder to calculate coding reliability. The coding, and reliability check took just over two weeks to complete.

Codebook for Content Analysis

Directions:

1. Fill out each item below for each excerpt on the corresponding excel spreadsheet
    a. Each row is a "mention" (or observation): an excerpt from a news article referring to one particular research study;
    b. Each column is a variable corresponding to one of the codes in the coding scheme presented below;
    c. Draw data from the mention, and enter data into corresponding columns (see var) based on coding scheme (e.g., 1 or 0).
2. Please use the "notes" column to document any idiosyncratic findings that may be important to the researchers (anything that is unique or stands out to you).
3. In the examples below, text that is underlined represents the indicator for the code; text that is **blue, bold, and underlined** represents the link to the research study that is being coded; text in *italics* that is following the example is a short explanation as to why this code was chosen.
4. If you have any questions, do not hesitate to ask Lisa (l.a.matthia@gmail.com). It is always better to be sure!

Universe: all online news articles published by *BBC*, *Breitbart*, *CBC*, *CNN*, *Fox News*, *Global News*, *New York Times*, *Vice*, and *The Washington* Post between January 1, 2017 - December 31, 2018, which mentioned or linked to research articles indexed under the following PubMed Medical Subject Headings ("MeSH terms") relevant to opioid-related disorders: *diagnosis, drug therapy, prevention and control, rehabilitation, therapy, epidemiology,* and *needle-exchange programs*.

Unit of Analysis: News mention.

Method of Data Collection: Altmetric Explorer for Researchers, news transcripts from news source's website.

Concept: Confidence in research results

Code:	**Trusted facts**
Brief definition:	The research results are presented as trusted facts.
When (not) to use:	Type 1 if the news article: ● describes the research results as valid; **AND** ● omits any uncertainties; **OR** ● generalizes broad scientific agreement, indicating consensus around the research results (e.g., "research/science shows", "researchers agree", or reference to systematic reviews/meta analyses/surveys of scientific studies); **OR** ● only provides a link to the research study, but does not discuss the research further. (Note: using terms such as "might" or "may" does not in and of itself indicate uncertainty, as this is common practice when discussing research results - e.g. "Naloxone may save as many as 3 million lives a year") Otherwise type 0. Also type 0 if any of the following codes are present: preliminary findings, questionable scientific credibility, contrasting research findings, conflicting views.
Examples	**TRUE:** Today's opioid crisis is already the **deadliest drug epidemic** in American history. Opioid overdoses killed more than 45,000 people in the 12 months that ended in September, according to the Centers for Disease Control and Prevention. → *This is just a link with no indication that it leads to a research study.*

	TRUE: **A 2013 study of New York City businesses** found that 58% of store managers had seen drug use in their toilets. → *The results of the study are presented as certain ("found"), and are not questioned.* **FALSE:** The new study, published on Tuesday in *The Lancet*, was only the second to compare the drugs, and the first in the United States. → *The study "was only the second" of this kind. Hence, it's unclear how reliable the results are.* **Close but FALSE:** Few studies have measured the outcomes of jail-based methadone treatment. But a 2001 study at Rikers Island, which started one of the country's first jail-based methadone programs in 1987, found that participants were less likely to commit new crimes and more likely to continue treatment. And a 2014 **Australian study** found fewer overdose deaths after release. → *Read in isolation, the results of the Australian study are presented as trusted facts. Stating that there have only been a "few studies" on this topic, weakens the reliability.*

Code:	**Preliminary findings**
Brief definition:	The news article presents research results as uncertain.
When (not) to use:	Type 1 if the news article: ● uses the term "uncertain"; **OR** ● uses the term "preliminary"; **OR** ● uses the term "incomplete"; **OR** ● uses the term "trial stage" (or something synonymous) to describe the research results of the reported study; **OR** ● uses the phrase "only few studies". Otherwise type 0. Also type 0 if the news article only provides a link to the research study, but does not discuss the research further.

Examples:	**TRUE:** The city said it does not keep track of the income or race of buprenorphine patients, and data on buprenorphine treatment demographics is sparse at the national level as well. **A study** published in 2016 in Drug and Alcohol Dependence, a scientific journal, found that buprenorphine and methadone access were correlated with income and ethnicity in New York City. Without broad government surveys, precision is difficult; the report lamented that no nationally representative data on ethnicity or income has been published since 2006, when a survey by the Substance Abuse and Mental Health Services Administration showed that 92 percent of buprenorphine patients were white. → *To be a* trusted fact, *more comprehensive data is needed. Until then the results are seen as preliminary.* **FALSE:** The drug naloxone, which can reverse prescription opioid and heroin overdoses, **may not be effective against potent synthetics**. → *This is just a link. The uncertain tone relates to the content of the sentence, but does not express uncertainty about the research study.* **Close, but FALSE:** But abstinence does not in and of itself treat substance use disorder. And upon release, prisoners generally have a reduced tolerance for opioids; **one study** found that within two weeks of being released, former inmates overdose at rates nearly 130 times as high as the general population. → *In this case, "one" does not highlight a lack of existing research, but that one study is used to support the journalist's claim that "abstinence does not in and of itself treat substance use disorder."*

Concept: Scientific credibility

Code:	**Positive scientific credibility**
Brief definition:	The research results are presented as scientifically credible.

When (not) to use:	Type 1 if the news article: ● includes supporting independent expert commentary; **OR** ● refers to the high methodological quality (e.g., large sample size) of the study; **OR** ● portrays the researcher(s) as competent; **OR** ● mentions the researchers' affiliation; **OR** ● mentions the researchers' funders; **OR** ● mentions the journal in which the study was published; **OR** ● states the study's findings have been applied or cited elsewhere; **OR** ● mentions that other studies have had similar results (although no clear consensus has been established); **OR** ● if the results deviate from other research, offers an explanation as to why this might be the case. Otherwise type 0. Also type 0 if the news article only provides a link to the research study, but does not discuss the research further.
Examples:	**TRUE:** Gail D'Onofrio, a pioneer of the practice who leads the department of emergency medicine at Yale, published a study in 2015 showing that starting patients on Suboxone in the emergency room **works**: 78 percent were still in treatment a month later, twice as many as those who got only referrals to treatment. She said hospitals in fewer than 10 cities offer Suboxone in the emergency room. (In Philadelphia, only a few do). "But way more are in process," she said, adding that she gets calls from new places every week. → *Scientific credibility is conveyed by mentioning D'onofrio's leading job position and that the research findings are being implemented into practice.* **FALSE:** A study **from 2010** in Sydney, Australia, found a supervised injection facility led to fewer ambulance calls for treating overdoses. → *There isn't any information provided about the credibility of the study or the researchers.*

	Close but FALSE: Five industry-funded clinical trials have **found** Vivitrol to be effective in treating opioid problems—at least for those who choose to stick with it. → *Although this mention refers to multiple clinical trials, which could imply credibility, it also says these trials have been "industry-funded," and the trial stages remain unclear.*

Code:	**Questionable scientific credibility**
Brief definition:	The news article casts doubt on the credibility of the research results and/or the researchers.
When (not) to use:	Type 1 if the news article: ● questions the scientific credibility of the research findings; **OR** ● questions the scientific credibility of the researchers; **OR** ● criticizes the methodology of the research study (e.g., small sample size); **OR** ● highlights a conflict of interests. Otherwise type 0. Also type 0 if the news article only provides a link to the research study, but does not discuss the research further.
Examples:	**TRUE:** Dr. Rotrosen and Dr. Joshua Lee, a co-author of the study and an associate professor at New York University School of Medicine, have both led or participated in previous studies for which Alkermes provided medication or funding. Two of the other authors also reported receiving research support and in one case, consulting fees from Alkermes. Indivior donated the Suboxone for the study. → *The researchers have received funding from Alkemeres, a major opioid producer, indicating a conflict of interest.*

	FALSE: A federally funded **study** last year found that naltrexone, a non-opioid medication that JourneyPure has offered to some patients since it opened in 2015, was just as effective as buprenorphine. → *"Federally funded" conveys credibility.*

Concept: Conflict

Code:	**Contrasting research findings**
Brief definition:	The news article suggests that the current study departs from previous research.
When (not) to use:	Type 1 if the news article: • juxtaposes the results of two or more separate studies; **OR** • emphasizes that the study discussed does not align with previous research findings; **AND** • no explanation is offered as to why results differ from one another. Otherwise type 0. Also type 0 if the news article only provides a link to the research study, but does not discuss the research further.
Examples:	**TRUE:** Zielinski found that for women in MMT, cannabis use was associated with falling off the wagon. Women who reported using recreational cannabis while in MMT were 82 percent more likely to also use illicit opioids, according to Zielinski's study, published last month in Biology of Sex Differences. But she told me it's not a clear cause-and-effect happening. (...) Other researchers **have found that cannabis use has no association** with how well someone manages to stay of opioids while receiving MMT. → *Two research studies on the same topic have produced different results.* **FALSE:** Gail D'Onofrio, a pioneer of the practice who leads the department of emergency medicine at Yale, published a study in 2015

	showing that starting patients on Suboxone in the emergency room **works**: 78 percent were still in treatment a month later, twice as many as those who got only referrals to treatment. (...) A follow-up study showed that the gains were holding at two months, but not at six months or a year. Nevertheless, Jeffrey Hom, a policy adviser to Philadelphia's public health department, said the program was still valuable. "For many people this is a chronic disease," he said. "Relapses happen. You may have tried Suboxone and had some success and it may not be sustained, but you may come back to it at a later date." → *The follow-up study was able to replicate and extend the findings of the original study.* **Close, but FALSE:** Eli Lilly's trials of the drug for osteoarthritis pain were unsuccessful. At the time, the drug's use in treating other kinds of pain and lessening opioid dependence wasn't tested. But researchers opted to start testing it after they found it interacted with the body on a target known to be involved with pain relief. → *Conflicting findings are presented, but these concern two unrelated medical issues, and it is explained how researchers discovered the drug might be used for different purposes.*

Code:	**Conflicting viewpoints**
Brief definition:	The news article presents conflicting viewpoints on the research topic.
When (not) to use:	Type 1 if the news article includes statements that present a different interpretation of the research findings **OR** their implication from: ● other researchers; **OR** ● experts; **OR** ● other credible individuals; **OR** ● the journalist themselves.

	(Note: This can sometimes appear as the journalist maintaining objectivity and balancing opinions.) Otherwise type 0. Also type 0 if the news article only provides a link to the research study, but does not discuss the research further.
Examples:	**TRUE:** "There is evidence on both sides," Elliot said during question period Monday. "We need to make sure that we review all of the evidence to understand what is happening. What is happening that is saving lives? What else can we do to save more lives? Are there other examples that we should be looking at besides supervised injection clinics?" Experts and advocates on the frontlines of the opioid epidemic, however, say there is already an overwhelming body of evidence to show that the overdose-prevention and safe injection sites save lives and help get people into treatment. (...) Studies on these facilities conducted in Canada and around the world have shown they are not only life saving but connect people with long-term addiction treatment, reduce the spread of HIV and hepatitis C, and ultimately save healthcare dollars. One study **published in 2011** examined overdose mortality in the two years before and after a supervised injection site opened in Vancouver in 2003 known as InSite. It found the fatal overdose rate in the area decreased by **35 per cent**. → *Elliot is questioning if safe injection sites have merit, the journalist then presents evidence that they have.* **FALSE**: History is filled with examples of scientifically sound guidance that was ignored or pilloried by those in power. In the late 1990s, for example, half a dozen major health agencies, including the Department of Health and Human Services, endorsed a **national needle exchange program** to curb the spread of H.I.V./AIDS. But President Bill Clinton rejected the advice, and the resulting H.I.V. infections cost the health care system as much as half a billion dollars. → *This is just a link.*

	Close, but FALSE: The drug courts often place offenders in treatment facilities or sober housing that allow only Vivitrol. "That's where we're handcuffed to Vivitrol," said Judge David Matia, who leads the drug court in Cuyahoga County, Ohio. Dr. Joshua Lee, the lead author of a **2016 study of Vivitrol**, said he questioned whether the drug had given criminal justice authorities "too easy of an out" not to make buprenorphine or methadone more widely available in their settings. → *The conflicting viewpoint does not relate to the study and the reference merely provides additional information about Dr. Lee but is not further elaborated.*

Reliability Coding

Two coders, using the same coding instrument (see this appendix, above), independently analyzed a random draw of approximately 20 percent of coded transcripts (n = 45). We present several measures of agreement. We include percent agreement, which is intuitive but overestimates true intercoder agreement. We also present Krippendorff's alpha and Cohen's alpha, both of which are more flexible and can account for multiple coders. Scores that approach 1 are indicative of greater agreement between coders. In most fields, a threshold of .7 is seen as an acceptable score of reliability. The results in Table 2 below show that we have met or exceeded that threshold for all measures.

Table 2. Reliability Coding Scores

Code	% Agreement	Cohen's kappa	Krippendorff's alpha
Trusted Facts	95	0.857	0.858
Preliminary Findings	97.5	0.844	0.845
Positive Credibility	85	0.699	0.703
Questionable Credibility	100	1	1
Contrasting Findings	100	1	1
Conflicting Viewpoints	95	0.722	0.726