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Using Nonprofit Narratives and News Media Framing to Depict Air Pollution in Delhi, India

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ABSTRACT

How is the air pollution issue in Delhi framed by the news media and narrated by nonprofit organizations? To study news media framing, we employed an inductive approach based on automated text coding of news coverage of the issue. To study nonprofit organization narrations, a deductive approach guided by the Narrative Policy Framework was used to focus on the stories told via online documents as found on nonprofit websites. The findings confirm existing theory and empirical research regarding the leading causes and effects of air pollution; however, perceptions are mixed regarding the government's ability to implement policy. The combined deductive and inductive approaches provide a systematic and multi-method research study for understanding perceptions of air pollution in one of the largest cities in the world. The result is a depiction of the priorities that influence public opinions, political decisions, and eventually public policies.

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Urban sustainability is a complex challenge, especially in developing countries that have infrastructure and administrative capacity concerns. Part of the challenge is allocating scarce attention and resources to competing priorities including water scarcity, environmental concerns, public health needs, and demand for economic growth. In democracies, two important sources of information for communicating priorities to the public and policymakers are the news media and nonprofit organizations (Ingram & Smith, 1993). In communicating priorities in a society, the news media and nonprofit organizations contribute to forming the boundaries between public policy choices that are possible and prohibited. This research seeks to understand societal priorities in relation to the air pollution issue in Delhi, India, as framed by the news media and narrated by nonprofit organizations through their descriptions of air pollution causes, effects, and solutions. In this study, the air pollution issue in one of the world's most polluted megacities Delhi, India is explored by asking: *How is the air pollution issue in Delhi being framed by the news media and narrated by nonprofit organizations involved in this issue?*

This study incorporates the concepts of frames and policy narratives, the use of which vary in academia (Boykoff, 2010; Crow, 2011; Kennamer, 1992; Shanahan, McBeth, & Hathaway, 2011; Tversky & Kahneman, 1981). Frames relate to the news media and how journalists construct and connect a sequence of events or ideas and intentionally or unintentionally weigh some issues more than others to persuade or spur emotional and psychological responses among readers (Druckman, 2001). As part of the issue definition, media frames relay a central idea in a text and bound the controversy, as directed by the journalist's opinion and agenda (Scheufele, 1999). In contrast, policy narratives relate to the stories told by individuals, organizations, or groups, such nonprofits, who are

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interested in particular policy issues and seek to construct reality by assigning meaning, shaping values, and signalling the importance of concepts and occurrences associated with a given policy domain (Fischer & Forrester, 1993; Roe, 1994; Shanahan, Jones, McBeth, & Lane, 2013; Stone, 2002).

There is an extensive literature surrounding the usage of "frame" versus "narrative." Frames do not always—although they can—utilize the same structural components of policy narratives (e.g. the telling of stories and the temporal sequence of events with symbols and characters) and are often nested within both the news media and narratives told by other organizational types (Druckman, 2001). Further, narratives may contain more than one frame. The distinction can be understood as the difference between (a) the use of framing to weigh some elements over others in a situation and (b) the use of policy narratives to tell an overarching story by connecting elements, such as characters, plots, and a setting, in a situation.

In this study, policy narratives are the documents, such as reports or blog entries, that tell a story "with a temporal sequence of events unfolding in a plot that is populated by dramatic movements, symbols, and archetypical characters" as might be found on nonprofit organization websites (Jones & McBeth, 2010, p. 329). A manual-coding approach is used to explore the overarching story told through the policy narratives. Frames are found within articles in the news media, uncovered through an automated coding approach specifically as the co-occurrence of concepts in regular patterns.[1]

Both news media frames and policy narratives do more than present information; they are often strategies for political communication among people vying for control of government agendas and policies (Campbell, 2010; Druckman, 2001; Stone, 2002; Surel, 2000). This is especially true for high salience issues that demand government action where public opinion is more likely to matter in shaping agendas and selecting policy alternatives (Burstein, 2003). Therefore, there is a need for content analysis of news media frames and policy narratives to understand the context in which people receive information (Druckman, 2001; Reese, 2007).

This paper will first review theoretical approaches and applications associated with news media framing and policy narratives. The study's two methods, automated text coding and narrative analysis, are then presented, followed by results and a discussion of the implications of the study. Exploring both news media frames and policy narratives is an innovative way not only to illuminate how a policy-relevant issue is being presented to the public, but also to understand policy actors' perceptions and priorities. Uncovering the logic behind the construction of information and information processing can lend meaning to the interaction between policy and policy actors (Surel, 2000). The way this issue is discussed in the media and narrated by interested nonprofit organizations can help improve our understanding of whether and how this issue is seen as a priority and may also play a role in shaping the policy processes and decisions designed to deal with the issue.

Theoretical approaches

News media framing

News media frames intersect with politics because individuals do not just simply rely on past experiences or make logical goal assessments when faced with political decisions. Rather, individuals' information processing takes into account their perceptions and priorities of various stimuli, as might be found on the Internet or print news media (Farnham, 1990; McGraw, 2000). How that information is framed can have an impact on their perceptions of cause and effect relationships and plausible solutions.

The average citizen does not read peer-reviewed academic journals, policy documents, or international treaties; the news media may be their main—or only—source of information on complex policy issues (Crow, 2011). The link between public opinion and news media is well studied (Crow 2010; Iyengar, 1991). Through public opinion, news media can impact government agendas, political

climates, evaluation, and policy formulations (Boykoff, 2010; Crow, 2010; Sullivan, Rahn, & Rudolph, 2002).

Frames can be impactful not only in influencing public opinion, but also in modifying the salience of an issue (Crow, 2010; Kuklinski, 2002; Sullivan et al., 2002). Knoll, Redlawsk, and Sanborn (2011) explored the impacts of news media frames, contending that the selection and application of frames in a given context are governed by the importance of the issue for the decision maker (2011). Given the significant levels of air pollution in Delhi—resulting in visual presence and widespread health effects—the issue is of high salience to both citizens and policymakers (Bickerstaff & Walker, 2001).

In the context of environmental issues such as air pollution, framing by the news media may influence salience (or lack thereof) and bound the politically feasible alternatives for dealing with the issue, which in turn can impact the policy agenda. According to Crow (2010, this is a two-stage process. First the media influences citizen perceptions. Citizen perceptions impact opinions, which then influence government officials, who are also simultaneously receiving messages from the media (Crow, 2010; Kennamer, 1992). In the "high-stakes, high-profile, and highly-contested case-study of climate change … media messages function as important interpreters of climate information in the public arena, and shape perceptions, attitudes, intentions, beliefs, and behaviors" (Crow & Boykoff, 2014, pp. 3–4).

News media presents information in a regular and patterned way and emphasizes some concepts and themes over others. This creates the frame through which the reader receives the information. Frames are the recurring descriptions used by the media and received by the individual. The co-occurrence of words establishes a frame upon which individuals draw to understand the issue and develop opinions, including positions on policy and politics. Exploring frames as co-occurrence of words through the news media brings awareness to the different ways in which an issue is described. Through such analysis, relationships between frames, such as the causes and solutions of a policy issue, may be linked to decisions by citizens and policymakers.

Narrative policy framework

Information on policy issues is also shaped and disseminated through policy narratives produced by people directly or indirectly attempting to influence governments. Researchers have begun to study narratives systematically through document analysis (Shanahan et al., 2013). Early work in narrative policy analysis argued that the study of narratives tells a relevant story of current policy debates, based on the premise that complexity and polarization of policy issues are embedded within the narratives (Roe, 1994). Narratives present the struggle over ideas that comprise political decisions, and political decisions create boundaries around those ideas, which can also define the impacts of public policy on society (Stone, 2002). Studying narratives exposes this web of policy actors' ideas, policymakers' decisions, and the people who are affected.

The narrative policy framework (NPF) is one approach to studying policy narratives (McBeth, Shanahan, Arrandale Anderson, & Rose, 2012; Shanahan et al., 2013). The NPF provides an empirical methodology with theoretical underpinnings on how policy narratives shape information processing and decision-making around policy issues. Policy narratives have four components (McBeth et al., 2012; Shanahan et al., 2013). The first is a setting or context, which may be geographically bound or be defined around a policy issue or controversy. Second, policy narratives must have a plot. As in literature, a plot should have a beginning, middle and end and establish relationships between setting and characters. The plot unfolds in various depictions of causes, effects, and solutions with identification of the relatedness between variables. Third, policy narratives have characters. Explicit in the narratives is the use of characters that improve, exacerbate, or are affected by the policy issue. In the NPF, characters can be "heroes" who seek to fix the problem, "villains" who cause the problem or "victims" who are harmed by the problem. The final element of a policy narrative is the inclusion of a moral of the story—most commonly, a policy solution. The NPF has been applied to a number of policy debates, particularly in the

environmental arena (see Heikkila et al., 2014; McBeth et al., 2012; Shanahan et al., 2013; Shanahan et al., 2011).

Theory in general suggests and specifies relationships. The relationships explored in this study are how heroes and villains relate to causes, effects, and solutions of problems. To date, there is little theoretical or empirical work in the NPF relating characters to causes, effects, and solutions (Pierce, Smith-Walter, & Peterson, 2014). In the NPF literature, there is no expectation about who should be a particular character or how that character should be associated with any particular cause, effect, or solution; as such, this study does not contain hypotheses about these relationships. Instead, this study draws more general deductive guidance from the NPF in identifying key structural elements of a policy narrative for empirical analysis, as well as methodological insights from the NPF in coding characters, causes, effects, and solutions. In this regard, our approach is similar to many NPF applications that use the framework for its general guidance on policy narratives, rather than for testing hypotheses from the framework (Pierce et al., 2014; Weible & Schlager, 2014). At the same time, this study adds to the methodological foundation of the NPF, which is necessary for advancing the framework (Weible & Schlager, 2014).

Case-study background

Megacities, such as Delhi, are important to study given the upward trend of global urbanization (Kraas, 2007; Wescott & Jones, 2007) and the governance, space, and resource constraints that megacities currently face. Delhi experienced a 40% population growth rate in only 10 years between 2001 and 2011 with 14% of its inhabitants currently living below the poverty line (Ahmad, Balaban, Doll, & Dreyfus, 2013). Delhi also has one of the highest population densities in the world, without adequate infrastructure to support the population (Gurjar, Butler, Lawrence, & Lelieveld, 2008).

The majority of academic research on air pollution in Delhi involves measuring air pollution levels, the causes and resulting effects (see Gurjar et al., 2008 or Nagpure, Gurjar, & Martel, 2014). Transport pollution is heavily represented in air pollution research because transport contributes to approximately 70% of Delhi's air pollution, followed by industrial emissions at 20% (Government of NCT of Delhi, 2012). Air pollution modelling studies often link to health impacts and call for new policies and norms to address the rising costs of pollution-related health issues (e.g. Gurjar et al., 2008; Nagpure et al., 2014). How this issue is being discussed in the media and narrated by interested policy actors can help improve our understanding of whether and how this issue is seen as a priority and may also play a role in shaping policy processes and decisions.

Methods

Exploring the frames used by news media and policy narratives used by nonprofits provides a depiction of the priorities of a selection of the individuals and organizations involved in an issue. This descriptive study utilizes two approaches to uncover priorities surrounding the air pollution debate in Delhi. The first is an inductive method exploring the framing in news media coverage of the issue via automated text coding using a large-n data set. The second is a deductive technique guided by the NPF's insights on the important structural elements of policy narratives, which examines a small-n data set of online documents from nonprofit organizations.

Automated text coding

Insights into news media issue framing are captured by analysing word frequencies, word co-occurrences, and concept frequencies. To find documents for the automated text analysis, a broad search revealed news media sources available via online access. Requirements for English language and online accessibility constrained the choice of news media sources, which resulted in using the newspapers *Hindustan Times*, *Indian Express*, *The Economic Times*, *The Financial Express*, and *The Times*

of India. LexisNexis and WestLaw Academic were searched for articles between 1 January 2012 and 31 December 2013 using Boolean logic terms: "Delhi" AND "air pollution." The results were compared and duplicates eliminated. Inclusion in the sample required that the article mention air pollution and Delhi as areas of discussion. However, if Delhi was only mentioned as the site of a meeting at which another jurisdiction was the topic, the article was excluded. The final sample contained 235 articles, the composition of which is roughly commiserate with the daily circulation and readership of the newspapers (Presseurop: The best of the European Press, 2012).[2] By readership, *the Times of India* and *Hindustan Times* are the most widely read English language newspapers in India (Indian Readership Survey, 2013). *The Financial Express*, *Indian Express*, and *The Economic Times* were included in the sample to bring in a breadth of subject focus. *The Financial Express* is India's oldest English language business daily; *The Economic Times* is primarily financial reporting, published simultaneously in 12 cities throughout India. The *Indian Express* tends towards a centre political alignment, compared with the other four newspapers which are considered conservative in their political alignment (Table 1).

The sample was then uploaded to the automated text content analysis software, AutoMap. AutoMap is an advanced text mining system that can extract a semantic network of concepts and their relation to each other, as co-occurrence (Carley, Columbus, & Landwehr, 2013). The texts were processed to (1) remove noise words and irrelevant concepts and (2) combine similar concepts, such as "automobile" and "cars" to automotive.[3] Remaining relevant concepts were then inductively funnelled into parent nodes and if possible, child nodes (see further discussion in Results section). For example, the concept "Delhi Pollution Control Board" was categorized first as *Actor*, then specifically as *government and authority*; "haze" was categorized as *visual aesthetics*; "emphysema" was categorized as *health*. A semantic network was then generated to reveal co-occurrence of concepts. The co-occurrence of concepts represents a pattern within the news media articles and serves as a proxy for a frame. Co-occurrence is "controlled by the distance between word occurrences: two vertices are connected if their corresponding lexical units co-occur within a maximum *N* words" (Mihalcea & Tarau, 1998, p. 3). Guided by work on text ranking and information retrieval used for benchmarking in language models, primarily within the field of web search relevance, proximity within a window size of 10 was used (Mihalcea & Tarau, 1998, p. 3).[4] That is, words within 10 words of each other were captured as co-occurring.

The semantic network was then uploaded into network analysis software UCINET to analyse the co-occurrences and network attributes. Proximity, measured as co-occurrence, "suggests a relationship between terms when entities of interest coexist within a certain scope of the text" (Chang, Popescu, & Arthur, 2013, p. 5). Co-occurrence can indicate cohesion within a given text, interpreted as a frame (Carley et al., 2013; Chang et al., 2013; Mihalcea & Tarau, 1998).

Narrative analysis

To find documents to analyse using NPF, keywords were searched using the same Boolean logic, "Delhi" AND "air pollution," using Google Chrome. From the search results, a list of 14 Indian-based organizations involved in air-pollution-related activities was generated. The websites of these organizations were combed for documents related to air pollution in Delhi. Inclusion

Table 1. News media sample.

Source	Number of articles	Composition of total (%)
The Economic Times	17	7.20
The Financial Express	10	4.26
Hindustan Times	71	30.24
Indian Express	34	14.47
The *Times of India*	103	43.83
Total	235	100.00

rules were created, requiring that documents (1) must contain some mention or reflection on the air pollution issue specific to Delhi, (2) be published and hosted by Indian-based sources between 1 January 2012 and 31 December 2013, (3) include downloadable as well as web-based published material in .pdf and .html formats, and (4) exclude newspapers. Each entire website and/or knowledgebase of the organizations' online presence was searched. The search resulted in 46 documents from 8 organizations. Four publications were excluded due to duplication and irrelevance to the study. Additionally, five documents by government authors were excluded in order to create a comparison between two distinct narrators: news media and nonprofits. Nonprofit organizations predominantly authored, published, and hosted web-based documents on the air pollution issue. The nonprofit was not required to have written the narrative but they had to be hosting it, which indicates that the narrative aligns with their policy beliefs. This resulted in 37 publications for analysis.

To partially inform the deductive coding instrument for the documents based on the NPF, we relied on five informal interviews conducted in Delhi in 2013.[5] These interviews were exploratory, did not use an instrument, and focused on general issues of city sustainability and reducing carbon emissions. Based on the NPF and the interviews, the following questions were crafted and a general code form was created:

(1) Which character types (hero, victim, and villain) are portrayed and by whom?
(2) What are the causes and effects of air pollution?
(3) What type of policy solution(s) does the document offer? At what level of government is the policy solution(s) proposed?

The manual-coding approach was guided by coding for main nodes and sub-nodes. The main nodes were developed based on a premise of the NPF: stories have plots that unfold with causes, effects, solutions, and characterization (i.e. actors). The sub-nodes capture nuances within the main codes. To illustrate, the main node of *actor* (i.e. someone involved in the air pollution issue in Delhi) was categorized into sub-nodes as *heroes, victims, and villains*. The main node *causes of air pollution in Delhi* was categorized into sub-nodes: *environment, household/business consumption, industrial production, infrastructure, transport*, and *urbanization*. Similarly, the main node *effects of air pollution in Delhi* was reduced to *economy*, *environment*, *health, social impacts, and visual aesthetics*. Lastly, the main node *policy solutions* (for dealing with air pollution in Delhi) was sorted into *administrative capacity and enforcement*, *market solution*, *new infrastructure/planning, regulation*, *research and information, implement current goals*, and *voluntary action*. The sub-nodes were developed inductively through literature review and by analysing a selection of documents.

Document coding was completed using NVIVO software. We tested the intercoder reliability of all variables on nine documents (20% of the sample). Results for all variables exceeded 85% for the percent agreement test and above .80 for the Cohen's kappa (1960) test using Freelon's reliability calculator, ReCal (2013).

Result

News media

Data analyses for the news media include word frequencies, parent node frequencies, and correlations between actors and parent category frequencies. After processing the newspaper texts, approximately 1600 words remained that were relevant to the issue of air pollution in Delhi. Table 2 shows the most frequently used 25 words, which account for 42.31% of the total 1600 relevant words (total occurrence within articles was 5578). For example, words related specifically to automobile comprise 532 of the 5578 occurrences of all relevant words, approximately 10% of occurrences of all relevant words, and appear in 112 articles.[6]

Table 2. Highest frequency words (within relevant word sample).

Concept	Frequency	% Across texts	Number of texts
Automobile	532	9.54	112
City	334	5.99	86
Fuel	255	4.57	64
Environment	163	2.92	85
Road	112	2.01	72
Burn	111	1.99	51
Firecracker	106	1.90	20
State	71	1.27	44
Disease	66	1.18	30
Industry	62	1.11	39
Problem	58	1.04	41
Country	53	0.95	34
Truck	44	0.79	12
Scientist	39	0.70	26
Lung	37	0.66	23
Patient	37	0.66	13
Temperature	35	0.63	19
Government	34	0.61	28
Bus	34	0.61	22
Motorized	31	0.56	16
Children	31	0.56	14
Breathe	30	0.54	23
Smoke	30	0.54	16
Agency	29	0.52	23
Cost	26	0.47	16

Table 2 shows that words relating to transportation—such as automobile, fuel, bus, and road—are highly prevalent. Health words—such as disease, lung, and breathe—also have multiple occurrences within the top 25 most frequently used words in articles about air pollution in Delhi. Conclusions about the causal or directional relationship cannot be made from automated text analysis, but high usage of transport and health words within news media communication on air pollution indirectly suggests potential causes and effects. Words indicating jurisdiction—such as city, state, and country—are used with regularity. Scientist is the most frequently used actor word; others are government, children, and agency. Negative valence words—such as problem and cost—cannot be explicitly linked to definite frames, but those words are relatively highly occurring nonetheless, indicating that there may be recognition of potential problems related to air pollution. Finally, "firecracker" occurs with reasonably high frequency, which may be a result of the marked increase in smog following the annual celebration of the religious festival Diwali in November, during which firecrackers are set off, coupled with the seasonal weather conditions that tend to trap the released sulphur (Singh, 2013).

Using words relating to transport and health, as well as jurisdiction and actors, are indicative of the frames discussing the issue of air pollution, its causes and effects, and actors and level of jurisdiction. No words relating to solutions—such as fine or monitoring—are found among the most frequently used words, which could indicate that the news media frame is not currently associating solutions with the air pollution issue.

Categorization was then conducted, assigning the relevant words into 19 concepts (parent categories). However, unlike NPF-driven manual coding in which the coder is able to assign valence to a term, such as "cause" or "effect," automated text coding is not able to decipher the author's intended usage of a word within a given window; therefore definitive conclusions cannot be drawn regarding intent.[7] Table 3 shows the frequency of all concepts.[8]

As with the simple word frequency, concepts of transport and health are the highest occurring. Words of *household/business consumption*—such as stove, kitchen, restaurant, and garbage—follow, with nearly the same relatively frequency across texts as *Environment* words—such as vapour, winter, atmosphere, and climate. Solutions to air pollution are more prevalent in this analysis; by grouping *solution* words—such as technology, law, policy, and prohibit—their relative importance within

Table 3. Concept frequency of parent categories within the news media sample.

Concept	Frequency	Relative % across texts	Number of texts
Transport	1143	47.63	157
Health	270	11.25	83
Household/business consumption	262	10.92	70
Environment	256	10.67	113
Solution	69	2.88	46
Industrial production	65	2.71	42
Government and authority	62	2.58	40
Pollution	44	1.83	28
Economy	41	1.71	25
University and research agencies	39	1.63	26
Visual aesthetics	38	1.58	23
People	34	1.42	17
Urbanization	27	1.13	19
Infrastructure	22	0.92	15
Nonprofit	12	0.50	11
Supreme court	6	0.25	5
Industry	5	0.21	3
Cultural/religious	3	0.13	3
Social impacts	1	0.08	1

the news media sample is better revealed. By developing parameters for the air pollution frame through the concepts, nuances such as solutions or actors such as the supreme court, are brought forward. The supreme court, which has played a prominent role in implementation of the recent bus rapid transit policy, is noted through the concept frequency but would have otherwise been lost in the analysis since its relative occurrence across all concepts is low.

To explore frames as patterned relationships between concepts, a semantic network can be used. Within texts, a semantic network is represented by co-occurrence of terms within a given number of words. Table 4 illustrates a semantic network as co-occurrences between actor concepts—*university and research agencies, government and authority, nonprofit, supreme court, industry*, and *people*—and the remaining concepts. The figure demonstrates that actors play different roles within news media frames of the air pollution issue. The *environment* concept co-occurs with all but one actor (*nonprofit*). For two actors, *industry* and the *supreme court*, *environment* is the only concept with which they co-occur, although note that the number of co-occurrence is relatively low. *Government and authority* is primarily associated with *transpor*t, but also with *environment*; however, *government and authority* is not associated with *solution*. *Solution* is associated only with *university and research agencies*, as is *urbanization*. The frame surrounding *university and research agencies* associates research with *solutions, urbanization* and *consumption*, which could be construed as a more scientific frame.

Health, a highly occurring concept, only co-occurs with *nonprofit* and *people*, which could imply that the effects of air pollution are heavily associated with specific groups (people) and emphasized by specific groups (nonprofit). The same actors also see the only co-occurrences with other actors. In contrast with the more scientific *university and research agencies* frame, the frames surrounding *nonprofit* and *people* appear to be more human-related, co-occurring with other actors, visual aesthetics and environment. *People* as a concept co-occurred most often with other concepts, representing one-third of the total co-occurrences.

Words associated with transportation and health are most commonly occurring, whereas solution-oriented words are relatively absent in the individual word analysis but appear prominently when the individual words are grouped into parent categories. Additionally, scientist, government, child, and agency are frequently used actor words. Problems and costs are also highly occurring. The co-occurrences between actor types and categories reveal that people are frequently associated with air pollution frames.

Table 4. Concept co-occurrence by actor type.

		Concept						
Actor	Total co-occurrences	Environment (%)	Transport (%)	Health (%)	Household/ business consumption (%)	Visual aesthetics (%)	Solution (%)	Urbanization (%)
People	12	25	0	42	8	25	0	0
Government and authority	11	27	73	0	0	0	0	0
University and research agencies (including WHO)	9	22	11	0	11	0	44	11
Nonprofits	7	0	29	43	0	29	0	0
Industry	2	100	0	0	0	0	0	0
Supreme court	1	100	0	0	0	0	0	0
Total	42	26	26	19	19	12	10	2

Narrative policy framework

Unlike the automated text coding used in the news media portion of the study, manual coding of nonprofits' narratives reveals a more comprehensive story of causes, effects, and solutions for air pollution in Delhi. Across all documents ($n = 37$), nonprofit organizations describe transportation (70%) as the leading cause of air pollution in Delhi, health impacts (81%) as the most commonly cited effect, and new infrastructure and planning (73%) as the most commonly advocated solution (see Table 5). The environment (30%) is sometimes cited as a cause of air pollution due to climatic and seasonal conditions that exacerbate air pollution levels.

Human health is discussed both broadly and specifically in the narratives, as the narratives cite general health issues (such as respiratory and cardiovascular diseases) as well as specific data (such as city and pollution rankings). In addition, qualitative analysis of the coded text reveals that the economic

Table 5. Portrayal within narratives of causes, effects, and solutions for air pollution (as frequency of total).

Causes	
Transport	70%
Industrial production	35%
Environment	30%
Household/business consumption	27%
Other	16%
Infrastructure	14%
Urbanization	14%
Effects	
Health	81%
Economy	19%
Visual aesthetics	14%
Social impacts	5%
Other	5%
Environment	3%
Solutions	
New infrastructure/planning	73%
Regulation	59%
Administrative capacity and enforcement	32%
Research and information	30%
Voluntary	30%
Implement current goals	27%
Other	24%
Market solution	14%

Table 6. Types of actors characterized in narratives (as frequency of total).

Character type	Hero (%)	Villain (%)	Victim (%)
Nonprofits	32	3	0
Government and authority	54	38	0
Supreme court	22	3	0
University and research agencies (inc. WHO)	24	8	0
Media	0	3	0
Wealthy people and car owners	0	11	0
People	14	3	22
Industry	3	14	0

burden to society caused by human health issues is frequently cited as an effect of air pollution (19%). The visual aesthetics characterized by haze and fog are also cited as effects (14%).

The documents characterized actors as heroes, victims, and villains: heroes who seek to solve the problem, villains who exacerbate it, and victims who suffer. Government and authority had the largest representation of the actor categories, divided as heroes (54%) but also as villains (38%), which typically focused on their ability or inability to enact solutions for air pollution (Table 6). Government agencies frequently cited were the Delhi Pollution Control Committee (DPCC) and Ministry of Forests and Environment.

Causes, effects, and solutions for air pollution are often discussed in the context of characters, or policy actors. In this study, cross tabulations were constructed to explore how the actor types are expressed in relationship to the causes and solutions.[9] *Wealthy people and car owners* are described as villains, as some narrators associate car owners with affluence, privilege, and selfishness. *People*—comprised of public, non-wealthy, vulnerable people, pedestrians, and transit users—are portrayed as victims. This points to the value-laden aspect of the narratives, whereby economic inequality and environmental justice issues underpin the narratives. For example, the nonprofits exposed the issue of relocating industries to Delhi's periphery, in areas occupied by poorer citizens, and that those who cannot afford cars, or even bus fare, are most at risk of air pollution. Lastly, the public is represented as a villain in one instance (3%) for preventing the government from effectively implementing its policies. More commonly, the general public, non-wealthy people, vulnerable populations, pedestrians, and transit users are rendered the victims of air pollution.

When actors are characterized as villains, transport is consistently expressed as a cause of air pollution, holding associations with many actors (Table 7). However, the *supreme court*, *university and research agencies*, and *people* were each only coded once in the data set. *Government and authority*, on the other hand, were observed 23 times in the data set and *industry* five times, with both actor types being associated with various causes of air pollution. Urbanization was portrayed as a cause associated with just one villain: *government and authority*. Neither the *media* nor *nonprofits* were villainized in any of the narratives.

The *supreme court* was coded distinctly from the more general *government and authority* category and was depicted as a hero in 22% and as a villain in 3% of the documents. The nonprofits

Table 7. Cross tabulation of villains to causes.

	Theme				
Actor	Transport (%)	Environment (%)	Household/business consumption (%)	Industrial production (%)	Urbanization (%)
Supreme court	100	0	0	0	0
University and research agencies (including WHO)	100	0	0	0	0
Wealthy people and car owners	100	0	0	0	0
People	100	0	0	0	0
Industry	40	20	20	20	0
Government and authority	39	22	17	22	4

commonly praise the supreme court for passing environmental directives, such as compressed natural gas fuel use and bus rapid transit systems. Similarly, *universities and research agencies* are frequently represented as heroes (24%) for releasing studies that expose the air pollution issue.

Industry, primarily representing automobile and petroleum interests, is predominantly described as a villain. In one narrative, however, industry is described as a hero and as a villain within the same article. In this instance, the narrator praised one of the industry's studies calling for more public transport then criticized a second study that the industry had published.

Fifty-four per cent of the documents present *government and authority* as actors, or heroes, who are trying to fix the air pollution problem. This actor group is associated with nearly all solutions, and primarily with regulation, new infrastructure and planning, and administrative capacity and enforcement (Table 8). *Government and authority* is least associated with market solutions. Public–private partnerships as a solution are only associated with *nonprofits* but not associated at all with *government and authority*, which may indicate the one-sided pitch for this particular type of solution. *Media* and *wealthy people and car owners* were not considered heroes in any of the documents. *Industry* was associated with new infrastructure and planning, but only in once in the coded documents. New infrastructure and planning is similarly correlated with all other heroes, perhaps indicating stakeholder engagement in new plans and policies.

The only actor type presented as victims were *people* (public, non-wealthy, vulnerable people, pedestrians, and transit users). Health effects were primarily associated with this victim category, followed by visual aesthetics such as haze and fog. Multiple documents expressed the economic burden of health problems that result from air pollution.

Discussion

In this section, automated text coding and NPF results are used to explore the similarities and differences between news media frames and nonprofit narratives, supported by qualitative analysis of NPF-coded text. Additionally, NPF results guide the extrapolation of automated text coding results to infer word associations (such as causes or effects).

Transportation and health

Although conclusions from automated text coding cannot be drawn regarding intentionality of words used in the news media sample, frequency results from the automated text coding indicating that air pollution frames heavily feature transport and health words are borne out in the in-depth

Table 8. Cross tabulation of heroes to solutions.

	Solution							
Actor	New infrastructure and planning (%)	Regulation (%)	Administrative capacity and enforcement (%)	Market solution (%)	Research and information (%)	Implement current goals (%)	Voluntary	Public–private partnership (%)
Government and authority	24	22	17	3	9	12	12	0
Industry	100	0	0	0	0	0	0	0
Nonprofits	29	26	10	10	13	3	6	3
University and research agencies (including WHO)	29	19	19	5	19	10	0	0
People	27	13	20	7	7	13	13	0
Supreme court	23	23	7	7	10	13	17	0

NPF analysis. Comparative conclusions are cautioned, however, as the samples used for the automated text coding and NPF narratives are from sources with various political affiliations and organizational goals, which impact the narrator's framing strategy.

Transport as a leading cause and health as a dominant effect are already well recognized in academic literature and government reports, so the high occurrence of frames relative to these issues is not surprising. However, exploring these concepts within the context of correlated words provides insight into how the issue is framed. For example, transport is most associated with *government and authority* in the automated text coding and most actor groups are correlated with causes of air pollution and the solution of new infrastructure and planning, which, in the narratives, is predominantly transportation-oriented.

Government and authority

The NPF analysis found that *government and authority* is characterized as both a hero and a villain. The automated text coding revealed that the news media frames the government without solution words. This supports the NPF finding that government is often cited for its lack of progressive action while simultaneously presented as a hero by the narrators, which perhaps suggests narrators want to maintain trust and reciprocity with the government by praising government's good work before offering proposals for the next set of actions.

Solutions

In the automated text coding, *university and research agencies* highly co-occurred with *solutions*. In the NPF results, solution words correlated with *government and authority, nonprofits, supreme court,* and *university and research agencies*. Each actor category showed high correlation with specific solution categories. For example, the specific solution for *research and information* is primarily fulfilled by university and research agencies, but also through air pollution monitoring administered by government agencies (e.g. DPCC). The solution for *new infrastructure and planning* is spread across most actor groups, indicating that most are involved in the air pollution policy process, perhaps through stakeholder engagement in workshops, as extrapolated from qualitative analysis of coded text.

The second and third most proposed solutions are *regulation* and *administrative enforcement and capacity*, respectively. It is logical to expect that *regulation* would correlate predominately with *government* but surprisingly, *regulation* is correlated with most actor categories. Regarding administrative enforcement and capacity, qualitative analysis of coded text reveals that the nonprofits propose (a) inspecting polluting industries, (b) establishing, monitoring and enforcing emissions standards, (c) implementing air quality and management plans, and (d) improving coordination between government departments.

People

The NPF analysis found *people* to be depicted as victims within the narratives, and automated text coding revealed that people are prevalent in co-occurrences with various other concepts. This indicates that narrators draw on many strategies to portray people in the story of air pollution. The narrators express issues of economic inequality in the context of wealthy car owners as villains for which transport planning centres around, juxtaposed against the non-wealthy population who are victims of the rich's actions.

In general, the findings show how different actors play different roles in the news media frames and nonprofit narratives of air pollution issues in Delhi, India. Some actors, such as universities and research agencies, are associated with exploring more broadly the concepts related to air pollution, while government may be more focused on description of the issue itself. As written in a 2013 article from the *Hindustan Times*,

> The CSE [Centre for Science and Environment] made light of the Delhi government's attribution of smog to the winter season only and pointed out the real reason—a manifold increase in pollution levels. It warned that after the initial smog cover lifted, it would come back stronger as the factors responsible for the phenomenon continued to persist. (Blame game over thick smog cover, 2013)

In this textual example from a news article, the government frame is associated with a basic description of increased air pollution as a result of seasonal conditions, but the nonprofit group CSE frame is associated with exploring various and enduring causes of the problem.

In addition to the observation that framing and narrations relate different actors with different aspects of the issue, the findings also show that framing and narrations tend to centre around reducing vehicular pollution, a middle class and above issue, and relocating industries outside of the city into areas with poor settlements. This supports Veron's argument that environmental discourse has been depicted as a middle-class issue (2006). The key argument of Veron's work is that the policy discourse has been framed with middle-class bias in both the dominant environmental nonprofit and supreme court public interest litigations.

Conclusion

Public policy and politics are shaped by multiple forces in any society. In open, democratic societies, two of the most important of such forces are the news media and nongovernment organizations. These sources influence public opinion, government agendas, the legitimacy of governments, the formation of public policy, and the likelihood of achieving short-term and long-term outcomes. This study focuses on the news media and nongovernment actors' portrayal of the air pollution problem in Delhi, India. It uses two methods of data collection, an inductive approach for capturing the framing of air pollution by the news media and a deductive approach for capturing the narratives about air pollution by the nonprofit organizations. The deductive approach draws insights from the NPF's insights on the key structural elements of policy narratives, as well as its methodological approach for coding these elements, and employs it in a previously untested context. In doing so, it stands out as one of the few applications of the NPF literature based on systematic methods of data collection and analysis (Pierce et al., 2014). By exploring media framing and nonprofit narratives, this study is first and foremost an exploration and comparison of methods and secondarily a contribution to theoretical insights into the use of media frames and policy narratives. Since the research was not designed to test theory, however, the theoretical insights that can be gleaned from these results should be considered preliminary. In other words, the study can begin to provide insights into how frames and narratives are presented around a salient public policy issue, but it cannot explain why particular frames or narratives are chosen or how they influence policy outcomes. Despite the limitations of this research for developing or testing theory, this study offers five key contributions to the literature.

1. *Understanding causes and effects of air pollution as a policy issue*: both the media and nonprofit community in Delhi present transportation as one of the leading causes of air pollution and health is one of the dominant, adverse effects from air pollution. The two approaches in this study support similar depictions of air pollution in Delhi (Gurjar et al., 2008; Nagpure et al., 2014). This is one of the first studies that confirms how mass media frames and narratives reflect the conclusions of physical science. The media analysis reveals the frames used in the news media, which reflect scientific depictions of the air pollution problem in Delhi. The results of the NPF analysis also reveal consistency in the references to scientific research in nonprofit narratives.
2. *Demonstrating the feasibility of quantitative data collection on policy framing using existing data*: this research presents quantitative data analysis using systematically collected data in India, which is uncommon as there are numerous barriers to collecting data in India or other developing countries. This study offers an approach for understanding an issue using available data sources, such as newspaper coverage and online content. There are obviously limitations to the generalizability of this approach, including the availability of the internet or different languages. This

study only focused on news media in English on air pollution in Delhi and thereby does not offer the perspective as might be found in Hindi newspapers on the same topic and location.

3. *Applying the NPF in a novel context to raise new research questions*: this research provides one of the few applications of the NPF in developing countries and the second in India (Gupta, 2014). In comparison to NPF studies in the United States (see Pierce et al., 2014), this study shows that villains are rarely used in narratives in the context of air pollution in Delhi, India. This finding suggests that the frequencies of characters used in policy narratives might depend on the culture, the level of conflict, or both. For example, is the relatively low use of villains a result of the Indian culture or the low conflict in the context of air pollution in Delhi? Given the current research design and given a limited number of other applications of NPF, such a question is currently unanswerable. Further study is needed on the intersection of cultural tendency, the level of conflict, and use of characters within the NPF.
4. *Building insights on how policy narratives structure relationships between characters and the causes, effects, and solutions to policy problems*: while this research does not offer direct expectations for how specific characters are likely to be associated with specific causes, effects, or solutions in policy narratives, our research does offer a few notable patterns in how characters and policy problems relate. First, we see that villains are more clustered around a few causes, while heroes are associated with a wide array of solutions. Second, in settings with disputed causes, effects, and solutions—and hence heroes and villains—we find narratives present more solutions than causes. According to Kingdon, these solutions are ideas in the policy "primeval soup" (1984). Many ideas are floated; several do not stick but the purpose of ideas is to push a particular political agenda onto a problem definition. Hence, ideas proliferate. Given that heroes and solutions are linked conceptually in this network, especially in the analysis of online documents, it is not surprising then that the hero/solution connections are more diffuse than villain/cause relationships. This pattern is to be expected given the theoretical background of the NPF, particularly when the causal story and solutions are in dispute or yet to be settled. Although the exploratory nature of this research is not suited to hypothesis testing or generation, the insights of this analysis can contribute to the eventual clarification of hypotheses regarding expectations of characters and their roles in an issue.

Demonstrating the value of two complementary methods of studying complex policy issues: this is a rare exploration of two methods of data collection: an inductive automated analysis of news media framing and a deductive manual coding of policy narratives of nonprofit organizations. While challenging, the use of multiple methods to explore a policy setting lends validity to the results. Such triangulation strengthened the depiction of how an issue, such as air pollution, is depicted in a locale and serves as a promising approach for studying complex issues. In addition, the study explores the potential of automated content analysis to detect frames in news media reporting by triangulating the results against more traditional manual coding. This research can inform a wide range of actors—from international aid donors to local organizations—in Delhi's air pollution policy subsystem. Situated in urban sustainability and policy narratives and news media framing literature, some findings from this study may be informative to air pollution debates in other contexts. Each policy issue, such as air pollution, reflects a rare combination of institutional, political, social, and economic conditions. Additional studies would need to be conducted in different contexts to compare and contrast priorities and perceptions on air pollution.

Air pollution discourse was explored for a critical urban issue in one of the world's most populated and polluted megacities. A novel, systematic social science research method to analyse a policy subsystem was applied. The methods are feasible even when the researcher is far from the study setting and replicable in other study settings, which grants high comparative potential across cities and topics. Future research efforts could focus on applying the same methods to various samples to explore comparability. Samples could be drawn from different sources to explore framing strategies used by various political affiliations or drawn from different regions to explore framing strategies

utilized by diverse populations. News media and other narratives continue to influence discourse, which restraints the arena for future climate adaptation and mitigation interventions (Boykoff, 2010). Failing to establish how an issue is being framed or narrated limits the potential for action by indiscriminately accepting the existing communication strategies of the news media and other policy actors without regard for how that restricts future strategies.

Notes

1. The methods used in this study draw upon different sets of literatures, and consequently a distinction was needed to separate frames and narratives within the two literatures. The automated coding method lends itself to the exploration of frames, while the manual-coding method is better suited to the exploration of narratives. There is a distinction by definition and in application.
2. The sample size of the automated coding document set was constrained by a need to match the timeframe of the manual coding document set. In addition, as this is not a longitudinal study, the timeframe for the documents needed to be restricted.
3. Word sense disambiguation was avoided by employing a manual review of the entire concept list of the text sample and eliminating any value-laden descriptive concepts, such as "harmful" or "suffer."
4. A sensitivity analysis was performed with varying window sizes. The window size was both doubled and halved, with variance as low as 0.33% and at most 15.69%. For this application, variance sensitivity is sufficient to test the stability of the results (Homma & Saltelli, 1996, p. 14). The proportions of the concept co-occurrence did not change.
5. Interviews were conducted with two government officials, a member of an environmental nonprofit organization, and two academics active in the issue area.
6. "Delhi,", "India," and "pollution" were removed from the sample as these were the original search terms.
7. For example, within a window size of 10, the following sentence could occur: "Busses contribute to air pollution." This would prompt a co-occurrence. However, the following sentence could also occur: "Busses do not contribute significantly to air pollution." This would also prompt a hit, but the meaning is entirely different. The word "bus" can be categorized as "transport," but cannot be assumed to be a "cause" frame within the news article.
8. The concept "people" is comprised of: public, non-wealthy, vulnerable people, pedestrians, and transit users.
9. Effects were not included in the analysis of character relationships primarily to maintain comparability with the automated coding, which is limited in its ability to validly identify effects (unlike cause and solution concepts).

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