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## Editorial

## Sequelae of giardiasis: an emerging public health concern



Although most individuals with a *Giardia* infection are asymptomatic, this pathogen is increasingly recognized as a cause of pathologies beyond the classical manifestations.<sup>1</sup> Morbidities associated with *Giardia*, including extra-intestinal manifestations and long-term consequences, have been identified increasingly over the past decades.<sup>2–4</sup> The importance of this pathogen in terms of patient well-being and its effect on quality of life, due to being a continuing cause of patient discomfort and pain, has been highlighted.<sup>5</sup>

Unfortunately, giardiasis is not a health priority. This may be due to a lack of political will, funding, or interest from the scientific community (more focused on other scientific priorities), or to public indifference, but is most likely a combination of all of these factors. Nowadays, regardless of the stage of economic development of the affected countries, neglect of this protozoan disease is not the best option. Numerically speaking, giardiasis has never been a minor disease, even for many industrialized countries; thus, the sheer volume affected and the problems it causes warrant reflection regarding control strategies.

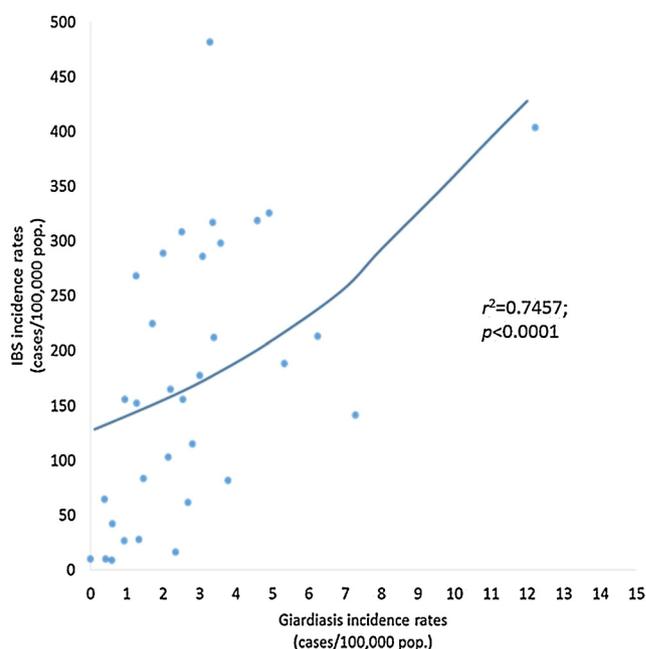
The sequelae of *Giardia* infections are of considerable scientific interest as well as of public health significance. Recently a large controlled prospective study of a cohort of individuals who had confirmed *Giardia* infections during a waterborne outbreak in Norway was published.<sup>6</sup> In that study, a significantly increased risk of both irritable bowel syndrome (IBS) and chronic fatigue (CF), even 6 years after the infection, was documented; fortunately, these decreased over time, indicating that *Giardia* may elicit very long-term, but slowly self-limiting complications. These data add to an all too slowly growing body of *Giardia* research, which, taken in aggregate, suggest that the time has come to encourage increased investigations.

In this issue of the *International Journal of Infectious Diseases*, we present an analysis of the incidence of IBS without diarrhoea in the departments of Colombia during 2013. This was significantly associated with the incidence of giardiasis ( $r^2 = 0.7457$ ;  $p < 0.0001$ ). Departments with higher giardiasis incidence had higher reported IBS (Figure 1), coinciding ecologically with the findings of the Norway study.

Current discussion on the natural course of IBS and CF after *Giardia* infection has been enriched, whether manifested by classical signs and symptoms or a less straightforward clinical presentation. Important contributions have been made regarding the spectrum of illness attributable to giardiasis. It is illustrated

that the potential development of sequelae may include both IBS and CF, in spite of the eradication of the organism. Additionally, this has opened new avenues of research. Further investigations on the pathogenic mechanisms behind the development of these two conditions are needed, which could lead to potential interventions to prevent them. This study also provides a clue to physicians whose patients do not respond with symptom resolution after successful therapy. They need to be aware of the potential sequelae of *Giardia* infection, to alert their patients of the possible importance of reporting a previous *Giardia* exposure when presenting for treatment if CF or IBS symptoms develop.

In summary, there remains much to be known about *Giardia* and the spectrum of disease it causes, its epidemiology, and treatment. Collaborative studies that focus on determining precisely those who are most prone to develop CF or IBS after this infection are needed. Up to now, only old age and female sex have been identified as high risk factors for post-infectious fatigue.<sup>7,8</sup> It is also important to determine whether the treatment – and the timing of initiation – might influence these outcomes.



**Figure 1.** Non-linear regression model between giardiasis incidence rates (cases/100 000 population) and irritable bowel syndrome (IBS) incidence rates (cases/100 000 population) by department, Colombia, 2013.

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According to previous studies, the continuation of symptoms post-elimination could be more frequent in those who have experienced chronic or treatment-refractory giardiasis.<sup>9</sup> Is there any therapeutic window for possible early intervention to avoid CF and/or IBS? Stratification among patients susceptible to these complications according medical, immunological, and/or epidemiological profiles is needed to identify determinants of these clinical expressions. The *Giardia* isolates from patients developing long-term sequelae also deserve further study, as they may be genetically different.

The study setting is also important when interpreting the results. It is also necessary to characterize the parasite genotype pattern in the region and to determine whether newly introduced genotypes could produce a synergistic interaction which could result in greater pathogenicity. Last, but not least, it is also important to evaluate the impact of *Giardia* infection and its post-infectious sequelae in low-income countries, where there is the greatest burden of disease and highest risk of transmission.

Fortunately, research on giardiasis is growing,<sup>10</sup> since there is no doubt that for *Giardia* infection, there are still many questions to be answered. Up to now, the more you look, the more you find. However, a question arises: “How much is there?”

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