

Preplanned Studies

Trends in Two-Week Prevalence of Fever and Diarrhea Among Infants and Young Children in Rural — China, 2016–2025

Yanli Wei¹; Lijuan Wang^{1,†}; Jian Huang¹; Jing Sun¹; Junsheng Huo¹

Summary

What is already known about this topic?

Infants and young children aged 6–23 months in poor rural China are vulnerable to fever and diarrhea; however, long-term trend data on their two-week prevalence remain scarce.

What is added by this report?

Using ten rounds of cross-sectional data (2016–2025) from the Nutrition Improvement Program for Children in Poor Areas, we analyzed trends among 422,425 children. The two-week prevalence of fever, diarrhea, and concurrent fever and diarrhea decreased significantly from 13.1% (4,236/32,444) to 7.0% (3,139/44,592), 12.3% (3,991/32,444) to 4.2% (1,886/44,592), and 4.1% (1,321/32,444) to 1.4% (640/44,592), respectively (all $P < 0.01$).

What are the implications for public health practice?

The significant decline reflects the effectiveness of comprehensive strategies, including economic development, public health management, and nutrition interventions. Sustaining progress will require robust health management systems and continued delivery of nutrition interventions to vulnerable populations.

were included. The two-week prevalence of fever declined overall from 13.1% (4,236/32,444) to 7.0% (3,139/44,592), with a nadir of 5.6% (2,408/43,008) in 2021; diarrhea decreased overall from 12.3% (3,991/32,444) to 4.2% (1,886/44,592), with a nadir of 3.9% (1,580/40,707) in 2022; and concurrent fever and diarrhea decreased from 4.1% (1,321/32,444) to 1.4% (640/44,592) (all $P < 0.01$). Significant downward trends were observed across all subgroups. Younger children (6–11 months) consistently showed higher prevalence but greater reductions over time. Males had higher baseline prevalence than females but experienced larger declines. Children with normal birth weight exhibited more pronounced improvements than those with low birth weight. Higher maternal education levels and maternal caregiving were associated with lower prevalence.

Conclusion: The two-week prevalence of fever and diarrhea among IYC in poor rural China has decreased substantially, which may reflect the combined effects of economic development, strengthened public health systems, and large-scale nutrition interventions.

ABSTRACT

Introduction: Infants and young children (IYC) aged 6–23 months are vulnerable to fever and diarrhea; however, the long-term trend data in poor rural China remain scarce.

Methods: Data were derived from ten rounds of cross-sectional surveys (2016–2025) under the Nutrition Improvement Program for Children in Poor Areas (NIPCPA), using a multi-stage cluster sampling design. Information on fever and diarrhea in the preceding two weeks was collected through caregiver-reported questionnaires. The Cochran–Armitage trend test was used to assess overall and subgroup-specific temporal trends.

Results: A total of 422,425 IYC aged 6–23 months

Infants and young children (IYC) aged 6–23 months are in a critical developmental period with immature immune function, which increases their susceptibility to fever and diarrhea. Poor rural areas in China have long faced relatively high childhood morbidity burdens. However, population-based data describing the status and long-term trends of the two-week prevalence of common childhood illnesses in these areas remain limited.

Data were obtained from ten rounds of annual cross-sectional surveys conducted from 2016 to 2025 under the Nutrition Improvement Program for Children in Poor Areas (NIPCPA)(1). A four-stage cluster sampling strategy was applied across all survey rounds. In the first stage, all 832 national poverty-stricken counties were stratified across 20 provinces and ranked

by gross domestic product and population size. Seven counties were randomly selected from each province; in the province with only five poverty-stricken counties, all five counties were included. The counties selected in 2016 were retained for all subsequent survey rounds. In the second stage, townships within each county were ranked by per capita net income and population size, and five townships were randomly selected from each county. In the third stage, 3–5 villages were randomly selected from each township. Finally, 12–20 children aged 6–23 months were randomly selected from each village (2).

Questionnaires were used to collect basic characteristics of the IYC. Core modules covered the sociodemographic characteristics of children and caregivers, 24-h dietary intake assessed by 24-h dietary recall, and caregiver feeding knowledge (2–3). All indicators, variable definitions, survey items, and survey timing used in this study were consistent across the 10 survey rounds from 2016 to 2025. According to the survey protocol, children were categorized into three age groups: 6–11, 12–17, and 18–23 months. Birth weight was classified as low (<2,500 g), normal (2,500–3,999 g), or macrosomia ($\geq 4,000$ g) birth weight. Caregivers were defined as individuals who cared for the child's diet, daily living, and personal safety, and were categorized as mother, father, grandparents or other caregivers. Maternal education was classified as primary school or below, junior high school, or senior high school or above. Fever was defined as a rectal temperature >37.8 °C, oral temperature >37.5 °C, or axillary temperature >37.4 °C. Diarrhea was defined as the passage of three or more loose or watery stools within a 24-h period. The two-week prevalence of fever, diarrhea, and concurrent fever and diarrhea was ascertained from caregiver self-report of symptoms during the two weeks preceding the survey. For each outcome, two-week prevalence was calculated as the number of children with the symptom or concurrent symptoms divided by the total number of surveyed children.

All investigators received standardized training before each survey. Uniform data-collection protocols were used across survey years. Double data entry and logical checks were performed to ensure data accuracy.

Statistical analyses were performed using R software (version 4.5.2; R Foundation for Statistical Computing, Vienna, Austria). The Cochran–Armitage trend test was used to assess temporal trends in the two-week prevalence of fever, diarrhea, and concurrent fever and diarrhea from 2016 to 2025. All tests were

two-sided, and $P < 0.05$ was considered statistically significant.

Among the 422,425 participants, 219,102 were male (51.9%) and 203,323 were female (48.1%). Children aged 6–11, 12–17, and 18–23 months accounted for 33.2% (140,233/422,425), 33.0% (139,546/422,425), and 33.8% (142,646/422,425) of the sample, respectively. As shown in Table 1, mothers were the primary caregivers for most children [75.9% (320,466/422,425)].

As shown in Figure 1, from 2016 to 2025, the two-week prevalence of fever, diarrhea, and concurrent fever and diarrhea among IYC aged 6–23 months in poor rural China decreased from 13.1% [95% confidence interval (CI): 12.7, 13.4], 12.3% (95% CI: 11.9, 12.7), and 4.1% (95% CI: 3.9, 4.3) in 2016 to 7.0% (95% CI: 6.8, 7.3), 4.2% (95% CI: 4.0, 4.4), and 1.4% (95% CI: 1.3, 1.5) in 2025, respectively. Fever prevalence declined from 13.1% (4,236/32,444) in 2016 to 5.6% (2,408/43,008) in 2021; after a slight rebound between 2022 and 2023, it was 7.0% (3,139/44,592) in 2025, corresponding to an overall relative decrease of 46.6% from the 2016 baseline. Diarrhea and concurrent fever and diarrhea showed similar long-term declines. The results were consistent across all subgroups.

Table 2 illustrates the trends in the two-week prevalence of fever, diarrhea, and concurrent fever and diarrhea among IYC in poor rural China from 2016 to 2025, stratified by sex and age. Overall, all three indicators decreased significantly over the ten-year period. The Cochran–Armitage trend tests confirmed significant linear downward trends for fever ($z = -44.081$, $P < 0.01$), diarrhea ($z = -67.214$, $P < 0.01$), and concurrent fever and diarrhea ($z = -34.972$, $P < 0.01$). Males had higher baseline prevalence and larger absolute reductions than females. Children aged 6–11 months had the highest prevalence and the largest declines, with the magnitude of decline gradually decreasing with age. Across birth weight subgroups, children with normal birth weight (2,500–3,999 g) showed the strongest downward trend, whereas those with low birth weight (<2,500 g) exhibited relatively weaker declines. By caregiver type, children cared for by mothers showed the most stable and significant decreases in all three indicators, followed by children cared for by grandparents; the father-care and other-care groups showed smaller reductions and relatively weaker statistical significance for some indicators. By maternal education, higher educational attainment was associated with lower two-

TABLE 1. Characteristics of IYC and their caregivers in 2016–2025 surveys in 20 provinces.

Characteristics	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Number <i>n</i>	32,444	38,564	43,814	45,182	45,082	43,008	40,707	44,620	44,412	44,592
Gender, <i>n</i> (%)										
Male	16,974 (52.3)	20,031 (51.9)	22,579 (51.5)	23,310 (51.6)	23,319 (51.7)	22,135 (51.5)	21,184 (52.0)	23,247 (52.1)	23,116 (52.0)	23,207 (52.0)
Female	15,470 (47.7)	18,533 (48.1)	21,235 (48.5)	21,872 (48.4)	21,763 (48.3)	20,873 (48.5)	19,523 (48.0)	21,373 (47.9)	21,296 (48.0)	21,385 (48.0)
Age group (month), <i>n</i> (%)										
6–11	10,243 (31.6)	13,318 (34.5)	13,796 (31.5)	15,184 (33.6)	14,999 (33.3)	13,736 (31.9)	13,048 (32.1)	15,328 (34.4)	15,382 (34.5)	15,199 (34.1)
12–17	11,386 (35.1)	12,944 (33.6)	14,673 (33.5)	14,594 (32.3)	14,998 (33.3)	14,216 (33.1)	13,783 (33.9)	14,210 (31.8)	13,924 (31.4)	14,818 (33.2)
18–23	10,815 (33.3)	12,302 (31.9)	15,345 (35.0)	15,404 (34.1)	15,085 (33.4)	15,056 (35.0)	13,876 (34.1)	15,082 (33.8)	15,106 (34.0)	14,575 (32.7)
Birth weight (g), <i>n</i> (%)										
<2,500	1,199 (3.7)	1,678 (4.4)	1,826 (4.1)	1,873 (4.4)	1,974 (4.5)	1,927 (4.5)	1,862 (4.6)	2,187 (4.9)	2,183 (4.9)	2,315 (5.2)
2,500–3,999	28,790 (88.7)	34,161 (88.6)	38,810 (88.6)	40,052 (88.5)	39,915 (88.5)	38,081 (88.5)	36,172 (88.9)	39,726 (89.0)	39,561 (89.1)	39,722 (89.1)
≥4,000	2,438 (7.5)	2,725 (7.3)	3,178 (7.2)	3,257 (7.1)	3,193 (7.2)	3,000 (7.0)	2,673 (6.6)	2,707 (6.1)	2,668 (6.0)	2,552 (5.7)
Main caregiver, <i>n</i> (%)										
Mother	24,171 (74.5)	28,727 (74.5)	32,947 (75.2)	33,514 (74.2)	34,625 (76.8)	32,723 (76.1)	31,869 (78.3)	34,383 (77.1)	33,981 (76.5)	33,506 (75.1)
Father	393 (1.2)	379 (1.0)	403 (0.9)	430 (1.0)	464 (1.0)	419 (1.0)	417 (1.0)	480 (1.1)	464 (1.0)	528 (1.2)
Grandparents	7,750 (23.9)	9,297 (24.1)	10,262 (23.4)	11,053 (24.5)	9,868 (21.9)	9,749 (22.7)	8,269 (20.3)	9,597 (21.5)	9,877 (22.2)	10,423 (23.4)
Others	130 (0.4)	161 (0.4)	202 (0.5)	185 (0.4)	125 (0.3)	117 (0.3)	152 (0.4)	160 (0.4)	90 (0.2)	135 (0.3)
Mother's education, <i>n</i> (%)										
Primary school and below	6,424 (19.8)	6,561 (17.0)	7,256 (16.6)	7,020 (15.5)	6,064 (13.4)	5,731 (13.3)	4,267 (10.5)	5,258 (11.8)	4,790 (10.8)	4,408 (9.9)
Junior high school	18,791 (57.9)	21,884 (56.7)	23,783 (54.3)	23,605 (52.2)	23,428 (52.0)	21,103 (49.1)	19,498 (47.9)	19,658 (44.1)	18,896 (42.5)	17,705 (39.7)
Senior high school and above	7,229 (22.3)	10,119 (26.2)	12,775 (29.2)	14,557 (32.2)	15,590 (34.6)	16,174 (37.6)	16,942 (41.6)	19,704 (44.2)	20,726 (46.7)	22,479 (50.4)

Note: Data were collected from annual cross-sectional surveys of the NIPCPA in poor rural China. Values are presented as *n* (%).

Abbreviation: IYC=Infants and Young Children; mo=months; g=grams; NIPCPA=Nutrition Improvement Program for Children in Poor Areas.

week prevalence of fever, diarrhea, and concurrent fever and diarrhea, and all three education subgroups showed significant decreasing trends.

DISCUSSION

This study used ten rounds of repeated cross-sectional surveys (2016–2025) to examine trends in the two-week prevalence of fever, diarrhea, and concurrent fever and diarrhea among IYC in poor rural China.

The findings demonstrate a substantial reductions in disease prevalence from 2016 to 2025, with fever decreasing by 46.6% and diarrhea declining by 65.9%.

The declines were most pronounced among children aged 6–11 months, children with normal birth weight, and children cared for by mothers or by caregivers with higher educational levels. In contrast, children with low birth weight and those cared for by non-maternal caregivers improved more slowly. The slight rebound between 2022 and 2023 may be explained by the relaxation of pandemic control measures and partial waning of population immunity to common respiratory and enteric pathogens. Across all survey years, children aged 6–11 months consistently had higher two-week prevalence of fever and diarrhea than older children, despite the overall downward trend.

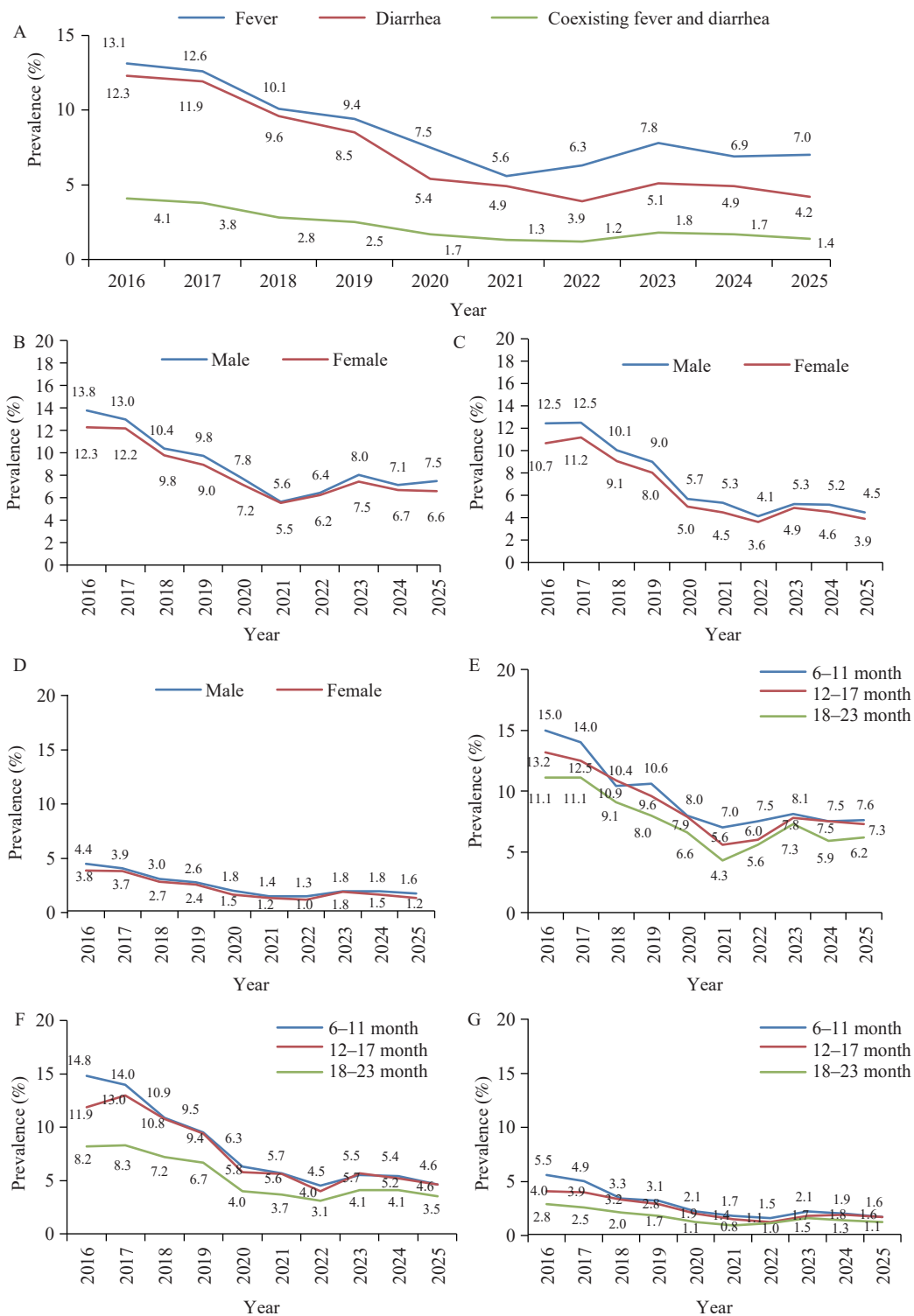


FIGURE 1. Trends in two-week prevalence of fever, diarrhea, and their coexistence among infants and young children in poor rural China, 2016–2025. (A) Overall trends in the two-week prevalence of fever, diarrhea, and coexisting fever and diarrhea. (B) Two-week prevalence of fever by gender. (C) Two-week prevalence of diarrhea by gender. (D) Two-week prevalence of coexisting fever and diarrhea by gender. (E) Two-week prevalence of fever by age group (months). (F) Two-week prevalence of diarrhea by age group (months). (G) Two-week prevalence of coexisting fever and diarrhea by age group (months).

TABLE 2. The prevalence and trends in two-week prevalence by subgroup from 2016 to 2025 in 20 provinces.

Characteristics	Fever					Diarrhea					Coexisting fever and diarrhea				
	2016 (%)	2025 (%)	z	P	P-int	2016 (%)	2025 (%)	z	P	P-int	2016 (%)	2025 (%)	z	P	P-int
Gender					0.416					0.793					0.236
Male	13.8	7.5	-35.451	<0.001		12.5	4.5	-51.404	<0.001		4.4	1.6	-26.592	<0.001	
Female	12.3	6.6	-32.384	<0.001		10.7	3.9	-45.888	<0.001		3.8	1.2	-25.790	<0.001	
Age group (mo)					<0.001					<0.001					0.007
6–11	15.0	7.6	-28.903	<0.001		14.8	4.6	-45.727	<0.001		5.5	1.6	-25.382	<0.001	
12–17	13.2	7.3	-28.220	<0.001		11.9	4.6	-41.556	<0.001		4.0	1.6	-22.114	<0.001	
18–23	11.1	6.2	-25.852	<0.001		8.2	3.5	-30.631	<0.001		2.8	1.1	-15.490	<0.001	
Birth weight (g)					–					–					–
<2,500	14.0	9.1	-7.088	<0.001		11.8	5.4	-13.743	<0.001		3.6	1.7	-7.076	<0.001	
2,500–3,999	13.0	7.0	-45.458	<0.001		11.6	4.2	-64.983	<0.001		4.1	1.4	-34.576	<0.001	
≥4,000	13.2	6.1	-14.903	<0.001		11.5	4.0	-18.600	<0.001		4.3	1.1	-11.637	<0.001	
Main caregivers					<0.001					<0.001					0.031
Mother	12.5	6.5	-39.454	<0.001		11.6	4.0	-59.002	<0.001		4.0	1.3	-31.726	<0.001	
Father	15.3	11.2	-2.618	<0.001		9.2	6.3	-3.422	<0.001		4.6	1.9	-2.475	0.013	
Grandparents	14.8	8.4	-19.501	<0.001		11.8	4.9	-27.764	<0.001		4.2	1.7	-14.581	<0.001	
Others	15.4	11.9	-1.080	0.280		9.2	5.9	-2.811	<0.001		5.4	3.0	-2.288	0.022	
Mother's education					<0.001					<0.001					<0.001
Primary school and below	11.5	7.1	-16.160	<0.001		10.2	4.3	-22.027	<0.001		3.4	1.7	-11.890	<0.001	
Junior high school	12.9	7.6	-28.790	<0.001		11.6	4.5	-44.126	<0.001		4.0	1.6	-23.934	<0.001	
Senior high school and above	14.8	6.6	-27.333	<0.001		12.8	4.0	-40.897	<0.001		4.8	1.3	-20.857	<0.001	
Total	13.1	7.0	-44.081	<0.001		12.3	4.2	-67.214	<0.001		4.1	1.4	-34.972	<0.001	

Note: Prevalence was presented as percentage. *P* are based on two-sided Cochran-Armitage trend tests; *P*<0.01 indicates a statistically significant decreasing trend.

"–" means not estimable due to perfect multicollinearity.

Abbreviation: mo=months; g=grams; *P*-int=*P*-interaction.

These findings suggest that disease prevention and nutrition interventions should prioritize younger infants, who have immature immune function and are in the early stage of complementary feeding. Children with low birth weight exhibited slower improvement and may require more targeted and intensive health support (4). Moreover, children cared for by mothers showed a more consistent downward trend in morbidity, and higher maternal educational attainment was associated with lower prevalence of fever and diarrhea. These findings underscore the importance of maternal care capacity and health literacy in reducing common childhood illnesses (5).

IYC aged 6–23 months are in a critical growth period with immature immunity, making them susceptible to various diseases, especially fever and diarrhea (2,6). These symptoms directly affect children's health and substantially increase the medical burden on families and society (3). Diarrhea and fever

contribute to nutritional deficiencies, reduced resistance to infections and impaired growth and development (7). In areas where Ying Yang Bao (YYB) was distributed, children's dietary patterns and nutrient intake improved, and their nutritional status was enhanced through YYB provision and complementary-feeding education. This nutritional improvement may have supported immune system development and strengthened resistance to infections. The two-week prevalence of fever and diarrhea in the study areas was substantially lower than the average estimates for children under five years of age in low- and middle-income countries (LMICs), where the corresponding estimates remained as high as 18.8% and 12.5%, respectively (8). This difference persisted through 2025. Our estimates were also lower than the national two-week prevalence reported among children under five years of age in the 6th National Health Service Survey (9). Nationally representative data on

two-week prevalence after 2018 remain scarce, underscoring the value of these long-term surveillance data for characterizing childhood morbidity trends in understudied poor rural regions of China (10).

In conclusion, IYC aged 6–23 months in poor rural China experienced substantial and significant declines in the two-week prevalence of fever, diarrhea, and concurrent fever and diarrhea from 2016 to 2025. These downward trends may reflect the combined contributions of comprehensive strategies, including economic development, strengthened public health management, and sustained nutrition interventions, including YYB consumption and feeding counseling. Continued efforts are needed to maintain robust public health systems and ensure consistent delivery of targeted nutrition interventions for vulnerable young children.

This study has several limitations. First, two-week prevalence was based on caregiver self-report and may therefore be subject to recall bias. Second, the repeated cross-sectional design precludes causal inference and cannot track individual-level changes over time. Third, the observed trends were based on the fixed study population enrolled in 2016; therefore, the findings should be generalized cautiously to the broader and evolving rural population of China in 2025.

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Corresponding author: Lijuan Wang, wanglj@ninh.chinacdc.cn.

¹ Key Laboratory of Public Nutrition and Health of National Health Commission, National Institute for Nutrition and Health, Chinese Center for Disease Control and Prevention & Chinese Academy of Preventive Medicine, Beijing, China.

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