Preplanned Studies

Community Incidence Estimates of Five Pathogens Based on Foodborne Diseases Active Surveillance — China, 2023

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Summary

What is already known about this topic?

Foodborne diseases, representing significant food safety and public health challenges globally, are not well-documented in terms of incidence, particularly for cases characterized by acute gastroenteritis (AGI) in China.

What is added by this report?

This study developed a pyramid model to estimate the incidence of five pathogens, stratified by gender and age. The estimated incidences per 100,000 people with 95% uncertainty intervals (*UI*) are as follows: Norovirus, 3,188.28 (95% *UI*: 2,518.03, 7,296.96); *Salmonella* spp., 1,295.59 (95% *UI*: 1,002.62, 1,573.11); diarrheagenic *E. coli* (DEC), 782.62 (95% *UI*: 651.19, 932.05); *Vibrio parahaemolyticus*, 404.06 (95% *UI*: 342.19, 468.93); and *Shigella* spp., 26.73 (95% *UI*: 21.05, 33.46).

What are the implications for public health practice?

This study elucidates the incidence rates across various gender and age groups, thereby identifying priority populations for targeted preventive interventions aimed at reducing disease burden. These insights are crucial for the development of public health policies and management of food safety risks.

Foodborne diseases represent a significant challenge in food safety and public health worldwide, necessitating increased focus on assessing their burden. In China, the majority of microbial foodborne illnesses are categorized as infectious diarrhea, excluding bacillary dysentery, under statutory category C infectious diseases. The traditional passive surveillance system in place often misses specific pathogens and is plagued by extensive under-reporting and under-diagnosis, complicating the understanding of the actual disease burden. However, the establishment of a laboratory-based foodborne disease surveillance platform in 2011 has enhanced disease tracking. This initiative relies on the ongoing cooperation between local disease prevention and control agencies and clinical laboratories. It involves regular audits to identify new cases and ensure the comprehensive reporting of all infectious diseases. By the end of 2023, over 900 hospitals across 31 provincial-level administrative divisions (PLADs) and Xinjiang Production and Construction Corps (XPCC) had participated in this sentinel surveillance. The pyramid model, commonly applied to estimate the incidence of pathogens causing acute gastroenteritis (AGI), systematically addresses uncertainty at each stage. This model considers steps such as patients seeking care, hospitals collecting stool specimens, laboratories analyzing these samples, and the subsequent identification of pathogens, incorporating parameter distributions to better estimate underreporting rates (*1*).

In this study, we merged data from both sentinel hospital surveillance and previous community surveys in China with data from the population census to estimate the incidence of diarrheal diseases using a pyramid model. The surveillance data encompassed cases defined by three or more daily bowel movements paired with altered stool consistency, attributable to foodborne or suspected foodborne pathogens. These pathogens included *Salmonella* spp., *Vibrio parahaemolyticus*, *Shigella* spp., diarrheagenic *E. coli* (DEC), and norovirus, detected according to the protocols specified in the National Foodborne Disease Surveillance Manual. Prevalences were derived as the proportion of positive results to the total samples tested. Details on administrative regions and population demographics were sourced from publicly accessible records. We determined the incidences of AGI within the community, as well as the likelihood of hospitalization and incidence of diarrhea due to AGI, based on data from prior national community-based surveys (*2*). Rates for stool sample collection, sample submission, and laboratory testing capacity were obtained from the same sentinel hospital data. We used probability distributions of consultation rates and AGI incidences, differentiated by sex and age groups, to enhance the model using average levels across the total population (Supplementary Table S1, available at https://weekly.chinacdc.cn/). We calculated overall incidences by multiplying age-specific incidences with data from the Seventh National Population Census and then dividing this by the broader population total.

Data cleaning and analysis were conducted using R version 4.3.2 (R Foundation for Statistical Computing, Vienna, Austria). The 95% confidence intervals (*CIs*) for prevalence were estimated using the binomial test, while differences between groups were assessed using the chi-squared test, with a significance threshold set at α=0.01. Uncertainties were addressed by calculating incidences through 20,000 Monte Carlo simulation iterations, relying on parameter distributions and available data.

The prevalence of infection by five pathogens varied significantly between genders (χ^2=81.09, P<0.000), with males showing a higher overall prevalence. Notably, *Salmonella* spp., DEC, and norovirus were more common in males than in females. In contrast, *Vibrio parahaemolyticus* was more prevalent among females, a statistically significant difference (Table 1). Regionally, southern China had the highest prevalence of these pathogens, followed by eastern China, whereas northeastern China had the lowest. Except for the northeastern China, no significant regional differences were observed in the prevalence of norovirus. *Salmonella* spp. was most prevalent in southern China and least prevalent in northeastern China. *Vibrio parahaemolyticus* showed the highest prevalence in coastal regions including the northeastern China, northern China, and southern China. Central China, northwestern China, and southwestern China had lower prevalence rates, with the northwestern China reporting no cases. DEC was most prevalent in northern China and least prevalent in southwestern China. Conversely, *Shigella* was most prevalent in northwestern China, yet was reported as least prevalent in the other region (Table 2).

Norovirus exhibited the highest incidence rate at 3,188.28 [95% uncertainty intervals (*UI*): 2,510.80, 3,872.96] cases per 100,000 population, predominantly affecting the 1–4 years, which showed an incidence of 5,133.68 (95% *UI*: 4,047.24, 6,229.35) cases per 100,000 population. In contrast, *Salmonella* spp. were most prevalent in infants under one year, with an incidence rate of 5,559.18 (95% *UI*: 4,377.10, 6,751.43) cases per 100,000 population, followed by the 1–4 year age group with a rate of 3,927.84 (95% *UI*: 3,096.26, 4,765.52) cases per 100,000 population. The highest incidence of *Vibrio parahaemolyticus* was noted among individuals aged 35–44, with an incidence rate of 716.57 (95% *UI*: 564.79, 869.70) cases per 100,000 population. DEC was most frequent in the 20–24 year age group, presenting a rate of 1,026.32 (95% *UI*: 808.21, 1,246.93) cases per 100,000 population. *Shigella* spp. showed the lowest incidence at 26.73 (95% *UI*: 21.05, 33.46) cases per 100,000 population, with the highest rates found among children aged 5–9 years, at 53.32 cases per 100,000 population (95% *UI*: 41.99, 64.78) (Table 3).

DISCUSSION

The incidence of foodborne diseases, along with other disease burden indicators, is essential for the development of prioritized food safety management and intervention strategies. In this study, norovirus displayed the highest incidence among the five pathogens estimated, aligning with the multi-regional findings reported by World Health Organization in 2015 (*3*). It is important to recognize that only a subset of norovirus cases is attributable to foodborne transmission. Notably, the incidence of norovirus is higher in children aged 1–4, likely due to their lower immunity and greater exposure in environments such as daycare centers and schools (*4*). The estimated overall population incidence of *Salmonella* spp. was higher compared to the rates reported by Li et al. (245 cases per 100,000 populations), Chen et al. (236 cases per 100,000 populations), and those reported in the United States (344 cases per 100,000 populations), Australia (427 cases per 100,000 populations), and Japan (199 cases per 100,000 populations) (*5*–*9*). In China, there are no specific standard restrictions on *Salmonella* spp. for fresh or frozen livestock and poultry products or during slaughtering and processing. This results in a higher positive detection rate of *Salmonella* spp. and an increased likelihood of cross-contamination during food storage, transportation, processing, and cooking. Infants under one year exhibit the highest incidence of *Salmonella* spp., likely due to their vulnerable immune systems and increased exposure to contaminated food or water sources, making them more susceptible to severe outcomes like bacteremia and meningitis. Variations in the study year, data sources, and parameter distributions could explain some differences. Additionally, this study acknowledges potential

TABLE 1. Prevalence of five pathogens across different genders and age groups based on the foodborne diseases surveillance system in China, 2023.

Group	Prevalence (%) (positive cases/total cases) 95% *CI*					
	***Salmonella* spp.**	***Shigella* spp.**	***Vibrio parahaemolyticus***	**Diarrheagenic *E. coli***	**Norovirus**	**All**
Gender						
Male	6.74 (6,172/91,563) (6.58, 6.91)	0.09 (68/79,596) (0.07, 0.11)	0.98 (884/90,096) (0.92, 1.05)	2.68 (2,073/77,430) (2.56, 2.79)	12.71 (6,675/59,463) (12.47, 12.97)	18.77 (17,413/92,774) (18.52, 19.02)
Female	6.15 (4,926/80,145) (5.98, 6.31)	0.09 (85/90,931) (0.08, 0.12)	1.24 (976/78,881) (1.16, 1.32)	2.46 (1,670/67,760) (2.35, 2.58)	11.23 (8,709/68,499) (10.97, 11.48)	17.11 (13,885/81,172) (16.85, 17.37)
χ^2	24.87	0.22	25.11	6.42	66.54	81.09
P	<0.001	0.64	<0.001	0.01	<0.001	<0.001
Age, years						
<1	18.90 (2,204/11,660) (18.20, 19.62)	0.10 (11/11,441) (0.05, 0.17)	0 (0/11,280) (0, 0.03)	1.76 (185/10,524) (1.52, 2.03)	10.21 (926/9,067) (9.60, 10.85)	27.46 (3,248/11,830) (26.65, 28.27)
1–4	13.40 (3,942/29,419) (13.01, 13.79)	0.11 (31/29,043) (0.07, 0.15)	0.02 (5/28,463) (0.01, 0.041)	2.33 (625/26,818) (2.15, 2.52)	17.59 (4,219/23,987) (17.11, 18.08)	28.45 (8,581/30,163) (27.94, 28.96)
5–9	5.55 (531/9,562) (5.10, 6.03)	0.19 (18/9,510) (0.11, 0.30)	0.08 (7/9,306) (0.03, 0.15)	2.08 (178/8,549) (1.79, 2.41)	14.09 (1,104/7,837) (13.32, 14.88)	18.19 (1,792/9,849) (17.44, 18.97)
10–14	3.01 (182/6,040) (2.60, 3.48)	0.15 (9/6,010) (0.07, 0.28)	0.40 (24/5,941) (0.26, 0.60)	2.33 (121/5,192) (1.94, 2.78)	11.39 (535/4,696) (10.50, 12.34)	13.73 (842/6,134) (12.87, 14.61)
15–19	2.54 (282/11,118) (2.25, 2.85)	0.05 (6/11,090) (0.02, 0.12)	0.84 (93/11,071) (0.68, 1.03)	3.01 (267/8,873) (2.66, 3.39)	12.45 (998/8,015) (11.74, 13.19)	14.07 (1,582/11,243) (13.43, 14.73)
20–24	2.11 (221/10,490) (1.84, 2.40)	0.06 (6/10,474) (0.02, 0.12)	1.74 (182/10,439) (1.50, 2.01)	3.50 (299/8,543) (3.12, 3.91)	12.97 (984/7,587) (12.22, 13.75)	15.46 (1,634/10,572) (14.77, 16.16)
25–34	2.74 (679/24,779) (2.54, 2.95)	0.07 (16/24,692) (0.04, 0.11)	2.38 (587/24,688) (2.19, 2.58)	3.37 (665/19,707) (3.13, 3.64)	14.04 (2,483/17,679) (13.54, 14.57)	17.05 (4,266/25,025) (16.58, 17.52)
35–44	2.94 (466/15,825) (2.69, 3.22)	0.05 (8/15,768) (0.02, 0.10)	2.45 (385/15,720) (2.21, 2.70)	3.39 (434/12,801) (3.08, 3.72)	11.78 (1,317/11,184) (11.18, 12.39)	15.76 (2,516/15,963) (15.20, 16.34)
45–54	4.31 (619/14,349) (3.99, 4.66)	0.11 (15/14,257) (0.06, 0.17)	1.62 (230/14,154) (1.42, 1.85)	2.32 (274/11,818) (2.05, 2.61)	9.02 (918/10,181) (8.47, 9.59)	13.84 (2,001/14,453) (13.29, 14.42)
55–64	4.66 (739/15,871) (4.33, 5.00)	0.09 (14/15,779) (0.05, 0.15)	1.4 (219/15,653) (1.22, 1.60)	2.54 (336/13,244) (2.28, 2.82)	8.29 (943/11,369) (7.79, 8.82)	13.74 (2,195/15,979) (13.21, 14.28)
65–74	5.13 (705/13,741) (4.77, 5.51)	0.08 (11/13,672) (0.04, 0.14)	0.76 (103/13,579) (0.62, 0.92)	2.08 (241/11,611) (1.82, 2.35)	6.38 (635/9,953) (5.91, 6.88)	12.00 (1,661/13,837) (11.47, 12.56)
75–84	6.17 (419/6,789) (5.61, 6.77)	0.12 (8/6,738) (0.05, 0.23)	0.32 (21/6,656) (0.20, 0.48)	1.66 (96/5,794) (1.34, 2.02)	5.01 (246/4,912) (4.41, 5.66)	11.34 (774/6,824) (10.60, 12.12)
≥85	5.28 (109/2,065) (4.35, 6.33)	0 (0/2,053) (0, 0.18)	0.20 (4/2,027) (0.05, 0.50)	1.28 (22/1,716) (0.81, 1.93)	5.08 (76/1,495) (4.03, 6.32)	9.93 (206/2,074) (8.68, 11.30)
χ^2	7,204.00	-	1,343.60	209.22	1,673.40	4,257.90
P	<0.001	0.035*	<0.001	<0.001	<0.001	<0.001

Note:"-"not applicable

Abbreviation: *CI*=confidence intervals.

* *P* values were calculated using fisher's exact probability method.

underestimations due to only sending a portion of collected fecal specimens for testing at sentinel hospitals. The The prevalence of *Vibrio parahaemolyticus* was mainly occurs in coastal provinces. The estimated incidence is higher than that reported by Li et al. (806 cases per 100000 people), but lower than that estimated by Chen et al. (206 cases per 100,000 population). However, it was considerably higher than those reported in the United Kingdom (<1 case per 100,000 population), Australia (4 cases per 100,000 population), and the United States (12 cases per 100,000 population) (*5*–*8*,*10*). The 35–44 age group showed the highest incidence of *Vibrio parahaemolyticus*, likely due to a preference for consuming raw or undercooked seafood, including shellfish. Since the COVID-19 pandemic, the newly identified serotype O10:K4 has frequently been detected in sporadic and outbreak cases in China (*11*), gradually supplanting the traditionally dominant serotype O3:K6 (*12*). Ongoing pathogen surveillance and tracing are critical to address this shift. *Shigella* spp. demonstrated an overall low incidence, attributed

TABLE 2. Prevalence of five pathogens in different administrative area groups based on foodborne diseases surveillance symstem in China, 2023.

Area	Prevalence (%) (positive cases/total cases) 95% *CI*					
	***Salmonella* spp.**	***Shigella* spp.**	***Vibrio parahaemolyticus***	**Diarrheagenic *E. coli***	**Norovirus**	**All**
Northeastern China	2.27 (218/9,618) (1.98, 2.58)	0.07 (7/9,601) (0.03, 0.15)	1.12 (107/9,595) (0.91, 1.35)	0.41 (39/9,596) (0.29, 0.56)	4.61 (307/6,664) (4.12, 5.14)	6.91 (668/9,673) (6.41, 7.43)
Eastern China	5.88 (4,347/73,886) (5.71, 6.06)	0.03 (19/73,749) (0.02, 0.04)	1.82 (1,343/73,788) (1.72, 1.92)	4.02 (2,109/52,508) (3.85, 4.19)	13.3 (6,999/52,620) (13.01, 13.59)	19.24 (14,322/74,420) (18.96, 19.53)
Central China	7.48 (1,340/17,926) (7.09, 7.87)	0.06 (11/17,695) (0.03, 0.11)	0.12 (21/17,355) (0.08, 0.18)	1.95 (337/17,276) (1.75, 2.17)	10.12 (1,582/15,632) (9.65, 10.60)	17.50 (3,196/18,263) (16.95, 18.06)
Northern China	4.90 (1,050/21,441) (4.61, 5.19)	0.08 (16/21,451) (0.04, 0.12)	1.05 (223/21,183) (0.92, 1.20)	4.48 (856/19,120) (4.19, 4.78)	11.44 (18,70/16,341) (10.96, 11.94)	17.62 (3,828/21,723) (17.12, 18.14)
Southern China	16.54 (2,518/15,228) (15.95, 17.14)	0.10 (15/14,607) (0.06, 0.17)	0.93 (136/14,576) (0.78, 1.10)	0.54 (79/14,573) (0.43, 0.68)	12.52 (1,124/8,977) (11.84, 13.22)	24.91 (3,816/15,321) (24.22, 25.60)
Northwestern China	3.56 (555/15,572) (3.28, 3.87)	0.36 (55/15,455) (0.27, 0.46)	0 (0/14,959) (0, 0.03)	1.72 (264/15,380) (1.52, 1.93)	12.31 (1,571/12,767) (11.74, 12.89)	14.92 (2,379/15,947) (14.37, 15.48)
Southwestern China	5.93 (1,070/18,037) (5.59, 6.29)	0.17 (30/17,969) (0.11, 0.24)	0.17 (30/17,521) (0.12, 0.24)	0.35 (59/16,737) (0.27, 0.45)	12.91 (1,931/14,961) (12.37, 13.45)	16.61 (3,089/18,599) (16.08, 17.15)
χ^2	3,218.86	170.36	813.53	1530.42	500.59	1,512.61
P	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Total	6.46 (11,098/171,708) (6.35, 6.58)	0.09 (153/170,527) (0.08, 0.11)	1.10 (1,860/168,977) (1.05, 1.15)	2.58 (3,743/145,190) (2.50, 2.66)	12.02 (15,384/127,962) (11.84, 12.20)	17.99 (31,298/173,946) (17.81, 18.17)

Note: Northeastern China includes Shaanxi, Gansu, Qinghai, Ningxia, and Xinjiang PLADs and XPCC; eastern China includes Shanghai, Shandong, Jiangsu, Anhui, Jiangxi, Zhejiang, and Fujian PLADs; central China includes Henan, Hubei, and Hunan PLADs; northern China includes Beijing, Tianjin, Hebei, Shanxi, and Inner Mongolia PLADs; southern China includes Guangxi, Guangdong, and Hainan PLADs; northwestern China includes Liaoning, Jilin, and Heilongjiang PLADs; southwestern China includes Chongqing, Sichuan, Guizhou, Yunnan, and Xizang PLADs.

Abbreviation: *CI*=confidence intervals; PLAD=provincial-level administrative divisions; XPCC=Xinjiang Production and Construction Corps.

to improvements in healthcare facilities and dietary habits in China. However, in Northwestern China such as Xinjiang Uygur and Xizang Autonomous Regions, where local dietary customs differ, the prevalence of *Shigella* spp. remains relatively high. It is crucial to conduct food safety and health education programs in these areas. This study primarily estimated the incidence of DEC, as only a limited number of sentinel hospitals conducted specific typing and identification. The potential adoption of culture-independent diagnostic testing (CIDT) methods is expected to address this issue gradually. Overall, the incidence of DEC is likely underestimated.

The study is subject to some limitations. First, the estimated incidence may be biased toward PLADs with higher reporting rates, which could affect the calculation of regional incidence rates. Second, the inclusion of data from a previous community AGI survey introduces a temporal discrepancy, potentially rendering the data unreflective of current conditions. Additionally, the lack of detailed information on population distribution concerning AGI and fecal retention cases required that age and gender distributions be inferred solely from the submitted case reports, without accounting for uncertainty. Finally, the reliance on test results from sentinel hospitals to indicate pathogen detection capabilities presupposes uniform sensitivity across all pathogens, an assumption that may not hold true.

This study provides the first estimates of the incidence of five pathogens, classified by age and gender, derived from active surveillance data on foodborne diseases in China. These findings serve as a crucial foundation for informed decision-making and regulation in assessing food safety risks based on disease burden. To maintain current data on disease trends and support effective supervision and management of food safety, continued surveys of the AGI population and the monitoring of sentinel hospitals are recommended.

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TABLE 3. Incidence estimates of five pathogens in different genders and ages groups based on the pyramid model in China, 2023.

Group	Incidence (case/100,000) (95% *UI*)				
	***Salmonella* spp.**	***Shigella* spp.**	***Vibrio parahaemolyticus***	**Diarrheagenic *E. coli***	**Norovirus**
Gender					
Male	1,324.47 (1,043.45, 1,607.92)	27.80 (21.90, 33.75)	373.64 (294.46, 453.49)	813.56 (640.69, 987.94)	3,345.81 (2,635.12, 4,063.80)
Female	1,265.34 (996.69, 1,536.63)	25.60 (20.16, 31.10)	435.94 (343.50, 529.20)	750.20 (590.82, 911.17)	3,023.19 (2,380.51, 3,672.95)
Age, years					
<1	5,559.18 (4,377.10, 6,751.43)	27.03 (21.29, 32.82)	0 (-)	507.70 (399.86, 616.68)	2,939.71 (2,313.59, 3,572.02)
1–4	3,927.84 (3,096.26, 4,765.52)	31.62 (24.93, 38.35)	5.13 (4.04, 6.22)	672.67 (530.44, 816.08)	5,133.68 (4,047.24, 6,229.35)
5–9	1,628.83 (1,282.83, 1,978.76)	53.32 (41.99, 64.78)	21.24 (16.73, 25.80)	607.53 (478.28, 738.45)	4,111.88 (3,236.75, 4,997.10)
10–14	877.93 (690.30, 1068.42)	50.57 (39.75, 61.57)	119.44 (93.88, 145.38)	690.05 (542.48, 840.14)	3,315.67 (2,604.74, 4,038.34)
15–19	743.20 (585.17, 902.74)	16.18 (12.74, 19.65)	243.84 (192.00, 296.12)	867.61 (683.00, 1,054.17)	3,584.01 (2,821.13, 4,356.19)
20–24	614.06 (483.66, 745.71)	17.25 (13.59, 20.96)	510.95 (402.41, 620.53)	1,026.32 (808.21, 1,246.93)	3,808.68 (2,998.18, 4,629.28)
25–34	798.92 (629.93, 969.42)	18.83 (14.84, 22.86)	695.65 (548.52, 843.96)	9,89.51 (779.44, 1,200.81)	4,116.38 (3,243.89, 4,996.47)
35–44	861.31 (678.73, 1,045.43)	14.84 (11.69, 18.01)	716.57 (564.79, 869.70)	990.76 (780.37, 1,202.92)	3,440.00 (2,710.14, 4,177.66)
45–54	1,269.18 (999.93, 1,540.39)	31.56 (24.87, 38.30)	466.21 (367.31, 565.90)	679.32 (535.09, 824.79)	2,642.93 (2,081.75, 3,209.47)
55–64	1,370.00 (1,079.77, 1,662.86)	26.74 (21.06, 32.45)	403.92 (318.27, 490.30)	743.67 (585.94, 902.83)	2,410.79 (1,899.08, 2,927.11)
65–74	1,502.83 (1,183.62, 1,824.64)	23.23 (18.30, 28.20)	220.93 (173.98, 268.26)	605.61 (476.94, 735.36)	1,864.06 (1,467.48, 2,264.44)
75–84	1,799.33 (1,415.88, 2,187.36)	34.66 (27.27, 42.15)	91.80 (72.23, 111.61)	483.44 (380.21, 588.18)	1,462.72 (1,150.12, 1,779.98)
≥85	1,583.40 (1,239.52, 1,937.40)	0 (0, 0)	63.98 (50.07, 78.31)	367.21 (286.90, 450.27)	1,472.45 (1,149.39, 1,808.13)
Total	1,295.59 (1,020.62, 1,573.11)	26.73 (21.05, 33.46)	404.06 (318.41, 491.45)	782.62 (616.34, 950.46)	3,188.28 (2,510.80, 3,872.96)

Note:"-"not applicable

Abbreviation: *UI*=uncertainty intervals.

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SUPPLEMENTARY MATERIAL

SUPPLEMENTARY TABLE S1. Variables for reconstructing the pyramid model for a specific pathogen in different age and gender.

Variables	Description	Distribution/Formula
a*	Probability of seek medical care	beta (a_1+1,a_2-a_1+1)
b*	Probability of submitting a stool specimen	beta (b_1+1,b_2-b_1+1)
c*	Probability of analysing a pathogen in specimens	beta (c_1+1,b_1-c_1+1)
d*	Sensitivity of laboratory analysis	beta (d_1+1,d_2-d_1+1)
e	Probability of diarrhea caused by five pathogens	beta (e_1+1,e_2-e_1+1)
f*	AGI incidence per person-year	norm (0.28,0.03)
b_1	Number of seek medical care of in SH	Data;
b_2	Number of seek submitting a stool specimen	Data;
c_1	Number of analysing a pathogen	Data;
m	Number of positive specific pathogen detected in SH	Data;
n	The actual number of cases of a specific pathogen in the population covered by SH	$m/(a \cdot b \cdot c \cdot d)$
N	The actual population of the community covered by SH	$b_1/(e \cdot f \cdot a)$
p	Incidence of specific pathogen	n/N

Abbreviation: SH=sentinel hospitals; AGI=acute gastroenteritis.

* The results are derived from previous national community-based AGI survey. a_1=346, number of seek medical care from AGI in community survey. a_2=948, number of total AGI in community survey. d_1=434, number of sentinel hospitals passing check. d_2=471, number of all sentinel hospitals participating check. e_1=28838, number of AGI with diarrhea in community survey. e_2=30048, number of AGI in community survey.