



Public engagements with smog in urban China: Knowledge, trust, and action

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ABSTRACT

Air pollution in China, increasingly known in policy circles and in popular discourse as “smog” (*wumai*), has aroused broad concern among citizens and in the international community. Although poor air quality has been a feature of urban life for decades in China, public engagement with the issue is a more recent phenomenon. In this article, we examine public knowledge and perceptions of smog, public trust in various sources of information about smog, and various actions, both individual and institutional, that people believe can be effective in managing and mitigating smog.

We draw upon qualitative interviews and quantitative survey data collected in Tangshan, a heavily industrialized city in northern China. Our findings illustrate that smog, with its effects on human health and quality of life, is perceived as a serious concern that people encounter every day. Various information sources on the severity of air pollution, including online media content and mobile apps, are increasingly accessed by the public. Our findings suggest that trust in these information sources is shaped by a variety of demographic factors, especially educational attainment. We also find a sense of ambivalence among study participants about which specific individual and institutional measures can and should be taken to manage and mitigate the effects of smog. We discuss these findings in light of recent research on the role of public awareness and engagement in environmental protection campaigns.

1. Introduction

China's struggle with smog (*wumai*) is not new; it is a predictable consequence of several decades of rapid economic growth with little consideration of the environment. Poor air quality has been a fact of life for hundreds of millions of Chinese citizens for at least twenty years, with well documented effects on human health and quality of life (Johnson et al., 2017; Li and Tilt, 2017). However, the amount of international and domestic media attention focused on smog is new, and so is the rise of China's middle class and its burgeoning environmental consciousness.

Although a variety of terms are commonly used to describe air pollution in China, depending on seasonality, climate and variation across spatial scales, for the sake of clarity and consistency this article adopts the term “smog” (*wumai*), which has been in wide use in policy and public discourse for the past decade, to refer to the phenomenon. Smog is both a growing public health threat and an increasingly salient topic of concern for the general public (Chen et al., 2016; Greenpeace and Peking University School of Public Health, 2015). Since record-high air pollution levels occurred for weeks on end in northern China in

2012 and 2013, the Chinese government has increasingly enforced stricter regulations to tackle smog. The State Council issued the Action Plan for the Prevention and Control of Air Pollution in September 2013, which set up the goal of decreasing $PM_{2.5}$ ¹ by 10% from 2012 to 2017 (Philip, 2014), along with specific instructions of reducing coal consumption by closing polluting mills, factories, and smelters, and switching to other eco-friendly energy sources (Chohan, 2014). The latest plan involves closing outdated industrial plants in industries such as iron, steel, aluminum, and cement and increasing nuclear capacity and other non-fossil fuel energy. According to early stage assessment reports released by the Ministry of Environmental Protection, average $PM_{2.5}$ levels in 74 key cities showed a 23.6% decrease between 2013 and 2015. Despite a few red-alert warnings in early 2017, periods in which daily averages were at hazardous levels for multiple consecutive days, northern Chinese cities are beginning to consistently meet air quality targets.

While smog itself, and the government's responses to the air pollution crisis, have attracted widespread media attention, public engagements with smog remain relatively unexamined. Yet public engagements with smog, including knowledge, perceptions, actions and

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¹ $PM_{2.5}$ is ultra-fine particles in the air that enter the lungs and are smaller than 2.5 micrometers in diameter, $PM_{2.5}$ has been correlated with cardiovascular illnesses and other health problems in epidemiological studies.

practices related to ambient air pollution, are crucial factors driving more effective environmental governance (Qian et al., 2016; Yue, 2006). How much do people in urban China know about the air pollution crisis they face? How do people cope with smog in the context of their daily lives? What are the information sources they trust to obtain data and information about smog? What steps do they believe can effectively mitigate smog, both in terms of individual actions and in terms of coordinated, institutional action?

This article aims to answer these questions, drawing upon data collected via qualitative interviews and a standardized, quantitative survey questionnaire with 444 residents undertaken in 2014 in Tangshan, Hebei province. We measure quantitatively how study participants rated their knowledge about smog, their trust in various information sources, and their views about various institutions and actions they believed were crucial in addressing the smog problem. We interpret

the survey results in the context of qualitative data and narratives collected from study participants about their everyday experiences with air pollution. We also contextualize these findings by drawing on several key interviews with officials within the municipal Environmental Protection Bureau of Tangshan. We interpret our findings in light of theoretical and empirical research in the social sciences about the interconnection between public perceptions, environmental actions, and trust in the governmental institutions charged with regulating air quality (Ajzen, 1991; Koger and Winter, 2010).

1.1. Smog in Tangshan

Our study location is Tangshan, a heavily industrialized prefecture-level city located in northeastern China, under the administration of Hebei province. Hebei borders the mega-cities of Beijing and Tianjin to the west, and is routinely ranked as one of the most polluted regions in China. Real-time data reports consistently show that Hebei province is home to several of the most polluted cities in China; Tangshan is routinely recognized as having some of the worst air-quality ratings in the country. As a major hub of heavy industry, Tangshan produces cement and chemicals, and is the world's largest steelmaking city, producing more than the whole of the United States' output in a single year. In terms of steelmaking, Hebei as a province produced 191 million tonnes of crude steel in 2017, which accounts for nearly 20% of China's total, and Tangshan accounted for over half of that output (DBS Research Group, 2017). Thus, while Tangshan has been playing a leading role in the regional economy for over a decade, the city is currently suffering from serious smog and other environmental ills (Li and Tilt, 2017).

Like most heavily industrialized cities in China, Tangshan has undergone a dramatic transformation in its economy and environment during the past few decades, following a strategy of “pollute first, control later” (*xian wuran, hou zhi li*) or “develop first, clean up later” (*xian fazhan, hou zhili*), a pattern familiar to earlier industrialized regions in Europe and North America (Azadi et al., 2011). Top government leaders have only recently begun to acknowledge the dire environmental consequences of this strategy. Despite the momentum brought by new policies such as the National Action Plan on Air Pollution, Tangshan's Environmental Protection Bureau officials acknowledge the agency's overall lack of capacity for effective enforcement of regulations (Li and Tilt, 2017).

China's war against smog is part of a broader reckoning with the health and environmental catastrophe wrought by rapid industrialization over the past few decades (Gardiner, 2017). Rapid economic growth has lifted hundreds of millions of Chinese citizens out of poverty, and in Tangshan, out of literal ruin, which was caused by the great earthquake in 1976. In many ways, Tangshan's environmental problems reflect the larger environmental crisis in China, which has prompted the government to create and implement more rigid and comprehensive environmental policies. Despite the official data released by the MEP showing a significant decrease in PM_{2.5} in major cities across China by

2017, a Greenpeace report (2017) pointed out that steel production actually increased in 2016, and that this was likely due to pressure on government officials to meet high economic output quotas. This is but one illustration of the dilemma that central and provincial government authorities face in balancing the tradeoffs between economic growth and environmental protection (Hansen and Ahlers, 2017).

2. Public engagements with smog before and after the release of *Under the Dome*

One of the most surprising aspects of China's war against smog is the unprecedented level of transparency embraced by the central government as it encourages the public to get involved in the campaign. The government also widely publishes PM_{2.5} monitoring data and allows the news media to more freely to report on the issue, but this public engagement is not without complications (Kay et al., 2015). In March of 2015, a documentary film *Under the Dome* (Qiongdong Zhi Xia) took China by storm. The film was produced and self-financed by former China Central Television journalist Chai Jing and posted on the Internet, where it was viewed more than 150 million times before being removed by government censors four days later amid fears that it would spark collective protests (Cui, 2017; Branigan, 2015; Wong, 2015). The film uses powerful imagery and emotional storytelling to highlight the human costs of air pollution, especially for the nation's children. The Minister of Environmental Protection, Chen Jining, praised the film and compared its significance with Rachel Carson's *Silent Spring*, which bolstered the emergence of the American environmental movement in the 1960s. At the end of *Under the Dome*, Chai urges individuals to take action in the war against smog.

After viewing *Under the Dome*, according to a study carried out by Cui (2017), more than 80% of viewers expressed that they were deeply concerned about air pollution in China, and approximately 70% of the viewers surveyed said they changed their views of smog and developed a better comprehension of the issue. Meanwhile, over 75% of surveyed viewers conveyed a willingness to take individual actions, such as restricting car usage and taking public transportation more often, to improve air quality. The release of *Under the Dome* has thus deepened public concern and consciousness over smog and potentially increased public involvement in anti-smog campaigns. However, public engagements concerning environmental issues in China did not happen overnight; this story has a trackable history in modern China (Ali et al., 2008; Wang, 2000; Yuan et al., 2002). Over a decade ago, the former Premier Wen Jiabao was already emphasizing the need for better environmental protection practices with implementation of interventions involving strong public participation. Furthermore, grassroots public participation in environmental issues, driven by interest groups and NGOs, has been on the rise for two decades (Haggart and Lan, 2000, 2006; Yue, 2006). However, many experts suggest that public engagement in the realm of environmental decision-making remains passive in practice in China despite the fact that public engagements is endorsed as a political principle by the Chinese government (Li et al., 2012).

Understanding public engagements with China's air pollution crisis has important implications for developing new technologies and policies to manage pollution (Saksena, 2007). A large body of research demonstrates that environmental problems are salient and important issues in both wealthy and poor nations, and that residents of poor nations express as much concern about environmental quality as do those living in wealthy nations (Dunlap and Mertig, 1997; Inglehart, 1995). This is particularly true for people who experience the impacts of pollution on a daily basis. While air pollution's distribution may be regional or even global in scope, people experience it in profoundly local and personal ways (Bickerstaff, 2004; Tilt, 2010).

In China specifically, a growing body of literature on public perceptions of pollution consistently shows that air pollution is a key concern for members of the emerging middle class, and that these concerns have the potential to drive more stringent policy controls at

various levels of government (Mol and Carter, 2006; Li and Tilt, 2017; Zhang et al., 2014). Recently, several studies have explored attitudes and behaviors in response to air pollution in China, including public knowledge and perceptions of air pollution in northern China (Yan, 2016; Lan et al., 2016; Liao et al., 2015; Li et al., 2016; Wang et al., 2015). To a great extent, public perceptions of air pollution are bound up with people's daily experiences. As Hansen and Liu (2017) observe based on fieldwork in Zhejiang Province, people's perceptions of air quality are entwined in their ideas about economic development, their aspirations for a higher quality of life, and even prominent national discourses such as 'ecological civilization' (*shengtai wenming*) currently promoted by the government. The choices people make about how to cope with pollution on a daily basis are also constrained by personal, social and demographic factors such as income, class, gender and educational background.

In China, public engagement can take many forms including discussing environmental issues, using microblogging platforms involving public figures and government agencies, and participating in environmental campaigns (Fedorenko and Sun, 2016). However, the Chinese government's attitude toward such activities varies depending on the issue at hand (Tang et al., 2008). In certain areas, such as forest management and water resources, public engagement is widely encouraged. By contrast, in cases where environmental issues are linked to human rights, ethnic tensions, or high-level economic decision-making, the government constrains public action. For example, public protests in several major cities against the manufacture of paraxylene (PX), a chemical with major public health and safety concerns, have met with strong government censorship (Martens, 2006; Xie, 2016). Although China has gradually taken steps to increase public engagement in order to overcome weak environmental enforcement, many obstacles remain (Tang et al., 2005; Martens, 2006; Johnson, 2010). The public still plays a limited role in environmental protection (Mol, 2006), and these public engagements are affected by people's perceptions, which in turn are shaped by access to trustworthy information sources (Ke, 2014).

The media can play a crucial role in shaping public perceptions. Environmental coverage in the Chinese media has been on the rise since the 1990s (Yang and Calhoun, 2007; Xie, 2012). However, because of the close relationship between the government and the media in China, many media outlets frame their coverage in ways that are favorable toward the government and the Chinese Communist Party (Chen et al., 2011; Huang and Yang, 2017; Wu, 2009). However, the release of *Under the Dome* stirred the public on the issue of air pollution in unprecedented ways. As public dissatisfaction accumulates regarding poor air quality, the central government has begun to realize the importance of including public opinion and public action in the policymaking process (Johnson et al., 2017).

3. Research methods

Data collection methods for this study included semi-structured interviews and a standardized, quantitative survey, supported by site visits and key interviews with environmental protection officials within the Tangshan municipal government. We used an intercept point survey approach to recruit middle-class, urban study participants in public places such as shopping centers. The intercept point sampling method is a non-probability sample (i.e., non-random) and therefore does not allow us to make generalizations about the Chinese public at large. However, it is a convenient and cost-effective way to collect large amounts of data and, if carefully conducted, can yield a study sample similar to a probability sample (McKenzie and Mistiaen, 2009; Keiding and Louis, 2016). Our results are thus meant to be viewed as a close examination of urban residents in Tangshan, rather than a nationally representative picture of China as a whole.

Data collection proceeded in two phases, and was carried out by the first author and four research assistants during 2014. Phase One consisted of 30 semi-structured interviews (14 women and 16 men, ranging

in age from 20 to 68). The interview protocol contained open-ended questions about study participants' perceptions and attitudes about smog, its influence on their daily activities, and its management and control.

Phase Two of the study, which employed a standardized survey questionnaire, included modules on personal background and demographics, plus sections specifically designed to understand knowledge and perceptions related to smog; access to, and trust of, various sources of information related to smog; and actions and behaviors, both individual and institutional, that study participants believed were effective in managing and mitigating smog. These questions were structured on a five-point Likert scale. The first author and research assistants administered the questionnaire to 477 Tangshan residents using the intercept point sampling method described above. A total of 444 valid surveys containing complete data were returned, resulting in a 93% response rate. In terms of basic demographic characteristics, our sample was 41.5% male and 58.5% female, with an average age in the late thirties, some educational attainment beyond secondary school, and a median household monthly income just under RMB 3,000, which is similar to the median income for Tangshan as a whole. This mixed methods approach allows us to better understand the conflict, complexity, and tradeoffs between air quality and public engagements of Tangshan residents.

4. Results

4.1. Breathing the smog: public knowledge and perceptions

The major contributor to Tangshan's smog problem is heavy industry, including coal-fired power plants and steel production. Automobile emissions also represent a significant and growing source of ambient pollution. Our survey data show that Tangshan residents consider smog to be a severe problem that affects their daily lives. Over half (56.2%) of the study participants considered the smog in Tangshan severe or very severe, while only 21.4% considered it not severe. More than 70% of study participants indicated that they were concerned or very concerned about air quality.

However, despite such high rates of concern over ambient air quality, residents in Tangshan had an incomplete understanding of the smog they faced every day. We collected responses on the question of "how much do you know about various aspects of smog?" We asked participants to rate their knowledge from one (not knowledgeable at all) to five (very knowledgeable) on a range of aspects related to smog that had been mentioned by study participants in the qualitative interviews. Results are shown in Fig. 1.

Although the term "smog" is now commonly used by the media and in weather reports, it is actually a new word in the Chinese language, combining two characters: *wu* meaning fog, and *mai* meaning haze (Li and Svarverud, 2017). It has been in common usage in China for only about ten years. When asked how well they understood the term "smog," 67.1% of study participants rated themselves as "somewhat knowledgeable," and the mean response among participants was 3.87. In qualitative interviews, many participants expressed that they frequently encounter the terms "smog" and "PM_{2.5}" in their daily lives and in the media.

To assess public perceptions of the severity of smog and its impacts on their lives, we provided study participants with a series of statements and asked them to indicate their level of agreement (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree). Results are shown in Fig. 2, which shows widespread consensus that smog affects daily activities, has negative health consequences, and is more hazardous for vulnerable groups such as children as compared to healthy adults. Interestingly, the statement with the lowest level of agreement pertained to the statement, "Smog is very severe in the area where I live."

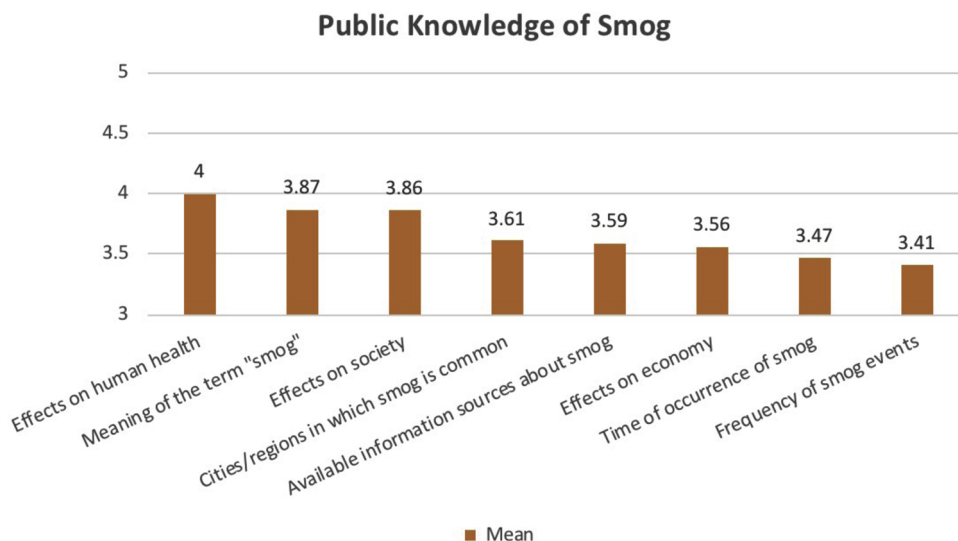


Fig. 1. Knowledge of smog in Tangshan (N = 444), level of knowledge are coded as 1 = Not knowledgeable at all, 2 = A little knowledgeable, 3 = Not sure, 4 = Knowledgeable, 5 = Very knowledgeable.

4.2. Trust and information sources

The Chinese Communist Party has long been accused by the international community of censoring the media for political purposes and to control public opinion. However, within the past decade, the central government has embraced some media transparency, at least on topics that have become widespread concerns for the middle class, such as the environment and healthy living conditions (Tilt and Xiao, 2010). As in most countries, Chinese citizens routinely consume news and entertainment media on television, on the Internet, and via popular social media platforms. In an effort to understand where the public obtains information regarding smog, and their level of trust in various information sources, we composed a series of rating questions about how trustworthy each information source was perceived to be (1 = don't trust at all, 2 = trust a little, 3 = neutral, 4 = trust, 5 = strongly trust). Results are shown in Fig. 3.

Our data show that government media (which mainly refers to media sources such as CCTV) enjoy the highest trust levels, followed by domestic scholars and mobile apps (which tend to draw from Ministry of Environmental Protection data to display real-time monitoring of air pollution). Foreign media sources and foreign scholars are trusted somewhat less, followed by word of mouth.

Various demographic, social and cultural factors can shape how people consume different media and take in different information sources. In particular, recent research suggests that educational attainment plays an important role (Lee 2010). In order to examine how educational attainment affected trust in various information sources about smog among our study population, we conducted a basic relational data analysis using the one-way analysis of variance (ANOVA). We categorized education level into five groups, including 1 = elementary school and lower, 2 = high school, 3 = technical school, 4 = bachelor's degree, 5 = master's degree and higher. Results are reported in Table 1.

We found a statistically significant relationship between education level and trust in foreign media sources ($F(4, 411) = 4.623, p = .001$), indicating that participants who held higher levels of education (a college degree and higher) put more trust in foreign media. We also observed a statistically significant relationship between education and trust in foreign scholars ($F(4, 406) = 3.926, p = .004$); although the effect size is minimal (Vaske, 2008), it suggests that study participants with higher educational attainment tend to trust foreign scholars more. Finally, we observed a negative relationship between education level and trust in word of mouth ($F(4, 409) = 4.542, p = .001$) with a minimal effect size, indicating that people higher educational

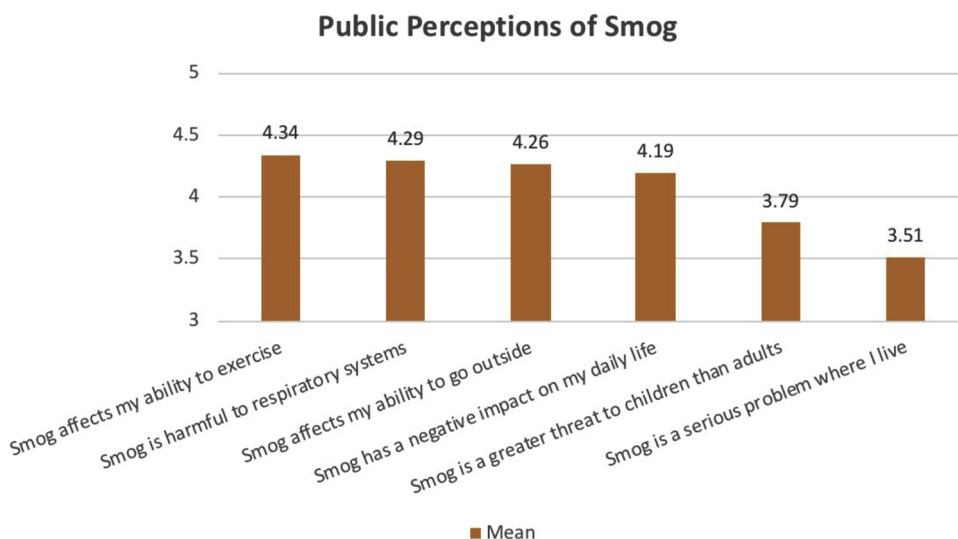


Fig. 2. Perceptions of smog in Tangshan (N = 444), level of agreement are coded as 1 = Strongly disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly agree.

Trust of Information Sources

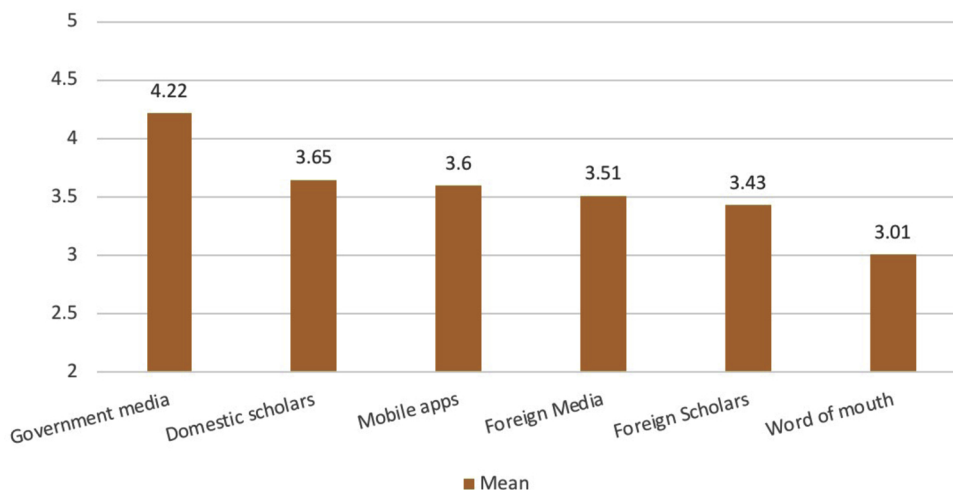


Fig. 3. Trust of various information sources (N = 444), level of trust are coded as 1=Do not trust at all, 2=Trust a little, 3=Neutral, 4=Trust, 5=Strongly trust.

Table 1

One-way ANOVA results for the correlation between education levels and trust sources.

	F	Sig. (p-value)	Mean ^a	SD	Effect size (η^2)
Government media	2.079	.083	1.79	.883	0.02
Foreign media	4.623	.001	2.50	.894	0.04
Domestic scholars	1.619	.169	2.36	.899	0.02
Foreign scholars	3.926	.004	2.57	.895	0.04
Mobile apps	2.301	.058	2.40	.887	0.02
Word of mouth	4.542	.001	2.99	.990	0.04

^a Questions were coded into SPSS as 1=don't trust at all, 2=a little trust, 3=neutral, 4=trust, 5=strongly trust.

attainment place less trust in smog-related information they obtain through word of mouth.

4.3. Dealing with smog: individual and institutional actions

As a final step in our analysis, we asked survey participants to rate their agreement level with statements about specific actions – at the individual level and in terms of coordinated government action – that can be taken to reduce smog or mitigate its effects. The range of possible individual actions were drawn from the semi-structured interviews and included: wearing face masks; wearing professional-grade face masks; opening doors and windows to improve air flow; minimizing going out; adjusting diet; washing skin exposed to air pollution; using an air purifier at home; avoiding disposable products; and taking public transportation. Results are shown in Fig. 4. All items were seen as generally effective means to mitigate the effects of smog, although there is considerable variation across the item scores.

Narratives from the qualitative interviews help to interpret these findings. When asked whether she actually did one or more of the above-mentioned practices, Ms. Wang, a woman in her thirties, shared her insights:

“(chuckles)...I do wear face masks most of the time during the year. I rarely think about wearing masks to avoid the pollution, but more for the warmth it brings in winter.... I ride my e-bike to work every day, and wearing a mask saves my skin from cracking. ... Also I wear laced masks in warmer weather to block the sun. I have never bought any professional-grade masks, I think they are ugly.”²

Moreover, many study participants indicated that they had to balance their concerns about air pollution against the other demands of life, and that this influenced their range of behaviors in response to air pollution. Another young woman in her twenties, also surnamed Wang, commented:

“I live very close to where I work, so it would make sense to just walk or bike to the company. Ideally, I would be able to breathe fresh air on the way, but we don't have that here. So I have to drive every day, even if it only takes five minutes. . . Everyone drives, and I certainly don't want to be the one who breathes in all the polluted air while walking or biking... I understand the concept of protecting the environment. I would love to 'go green' and to make it a part of my daily life, but I think it's too hard in my current situation.”³

Similarly, another interview participant, Mr. Zhao, who is in his late forties, expressed a reluctance to reduce his personal driving, but from a completely different perspective:

“... Drive less? Why? I enjoy driving! ... (scoffs) I don't think it matters that much. If I started to drive less, would the air quality get better? Would the sky turn blue? Everyone has cars, everyone drives. It would feel like a loss of face if you didn't drive or if you didn't have a nice car.”⁴

These narratives illustrate the gap between perceptions and actions in the arena of air pollution. Despite widespread agreement about the severity of smog and the importance of taking individual action, people are constrained by social status, economic needs, and personal feelings when it comes to engaging in the war on smog.

Beyond individual action, we also sought to understand public support for various governmental measures to reduce smog. Survey respondents showed a high level of agreement with each measure, including: limiting vehicles, more stringently regulating polluting industries, spraying water to mitigate dust, restructuring the energy sector, prohibiting fireworks, increasing urban green spaces, establishing an inter-agency body to reduce pollution, and promoting public awareness of environmental problems. Results are shown in Fig. 5.

Support for strong governmental action is also reflected in the qualitative interviews. Despite their support for individual actions to avoid smog or mitigate its effects, many interview participants

² Interview, September 18, 2014.

³ Interview, September 3, 2014

⁴ Interview, August 29, 2014

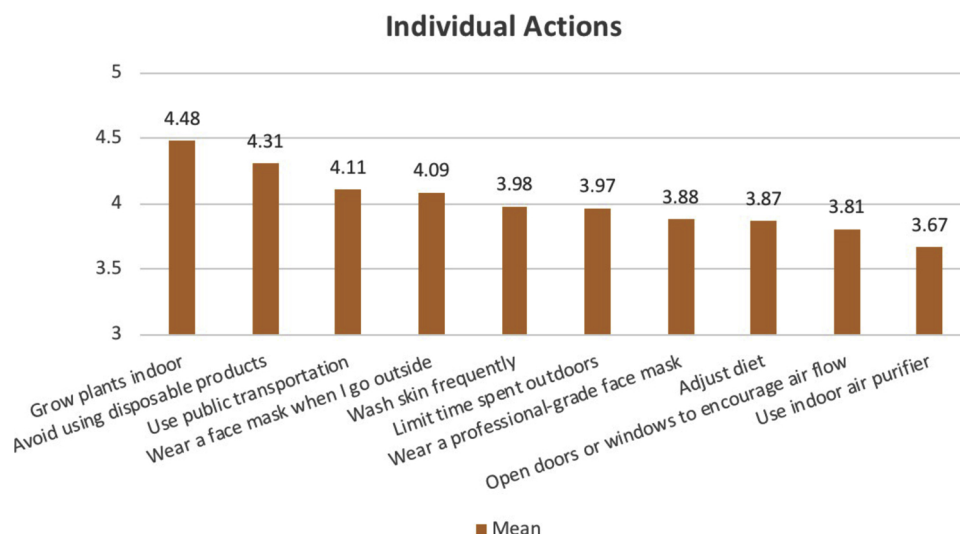


Fig. 4. Individual actions perceived to cope with smog (N = 444), level of agreement are coded as 1=Strongly disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly agree.

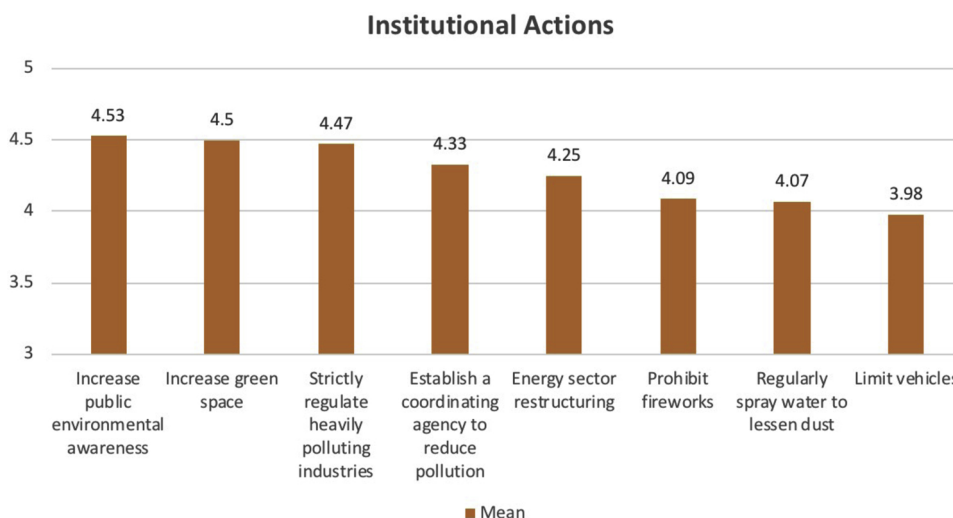


Fig. 5. Institutional actions perceived to tackle smog (N = 444), levels of agreement are coded as 1=Strongly disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly agree.

expressed pessimism that individual actions could ever meaningfully and significantly reduce smog. These participants frequently used phrases such as “Ordinary people can’t do anything” or “It’s up to the government.” Mr. Liu, a retiree in his early sixties, conveyed this sense of fatalism:

“I survived the great earthquake (in 1976), but I think I will die from choking on this smog. ... There is so little that ordinary people can do to stop pollution. It’s up to the government. If the government does not want to shut down the polluting factories, all we can do is watch the black smoke rise from the chimneys. Tangshan has been polluted for so long. Look at those factories; they are still open and workers are still working. ... Vehicle limitation is not a good policy, because it causes so much inconvenience for ordinary people. This is not Beijing, we don’t have that much traffic or political functions, it seems senseless to me to carry out such policy. But we have to follow what the government says.”⁵

Another interview participant, Mr. Huang, who is in his fifties, shared a similar skepticism:

“I think it’s very simple: if the Tangshan government would shut down the steel factories, the air quality would get much better. But then the government wouldn’t have much GDP (laughs). Those industries made Tangshan wealthy, but they also brought the smog. We ordinary people can only follow the [Communist] Party. I think that if they could improve our quality of life so much within just a few decades, then they are definitely capable of cleaning up the air pollution. The only question is whether they want to or not.”⁶

5. Discussion and conclusion

Smog is an increasingly severe public health problem in many developing countries. In China, where environmental degradation has accompanied rapid economic growth, air pollution is now a major focus of public concern, media attention, and governmental policymaking. Residents in Tangshan, like their counterparts in many heavily industrialized areas throughout China, face a daily battle with smog and

⁵ Interview, September 4, 2014

⁶ Interview, September 15, 2014

its effects on their health and quality of life.

Using qualitative interviews and a standardized survey questionnaire, we have examined public knowledge and perceptions about smog, people's level of trust in various information sources, and people's perceptions of various actions that can be taken, individually and through government policy, to improve the situation. Our findings on self-rated knowledge about air pollution among the public resonate with previous studies carried out with urban residents in the south-eastern Chinese city of Guangzhou (Gu et al., 2013) and in the city of Ningbo (Qian et al., 2016), although the latter found evidence of greater knowledge and familiarity with smog among the public. Our findings also illustrate that smog, with its effects on human health and quality of life, is perceived as a serious concern that people encounter every day.

Recent research suggests a sense of ambivalence among the Chinese public when it comes to taking specific measures to address the smog problem (Chen et al., 2015). Our findings confirm this ambivalence and suggest that it stems from several sources: the need to balance concerns about air pollution with other economic and social concerns common to urban life; a lack of clarity about which individual actions can most effectively mitigate the effects of air pollution; and a sense of skepticism about whether local and regional governmental authorities will promote environmental protection if it means undermining economic growth. In terms of individual actions to combat pollution, there seems to be a gap between those measures that most people agree need to be taken and those that people are willing to enact themselves on a regular basis.

According to Pei and Li (2014), television and the internet are replacing traditional newspapers as the most common means through which the public obtains information about ambient air pollution. Our findings suggest that, even with a wider range of information sources than ever before, citizens continue to place the highest level of trust in government media sources when it comes to information about air quality. Educational attainment also shapes how people consume various media; more highly educated individuals tend to place greater trust in foreign information sources and also tend to be cautious about word of mouth as an information source about pollution.

Thinking beyond the Chinese context, our findings resonate with social science research on the theory of planned behavior (Ajzen, 1991), which uses social-psychological principles to explain why people's attitudes and intentions may not match their actual behavior and actions. Demographic factors, along with social, cultural, political and situational context, can influence how individuals and groups think and act on environmental issues in general (Koger and Winter, 2010) and in relation to air pollution specifically (Bickerstaff, 2004; Barr and Gilg, 2005). Moreover, public perceptions are tied to the amount of trust people place in the governmental institutions charged with regulating and controlling pollution (Siegrist and Cvetkovich, 2000).

Although public engagement in environmental issues, especially in the air-quality arena, has been growing in recent years, significant barriers will need to be overcome in the future if China is to see durable improvements in air quality. One key barrier is the widespread perception that environmental protection is solely up to the government (Chen and Hua, 2006). This view, grounded in China's long-standing tradition of top-down governance, minimizes the importance of public perceptions and engagement, making it more difficult to involve citizens in environmental action. This is gradually beginning to change, and researchers are increasingly showing that public concerns are driving more stringent environmental policy at various levels of government (Mol and Carter, 2006; Qian et al., 2016; Li and Tilt, 2017; Zhang et al., 2014). However, it is important to note that public engagements in environmental issues in China is not solely related to political governance; rather, it is deeply embedded in the ways environmental issues are perceived and understood among different stakeholders (Tilt, 2006; Lora-Wainwright, 2013).

China's central government is acutely aware of public dissatisfaction

over poor air quality and has repeatedly stated its commitment to tackling the problem. Public engagement will be a crucial part of the solution. As a 2002 UN Development Program report on the potential for sustainable development in China observed, public environmental awareness and concern are important factors driving environmental improvements worldwide, and a well-informed society is a necessary precondition for successful environmental protection campaigns (Liu and Leiserowitz, 2009). If long-term progress toward addressing China's air pollution crisis is to be made, public engagement, particularly among the growing urban middle class, will undoubtedly be a driving factor.

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