http://dx.doi.org/10.1016/jmeegid.2008.04.002
2. Hill DJ, Griffiths NJ, Borodina E, Virji M. Cellular and molecular biology of *Neisseria meningitidis* colonization and invasive disease. Clin Sci. 2010;118:547–64.
3. Shao Z, Li W, Ren J, Liang XF, Xu L, Diao BW, et al. Identification of a new *Neisseria meningitidis* serogroup C clone from Anhui Province, China. Lancet. 2006;367:419–23. http://dx.doi.org/10.1016/S0140-6736(06)68141-5
4. Zhou H, Gao Y, Xu L, Li M, Li Q, Li Y, et al. Distribution of serogroups and sequence types in disease-associated and carrier strains of *Neisseria meningitidis* isolated in China between 2003 and 2008. Epidemiol Infect. 2012;140:1296–303. http://dx.doi.org/10.1017/S0950268811001865
5. Lemos AP, Harrison LH, Lenser M, Sacchi CT. Phenotypic and molecular characterization of invasive serogroup W135 *Neisseria meningitidis* strains from 1990 to 2005 in Brazil. J Infect. 2010;60:209–17. http://dx.doi.org/10.1016/j.jinf.2009.11.014
6. Doyle TJ, Mejia-Echeverry A, Fiorella P, Leguen F, Livengood J, Kay R, et al. Cluster of serogroup W135 meningococci, southeastern Florida, 2008–2009. Emerg Infect Dis. 2010;16:113–5. http://dx.doi.org/10.3201/eid1601.091026
7. Sacchi CT, Lemos APS, Popovic T, Cassio de Morais J, Whitney AM, Melleset CEA, et al. Serosubtypes and PorA types of *Neisseria meningitidis* serogroup B isolated in Brazil during 1997–1998. Overview and implications for vaccine development. J Clin Microbiol. 2001;39:2897–903.http://dx.doi.org/10.1128/JCM.39.8.2897-2903.2001
8. Apicella MA. Extrameningeal complications of *Neisseria meningitidis* serogroup W135 infection. Clin Infect Dis. 2004;38:1638–9. http://dx.doi.org/10.1086/421030
9. Weidlich L, Baethgen LF, Mayer LW, Moraes C, Klein CC, Nunes LS, et al. High prevalence of *Neisseria meningitidis* hypervirulent lineages and emergence of W135:P1.5,2:ST-11 clone in southern Brazil. J Infect. 2008;57:324–31. http://dx.doi.org/10.1016/j.jinf.2008.07.014
10. Shao Z, Zhou H, Gao Y, Ren H, Xu L, Kan B, et al. *Neisseria meningitidis* serogroup W135, China. Emerg Infect Dis. 2010;16:348–9. http://dx.doi.org/10.3201/eid1602.090901

Address for correspondence: Jianguo Xu, National Institute for Communicable Disease Control and Prevention, Beijing 102206, China; email: xujianguo@icdc.cn

Early Public Response to Influenza A(H7N9) Virus, Guangzhou, China, May 30–June 7, 2013

To the Editor: On May 15, 2013, surveillance in live poultry markets (LPMs) identified an influenza A(H7N9) virus–infected chicken in Guangzhou, the capital of Guangdong Province, China. During May 30–June 7, 2013, we conducted a population-based survey in Guangzhou to investigate changes in the public's buying behavior at LPMs and to determine the public's attitude toward potential implementation of specific interventions against avian influenza in LPMs. Behaviors and attitudes in 3 residential areas of Guangzhou were compared: urban districts, Conghua (a semirural area), and Zengcheng (a semirural area where subtype H7N9 infection had been detected in an LPM on May 15, 2013). These locations were chosen to compare possible urban–rural differences in live poultry exposure, as observed in an earlier study (*1*), and to assess the effect of epidemic proximity on the public's attitude and behavior.

Study participants were recruited by using the Mitofsky–Waksberg 2-stage sampling method (*2*). First 120, 60, and 60 telephone prefixes in urban districts, Conghua, and Zengcheng, respectively, were randomly selected. Then for each prefix, telephone numbers were randomly generated and called until 5 households were successfully recruited. Within each household, the person whose birthday was closest to the interview date and who was ≥15 years of age was invited to participate in the telephone interview. Using a standardized questionnaire, we collected demographic information and information on behavior related to buying live poultry from LPMs, attitudes toward measures for reducing avian influenza transmission in LPMs, and perceived risk for infection from LPMs.

Of 1,930 persons recruited, 1,196 (62.0%) completed the interview. Information on age was missing for 19 persons, so they were excluded; thus, a total of 1,177 persons were included in the analysis. Responses from the 3 residential areas were generally comparable, with the exception that respondents from urban districts reported higher levels of education and personal income (online Technical Appendix, http://wwwnc.cdc.gov/EID/article/20/7/13-1155-Techapp1.pdf). Compared with the overall Guangzhou population (*3*), the respondents were slightly better educated and less likely to be single (online Technical Appendix).

We used logistic regression models (*4*) adjusted for age, sex, and education level to calculate the percentages and 95% CIs related to buying live poultry from LPMs, attitudes, and risk perception in each area and for the sample as a whole. During the 2 months before the survey, ≈33.5% (95% CI 29.7%–37.5%) of the sampled households bought live poultry from LPMs at least once a week (Table). The number of households that bought live poultry on a weekly basis was substantially lower in Zengcheng than in urban areas. After the epidemic in Zengcheng was announced, 59.1% (95% CI 55.1%–63.0%) of all respondents reported buying less poultry or having completely stopped buying live poultry. Compared with respondents in the other 2 areas, Zengcheng respondents were more likely to report a reduction in buying (Table).

Most respondents expressed support for the policy of introducing 1 or 2 monthly market rest days in Guangzhou, but only 21.1% (95% CI 18.1%–24.4%) agreed with complete closure of LPMs (Table). Zengcheng respondents were more likely to agree on closure of LPMs. Approximately

Table. Public attitudes and behaviors in response to influenza A(H7N9) virus, Guangzhou, China, May 30–June 7, 2013*

Characteristic	% (95% CI) persons with characteristic			
	Urban districts, n = 594	Semirural districts		Total, N = 1,177
		Conghua, n = 283	Zengcheng, n = 300	
Household purchase of live birds from LPMs				
Weekly to monthly	21.2 (17.6–25.2)	29.7 (23.8–36.5)	19.7 (14.7–25.8)	21.6 (18.5–25.0)
At least weekly	34.1 (29.7–38.7)	29.5 (23.2–36.6)	**23.3 (18.1–29.6)**	33.5 (29.7–37.5)
Buying less/stopped buying because of A(H7N9) epidemic	58.7 (54.0–63.3)	56.3 (49.3–63.2)	**71.6 (64.8–77.5)**	59.1 (55.1–63.0)
Attitude (agree/strongly agree) toward control measures				
Introducing 1 or 2 market rest days per month	88.7 (85.4–91.4)	90.5 (85.9–93.7)	91.2 (87.1–94.0)	89.7 (87.6–91.5)
Closing LPMs	20.8 (17.3–24.7)	16.2 (12.0–21.4)	**31.1 (25.4–37.3)**	21.1 (18.1–24.4)
Perception (agree/strongly agree) of risk from LPMs				
Live animals sold in markets are a risk to human health	34.0 (29.8–38.5)	33.3 (26.9–40.4)	38.2 (32.0–44.7)	34.3 (30.7–38.1)
Poor market hygiene is main cause of avian influenza transmission	68.5(64.0–72.7)	73.1 (66.9–78.6)	68.3 (61.7–74.4)	69.0 (65.2–72.5)
Likelihood (likely/very likely) of getting sick as a result of buying live birds from LPMs	18.7 (15.5–22.4)	**9.9 (6.8–14.1)**	**30.0 (23.8–37.0)**	19.1 (16.3–22.3)

*All values are weighted by population age and sex and adjusted by sample age, sex, and education level, using logistic regression models. Boldface indicate that attitudes/perceptions in Conghua or Zengcheng were significantly different ($p<0.05$) from those in urban districts. LPMs, live poultry markets.

one third of the respondents agreed that live animals sold in LPMs posed risks to human health, and more than two thirds agreed that avian influenza transmission was due to poor market hygiene. However, only 19.1% (95% CI 16.3%–22.3%) of the respondents perceived that they would be likely/very likely to get sick from buying live poultry from LPMs. Perceived risk from buying was highest in Zengcheng and lowest in Conghua (Table).

Although there were no cases of human A(H7N9) infection in Guangzhou at the time of study, >50% of respondents reported a reduction in buying live poultry from LPMs after the A(H7N9) epidemic in China was officially announced (*5*). Information on A(H7N9) virus may have motivated a population-level change in live poultry buying habits; however, such change is likely to be temporal (*6*). Detection of A(H7N9) virus infection in poultry may have further raised risk awareness and prompted behavioral change in the local area (*7*). However, respondents seemed to prefer measures such as monthly market rest days in LPMs rather than the more extreme measure of complete LPM closure. This finding suggests that the progressive introduction of measures to control avian influenza risk in LPMs would be more acceptable to the public. Although the risk from sales of live animals in LPMs was generally ignored, poor market hygiene was commonly accepted as a cause of avian influenza virus transmission. The public should be educated about the risk from sales of live animals in markets.

This study was limited by its reliance on self-reported data, making results potentially subject to social desirability bias. In addition, stratified rather than simple random sampling was used to recruit participants, so the sample may not be representative of the general population of Guangzhou. Furthermore, the study was conducted before any human cases of A(H7N9) infection were confirmed in Guangzhou, so the results may not apply to other parts of China with confirmed human cases. The results should, however, guide public health responses in regions neighboring epidemic areas.

Acknowledgments

We thank the team at Guangzhou Center for Disease Control and Prevention for assistance in administering the telephone surveys.

This work was supported by grants from the National Science and Technology Major Projects of China (No. 2012ZX10004213-005); Key Medical Science and Technology Research Projects of Guangzhou Municipality (No. 201102A212006); and the Area of Excellence Scheme of the University Grants Committee (AoE/M-12/06), Hong Kong Special Administrative Region government.

Jun Yuan,[1] Qiuyan Liao,[1] Eric H.Y. Lau,[1] Zhi Cong Yang,[1] Xiao Wei Ma, Jian Dong Chen, Yan Hui Liu, Chang Wang, Xiao Ping Tang, Yu Fei Liu, Gabriel M. Leung, Xin Cai Xiao, Richard Fielding, Ming Wang,[2] and Benjamin J. Cowling[2]

Author affiliations: Guangzhou Center for Disease Control and Prevention, Guangzhou, China (J. Yuan, Z.C. Yang, X.W. Ma, J.D. Chen, Y.H. Liu, C. Wang, Y.F. Liu, X.C. Xiao, M. Wang); The University of Hong Kong, Hong Kong, China (Q. Liao, E.H.Y. Lau, G.M. Leung, R. Fielding, B.J. Cowling); and The Eighth People's Hospital of Guangzhou, Guangzhou (X.P. Tang)

DOI: http://dx.doi.org/10.3201/eid2007.131155

[1]These first authors contributed equally to this article.

[2]These senior authors contributed equally to this article.

References

1. Liao Q, Lam WT, Leung GM, Jiang C, Fielding R. Live poultry exposure, Guangzhou, China, 2006. Epidemics. 2009;1:207–12. http://dx.doi.org/10.1016/j.epidem.2009.09.002
2. Yuan J, Zhang L, Xu W, Shen J, Zhang P, Ma H. Reported changes in health-related behaviours in Chinese urban residents in response to an influenza pandemic. Epidemiol Infect. 2009;137:988–93. http://dx.doi.org/10.1017/S0950268809002726
3. Statistics Bureau of Guangzhou. The 6th national population census, Guangzhou, 2010 [in Chinese]. 2011 [cited 2013 Jul 2]. http://www.gzstats.gov.cn/tjgb/glpcgb/201105/t20110517_25227.htm
4. Korn EL, Graubard BI. Analysis of health surveys. New York: Wiley; 1999.
5. Ministry of Health of the People's Republic of China. Shanghai and Anhui confirmed three cases of human infected with avian influenza A/H7N9 [in Chinese]. Beijing: the Ministry; 2013 [cited 2014 Feb 13]. http://www.moh.gov.cn/mohwsyjbgs/s3578/201303/44f25bd6bed14cf082512d8b6258fb3d.shtml
6. Fielding R, Lam WWT. Reducing avian influenza risk: a qualitative exploration of issues in Hong Kong. Health Educ. 2007;107:437–47. http://dx.doi.org/10.1108/09654280710778574
7. Fielding R, Bich TH, Quang LN, Lam WWT, Leung GM, Tien TQ, et al. Live poultry exposures, Hong Kong and Hanoi, 2006. Emerg Infect Dis. 2007;13:1065–7. http://dx.doi.org/10.3201/eid1307.061031

Address for correspondence: Ming Wang, Guangzhou Center for Disease Control and Prevention, Guangzhou, Guangdong Province, 510440, China; email: wangming@gzcdc.org.cn

Socioeconomic Status and Campylobacteriosis, Connecticut, USA, 1999–2009

To the Editor: *Campylobacter* is the second most common bacterial cause of foodborne gastrointestinal illnesses in the United States and the leading cause of these illnesses in Connecticut (*1*). It is also the leading identifiable cause of Guillain-Barré syndrome in the United States and all industrialized countries in which it has been studied (*2*). According to the Foodborne Disease Active Surveillance Network (FoodNet), campylobacteriosis incidence in the United States is increasing (*1*). Clarification of the epidemiology of campylobacteriosis is needed to control and prevent infection.

Socioeconomic status (SES) measures have not been explored in the United States as determinants for *Campylobacter* infection. Although individual SES measures are not routinely collected in FoodNet, street address of patient residence is. Following the recommended method of the Public Health Disparities Geocoding Project (*3*), we used census tract–level poverty as an SES measure for analysis. We attempted to geocode patient residences for all campylobacteriosis cases reported in Connecticut during 1999–2009 and to categorize them into 4 groups on the basis of percentage of residents in the census tract living below the federal poverty line: 0–<5%, 5%–<10%, 10%–<20%, and ≥20%. The average annual age-adjusted (on the basis of 2000 US Census data for Connecticut) incidence rate was calculated for each of 4 census tract-level neighborhood SES (i.e., neighborhood poverty) categories for all years combined and for 3 periods (1999–2002, 2003–2005, and 2006–2009). In addition, age group-specific rates were calculated for case-patients in the 4 SES categories. We used the χ^2 test for trend to assess the statistical significance of observed gradients of incidence across SES levels.

We geocoded 5,708 (95.9%) of the 5,950 campylobacteriosis cases reported during 1999–2009 to census tract level. The average annual crude incidence rate was 15.9 per 100,000 population; average age-specific incidence ranged from 9.4 in the 10–19-year age group to 18.1 in the ≥50-year age group. We found a strong dose-response relationship between higher campylobacteriosis incidence and higher neighborhood SES. Average annual age-adjusted incidence was 10.1 (95% CI 9.1–11.1) for the lowest SES group (≥20% below poverty), 11.9 (95% CI 11.0–12.9) for the 10%–<20% group, 14.8 (95% CI 14.0–15.7) for the 5%–<10% group, and 16.9 per 100,000 (95% CI 16.3–17.4) for the highest SES group (0–<5% below poverty) ($p<0.001$ by χ^2 for trend). A strong SES gradient was also consistent and significant ($p<0.001$ by χ^2 for trend) for each of the 3 periods.

Incidence within age groups by neighborhood SES level is shown in the Figure. For all age groups ≥10 years, incidence of campylobacteriosis increased as neighborhood SES increased ($p<0.001$ for each category by χ^2 for trend). However, for children 0–<10 years of age, the socioeconomic gradient seen in teenagers and adults reversed direction; incidence increased as neighborhood SES decreased ($p<0.001$ by χ^2 for trend). Because only 51% of case reports included information on race and ethnicity, we were unable to examine whether SES gradients occurred within each major racial/ethnic group in Connecticut.

Previous studies using similar area-based methods in Denmark; Manitoba, Canada; Queensland, Australia; and Scotland also found an association between *Campylobacter* infection incidence and higher area-based SES (*4*–*7*). A true higher prevalence of major campylobacteriosis risk factors among patients with a higher SES

Article DOI: http://dx.doi.org/10.3201/eid2007.131155

Early Public Response to Influenza A(H7N9) Virus, Guangzhou, China, May 30–June 7, 2013

Technical Appendix

Technical Appendix Table. Characteristics of the population of Guangzhou, China, and of survey respondents in urban districts and semirural areas of Guangzhou, May 30–June 7, 2013

	% (95% CI) participants by area						
Characteristic	Urban districts, n = 594	Conghua, n = 283	Zengcheng, n = 300	Total, N = 1,177	% Guangzhou population*	Difference between residential areas (p)†	Effect size‡
Sex							
F	59.1 (55.0–63.1)	53.7 (47.7–59.6)	57.0 (51.2–62.7)	57.3 (54.4–60.1)	48.0	0.320	0.19
M	40.9 (36.9–45.0)	46.3 (40.4–52.3)	43.0 (37.3–48.8)	42.7 (39.9–45.6)	52.0		
Age group, y							
15–34	35.5 (31.7–39.5)	34.3 (28.8–40.1)	41.7 (36.0–47.5)	36.8 (34.0–39.6)	49.1	0.154	0.25
35–54	40.6 (36.6–44.6)	43.5 (37.6–49.5)	40.7 (35.1–46.5)	41.3 (38.5–44.2)	34.8		
≥55	23.9 (20.5–27.5)	22.3 (17.6–27.6)	17.7 (13.5–22.5)	21.9 (19.6–24.4)	16.1		
Education							
Primary or below	12.3 (9.8–15.2)	19.8 (15.3–24.9)	18.0 (13.8–22.8)	15.6 (13.5–17.7)	17.7	<0.001	0.34
Secondary	46.1 (42.1–50.2)	51.9 (46.0–57.9)	53.3 (47.5–59.1)	49.4 (46.5–52.3)	61.7		
Tertiary or above	41.1 (37.1–45.2)	27.2 (22.1–32.8)	27.7 (22.7–33.1)	34.3 (31.6–37.1)	20.6		
Unknown	0.5	1.1	1.0	0.8	0		
Marital status							
Single	14.6 (11.9–17.7)	13.8 (10.0–18.4)	18.0 (13.8–22.8)	15.3 (13.3–17.5)	32.4	0.316	0.36
Married or formerly married	85.2 (82.1–87.9)	85.5 (80.9–89.4)	82.0 (77.2–86.2)	84.5 (82.3–86.5)	67.6		
Unknown	0.2	0.7	0.0	0.3	0		
Monthly income (US$)§							
≤163	18.9 (15.8–22.2)	29.3 (24.1–35.0)	23.7 (19.0–28.9)	22.6 (20.2–25.1)	Not known	<0.001	
163–488	26.6 (23.1–30.3)	35.0 (29.4–40.9)	32.7 (27.4–38.3)	30.2 (27.5–32.9)	Not known		
488–813	20.9 (17.7–24.4)	16.3 (12.2–21.1)	12.0 (8.6–16.2)	17.5 (15.4–19.8)	Not known		
>813	20.2 (17.0–23.7)	5.3 (3.0–8.6)	9.0 (6.0–12.8)	13.8 (11.8–15.9)	Not known		
Unknown	13.5 (10.8–16.5)	14.1 (10.3–18.7)	22.7 (18.1–27.8)	16.0 (13.9–18.2)	Not known		

*Population structure was obtained from the 2010 Guangzhou census data (http://www.gzstats.gov.cn/tjgb/glpcgb/201105/t20110517_25227.htm [in Chinese]).
†p values were based on χ^2 test.
‡Cohen's effect sizes w were calculated using the formula $w=\sqrt{\sum_{i=1}^{m}(p_0(i)-p_1(i))^2/p_0(i)}$, where $p_0(i)$ and $p_1(i)$ represent the observed proportions in the i'th category from the population (based on the 2010 Guangzhou census data) and the total sample, respectively.
§≤US$163, US$163–488, US$488–813 and >US$813 are approximate to categories of ≤1,000 Chinese Yuan (CNY), 1,000–3,000CNY, 3,000–5,000CNY, >5,000CNY (1US$ = 6.15CNY).