

# The Inadequate Life: Rural Industrial Pollution and Lay Epidemiology in China\*

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## Abstract

Based on fieldwork in a heavily industrialized Yunnan village, this article examines how villagers understand and respond to pollution-related health risks. Building on Robert Weller's (2006) concept of environmental consciousness, it shows that Baocun villagers have developed an acute environmental health consciousness. However, despite earlier instances of collective activism, they no longer act as a community to oppose the harm to their bodies caused by pollution. The article investigates the role of uncertainty surrounding illness causation in deterring action. It argues that uncertainty about pollution's effects on health is reinforced by the social, political and economic contexts and developments in the past few decades. As a result, villagers engage in a form of "lay epidemiology" to make sense of the effects of pollution on their health, but not in a "popular epidemiology" consisting of collective action against presumed health damages. The article concludes with some thoughts on how locals act within and despite uncertainty.

**Keywords:** lay epidemiology; popular epidemiology; industrial pollution; health effects; uncertainty; activism; China

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Pollution and illness are major concerns for China's population at large. Recently, citizens have become increasingly vocal about environmental health concerns ranging from food safety to occupational health, waste and industrial pollution.<sup>1</sup> However, their efforts to seek redress are fraught with immensely complex contestations surrounding what is evidence of exposure and of impact. The heavily industrialized field site I studied, Baocun village, is affected by a range of illnesses that may be correlated to types of pollution prevalent locally. While villagers are concerned about the potential effects of pollution on their health, they engage in very limited collective efforts to limit it. This article examines the factors which created and maintain this discrepancy.

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1 See other articles in this collection.

A number of excellent social science studies of environmental health have emerged in the context of the developed and, most recently, the developing world (see below). They have explored issues of uncertainty surrounding illness causation, lay understandings of health, and the factors that motivate citizens to mobilize against pollution. This article applies these insights to the study of perceptions of environmental health and activism in industrialized rural China. Drawing from this literature, it describes a gap between a strong “lay epidemiology” (perceptions of illness causation where pollution features alongside a range of other factors) and a weak “popular epidemiology” (activism demanding a decrease in pollution based on its perceived threats to health). It argues that the interaction between uncertainty surrounding illness causation (evident in lay epidemiology) and local power relations is at the root of weak anti-pollution activism.

Studies of environmental consciousness have tended to focus on the urban middle classes. According to the “post-materialist” thesis, concerns for the environment only arise among those who are not preoccupied with meeting their basic subsistence needs. The poor, in other words, cannot afford to care. Writing against this view, Robert Weller argues that the rural Chinese he studied *are* “concerned about environmental effects on the health of their children and the quality of their crops... They lack environmental consciousness only in the sense that they are not concerned with the same issues as national and global elites, or as people who write questionnaires about values.”<sup>2</sup> With this in mind, he argues that it is at the least inaccurate to accuse people of lacking an environmental consciousness if the parameters used to assess it are different from those used by local people themselves.

Premised upon Weller’s understanding of environmental consciousness, this article examines the origins and implications of the parameters of environmental health consciousness which emerged in Baocun village. It argues that these very parameters are inseparable from local power relations and in turn affect villagers’ attitudes towards collective action against pollution. Many examples suggest that Baocun villagers are concerned about the deterioration caused by industry and its effects on health. However, by and large, they do not premise their complaints to local industries upon claims of damaged bodies. This article explains why, despite having a fairly strong sense of such harm, locals’ complaints focus largely on compensation for damaged crops rather than on harm to health and demands for a decrease in pollution. Overall, this shows the extent to which the local population is powerless to stop pollution, even when it is so clearly alarmed by it. It is not ignorance of the threat which curtails collective action, but a lack of sense of entitlement to a clean environment rooted in the local political economy.

The article begins with an introduction to the analytical concepts of popular epidemiology and lay epidemiology, and considers their applicability and

2 Weller 2006, 157.

usefulness. It provides an account of the methodology employed, and of Baocun's industry and potential environmental health problems. It then illustrates the various ways in which an environmental health consciousness has come into being and the forms it has taken. Against this backdrop, it probes the absence of a full-blown popular epidemiology focusing on uncertainty, its origins and its effects on locals' attitudes and responses to pollution. It examines past activism against pollution in Baocun and its current refashioning in light of recent studies of pollution and its social, political and economic contexts in China, particularly economic dependency, compensation and community divisions. This shows that uncertainty is closely intertwined with local economic and political configurations. In combination, these undermine the potential for collective action. The article concludes that villagers have a sophisticated understanding of environmental health and its risks, and display complex lay epidemiologies, but act individually rather than collectively to protect themselves despite the limited effects of individual efforts. This has worrying implications.

### **Popular and Lay Epidemiology in Industrialized Rural China**

Environmental health is a field ripe with contestations. Many of these arise as a consequence of scientific uncertainty in both toxicology and epidemiology. As the introduction to the influential volume, *Illness and the Environment*, puts it, “virtually all diseases and conditions that can be attributed to environmental causes are highly contested and the source of considerable confusion, anger and resentment.”<sup>3</sup> In this context, citizens often engage critically with scientific evidence. The field of citizen science has raised important theoretical and analytical questions on the contestability of science, competing definitions of evidence, and the role of citizens in mobilizations on local, national and transnational scales.<sup>4</sup> Popular epidemiology is one example of an environmental health-focused citizen science. It may be defined as “the process by which laypersons gather scientific data and other information, and also direct and marshal the knowledge and resources of experts in order to understand the epidemiology of disease.”<sup>5</sup> Just as importantly, it may involve the local population resorting to their embodied experience as evidence of pollution's harm and conducting their own place-based surveys to map particular ailments onto the physical presence of factories, dumps, incinerators, or even manufactured products.<sup>6</sup> Indeed, popular epidemiology regards human experience as a valid mode of knowing and highlights citizens' key role in developing scientific investigation.

This literature is useful in posing questions on the role of citizens in environmental health contestations in China. However, neither citizen science nor

3 Brown, Kroll-Smith and Gunter 2000, 9.

4 Literature on citizen science is vast and growing. See, for instance, Callon, Lascoumes and Barthe 2001; Irwin and Wynne 1996; Leach, Scoones and Wynne 2005.

5 Brown 2000, 266.

6 Murphy 2006, 107.

popular epidemiology has been systematically applied to the study of the region. While Chinese citizens have increasingly contested environmental pollution through instances of activism, resorting to new media and to environmental NGOs, there is little sign of an emerging popular epidemiology in rural areas (with the exception perhaps of environmental health-oriented activism in “cancer villages”).<sup>7</sup> This article will illustrate why this may be the case. The absence of a social movement premised on pollution’s effects on health is partly due to the inherent complexity of environmental health and the difficulties in gathering scientific evidence that particular ailments can be conclusively traced to exposure to particular chemicals. Villagers’ uncertainty is consonant with the vast and growing amount of literature on the contested nature of environmental health problems.<sup>8</sup> Yet, the absence of an environmental health social movement stems not only from the nature of the hazard, but also from the nature of society.<sup>9</sup> In Baocun, uncertainty about pollution’s effects on health is perpetuated because of local power relations and social, political and economic contexts.<sup>10</sup>

A number of recent qualitative social science analyses of environment and health in China have begun to highlight the importance of social and economic dependency and wider opportunity structures in shaping the local population’s perceptions of, and responses to, pollution.<sup>11</sup> This article argues that dependency, (limited) opportunity structures and past experiences with seeking redress all serve to reinforce locals’ sense of uncertainty in attributing illness to pollution. Uncertainty in turn further crystallizes these economic and political configurations by undermining the villagers’ ability and willingness to claim that they are physically harmed by pollution and to act collectively on this basis. The absence of popular epidemiology in Baocun is a result of these dynamics and effectively stops the local population from even conceiving of demanding a clean environment.

Popular epidemiology is a politically-driven concept. It is, above all, an example of an environmental justice movement couched in deeper social injustices in which local populations mobilize against pollution. The concept of lay epidemiology as it was developed by Frankel, Davison and Davey Smith outlines a rather different territory. They define lay epidemiology as “a scheme in which individuals interpret health risks through the routine observation and discussion of cases of illness and death in personal networks and in the public arena, as well as from formal and informal evidence arising from other sources, such as television and magazines.”<sup>12</sup> Whereas popular epidemiology focuses on one causal factor alone (pollution) as the basis for political action, lay epidemiology outlines a

7 Chen and Cheng 2011a. For an urban example of popular epidemiology, see Johnson 2013.

8 See, for instance, Kroll-Smith, Brown and Gunter 2000; Callon Lascoumes and Barthe 2001; Murphy 2006.

9 Kasperson and Kasperson 2005.

10 Auyero and Swistun 2009.

11 Deng and Yang 2013; Lora-Wainwright, Zhang, Wu and van Rooij 2012; Tilt 2006; Yang 2010; van Rooij 2006.

12 Frankel, Davison and Davey Smith 1991, 428.

range of interacting causal factors which are less likely to lead to contention. In the Baocun context, lay epidemiology is analytically useful in portraying perceptions of pollution as only one potential cause of illness.

The embeddedness of locals' environmental health consciousness in a wider lay epidemiology is at least partially a result of industry's position in the local context. Knowledge of pollution cannot be separated from the many other challenges locals face – such as finding work, paying for healthcare and improving their family homes.<sup>13</sup> As industry becomes enmeshed with the local community and locals become more and more closely tied to their place of residence, pollution can come to be regarded as a fact of life and only one of a number of potential causes of illness. Attention to lay epidemiology situates experiences of pollution within the wider context. It shows that locals are concerned about pollution but uncertain about whether they can attribute particular symptoms or illnesses to it. This article focuses on the forms of lay epidemiology villagers engage in and examines why they do not lead to popular epidemiology.

### Methodological Strategies

Research for this project was spearheaded by the NGO Yunnan Health and Development Research Association (YHDRA), as part of the China Environment and Health Initiative based at the United States Social Science Research Council. YHDRA recruited a small team of researchers, including one of its own project officers, Zhang Yiyun 张艺蕴. I served as a key consultant to the project and as a fieldworker. Fieldwork was arranged with the assistance of two additional consultants, Wang Qiliang 王启梁 from Yunnan University's School of Law, and Benjamin van Rooij (Amsterdam University), and took place between April and July 2009.<sup>14</sup> The project focused on one site which we called Baocun village, a fairly large administrative village less than 40 km from a large city in a heavily industrialized area of Yunnan. It has a total registered population of over 2,000, but also accommodates 10,000 migrant workers attracted by work opportunities in the local industries and mines.

Baocun is divided into five sub-villages (roughly mapped onto natural villages). The most affected by industry, Tacun, served as the key focus of research. Interviews were also carried out in other sub-villages, particularly Sancun and Qingcun. Fieldworkers conducted roughly 100 interviews with men and women, younger and older residents, formal residents and migrant workers, those employed by industries as well as those engaged in other activities, such as farming or running small shops. Interviews lasted a minimum of half an hour and, in some cases, ran for several hours. Some villagers were interviewed twice to clarify particular points raised in the first interview. Fieldworkers

13 Auyero and Swistun, 2009; Irwin, Dale and Smith 1996.

14 Given the sensitivity of the research focus, it was not possible to conduct fieldwork for a longer period of time or more extensive participant observation.

lived with local families during the research and this also provided them with vital opportunities for more informal exchanges and participant observation.

The project aimed to unravel how a population living with severe pollution comes to understand its effects on health. However, it was presented to the local officials and population as a project on public health and health system reform. This was partly intended to ease access to the site; but framing the research in such a way was also of vital importance to data collection. Introducing the research as focused on the link between pollution and health would have sensitized respondents to this concern and may have biased answers to questions about pollution's effects on health. This would not have allowed researchers to assess how serious the concerns about pollution's effects on health were for the local population, and how they relate to other concerns.<sup>15</sup>

### Baocun's Industry and Environmental Health

Baocun village, the township of which it is part, and neighbouring towns are heavily mined and industrialized. The main industry in Baocun is the very large, formerly state-owned fertilizer plant which I call Linchang. Production started in 1982, mainly centred on cement, insoluble neutral calcium phosphate ( $\text{Ca}_3(\text{PO}_4)_2$ ), and sulphuric acid ( $\text{H}_2\text{SO}_4$ ). In 2001, reforms were implemented in Linchang and it was transformed from a state-owned enterprise into a joint-stock company, still partly owned and administered by the provincial government, but also, from 2005, forming part of a multinational corporation. In 2006, Linchang produced 1.85 million tons of phosphoric acid ( $\text{H}_3\text{PO}_4$ ), 550,000 tons of sulphuric acid ( $\text{H}_2\text{SO}_4$ ), 300,000 tons of ammonium dihydrogen phosphate ( $\text{NH}_4\text{H}_2\text{PO}_4$ ), 18,000 tons of potassium sulphate ( $\text{K}_2\text{SO}_4$ ) and 35,000 tons of sodium hexafluorosilicate ( $\text{Na}_2\text{SiF}_6$ ). Alongside Linchang, there is a plethora of privately-run mines and 14 small and medium industries which provide much of the supporting infrastructure for Linchang's resource extraction and processing.

A number of the chemicals processed and used in these industries are epidemiologically correlated to a variety of health problems. Short-term exposure to phosphorous in the air may cause acute phosphorous poisoning, which damages the liver and kidneys. Long-term exposure, even in a low dose, can cause chronic phosphorous poisoning which results in damage to teeth and the mandible, as well as liver and kidney damage. Breathing mercury fumes causes severe damage to the central nervous system and the oral cavity. It can also result in respiratory, gastrointestinal or kidney diseases. Fluorosilicate dust harms the lungs and irritates eyes and skin. Excessive fluoride can lead to fluorosis, which causes dark stains and cracking on teeth, joint pain, joint stiffness and, in its more severe

15 For more details on methodology, see Lora-Wainwright 2013.

forms, can lead to osteoporosis, arthritis, calcification of ligaments and impaired joint mobility. All of these ailments are locally prevalent, both according to residents of Baocun and to local doctors, and respiratory problems in particular featured prominently in in-patient records collected at the local community health centre in 2008.

Villagers' lay epidemiology correlated a number of common ailments to pollution. Many argued that the "poisonous air" (*du qi* 毒气) emitted by local industries caused nose and throat infections, chronic lung diseases, nose bleeds and decreased life expectancy. Guo Lin, a 31-year-old man born and raised in Tacun and employed in Linchang as a crane driver, argued that the local lifespan had decreased to around 60 because of water polluted by fluoride and mercury. A 28-year-old man, whose parents had worked in Linchang, argued that "breathing poison makes you age faster" and regarded the prospect of living past 50 as an achievement. He warned us "you will have lost a few years just by coming here a few days." Most residents complained of painful joints, which some referred to as "rheumatism" (*fengshi* 风湿), and of pain and swelling in their hands and feet (a form of fluorosis according to the public health expert on the research team). Indeed, it was common to see young adults with Chinese medicine plasters to treat rheumatic symptoms.

Many suspected that crooked teeth may also be linked to pollution. Guo Lin, for instance, said that his son's teeth were unhealthy and that he himself had lost half of his lower teeth. Immediately following his account of water pollution, he also noted that many people suffered with kidney and gall stones. He estimated that the incidence rate might be as high as 40 per cent. Indeed, many of those we interviewed had experienced these problems, as well as appendicitis. Some suspected that pollution posed a particular threat to children. Guo Lin argued: "it certainly affects them, especially their bones and teeth. My child is shorter than others from outside the village, as if he were one or two years younger. My nephew has impaired cognitive skills. He is 11 but only up to six or seven in terms of intelligence. I am not sure why." Thirty-one-year-old Zhangjie worried for the welfare of her daughter and, in particular, that persistent nose infections might result in memory loss. Given these fears, one young man who had two children already reflected that he would not want any more because he could not be sure what the effects of pollution would be on them and feared that they might be born disabled.

### **The Contours of an Evolving Environmental Health Consciousness**

How, when and why did villagers come to regard particular illnesses as potentially linked to pollution? What form of environmental health consciousness did it result in? When a villager volunteered a considerable amount of reflections on the effects of pollution on health, we commented: "you are very knowledgeable, how did you learn so much?" Some replied that they read newspapers, listened to the radio or watched investigative programmes on television which

exposed the effects of pollution in other localities. Some pointed to the water test carried out on one of Tacun's wells, which showed contamination by mercury and fluoride in excess of China's Centre for Disease Control standards, as raising the alarm about local pollution. They rarely cited doctors as a source of information; more often they remarked that doctors never inform patients about the cause of illness, and that they cannot be trusted even when they do.

Personal experience and reflections were by far the most important element in developing an environmental health consciousness and therefore deserve special attention. Comparisons between illnesses in the present and those in the past (before industrialization, when pollution was less severe or when exposure had not yet had clear effects) often served to account for a potential link between illness and pollution. The head of Sancun sub-village observed that only those in their 20s, or younger, have poor teeth, and related this to fluoride poisoning. This generational difference served as evidence that crooked teeth were related to pollution. An 85-year-old man told us:

the hospital is full of these "strange illnesses" (*guai bing* 怪病), you feel nothing, no pain, and all of a sudden you are ill. It is all because of poisoned air, pollution. In the old society [usually referring to the period before the founding of the People's Republic in 1949], we did not have these strange illnesses. The more science progresses, the more strange illnesses increase (*kexue yue fada, guai bing yue duo* 科学越发达怪病越多).

Likewise, comparisons with different places made those residing in Baocun reflect on pollution's effects on health and contributed to the development of an environmental health consciousness. Experience of living outside of Baocun (or even visiting other localities) gave people some terms of comparison to evaluate the local environment. Women who married into Baocun compared the air there to that in their natal home, often in remote and less developed localities. Zhangjie, originally from Xuanwei 宣威 county, claimed that she loses her sense of smell in Baocun, but that when she returns home, she regains it within a couple of days. This served as evidence of the harm of pollution. Migrant workers articulated similar comparisons regarding both air and water quality between their native villages and Baocun. The increased wealth has made it possible for Tacun villagers to organize trips to tourist destinations in China and, in 2008, some visited Xishuangbanna 西双版纳, a tourist area in the south of Yunnan, famous for its natural beauty and ethnic minority culture. However, this visit made the Tacun accountant – a university graduate in her 30s who had recently returned from Kunming – even more aware of the poor air quality in Tacun: "The air was so fresh, so clean [in Xishuangbanna]. I think if I lived there, I could live to be one hundred. But in this village, it's impossible."

The most pervasive factor influencing the formation of an environmental health consciousness seemed to be embodied experience. Three young women explicitly related the "smell" emitted by Linchang to the increase in nose infections. A middle-aged woman recently diagnosed with a uterus tumour elaborated further on when emissions occur and what their effects are: "the smell is poison from Linchang and from a paper factory, it smells like dead mice, especially when



a northerly wind blows and when it is cloudy. Smelling it long term makes you sick, it affects the lungs, so local men can no longer pass the army tests.” While she did not specify whether emissions were worse or more perceptible in cloudy weather, others claimed that Linchang deliberately released more fumes when it rained because they were less visible. Some argued that Linchang emitted most fumes after midnight when villagers were supposedly all in bed and therefore less likely to notice. Others complained that the emissions took place during the day, too. One evening, while we sat at the outdoor gym in Tacun market square, we asked two bystanders what the strong stench we could smell was. One, a man in his 30s, commented that “everyday, from 4 to 5 pm, Linchang lets out poisonous air, it’s very thick/strong (*nong* 浓).” Asked how he knew that, he replied: “[when] it’s your own body, you know (*ziji de shenti ziji zhidao* 自己的身体, 自己知道).”

Embodied knowledge of pollution’s harm was often founded on experiences of working in one of the local industries – especially when this involved direct contact with chemicals. A middle-aged man from Huize 会泽 county, who had been in Baocun with his wife for three years, earned 50 to 60 yuan per day from shovelling raw material from the mines onto a conveyor belt that carried it to the processing equipment. Asked about air quality in the workplace, he commented: “the smell irritates the nose, especially the new, fresh [raw] material.” Reflecting further on air quality, he added that one of his colleagues had lost all his teeth: “it wasn’t painful, they just dropped out... it’s probably because of pollution, the air has acid content.” To reduce the effects of pollution on his body he said he took a shower and washed his eyes carefully every night after work, “otherwise a deposit forms in the corner of your eyes by the following morning, and your eyes become red.” He had also bought himself a mask and gloves, which he changed frequently. He insisted that he could endure these conditions because he was in extremely good health – citing that he had only ever had two injections in his life as evidence of his excellent health. Yet, the potential harm entailed by his work was also obvious to him. He and his wife reflected that, as migrants, they had to take on heavy and often dangerous work in order to earn money. For this reason, they explained, migrant workers usually did not make it to old age (*guobudao lao* 过不到老). Conversely, those under 40 rarely do these jobs because “they make you sick.” Indeed, two young villagers who initially worked in direct contact with raw materials told us they had subsequently quit their jobs because of the effects on their health.

### Lay Epidemiology and Epistemic Uncertainty

Studies of environmental health movements have highlighted the importance of embodied experience and lay knowledge in enabling citizen activism and when questioning the industry (and often government’s) claims that there is no scientific evidence of pollution’s harm to health. Phil Brown argues that reference to the embodied experience of people affected poses a challenge to existing medical and

scientific knowledge and practice, and lends moral credibility to popular epidemiology movements.<sup>16</sup> However, this did not seem to be the case in Baocun. As I have shown, embodied experience played a crucial role in alerting Baocun villagers to environmental health risks and harm and it served as evidence in their accounts of how they came to realize that pollution was harmful. However, it did not give rise to a popular epidemiology movement. Villagers and migrants displayed a clear sense of the dangers pollution posed to their health. A collective illness experience for common problems such as respiratory system infections, rheumatism, and gall and kidney stones was present, but did not lead to activism.

To the contrary, we found that embodied experiences that might point towards pollution as a potential cause of illness were integrated with a range of other explanations for illness, which reinforced villagers' uncertainty in attributing particular illnesses to pollution. When science was referred to, it was mostly in terms of evidence that would be required to prove harm but that it was impossible to obtain. While tests conducted in one of the local wells found the water to be unsafe for drinking, it would be quite another matter to prove that particular types of illnesses in individual cases were the result of drinking that water. Most evidence for environmental health harm was drawn from personal experience, and remained highly contested by its very proponents. As they often argued, "I suspect it is pollution, but cannot say for sure."

It was villagers' grasp of the complexity of illness causation, rather than their ignorance, that served to undermine their confidence in attributing illness to pollution. Examples abound for a range of ailments potentially correlated with pollution. Locals often described symptoms such as "rheumatism" (*fengshi* 风湿) or hand and foot swelling and pain (*shou jiao zhong* 手脚痛), which potentially converge with joint pain correlated with fluoride pollution known to affect this area. However, they rarely attributed these symptoms to pollution. Aunt Tian, after complaining about Linchang's emissions, attributed her "rheumatism" to old age and to the humid weather. A migrant woman in her late 30s who had lived in Tacun for six years and who complained of rheumatism attributed it to not having adequately rested during the month following childbirth (*zuo yuezi* 坐月子). A 66-year-old man attributed his back pain to having endured strenuous physical work. Two men who had served in the army – one 85 years old and one middle aged – both attributed their joint pain to getting cold and wet while sleeping outdoors when they were soldiers. However, the older man did describe his wife's sudden paralysis (possibly a severe form of fluorosis) as a "strange illness" made common by "poisonous air." Aunt Li, an active voice in protests against pollution, explained her osteoporosis as a consequence of a fall during the Great Leap Forward (1959–61), which started to hurt as she approached old age. At the same time, she also noted that the doctor who had diagnosed her had told her that joint swelling and

16 Brown 2007, 28.

breathing problems were all caused by local pollution, hence their commonality in the area. In both these cases, pollution was considered to be potentially linked to illness, alongside other possible causes.

The same uncertainty pervaded other ailments. For instance, unhealthy and crooked teeth amongst the youngest generation were thought by some to be caused by pollution, but the link was also dismissed with reference to a potential genetic aspect. Similarly, many believed that frequent nose infections were probably caused by air pollution and felt that this was confirmed by the fact that, when they had lived elsewhere, they were not afflicted with this problem. But, again, they were also unsure that this was indeed the case. A 26-year-old woman, a native of Baocun who worked in a small local industry, explained that her one-year-old son had had a nose and lung infection when he was only a month old. What started as a runny nose became a blocked nose and was diagnosed at the Linchang hospital as a nose infection and treated in Kunming children's hospital. She argued that "with such a small child, it is hard to know why he got it, children are hard to bring up (*buhao yang* 不好养). Being too thin also makes it easier to fall sick." She was not confident about the link between air pollution and nose infections:

industry causes air pollution, not much else. The influence on health is not yet visible, I really have not thought of it. I just know in the past there were no nose infections, now there are. I don't know why, some could be an allergic reaction to pollen, some could be a reaction to pollution, this cannot be established for sure (*shuobuqing* 说不清).

Asked directly whether she thought that nose infections were caused by industry, she reiterated: "no, *pollution* is caused by industry. I did not say people have nose infections because of the industry, and if you say to others I told you so it's not good. I only said there is pollution here." While she condemned the industry for causing pollution, she was uncertain about what its effects actually were, especially on health, and was eager not to appear to attribute nose infections to the nearby industry. This begins to illustrate that obstacles to proving the harm of pollution are not only scientific or experiential, but also to do with fear of political and economic repercussions for attributing blame to the industry.

The complexity of illness causation is articulated even more explicitly by Uncle Wang, a man in his fifties who opened a small convenience store in Baocun. He stated that young babies and migrants were more prone to having nose bleeds, but that he was unclear as to the reason. He speculated that nose bleeds particularly affect those with weak immune systems, such as pregnant women and young children. He also reflected that nose bleeds are acute ailments caused by pollution and therefore affected those new to it (like migrants). While the young woman was keen to stress her uncertainty over the link between nose infections and pollution, Uncle Wang referred to additional causes of nose bleeds to explain that it was not pollution by itself that caused them, but a combination of pollution with particular risk factors and individual vulnerability that accounted for its incidence among particular people. Asked about the correlation between illness and pollution, he tellingly responded with an anecdote based on farming:

“We just know, we used to have lots of fruit, lots of cherries, we couldn’t finish them, and since the industry opened they all died. If it’s not the industry, what is it?”

However, Uncle Wang was less confident using this argument with regard to illnesses. In part, this is because pollution may elude personal sensorial experience: “some pollution is invisible.” But uncertainty was also reinforced by the complexity of science itself: “we do not know the actual situation... chemistry is complex, we don’t understand and can’t really say what is the cause [of damage].” In light of this, Uncle Wang argued that villagers would need “hard evidence” of pollution, obtained through scientific tests, in order to have a basis on which to argue about its potential harm. His reflections on the complexities of chemistry and the impossibility of measuring imperceptible pollution through sensory experience at once underscored the importance of scientific tests and the potential harm of invisible threats. The villagers’ grasp of the sophistication of science, and therefore the difficulties in proving a causal relationship between pollution and illness, undermined their confidence in taking action. In other words, the broad span of lay epidemiology beyond environmental health consciousness weakened the potential for a popular epidemiology.

While Uncle Wang still put his faith in science, Wangjie (31), who also acted as the village accountant, was more sceptical. She told us that, in 2006, the villagers had asked Linchang to relocate the entire village. However, Linchang had responded sarcastically: “you go have a health check, and see what the problem is.” Wangjie commented: “you know it too, chronic illnesses, it will take a few years for them to manifest themselves.” Her comment on the complexity of long-term exposure and the delay between exposure and the onset of illness demonstrates that she was aware of the difficulties in attributing blame to pollution. As a consequence, the villagers’ collective illness experience failed to translate into a popular epidemiology movement. The way in which she reported the whole exchange also implies that industry uses such uncertainty to their advantage. The sarcastic suggestion to have a health check was intended to discourage people from complaining and to assert power. Examining the wider socio-economic and political context further illustrates the complex relationships between villagers, the industry and the local government.

### **Uncertainty and Power: Dependence, Compensation and Community Divisions**

A number of recent studies have examined the social, political and economic context in which local communities understand and respond to pollution. Bryan Tilt argues that farmers who do not depend on industry for their income and who stand to lose crops from pollution are less inclined to accept the risks posed by pollution than those who work in the polluting industries.<sup>17</sup> Similarly,

<sup>17</sup> Tilt 2006.

Benjamin van Rooij's study of two communities exposed to analogous types of pollution demonstrates that locals' degree of dependence on the industry for jobs is inversely proportional to the extent to which they take action to stop or decrease pollution.<sup>18</sup> Anna Lora-Wainwright, Zhang, Wu and van Rooij further illustrate the extent to which the dependence of local residents on polluting industries not only for jobs but also for land rental fees and compensation has reshaped local opposition to pollution into small scale protests intended not to stop pollution, but to demand higher compensation.<sup>19</sup> Dependency remoulds their understanding of what is possible. These perceptions are also shaped by the political opportunity structure within which pollution may be opposed or accepted. Guobin Yang suggests this with reference to the focus of environmental campaigns in China, which tend to be centred around relatively non-political issues and framed in non-oppositional terms.<sup>20</sup> His article, co-authored with Yanhua Deng, in this volume describes how locals opposed to the siting of a polluting industrial park in their vicinity refocused their complaints in terms of land expropriation, which is easier to prove than environmental health harm. Deng and Yang's piece also highlights the more accepting attitude of locals towards the equally polluting plastic recycling operations set up by other locals.<sup>21</sup> Similarly, Ajiang Chen's research finds that village relations shape responses to pollution in the context of his research on "cancer villages."<sup>22</sup>

The effect of dependency and opportunity structures upon Baocun villagers' perceptions of, and responses to, pollution is considerable. Not only is industry the main source for local employment, it also provides significantly high compensation rates for accidents and for routine pollution. Linchang has developed local infrastructure such as roads, a middle school and a hospital. Tacun villagers benefit from high land rental fees secured for renting collective land to mining companies (reaching a peak of 15,000 yuan per registered resident in 2008). Finally, the local government maintains a very close relationship with local industry, taking the lead in securing compensation deals, and controlling the employment of unskilled workers in Linchang. All of these factors have created a situation in which locals' life experience and opportunities (as well as dangers) are inextricable from industry.<sup>23</sup>

Most crucially, not all have benefited equally from industry. There are discrepancies between compensation amounts distributed to sub-villages, with Tacun receiving the highest amounts. In Tacun, land rental fees are distributed by village officials through payments to registered residents. Similarly, routine compensation is paid to the village and then distributed among the residents. Tacun received 130,000 yuan in 2009, and the sum is due to rise every three years. However, distribution patterns are unclear: they depend on the quality of the land and its proximity to the industry,

18 van Rooij 2006.

19 Lora-Wainwright, Zhang, Wu and van Rooij 2012.

20 Yang 2009; 2010; 2013.

21 Deng and Yang 2013.

22 Chen and Cheng 2011b.

23 Lora-Wainwright, Zhang, Wu and van Rooij 2012.

but allegedly also on the connections between individual villagers and officials. Consequently, there are accusations of unequal distribution.

Industrialization has attracted a large number of migrants to Baocun. Indeed, for every local there are five migrants. This has created an increasingly stratified community, with divided interests, stakes and prospects. Importantly, land rental fees and compensation are only available to locally registered residents. This means that the majority of those living locally and working in the industries are excluded from compensation and have no vested interest in taking part in actions to demand it. Doing so may cost them their jobs and, as temporary settlers, they have no long-term investment in the health of the local environment. Workers themselves are divided between skilled and unskilled labourers. The former are relatively well paid, work regular hours, have access to a good welfare system, including healthcare and pensions, and usually return to their homes outside Baocun at the weekend. The latter, by contrast, undertake low paid work, often working long hours and in dangerous conditions, have no real welfare protection to speak of, and are constantly exposed to pollution because they live locally. Locally registered residents are also becoming an increasingly stratified group: some have become managers of private mines and industries, others have opened thriving local businesses, and yet others rely on unskilled labour in the industry for income. With such diverse structural positions, the local community has little sense of cohesion or shared interests and they approach compensation largely as an individual or family matter.

While they point to a range of harmful effects of pollution on their health, formal residents have done little recently to oppose pollution collectively on this basis. When the industry was first established in the early 1980s, they protested against pollution on the basis of its harm to health and to crops.<sup>24</sup> Linchang made efforts to meet demands for cleaner water but did not provide a free yearly health check as demanded by the villagers in the 1980s. In retrospect, our host and prominent local activist, Lijie (female, early 30s), reasoned that a health check would serve little purpose, especially one provided by Linchang, because “they won’t really tell you what is wrong and you still have to pay for treatment.” Scepticism towards Linchang’s willingness to reveal the “true” diagnosis unsettled initial hopes that it could be held accountable through health checks. Lack of trust in the industry intersected with a lack of trust in doctors and hospitals, which are understood to be driven by profit. Villagers suspected that Linchang would hide diagnoses that could be used to highlight a potential correlation between illness and pollution; they also suspected that doctors would diagnose illnesses that would require expensive tests and treatment. A lack of support for this demand by village officials may explain why villagers have stopped requesting health checks.

These patterns of dependency and (limited) opportunity structures reinforce uncertainty about pollution’s effects on bodies. Uncertainty about the evidence of

24 See *ibid.* on the process which led to this attitude.

environmental health harm and its potential to obtain redress is just as telling of villagers' understanding of the complexity of science and inherent uncertainty as it is of their scepticism that local officials would really protect their interests, that the industry would really listen, and that doctors would really disclose their illnesses and make suggestions about their causes.<sup>25</sup> The intertwining of (1) uncertainty; (2) local perceptions of industry, pollution and illness; and (3) power relations and social, political and economic configurations is brought to light very powerfully in Javier Auyero and Debora Swistun's ethnography of environmental suffering in the Argentinian shantytown of Flammable.<sup>26</sup> The community's attitude to pollution is characterized by confusion, uncertainty, disagreement and waiting. As pollution developed gradually over the years, it became routinized and contextualized alongside many other pressing problems, such as growing crime, difficulty in finding a job and bureaucratic hurdles in accessing welfare. At the same time, locals became rooted in the neighbourhood through work, family and friendship networks, and therefore they tended to play down the dangers.<sup>27</sup> Auyero and Swistun argue that "toxic uncertainty" and the normalization of risk are part of domination. Knowledge of pollution, habituation and citizen inaction are rooted in power relations, the flow of bribes, community divisions, government inaction and citizens' sense of their own powerlessness.

Many of these points are very pertinent to Baocun. In Baocun, as in Flammable, the local political economic context is central to maintaining uncertainty about pollution's effects on health. The fact that protests initially involved demands for better pollution control and better health shows that the present subsiding of these demands is not owing to a lack of awareness or uncertainty alone. Rather, uncertainty is reinforced by the current social and political economic setting. Through years of living with industrialization, pollution has become routinized and normalized. It is experienced as an inevitable fact of life. For those with a Baocun *hukou* 户口 (household registration), job opportunities and compensation rates have tied them to the locality and yet have failed to provide enough wealth to be able to afford to move elsewhere unless relocated by the industry. Pollution is only one part of their life experience, alongside finding work, negotiating compensation, securing enough resources to care for elderly parents and to support children's education and renovating one's home. This normalization is central to allowing the hegemonic view of industrialization as an inevitable development path to mould locals' expectations and leave pollution unquestioned.

In this context, complaints focus on elements for which individual households can more easily gain compensation (damage to crops), and which have proven more successful in obtaining redress so far. The more visible, positive and quantifiable outcomes of industry (work opportunities and compensation) overshadow the much more elusive and potentially contestable effects of pollution on the

25 Irwin, Dale and Smith 1996.

26 Auyero and Swistun 2009.

27 Ibid. 81–87.

body, which remain the object of suspicion rather than certainty. Local power relations, opportunity structures and interactions with the industry and the local government have disciplined villagers into making demands that comply with the economic and materialistic approach to welfare put forth by the industry. Conversely, harm to bodies came to be constructed as difficult to prove not only scientifically but also socially, politically and economically. The result is that industry is asked to compensate for damages rather than prevent them from taking place again in the future. Ultimately, this also perpetuates the uneven distribution of benefits (and harm) which underpin industrialization. Migrant workers, in particular, are a vital engine for industrialization but they are excluded from the large share of benefits while they bear much of its (physical) costs.

### **Conclusion: Acting with Uncertainty**

Villagers' lay epidemiology, their individual reactions to pollution and the fact that they protest about it (even if not about its effects on health) all demonstrate that they have a sophisticated environmental health consciousness. Examples have shown that villagers are concerned about pollution's health effects, even if they cannot be sure about what they are. Their engagement with pollution, illness, and what they see as evidence, casts some light on debates on citizen science and popular epidemiology. Villagers postulate a potential correlation between pollution and illness on the basis of their embodied experience, but they also doubt it. They are keenly aware of the narrow boundaries around the hard evidence required to prove that pollution is correlated with illness and are conscious of the difficulty of establishing such a link. The complexity of lay epidemiology – stretching far beyond pollution to include a variety of other factors such as genes, weak immune systems and past hardship – undermines the development of a popular epidemiology focused specifically on the role of pollution in causing disease. In this case, power configurations and a nuanced understanding of illness causation (approximating epidemiological knowledge) does not empower them as in classic citizen science scenarios but, on the contrary, convinces them further of the difficulties of proving the correlation between illness and pollution.

Robert Weller suggests that environmental consciousness needs to be examined according to locals' own definitions of environment and their ways of valuing it. Baocun's case has illustrated the importance of this point in understanding the development of environmental health consciousness. For Baocun villagers, it involves a realization that complaining on the basis of illness does not yield results. Accordingly, the concept ought to be defined in light of local structural possibilities and locals' own perspectives to encapsulate the kinds of practices they do engage in to protect themselves from pollution.<sup>28</sup> This requires re-thinking how villagers approach risk. Bryan Tilt has argued that industrial

28 Weller 2006.



workers' and managers' narratives about pollution display a form of "strategic risk repression," since it allows them to persist in manufacturing industrial products and profits while compromising their own health as well as the environmental quality of the community and the region at large."<sup>29</sup> Among Baocun villagers, however, the awareness of risk was not completely silenced. Although they perceived pollution as inevitable and stopped engaging in collective action on this basis, they still took measures to limit pollution and acted *despite* uncertainty, rather than trying to overcome it.

Villagers did this predominantly in two ways. First, residents have chosen the less uncertain option for redress: opting for compensation rather than demanding less pollution. We have seen that pollution is extremely difficult to quantify, and its effects even more so. Locals have become painfully aware of these problems of quantification – in fact, they are inseparable from the very texture of local political economy. Compensation is easily measured and tangible. Locals know exactly how much money is handed over to them – even though they do not believe that this amount is fair, or fairly distributed, and suspect that officials will derive the most benefit.

Second, rather than being repressed or interpreted away, risk awareness has given rise to individualized strategies for coping with risk. Many villagers wore a variety of hematite bracelets and necklaces, widely available in the local market and said to help ease rheumatic pain. Similarly, many could be seen wearing Chinese medicine plasters and wraps on their necks, arms and knees, often prescribed and applied by practitioners in Kunming to treat rheumatism. Some have resorted to medicinal drinks from their home towns. A young woman from Huize showed us a bottle of spirit filled with bees, intended to cure rheumatism. Those who could afford it (mostly registered residents from Tacun, who were entitled to compensation) did not drink the local water but purchased instead a water cooler. To cope with air pollution, Aunt Li wore a mask when she found the smell particularly strong. Others reported pulling their jackets over their heads. A young woman urged us always to close the bedroom window before going to sleep, because the emissions are worst at night. Uncle Wang went further than simply closing his windows at night. As we sat with him, sipping tea in a sitting room overlooking his courtyard, he proudly pointed out: "did you notice that the air is better here?" He had sealed off his entire inner courtyard – usually opened to the elements – with a glass ceiling and windows, to limit air pollution.

These ways of coping with pollution and with uncertainty have some important implications if China is to make progress in providing healthier environments for its citizens. Everett Zhang recently reflected on the growing search for an "adequate life" in contemporary China: "along with rapid economic development, there has been, in official discourse, an abandonment of the ethos of sacrificing life and an emerging appeal for valuing life."<sup>30</sup> In the context of

29 Tilt 2010, 103; 2006.

30 Zhang 2011, 1.

Baocun, as in many other heavily industrialized settings, the question needs to be: adequate according to whom and by which standards? No doubt, industrialization has brought enormous financial benefits to the residents of Baocun and of many other places like it. Industry may be experienced as the provider of an adequate life, even a good life for some, but the very parameters of what has become acceptable as an adequate life need to be questioned. Citizens living with severe pollution (as Baocun villagers are), often knowingly sacrifice life – their health – in the pursuit of an adequate life (economically) for themselves and their close relatives. When, as in Baocun, potential damages to health are largely written out of this pursuit and citizens limit themselves to individual strategies to avoid pollution, “adequate life” is very much a compromise. This article has ventured some explanations of why Baocun’s villagers make such a compromise, despite a clear awareness of the dangers they face. Stricter and better implemented environmental protection is needed to ensure that residents of noxious places do not come to regard them as the norm, but instead feel entitled to demand a cleaner environment and be able to realize that demand. Until then, popular epidemiology will remain limited, no matter how acute the environmental health consciousness of the Chinese people may become.

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