

Review

Re-analysis of the risks attributed to ciprofloxacin-resistant *Campylobacter jejuni* infections

Trudy M. Wassenaar^{a,*}, Manfred Kist^b, Anno de Jong^c

^a Molecular Microbiology and Genomics Consultants, Tannenstrasse 7, 55576 Zotzenheim, Germany

^b Department of Microbiology and Hygiene, University of Freiburg, Freiburg, Germany

^c Animal Health Division, Bayer HealthCare AG, Leverkusen, Germany

Abstract

Recent publications were compared and analysed in addition to novel surveillance data to assess the hypothesis that fluoroquinolone-resistant *Campylobacter* infections are causing more severe disease than susceptible infections. The available data did not support this hypothesis. There was no significant difference in duration of disease between susceptible and resistant infections. However, both for resistant and susceptible infections, disease symptoms were prolonged by on average 1–2 days for *Campylobacter* cases acquired during foreign travel. Nevertheless, the likelihood and duration of hospitalisation were not increased for cases related to foreign travel. These observations were confirmed by a new analysis of almost 11 000 cases. We conclude that fluoroquinolone-resistant *Campylobacter* infections are not more severe than susceptible infections.

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1. Introduction

Campylobacter jejuni is a common food-borne pathogen, in some countries surpassing *Salmonella* as the most frequent cause of bacterial gastrointestinal infection [1–3]. The disease is self-limiting in most cases, but patients at risk, such as young children, elderly people and immune-incompetent patients, require medication beyond fluid replacement, as extended diarrhoea or extraintestinal complications are more common in these cases [4]. In most European countries, treatment of campylobacteriosis with macrolides is recommended as the first choice [5]. In the USA, fluoroquinolones are frequently used as treatment of diarrhoea without bacteriological confirmation of the causative agent, as they are highly effective against *Escherichia coli* and *Salmonella* infections [6]. Fluoroquinolones are not registered for the treatment of children, with few exceptions.

In the last decade, *Campylobacter* resistance to fluoroquinolones has arisen and has subsequently increased in many

countries, with variations in the time of onset and the speed of increase [7–9]. These patterns roughly coincide with the introduction of fluoroquinolones in veterinary applications, notably their use in poultry to combat respiratory infections. Chickens are frequently asymptotically colonised by *C. jejuni*, and poultry meat is a known source for transmission of *Campylobacter*, either by consumption of undercooked meat or by cross-contamination to other foods [10–12], although the importance of poultry as a main source is diminishing [13–16].

The prevalence of fluoroquinolone resistance in human *Campylobacter* isolates currently varies from <10% to >90%, depending on the country, method of determination and local use of fluoroquinolones in animals and humans, with an increasing trend for most countries. This resistance has resulted in changed recommendations for treatment, with macrolides now preferably used in case of confirmed campylobacteriosis also in the USA [17]. Nevertheless, a number of patients will receive a fluoroquinolone as medication, for instance as empirical treatment. When such a patient is infected with a *Campylobacter* strain that shows in vitro resistance to the antibiotic, this may have consequences for

* Corresponding author. Tel.: +49 6701 8531; fax: +49 6701 901803.

E-mail address: mmgc.de@t-online.de (T.M. Wassenaar).