'Family-based' strategy for *Helicobacter pylori* infection screening: an efficient alternative to 'test and treat' strategy

We read with utmost interest the study by Zhou *et al*,[1] which was the first family-based investigation of *Helicobacter pylori* (*Hp*) infection in China. The authors provided valuable insights into the occurrence of familial cluster effect on *Hp* infection and the superiority of the 'family-based strategy'. However, their work failed to compare the screening efficiency of various established *Hp* management methods, leaving us curious about whether the 'family-based strategy' could identify more *Hp*-infected participants with equal number of tests conducted as compared with the widely used 'test and treat strategy'.[2] Fortunately, the family-unit data in Zhou's study offers the possibility for such exploration.

To address this gap, we built a database consisting of over one million

households, based on the infection status of households and individuals from 29 provinces reported by Zhou, in order to simulate real-world scenarios. The screening protocols were simulated in national database and subdataset by province, and were defined as follows (figure 1A)[1]: The 'test-and-treat strategy' involved randomly selecting participants for *Hp* testing until all participants were tested.[2] The 'family-based strategy' involved participants selecting, as well as *Hp* testing of family members only if the selected individual tested positive for *Hp*. If the selected individual tested negative, no further testing of family members was required and a new participant was selected at random; it is noteworthy that each individual was tested only once at most. The main difference between the two strategies was the order in which participants underwent *Hp* testing. The testing and sampling processes were simulated using Python.

Our study found that, on average, the 'family-based strategy' exhibited an improvement of 4.02% in the ability to detect *Hp* infections throughout the screening process (table 1), despite the final number of *Hp*-positive individuals identified was the same after both methods were applied to all participants. We used the x-axis to represent the number of tests conducted and the y-axis to reflect the number of *Hp*-infected individuals tested (figure 1B). The discrepancy between the two curves in figure 1B was particularly apparent during the mid-screening period (when screening was completed for part of the population). The 'family-based strategy' was able to identify an additional 1.26%–12.15% of *Hp*-infected individuals across the 29 provinces, with the greatest advantage seen in Shanghai (12.15%) (figure 1B). Furthermore, a positive correlation was observed between the advantage of the 'family-based strategy' in detecting *Hp* infections and the per capita gross domestic product across the 29 provinces (figure 1C).

This result serves as an important complement to Zhou's conclusion and revealed previously unknown benefits of 'family-based management' of *Hp* infection in real-world practices. Our finding suggests that searching for *Hp* infection along the intrafamilial transmission chain would be more effective compared with random screening, although the advantage may not be substantial. One possible explanation for the limited

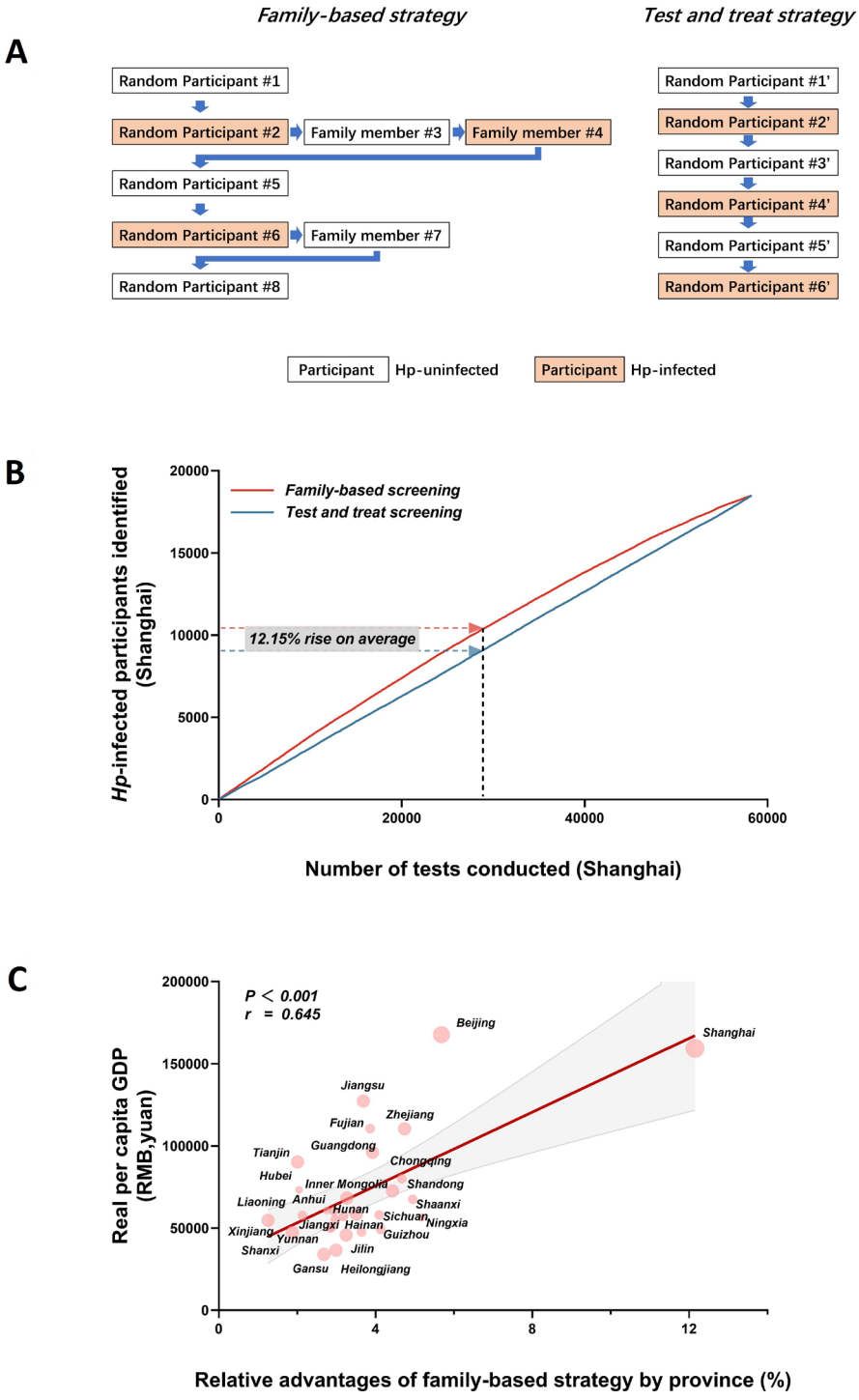

Figure 1 Protocol and screening efficiency of the 'family-based strategy' and 'test and treat strategy'. (A) Under the 'test-and-treat strategy', participants were selected at random for *Hp* testing until all participants had been detected. In 'family-based strategy', if the randomly selected individual tests positive for *Hp*, additional testing is carried out on all his/her family members, with the rest of the process remaining unchanged. The numbers inside the boxes represent the order of screening, and the colour indicates the *Hp* infection status. (B) By simulating data from Shanghai, the family-based strategy was found to identify an average of 12.15% more *Hp*-infected participants throughout the screening process, when same number of tests were conducted. The y-axis represents *Hp*-infected participants identified and x-axis indicates the number of participants screened. (C) Positive correlation of relative screening advantages of family-based strategy and real per capita GDP by province. The y-axis represents the real per capita GDP, and x-axis represents relative advantages of family-based strategy (r=0.645, p<0.01), each dot represents data from one province. GDP, gross domestic product; HP, Helicobacter pylori.

Table 1 Comparison of *Helicobacter pylori* screening efficiency between the two strategies

No	Provinces	Average positive rate of test and treat strategy*	Average positive rate of family-based strategy	Relative screening advantage†
1	Anhui	40.86%	42.02%	2.76%
2	Beijing	34.21%	36.26%	5.68%
3	Chongqing	36.95%	38.75%	4.67%
4	Fujian	49.35%	51.33%	3.86%
5	Gansu	50.55%	51.94%	2.68%
6	Guangdong	35.31%	36.75%	3.92%
7	Guizhou	25.32%	26.40%	4.13%
8	Hainan	51.17%	53.03%	3.51%
9	Hebei	39.20%	40.68%	3.64%
10	Heilongjiang	41.19%	42.46%	2.99%
11	Henan	42.60%	44.00%	3.18%
12	Hubei	34.91%	35.63%	2.05%
13	Hunan	38.95%	40.13%	2.94%
14	Inner Mongolia	34.57%	35.74%	3.27%
15	Jiangsu	50.16%	52.08%	3.69%
16	Jiangxi	38.52%	39.70%	2.97%
17	Jilin	39.28%	40.61%	3.25%
18	Liaoning	44.22%	45.17%	2.13%
19	Ningxia	36.30%	38.28%	5.17%
20	Qinghai	59.47%	61.21%	2.84%
21	Shaanxi	44.20%	46.49%	4.95%
22	Shandong	43.12%	45.12%	4.43%
23	Shanghai	31.46%	35.81%	12.15%
24	Shanxi	42.91%	43.73%	1.88%
25	Sichuan	40.36%	42.07%	4.09%
26	Tianjin	39.52%	40.33%	2.01%
27	Xinjiang	47.09%	47.69%	1.26%
28	Yunnan	31.06%	31.98%	2.88%
29	Zhejiang	36.78%	38.61%	4.74%
	Nationwide	40.64%	42.34%	4.02%

*The average positive rate was defined as the average value of (*Hp*-infected participants identified/number of tests conducted) throughout the screening process.
†The relative screening advantage = (average positive rate of test and treat strategy − average positive rate of family-based strategy)/average positive rate of family-based strategy.
HP, Helicobacter pylori.

benefit is the 'family-based approach' merely connects members within the family to facilitate easier tracing of infections ; however, the process of locating from one *Hp*-infected household to another remains randomised.

Our findings have significant implications, as the topic of comprehensive *Hp* screening for entire population in specific regions is currently widely discussed among gastroenterologists.[3] Achieving population-wide *Hp* eradication often takes years or decades and, during this period, reinfection and antibiotic resistance can pose serious challenges[4 5]; adopting a 'family-based approach' would identify infected individuals more rapidly, decrease the population prevalence of *Hp* more quickly and break the chain of interpersonal transmission more effectively, thereby partially addressing above challenges. However, completing *Hp* screening across the entire population in areas with high prevalence can be challenging due to limitations in medical and financial resources; meanwhile, in areas with low prevalence, there often exist no compelling reason or motivation to complete such screening. These imply screening completed in a portion of the population is common practice for *Hp* testing in reality, and under this context, the advantages of 'family-based approach' would be well demonstrated as the current data presented. Our analysis also revealed a concordance of economic developed regions having higher benefits of implementing 'family-based strategy', making this strategy particularly relevant in economically developed countries with a heavy burden of gastric cancer, such as Central and Eastern Europe.

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