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Knowledge Gaps on Water Issues and Consumption Habits in At-risk Chinese Cities[+]

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Abstract

This research explores awareness of water issues and beverage consumption habits of students at four universities in northern China, the region most at risk for water shortages. While water is treated as a common property resource in China, there are significant demographic differences in attitudes towards state responsibility for water quality and supply, with older respondents, urban residents, and women showing more faith in the government. Surveys of 671 university students reveal a disjuncture between their awareness of shortages and pollution issues at the national level, and awareness of local conditions. A second disjuncture is apparent in respondents' views of local water quality and their own beverage consumption habits. Information on environmental degradation, including water pollution and water depletion, are considered internal documents and are not publicly available. Consequently, non-market mechanisms to manage water do not reflect water's real value. I discuss implications of these issues for the understanding of environmental policy in China.

Keywords: *Chinese cities, water resources, water pollution, public knowledge, water consumption, public health*

JEL classification: *D82, I18, Q25, Q53*

1. Introduction

Per capita water availability in China is only about one quarter of the world average. Water scarcity is particularly severe in northwest China as the majority of the country's water resources are located in the south (MWR, 2004). Northwest China also hosts one of the world's most fragile dry-land ecosystems – the Loess Plateau of the Yellow River basin. The region contains more than twice as much dry-land habitat as any other single country, and

about half of it is already seriously degraded. The region's severe water scarcity coupled with increasing water pollution in recent years ranks it among the worst environmental hot spots in the world (Kim, 2001; Nickum, 1998; Wang *et al*., 2005).

Historically, the term "northwest" in China connotes areas that are "poor, backwards, and harbouring large populations of minority people" (Sines, 2002). In early 2000 the central government launched the Great Western Development Strategy to bridge the economic gap between western China and the more prosperous coastal cities and provinces. Recent economic growth rates indicate that western China is growing faster than the rest of the country. Water demands are also growing significantly. Because of competing water needs, farmers in Shaanxi province reportedly unscrew the manhole covers over sewage pipes to irrigate their crops while urban residents go without tap water for days at a time during the driest months of the year (Economy, 2004). Coalmines in the province lose 100 million dollars a year because they do not have enough water for their coal during a significant portion of the year (Economy, 2004).

In addition, much of the region's water supply, historically inadequate to meet the population's demands, is now being rendered as unusable because of pollution caused both by domestic and industrial activities (Ma, 1999; Bellier, 2003; Zhao *et al*., 2005). Water shortages are exacerbated by the massive increased industrial and municipal discharge of untreated wastewater into rivers and lakes every year, increasing pollution in water source. These problems mirror a water crisis in the country. At the national level, water situation has also been aggravated by severe and extensive pollution that came with its booming economic growth. It is estimated that about 70 per cent of cities' groundwater and 75 per cent of rivers and lakes are contaminated by chemical, human, or animal waste (Nickum, 1998; Ma, 1999; Wang *et al*., 1999; Economy, 2004). Water scarcity will predictably increase as demand grows. To find a solution to this growing crisis, it is important to understand the current level of popular knowledge about water conditions as well as people's water consumption patterns.

Research on environmental awareness of the Chinese public has increased as the country's ecological problems have escalated, and there is an emerging consensus that environmental knowledge is at the heart of environmental protection. With respect to the environmental awareness of the Chinese public, it has been argued that Chinese residents are aware of many environmental problems, but they have a superficial knowledge of environmental protection (Xi, 1998; Lee, 2000; Hong and Xiao, 2007). Survey data indicates that Chinese generally recognize that serious environmental problems exist and regard water pollution one of the most serious aspects of environmental degradation. They also place priority on environmental protection over

economic growth (Shen and Saijo, 2008; Xiao and Hong, 2010). However, surveys have also found that people generally believe that the government is responsible for environmental protection, and they see little value in citizen action to protect the environment (Xi, 1998; Huang *et al*., 2006; Harris, 2008). Education appears to have a consistent positive influence on environmental awareness, although other demographic factors, such as age, class and gender, are found to have mixed impact on environmental concern (Hong and Xiao, 2007; Shen and Saijo, 2007). More recently, research cites the importance of employment status and city size in understanding environmental attitude and pro-environmental behaviour in China (Chen *et al*., 2011).

Several studies specifically assess the environmental awareness of Chinese students. One notable study compares student's environmental perceptions in Hong Kong and Beijing (Lee, 2000). Its findings suggest that secondary students are generally more concerned about the environment than primary students, and that students in Beijing are most concerned about solid waste disposal and wastewater disposal. Other surveys conducted on university campuses found that Beijing students ranked water pollution as China's most urgent environmental problem, ahead of both deforestation and urban air pollution (Wong, 2003). Students were also critical about the government's treatment of the environmental protection and were pessimistic about the future of China's environment (Wong, 2003).

As a whole, most of these studies focus mainly on the environmental attitudes and concern of college students in Beijing or other coastal areas such as Shanghai, Ningbo, and Hong Kong. While these areas are important politically and economically, they are not ideal for studies on water shortages because, with the exception of Beijing, the water supply in these areas is fairly secure. In contrast, little is known about people's attitude toward water shortages in dry areas in western China where climate renders its water situation much worse.

The present study aims to fill this gap. It compares the opinions and behaviour of college students living in Xian, a city in northwestern China, with students in Beijing. A metropolitan city with more than eight million residents, Xian is the capital of Shaanxi province and one of China's ancient capitals as well as a major centre of the western region. The Loess Plateau is within easy reach to the north. Its naturally dry climate coupled with fast economic growth has accelerated the rate of water shortages in the area over the past two decades (Zhao *et al*., 2005; Kahrl and Roland-Holst, 2008). Beijing is the political and cultural capital of China as well as the epicentre of the northern region of the country. For decades, Beijing has suffered from serious water shortages as well. The city experienced a drought every year since 1999, and at the same time, the growth rate of its enormous population accelerated (NBS, 2005). Because of Beijing's important status, however,

its water supply is fairly secure, and residents are rarely affected by water shortages in the area except rising water prices.

Public campaigns and media exposure have highlighted issues of water shortages and pollution at the national scale. While awareness of these issues is widespread, little is known about people's knowledge of health repercussions of such water pollution and scarcity. There are three ways that water can affect the public. First, access to the world's standard of the minimum per capita amount of water is essential to basic health and hygiene. Shortages can deprive the population of the amount of water needed to maintain a healthy lifestyle. Secondly, water can serve as the pathway for microbiological and infectious diseases if it is contaminated with human and animal waste. Finally, water can also be a conduit for transporting toxic chemicals from industrial and urban waste that can cause increased incidences of disease and death from disease in a population. China is uniquely susceptible to all three threats from its water supply because of its status as a transitioning market (Wu *et al*., 1999).

Unmistakably, attitudes and opinions have a powerful influence on behaviour. The opinions of college students concerning China's water crisis are particularly valuable since these students will one day become leaders and policy makers, working on issues related to water quality, supply and consumption.

2. Methods and Settings

To gauge the awareness of water scarcity and public health issues among young educated Chinese as well as their water consumption behaviour, surveys were conducted among college students in Xian (Xi'an 西安) and Beijing (北京) in July 2004, a time when both awareness of and conflict over water problems were fast increasing in China. In fact, in the summer of 2005, the Chinese central government released statistics on mass disturbances, the first time in post-1949 China. Many of the protests are over environmental and water pollution. For the current study, survey responses were collected from three universities in Xian and one university in Beijing. The four institutions are Shaanxi Normal University, Northwest University of Politics and Law, Xi'an College of Arts and Science, and Peking University. The survey questionnaire was comprised of a series of questions on water shortage, water safety concern measures, and personal beverage consumption habits. Most of the awareness and attitude questionnaire items used a dichotomy (yes or no) or double dichotomy format (strongly agree, agree, disagree, or strongly disagree).

Building on prior research, the survey questions focused on two issues: 1) awareness of water pollution and water shortages at the national level

and/or local level; 2) how concerns about water quality may affect beverage consumption habits. A total of 671 valid surveys on four university campuses were collected, of which 520 were from Xian (240 men, 278 women, 2 unknowns) and 151 were from Beijing (76 men, 75 women). Most of the students were between 19 – 25 years of age. Since Xian College of Arts and Science was a junior institution offering only three-year degree programmes, it had a somewhat younger student population. The college has since then been granted a university status and it now offers four year degree programmes. The other three institutions offered both baccalaureate and post-graduate degree programmes and therefore had some older students.

3. Results

3.1. Disparities in Knowledge of Water Quality Issues

Table 1 summarizes the respondents' knowledge and concerns on water issues. It is clear from the survey that awareness of water shortages is high among Chinese college students. Over 86 per cent of the respondents in Beijing and 80 per cent of the respondents in Xian agree that water shortages are a serious problem in China. A large majority of the respondents (87 per cent in Beijing and 77 per cent in Xian) also believe that there is a water shortage in their areas. Among those who are concerned about water shortages, Beijing students (58 per cent) are more likely than Xian students (36 per cent) to consider it a severe problem. Consistent with findings from other studies, most of the respondents (94 per cent) agree that water pollution is a serious problem. Many respondents (64 per cent in Beijing and 59 per cent in Xian) recognize that polluted water has a negative effect on health. Overall, respondents in Beijing are more likely than those in Xian to be concerned about water shortages, water pollution, and other water issues.

It is worth noting, however, that three quarters of the students in Xian and 64 per cent of the students in Beijing believe that water quality in their areas to be safe and clean, although a massive majority of them consider water pollution to be a serious problem in China. This indicates that university students are well aware of the grave problem of water pollution in the country. For many students, however, there appears to be a disconnection between their knowledge of national problems and awareness of local conditions. In some ways, this is expected since Chinese universities are all located in large cities where water system and water infrastructure are much better than other parts of the country.

There is a disconnection between the respondents' view of water quality in their area and their water consumption habits. As it is shown in Table 2, less than one third of Beijing students and less than half of Xian students

Table 1 Respondents' Awareness and Knowledge of Water Issues

	Beijing		Xian	
	%	n	%	n
Water shortage is a serious problem in China				
Agree	86.2	131	80.0	416
Disagree	13.8	21	20.0	104
There is a water shortage in the area				
Yes	86.8	132	77.1	401
No	13.2	20	22.9	119
Water shortage in the area is				
Severe	58.0	76	36.4	145
Mild	42.0	55	53.6	253
Water pollution is a serious problem in China				
Agree	94.6	140	94.3	481
Disagree	5.4	8	8.1	29
Water is safe and clean in the area				
Agree	64.0	89	75.2	352
Disagree	36.0	50	24.8	116
Water quality had a negative effect on your health				
Agree	64.1	75	59.1	251
Disagree	35.9	42	40.9	174

Table 2 Water Quality Concern and Drinking Water Consumption

	Beijing		Xian	
	%	n	%	n
Aware of water-borne diseases in the area				
Yes	32.9	49	49.2	255
No	67.1	100	50.8	263
Boiling water before drinking it				
Yes	96.0	145	95.0	488
No	4.0	6	5.0	26

believe there are water-borne diseases, yet more than 95 per cent of them boil water before drinking it. Indeed, Chinese have the tradition of drinking boiled water, but most of the students don't connect this practice with the prevention of water-borne diseases. In the survey, few people reported that they have become sick within the last year due to poor water quality in their area, and most are not even aware of different types of water borne diseases that may come from poor water quality. This indicates that the education of water safety issues and its effects on public health is still lacking in these areas and perhaps around the country.

There are also consistent differences between campuses in student's knowledge of water issues. As it is shown in Table 3, Peking University students display the lowest confidence in water quality and the highest level of awareness of a water shortage. When asked who is responsible for providing water to households, responses vary significantly among the universities. While more than three quarters of the respondents in Northwest University of Politics and Law agree that the government should be in charge of water supply, only 36 per cent of the students in Xi'an College of Arts and Science share this view. Instead, a majority of the students from this college believe that individual citizens should be responsible for securing household water. The percentage distributions of the responses by the students of the other two universities are quite similar, with a majority of them holding the government responsible for water supply.

These attitudinal differences may be explained at two levels: institutional and individual. At the institutional level, Peking University is one of the most selective universities and is known for its liberal tradition. It is also located in the capital city of Beijing, close to the information distribution centre of the country. At the individual level, its students are more liberal in their outlooks and more likely to be well informed on political, social, as well as environmental issues. Northwest University of Politics and Law in Xian is responsible for educating some of the country's political leaders, law enforcement officers, and lawyers. As a result it holds a strong allegiance to the government and its agendas. Its students tend to be politically conservative. Xian College of Arts and Science is a less competitive and regional institution, drawing students generally from small towns and rural areas where many households get water from either private wells or rivers. Both institutional and individual profile differences have an impact on the students' responses in the survey.

3.2. Regional and Generational Differences in Beverage Consumption

Water and beverage consumption habits reflect people's concern about water quality, knowledge of health repercussions of water pollution, as well as their standard of living. In the survey, respondents were provided

Table 3 Regional and College Differences in Water Concerns

	Peking University		Shaanxi Normal University		Xi'an College of Arts and Science		Northwest University of Politics and Law	
	%	n	%	n	%	n	%	n
Water in the area is safe and clean								
Agree	64.2	(89)	75.8	(250)	73.0	(81)	77.8	(21)
Disagree	35.8	(37)	24.2	(80)	27.0	(30)	22.2	(6)
There is a water shortage in this area								
Yes	86.0	(129)	75.8	(297)	73.0	(83)	72.4	(21)
No	14.0	(21)	24.2	(71)	27.0	(36)	27.6	(8)
Responsible for providing water to households								
Government	60.1	(89)	54.8	(201)	35.9	(42)	78.6	(22)
Work Unit	6.1	(9)	10.3	(38)	2.5	(3)	3.6	(1)
Private Companies	2.0	(3)	4.4	(16)	2.5	(3)	7.1	(2)
Citizens	31.8	(47)	30.5	(112)	59.0	(69)	10.7	(3)

Table 4 Beverage Consumption by College Students and Their Parents

	Beijing		Xian	
	%	rank	%	rank
Students				
Beer	21.6	5	28.3	4
Boiled water	79.8	1	82.1	1
Bottled water	55.1	2	38.3	3
Soft Drinks	34.8	4	25.4	5
Tea	46.3	3	64.2	2
Parents				
Beer	32.4	4	26.7	4
Boiled water	77.5	1	89.3	1
Bottled water	57.6	3	60.8	3
Soft Drinks	23.4	5	20.1	5
Tea	63.3	2	72.5	2

with a list of beverages and asked to mark three items that they consume most frequently. They were also asked to report on their parents' beverage consumption habits. Items on the list are: beer, boiled water, bottled water, juice, liquor/wine, soft drinks, tea, and others. Table 4 presents the percentage distribution and rankings of the beverages. As expected, boiled water is the most popular type of beverage consumed by both students and their parents. Other types of beverages commonly consumed by the students are bottled water, tea drinks, and beer. There is, however, a regional difference. While bottled water is consumed second most frequently by students in Beijing (55 per cent), their counterparts in Xian are much less likely to buy it (38 per cent). For many students in Beijing, tea and soft drinks are also popular choices for drinks. Xian students, on the other hand, prefer tea drinks more than bottled water. One possible reason for this difference is the cost of bottled water. At the time of our surveys, bottled water was more expensive than most other beverages in China, because there were a limited number of bottled water manufacturers. That is, however, no longer the case. Today the cost of bottled water has come down greatly. Given that per capita income in Beijing was much higher than that in Xian (*China Statistical Yearbook*, 2007), the disparity in bottled water consumption is hardly a surprise. With regard to students' income, about 40 per cent of those in Beijing report that they have monthly income of 500 Yuan or above, whereas only 6 per cent of the students in Xian enjoy the similar income level. It is clear that students in Beijing have a higher probability of affording soft drinks and bottled water.

In fact, we found in our interviews that respondents in Xian are more likely to think that bottled water was too expensive.

There is also a generational difference in beverage consumption habits. Parents of college students are much more likely to drink boiled water and tea than their children. Other types of beverages preferred by parents are bottled water and beer. Students, on the other hand, consume soft drinks at a higher rate than do parents. These trends mirror generational dynamics in consumption behaviour of Chinese residents.

3.3. Geo-demographic Effects: Regression Analysis

To gain a good understanding of how demographic characteristics affect people's knowledge of and concern on water, I performed logistic regression analysis on three dependent variables – water shortages, water quality, and attitude toward the government's responsibility for water supply. Table 5 summarizes the results of logistic regression model, reporting standardized coefficients. With regard to the perception of a water shortage, monthly income is a significant predictor. The positive coefficient suggests that respondents with high monthly income have a higher level of awareness of a water shortage than others. Place of origin also has an important effect on the awareness of a water shortage. That means the problem of water scarcity is more of a concern for students with city origin than students from rural areas, suggesting a regional effect on the variable. The influence of hometown origin is small but statistically significant in affecting the respondents' opinions

Table 5 Demographic Differences in Water Quality Concerns: Logistic Regression Coefficients

	Water Shortage	Clean Water	Water Provision
Age	-.080	.080	.119*
Gender[a]	.062	.028	.113*
Monthly Earnings	.121*	-.017	.019
College Location[b]	-.114*	.013	.028
Home Town[c]:			
City	.142**	.101*	.240**
Small Town	.022	-.059	.013
Constant	1.945	.783	3.183

Notes: [a] 1 = female and 0 = male
[b] 1 = Xi'an and 0 = Beijing
[c] Rural is the reference category.
* $p \leq .05$; ** $p \leq .01$.

about water quality. People from cities are more likely to believe their water is clean and safe. Most importantly, college location retains its statistical significance in shaping people's awareness of a water shortage. The negative coefficient indicates that the awareness of Xian students is lower than that of Beijing students, confirming the regional factor.

Age matters with regard to the perception of government's responsibility in water supply. Importantly, there is a positive relationship between age and the belief that the government is responsible for providing household water. Older respondents place more responsibility on the government than younger respondents. The age effect is likely due to the socialist environment in which the older adults grew up, where the needs of individuals were taken care of by the government. Women are more likely than men to hold the government responsible for water supply, highlighting a gender difference in attitude toward the role of the government in water issues.

Among the demographic variables, hometown location appears to have a significant effect on all three dependent variables. Compared with students from rural areas, students from cities are more aware of a water shortage and yet are more likely to feel that water in their areas is clean and safe for drinking. Urban students also emphasize more the government's responsibility for water supply. It is interesting to note that controlling for other factors, the effects of university location and university type on water concerns have become muted.

4. Discussion and Conclusion

University students in both Xian and Beijing are keenly aware of water challenges in the country. A great majority of them recognize that water shortages and water pollution are grave problems in the country. In general, urban students are more likely to be concerned about water quality and water supply than are those who are from rural areas, suggesting hometown origin matters with people's perceptions on water issues. This urban-rural difference in water concerns is consistent with past studies reporting that peasants express lower levels of environmental concern than do urbanites. There are two possible reasons for the observed difference. First, people in rural areas tend to have no or very low water bills; they get water from rivers, streams, as well as private wells. Urban residents, on the other hand, saw a series of water price increases in recent years, feeling more the consequences of ever growing water shortages. Second, compared with rural residents, urbanites have better access to various types of media that cover news and information on environment conditions. As a result, students growing up in cities are better informed on the environmental degradation in China as a whole. However, despite the large body of literature documenting the dismal situation of

China's water systems, a good percentage of the respondents surprisingly believe that water in their local areas is of good quality. It certainly indicates a gap between perception and reality in the students' knowledge of China's water problems.

It is not surprising that boiled water is the top beverage consumed in China. Following a long time tradition, both college students and their parents boil water before drinking it. A popular knowledge in China is that tap water is not drinkable without being boiled first. Yet, many respondents believe water in their area is clean and safe. This is a unique Chinese (if not an East Asian) concept of clean water. If boiled water does not cause any health problems, it is then clean water. Indeed, drinking boiled water has been a Chinese way of life that people don't connect with the reasons behind the practice. Customs and traditions are part of culture and the principal mechanisms by which people adapt to the world around them. Practices that help a society adapt to its environment are often taken for granted. Chinese perception about clean water is no exception.

This clean water concept indicates that people are uninformed about the fact that boiling will kill bacteria, but will not remove heavy metals and other toxins. Indeed, surveys results reveal that there is little public knowledge about the health effects of polluted water and the diseases that result from dirty water. It would seem that more active campaigns to promote such knowledge would help improve public awareness of this important issue.

Regional differences have been observed in beverage consumption. Overall, students in Beijing are more likely to purchase bottled water than students in Xian. Soft drinks consumption is also higher in Beijing than Xian, due primarily to different levels of students' income. The past decade has seen a rapid increase of soda and soft drinks products in China. With the changing lifestyle and income level, Chinese are shifting their beverage consumption patterns and buying more bottled water and soft drinks. This change has enormous consequences for both people's health and environment.

The survey data indicates that students in both Xian and Beijing have a high level of consciousness about water scarcity in China. Many of them, however, do not feel that water challenges are very urgent. It is also clear that they are well aware of severe water pollution in the country, but many of them are confident that their local running water is safe and clean. The lack of knowledge on water scarcity and water-borne diseases displayed by university students may be due to two reasons. First, water in China is treated as a common property resource. As a result, non-market mechanisms are in place to allocate and manage water resources. Water supply relies heavily on public subsidy and low price do not reflect water's real value. Marginal prices lead to not only overuse and abuse, but also misinformation. Second, people in China have limited access to accurate information related to water. Currently

China's legislation does not have mandate on the kind of information to be published or the frequency of its publication. Data on environmental degradation, including water pollution and water depletion, are considered internal documents and are not publicly available. Accessible information is often incomplete or inconsistent.

The development of improved mechanisms to manage and allocate scarce water resources will be crucial to sustaining China's economic development. It will be equally important for China to develop institutional transparent structure in publishing important data on its environment. Unless citizens in both rural and urban areas are well informed about the extent of the country's water shortages and water pollution, China will face an even greater water crisis as industrial and urban sectors continue their phenomenal growth and demands on the nation's water resources continue to expand. Informing and educating the public about the problems of water shortages is particularly important, because unlike other environmental degradations that are readily observable, water shortages in the form of ground water depletion may not be easily visible. Hopefully, future studies of water awareness and consumption in China will find a population that is more informed about the reality of its country's resources and their roles in water conservation and protection.

Notes

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