



## Role of Azithromycin in Enteric Fever

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### Declaration

#### Authors' Contribution

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### ABSTRACT

**Background:** In low- and middle-income nations, particularly in South Asia, where growing resistance to first-line and fluoroquinolone antibiotics has made treatment more difficult, enteric (typhoid) fever continues to be a serious public health concern. An alternate therapy option that has showed potential is azithromycin, an oral macrolide antibiotic. Nevertheless, there is a dearth of local data assessing its therapeutic effectiveness, especially in young patients. **Objective:** The purpose of this study was to assess azithromycin's clinical results, safety, and tolerability in treating pediatric patients (ages 2–12) with enteric fever in a local healthcare facility. **Methods:** Over the course of six months, 121 pediatric children receiving azithromycin for clinically confirmed enteric fever participated in a cross-sectional, qualitative study. Structured interviews were used to gather clinical data, which were then backed up by TyphiDot or other lab testing. Defervescence time, clinical improvement by Day 7, and side effects were important end indicators. **Results:** Of the 121 patients, 86.8% attained defervescence in five days, and 85.1% demonstrated clinical improvement by Day 7. 83.5% of patients reported no side effects from azithromycin, indicating that medication was well tolerated. The most frequent adverse effects, which included nausea (8.3%) and abdominal pain (5%), were minor and self-limiting. Treatment success was positively connected with positive TyphiDot (IgM or IgM+IgG), while positive responses were seen even in clinically diagnosed individuals without confirming testing. **Conclusion:** For pediatric enteric fever, azithromycin is a safe, well-tolerated, and clinically effective oral antibiotic that provides a useful substitute in outpatient and resource-constrained settings. These results provide credence to its inclusion in regional therapy protocols. It is advised that research that is more extensive be done to validate these findings and guide national policy.

### INTRODUCTION

Typhoid fever is a serious health problem around the globe as there are about 10.9 million infections and over 117,000 deaths every year. It is believed that prior to the development of the antibiotics; the death rate relating to the enteric fever was at 10-30 percent. Seeing that, it is true that the general death rate has decreased to less than 1 percent due to the invention of a viable antibiotic treatment within the past 70 years. From the recent past, emergence and geographical spread of fluoroquinolone and multi-drug-resistant strains of *S. Typhi* and *Paratyphi* has reduced the available number of viable treatment option in enteric fever.

Lately, fluoroquinolone-resistant *Salmonella* has made it to the list of the World Health Organization (WHO), the officials of which have included this bacterium in the twelve families making the greatest threat to human health due to its growing antibiotic resistance. (5)

Its occurrence is maximum in South Central and Southeast Asia (100/100000 cases per year) and this burden is borne by children between 2-15 years. The recent researches specify the 149 to 573 cases of typhoid in 100,000 children every year in India, Pakistan and Indonesia. 8. It propagates with the help of crowding and filthy conditions. It spreads via the fecal to oral path. (4-7) It also becomes even harder to treat due to the misuse of antibiotics and over the counter medications and subsequent development of resistance. It had previously been treated by Chloramphenicol, Ampicillin and Co-trimoxazole. In 1980 development of the resistance to these first line drugs [defined as multidrug resistance (MDR)], use of such drugs was curbed with the reports of Multidrug resistant (MDR) strains being reported first in Asia and the Middle-East regions before being reported in other parts of the world. In the situation at hand, there has been over-utilization of Fluoroquinolones such that their emerged strains of quinolone resistance (7). On the same

lines, recent surveys covered in India also showed increasing opposition against Ceftriaxone (9, 10) hence, new possibilities of antibiotics to cure enteric fever need to be tried.

New ways of antibiotics have to be sought-out in enteric fever. The usual treatment of the typhoid fever includes the use of ceftriaxone, which is a broad-spectrum third generation cephalosporin, which is very effective against *S. typhi*, but because of its parenteral method of administration it cannot be termed as the most suitable one (11).

Another alternative is now available to cure the typhoid fever as a result of appropriate application of azalide family of antibiotics. *S. typhi* is among the numerous intestinal diseases of the intracellular type, on the action of which azithromycin has an effect in test tube. The give parameter given under the mean defervescence time (days) 3.82 +/- 1.496 and 3.3 +/- 1.2 against the application of ceftriaxone depicts that through orally admitted azithromycin, the response is equivalent to that of parenterally utilized ceftriaxone. In the aftermath of treating the group of people infected with MDR typhoid fever, azithromycin loosens the gauge of hospital stay, the failure rate of therapy and the relapse of the enteric fever as against ceftriaxone. (12)

According to a study carried out by Aggarwal et al., 92 (84.4) of the individuals improved clinically on the 7th day (Aggarwal et al., 13). The other study indicated that it took 4.48 1.13 days (95 percent confidence interval) to the resolution (defervescence) of fever in patients who received azithromycin (14), whereas Islam et al. (15) showed that the resolution of fever among patients who received azithromycin was 4.44 1.25 days, with 95 percent confidence interval.

The aim will be to determine the clinical outcome of the use of azithromycin on the patient with enteric fever. Studies on the problem have been conducted severally at international levels than at the local levels. In addition, the results of any study carried out by a country cannot be applied to our local population because there is a difference in the standard of living and disease pattern. In addition, in the local health set up, a coherent consensus in the decision of treatment of enteric fever is absent due to lack of evidence. Not only will the findings of our studies be helpful in coming up with local evidence, and it will help the physician to rationalize the need of using useful antibiotics in a patient with enteric fever.

## LITERATURE REVIEW

This is in accordance with earlier research by Aggarwal et al. and Islam et al., who found that defervescence took about 4–5 days. Due to lack of response, only 14.9% of patients needed to be switched to another antibiotic. Azithromycin's

promise as a frontline treatment is demonstrated by its low treatment failure rate, particularly in situations when parenteThe main problem which leads to enteric fever is *Salmonella enterica* Typhi serovars and *Salmonella enterica* Paratyphi, and the enteric fever is a major issue of the problem of population health, especially in countries that lack sanitation. There is need to come up with better

and more effective antibiotics because resistance to antibiotics has significantly influenced the treatment process over the years.

The standard treatment methods of typhoid fever included ampicillin, co-trimoxazole and chloramphenicol but by the end of the 1980s till the beginning of the 1990s, the effectiveness of these drugs started to decline because of the emergence of multidrug-resistant (MDR) bacteria (16). Ciprofloxacin was then hailed as the basis of treatment along with fluoroquinolones. Nonetheless, since fluoroquinolones have widely and inappropriately been used, nalidixic acid-resistant *S. Typhi* (NARST) developed and significantly diminished the treatment (17).

According to various studies even third generation of cephalosporins such as ceftriaxone is losing its effectiveness. The issue of the long-term efficacy of ceftriaxone in first-line therapy has been voiced due to an Indian study, which reported the steady rise in the fraction of isolates with reduced susceptibility to ceftriaxone (18). In addition, the parenteral administration of ceftriaxone limits its application, specifically, in the outpatient care and in the limited resources settings where hospitalization is impossible (19).

Since this antibiotic, a macrolide antibiotic but of the sub-category azalide, has to be taken in a form that is oral, has a long half-life, and acts intracellularly against *S. Typhi*, there is a promising report of the antibiotic in the cure of enteric fever (20). Clinical trials have shown that Azithromycin is equivalently effective to ceftriaxone, in terms of defervescence periods and lower relapses (21). According to Effa and Bukirwa meta-analysis, azithromycin was superior than the fluoroquinolones in terms of tolerability and clearance of fever, especially in areas where the drugs are resistant (22).

According to Aggarwal et al., the clinical improvement had been observed in 84.4 percent of patients using azithromycin by the seventh day (23). A different study by Parry et al. (24) discovered that azithromycin significantly reduced the rate and after-effects of the typhoid fever in endemic regions. Effectiveness and safety profile of azithromycin in terms of paediatric populations was also emphasized by a randomized control trial carried out in Bangladesh, which exhibited that defervescence time of children is 4.44 + 1.25 days (25). Regardless of these promising outcomes, local South Asian, and/or Pakistani data remain sparse. Most of the clinical recommendations in the field are determined by studies performed in other countries that may not be consistent with socioeconomic conditions, resistances, or the epidemiology of illnesses in the region (26). To determine the clinical efficacy of azithromycin and develop a unification on the therapy of enteric fever in the healthcare system in the region, it is essential to present local indigenous statistics.

## RESEARCH OBJECTIVE

The purpose of the study is to evaluate the clinical effect of azithromycin on the local population due to enteric (typhoid) fever. Azithromycin is a potential oral alternative to classic therapies such as ceftriaxone in the face of spreading antibiotic resistance and dearth of available therapies, particularly where resources are constricted.

This study aims at: assessing significant clinical measures, such as patient tolerability, success rate of the treatment, the recurrence rate, and its defervescence period. It also wants to generate domestic evidence based on the understanding of patient demographics, environmental factors, and indigenous resistance patterns which are often ignored by foreign-generated studies. Its findings will ultimately benefit the treatment process and consumer health responses because they will help medical practitioners to make rational, more evidence-based decisions regarding the utilization of antibiotics in the treatment of enteric fever.

**METHODOLOGY**

This was intended as cross-sectional qualitative research that was to be conducted over a period of six months at tertiary care hospital Quetta. It aimed at analysing the clinical efficacy of azithromycin when used to treat children who are victims of enteric (typhoid) fever. The research population was composed of children aged 2 and 12 years who are under azithromycin treatment and show clinical symptoms of enteric fever. Non-probability consecutive sampling method was employed, total of 121 patients was recruited; every subject who was eligible and met the inclusion criteria was included step by step and there was no randomization.

The clinical manifestations and symptoms that gave rise to a diagnosis of enteric fever were supported by laboratory tests including the Widal test, Typhi Dot o requiring blood cultures as long as they were available. Children diagnosed clinically with enteric fever, aged 2-12 years (inclusive) and who received azithromycin as the primary drug were allowed to take part in the trial. The exclusion criteria were previous intake of antibiotics in the acute illness as well as a known allergy or contraindication to azithromycin, and the presence of serious comorbid diseases including immunosuppressive disorders.

Collected data was based on demographics, clinical presentation (duration of the fever), defervescence time, any side effect, and overall treatment outcome (e.g. clinical improvement, failure or relapse), and achieved using organized interviews. Also, narratives of themes and patterns related to patient reactions and the effectiveness of the treatment were identified and analyzed. A prior ethical approval was obtained before the commencement of the actual study and the informed consent obtained of the parents of participants or legal guardians. It was ensured that it was within their right to withdraw out of the study at any given time without any Omitting impact to the medical care, the confidentiality of the nature, and voluntary nature of participation.

**RESULTS**

**Table 1**

*Demographic Characteristics of Study Participants (n = 121)*

Variable	Frequency (n)	Percentage (%)
<b>Gender</b>		
Male	67	55.4%
Female	54	44.6%
<b>Age Groups (Years)</b>		
2-4	35	28.9%
5-8	52	43.0%
9-12	34	28.1%

<b>Residence</b>		
Urban	70	57.9%
Rural	51	42.1%

**Table 2**

*Clinical Presentation of Patients at Time of Admission*

Symptom	Frequency (n)	Percentage (%)
Fever	121	100%
Headache	85	70.2%
Abdominal pain	68	56.2%
Diarrhea	39	32.2%
Vomiting	48	39.7%
Loss of appetite	77	63.6%
Constipation	24	19.8%

**Table 3**

*Clinical Outcomes of Azithromycin Therapy*

Clinical Outcome	Frequency (n)	Percentage (%)
Defervescence within 3 days	44	36.4%
Defervescence within 4-5 days	61	50.4%
Defervescence >5 days	16	13.2%
Clinical Improvement by Day 7	103	85.1%
No Improvement / Shift to another drug	18	14.9%

**Table 4**

*Adverse Effects Noted During Treatment*

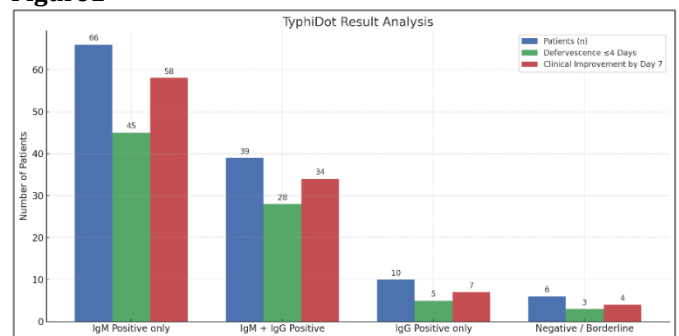
Adverse Effect	Frequency (n)	Percentage (%)
No adverse effect	101	83.5%
Nausea	10	8.3%
Mild abdominal discomfort	6	5.0%
Vomiting	4	3.3%
Diarrhea	0	0.0%

**Table 5**

*Typhi Dot Test Results and Treatment Response with Azithromycin (n = 121)*

TyphiDot Result	Patients (n)	Percentage (%)	Defervescence ≤4 Days (n)	Clinical Improvement by Day 7 (n)
IgM Positive only	66	54.5%	45	58
IgM + IgG Positive	39	32.2%	28	34
IgG Positive only	10	8.3%	5	7
Negative / Borderline	6	5.0%	3	4
Total	121	100%	81	103

**Figure 1**



**DISCUSSION**

This research was conducted to determine the effectiveness of azithromycin as a therapeutic agent in the treatment of enteric (typhoid) fever in the paediatrics. These results give credit to the use of the azithromycin

compound as a safe and effective oral alternative to injectable antibiotics like ceftriaxone in areas where conventional forms of treatment are hampered by the insufficient resources and multidrug resistance.

The number of the kids within 2-12 years of age participating in the study was 121, and men slightly outnumbered women (55.4%). The highest age bracket was 5-8 Years and that consists of 43.1 percent in line with epidemiological studies that identify that the early school-age children are more vulnerable. Majority of the respondents (57.9%) were those located in urban areas, a fact attributed to the fact that it is easy to access healthcare in the city and people living in the city tend to seek treatment. The urban predominance may be also caused by the spread in the poor sanitation and dense population places.

The most frequent symptom (100%) is fever and this goes in accordance with the pattern of presentation of enteric fever. Such other common symptoms which were seen to match the clinical profile of typhoid fever were headache (70.2%), loss of appetite (63.6%) and abdominal pain (56.2%). Even apart from constipation which was less frequent (19.8%), GI manifestations involving vomiting (39.7%) and diarrhoea (32.2%) also indicate the enteric nature of the disease. These findings underline the importance of detecting a number of GI symptoms in a diagnosis.

Within 3 days of commencing apparent medication with azithromycin, 36.4 percent of the patients showed defervescence and 86.8 percent of them showed defervescence within 5 days. The therapeutic efficacy of azithromycin was put into evidence by the clinical amelioration of 103 patients (85% single-doses therapies are not possible).

The population of the research tolerated Azithromycin well. The highest percentage of patients (83.5%) claimed that they had no side effects. There were mild side effects that include nausea (8.3%), abdominal pain (5%), but these did not support the need to withdraw the therapy. This confirms earlier evidence of the desirable safety profile of azithromycin towards children. It is remarkable that diarrhoea was not reported, which is common in the antibiotic treatment and implies good tolerability of the GI tract.

## REFERENCES

1. Stanaway, J. D., Reiner, R. C., Blacker, B. F., Goldberg, E. M., Khalil, I. A., Troeger, C. E., ... & Hay, S. I. (2019). The global burden of typhoid and paratyphoid fevers: a systematic analysis for the Global Burden of Disease Study 2017. *The Lancet Infectious Diseases*, 19(4), 369-381. [https://www.thelancet.com/journals/laninf/article/PIIS1473-3099\(18\)30685-6/fulltext](https://www.thelancet.com/journals/laninf/article/PIIS1473-3099(18)30685-6/fulltext)
2. Gay, F. P. (1918). *Typhoid fever considered as a problem of scientific medicine*. Macmillan.
3. Parry, C. M., Hien, T. T., Dougan, G., White, N. J., & Farrar, J. J. (2002). Typhoid fever. *New England Journal of Medicine*, 347(22), 1770-1782. <https://doi.org/10.1056/nejmra020201>
4. Wong, V. K., Baker, S., Pickard, D. J., Parkhill, J., Page, A. J., Feasey, N. A., ... & Dougan, G. (2015). Phylogeographical analysis of the dominant multidrug-resistant H58 clade of Salmonella Typhi identifies inter- and intracontinental transmission events. *Nature genetics*, 47(6), 632-639. <https://doi.org/10.1038/ng.3281>
5. Tacconelli, E., Carrara, E., Savoldi, A., Harbarth, S., Mendelson, M., Monnet, D. L., ... & Zorzet, A. (2018). Discovery, research, and development of new antibiotics: the WHO priority list of antibiotic-resistant bacteria and tuberculosis. *The Lancet infectious diseases*, 18(3), 318-327. [https://www.thelancet.com/journals/laninf/article/PIIS1473-3099\(17\)30753-3/abstract](https://www.thelancet.com/journals/laninf/article/PIIS1473-3099(17)30753-3/abstract)
6. Behrman, R. E., & Vaughan, V. I. (1983). *Nelson textbook of pediatrics* (No. Ed. 12, pp. xxxiv+-1899pp). <https://www.cabidigitallibrary.org/doi/full/10.5555/19851470771>

One of the diagnostic modalities that assisted in guiding treatment was Typhi Dot test. This category had the best response to therapy with 45 of them defervescing within the 4-days and 58 having clinical improvement within Day 7. Even more than half of the patients (54.5%) were IgM positive but not IgG, which means the presence of acute infection. The IgM positive and IgG positive group as well (32.2%) showed good clinical outcomes, which reflected on the fact that they presented with a recent or a current infection. Even patients with only IgG positivity, an indicator of previous exposure responded positively albeit at a slightly lower rate. More to the point, the symptomatic relief was observed in the patients with the equivocal or negative Typhi Dot test results, which repeated the idea that the clinical-based treatment of azithromycin is equally useful even in the setting when clear confirmatory tests could not be provided.

## CONCLUSION

The research demonstrates that azithromycin is a useful, secure and well tolerated by the body oral antibiotic intended to treat paediatric enteric fever, also referred to as typhoid. The effectiveness of Azithromycin in clinical setting is comparable to ceftriaxone and 85.1 percent of children show clinical improvement on Day 7 and most of them achieve defervescence on the fifth day. It is also used in children owing to its favourable patient tolerability and minimal side effect rate. The usefulness of azithromycin can also be based on the fact that, most patients in the study group responded well to the drug in spite of having only a clinical diagnosis to rely on and the fact that most of the patients constituting my areas demographic had TyphiDot IgM positive tests- which are indicative of recent infection.

The study results reflect the global information but offer the essential local data, as there is a need to investigate the regional data. Since there is growing antibiotic resistance, particularly in South Asia, azithromycin ought to be viewed as a first-line oral therapy against uncomplicated enteric fever. It is suggested that local treatment guidelines be updated to include azithromycin and that future studies with larger populations over more geographical locations are to increase evidence base.

7. Harish, B., & Menezes, G. (2011). Antimicrobial resistance in typhoidal salmonellae. *Indian Journal of Medical Microbiology*, 29(3), 223-229. <https://doi.org/10.4103/0255-0857.83904>
8. Crump, J., & Mintz, E. (2010). Global trends in typhoid and paratyphoid fever. *Clinical Infectious Diseases*, 50(2), 241-246. <https://doi.org/10.1086/649541>
9. Menezes, G., Harish, B., Khan, M., Goessens, W., & Hays, J. (2012). Antimicrobial resistance trends in blood culture positive Salmonella Typhi isolates from Pondicherry, India, 2005–2009. *Clinical Microbiology and Infection*, 18(3), 239-245. <https://doi.org/10.1111/j.1469-0691.2011.03546.x>
10. Kumar, P., & Kumar, R. (2016). Enteric fever. *The Indian Journal of Pediatrics*, 84(3), 227-230. <https://doi.org/10.1007/s12098-016-2246-4>
11. Trivedi, N., & Shah, P. (2012). A meta-analysis comparing the safety and efficacy of azithromycin over the alternate drugs used for treatment of uncomplicated enteric fever. *Journal of Postgraduate Medicine*, 58(2), 112-118. <https://doi.org/10.4103/0022-3859.97172>
12. Geetha, V., Yugendran, T., Srinivasan, R., & Harish, B. (2014). Plasmid-mediated quinolone resistance in typhoidal salmonellae: A preliminary report from South India. *Indian Journal of Medical Microbiology*, 32(1), 31-34. <https://doi.org/10.4103/0255-0857.124292>
13. Aggarwal, A., Ghosh, A., Gomer, S., Mitra, M., & Parikh, A. O. (2011). Efficacy and safety of azithromycin for uncomplicated typhoid fever: An open label non-comparative study. *Indian Pediatrics*, 48(7), 553-556. <https://doi.org/10.1007/s13312-011-0093-y>
14. Rafique, S., Rasheed, S., Lodhi, M. A., & Ahmad, A. M. (2020). Comparison of clinical effectiveness of azithromycin versus ceftriaxone in treatment of enteric fever in paediatric population. *Pakistan Armed Forces Medical Journal*, (1), S45.
15. Islam, M. A., Mobarak, M. R., Hasan, A. R., & Hanif, M. (2015). Clinical efficacy of azithromycin in typhoid and paratyphoid fever in children. *Journal of Enam Medical College*, 5(1), 34-38. <https://doi.org/10.3329/jemc.v5i1.21495>
16. Rowe, B., Ward, L. R., & Threlfall, E. J. (1997). Multidrug-resistant Salmonella typhi: A worldwide epidemic. *Clinical Infectious Diseases*, 24(Supplement\_1), S106-S109. [https://doi.org/10.1093/clinids/24.supplement\\_1.s106](https://doi.org/10.1093/clinids/24.supplement_1.s106)
17. Crump, J., & Mintz, E. (2010). Global trends in typhoid and paratyphoid fever. *Clinical Infectious Diseases*, 50(2), 241-246. <https://doi.org/10.1086/649541>
18. Dutta S, Sur D, Manna B, et al. (2014). Emergence of highly resistant strains of *Salmonella enterica* serovar Typhi in India. *J Clin Microbiol*, 52(5), 1819–20.
19. Wain, J., Hendriksen, R. S., Mikoleit, M. L., Keddy, K. H., & Ochiai, R. L. (2015). Typhoid fever. *The Lancet*, 385(9973), 1136-1145. [https://doi.org/10.1016/s0140-6736\(13\)62708-7](https://doi.org/10.1016/s0140-6736(13)62708-7)
20. Girgis, N. I., Butler, T., Frenck, R. W., Sultan, Y., Brown, F. M., Tribble, D., & Khakhria, R. (1999). Azithromycin versus ciprofloxacin for treatment of uncomplicated typhoid fever in a randomized trial in Egypt that included patients with multidrug resistance. *Antimicrobial agents and chemotherapy*, 43(6), 1441-1444. <https://doi.org/10.1128/aac.43.6.1441>
21. Pandit A, Arjyal A, Day JN, et al. An open-label randomized comparison of azithromycin versus chloramphenicol for the treatment of uncomplicated typhoid fever in Nepal. *PLoS One*. 2007;2(11):e1248
22. Effa, E., & Bukirwa, H. (2006). Azithromycin for treating uncomplicated typhoid and paratyphoid fever (enteric fever). *Cochrane Database of Systematic Reviews*. <https://doi.org/10.1002/14651858.cd006083>
23. Aggarwal A, Arora U, Khanna S. (2011). Comparison of efficacy of azithromycin and ceftriaxone in the treatment of uncomplicated typhoid fever. *J Indian Med Assoc*, 109(10), 740–2.
24. Parry, C. M., Hien, T. T., Dougan, G., White, N. J., & Farrar, J. J. (2002). Typhoid fever. *New England Journal of Medicine*, 347(22), 1770-1782. <https://doi.org/10.1056/nejmra020201>
25. Islam, A., Butler, T., Kabir, I., & Alam, N. H. (1993). Treatment of typhoid fever with ceftriaxone for 5 days or chloramphenicol for 14 days: A randomized clinical trial. *Antimicrobial Agents and Chemotherapy*, 37(8), 1572-1575. <https://doi.org/10.1128/aac.37.8.1572>
26. Qamar, F. N., Yousafzai, M. T., Khalid, M., Kazi, A. M., Lohana, H., Karim, S., Khan, A., Hotwani, A., Qureshi, S., Kabir, F., Aziz, F., Memon, N. M., Domki, M. H., & Hasan, R. (2018). Outbreak investigation of ceftriaxone-resistant Salmonella enterica serotype Typhi and its risk factors among the general population in Hyderabad, Pakistan: A matched case-control study. *The Lancet Infectious Diseases*, 18(12), 1368-1376. [https://doi.org/10.1016/s1473-3099\(18\)30483-3](https://doi.org/10.1016/s1473-3099(18)30483-3)