

Upsurge of infections caused by *Salmonella* Concord among Ethiopian adoptees in Denmark, 2009

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Multidrug-resistant (MDR) *Salmonella* Concord has been associated with adoptees from Ethiopia. In 2009, Denmark saw an increase in MDR *S. Concord* infections: all eight cases reported in 2009 were among Ethiopian adoptees. The upsurge was linked to an increased number of infants adopted from Ethiopia. Data from other European countries suggests that they may face a similar problem.

Introduction

Two studies from seven European countries and the United States (US) have shown an increased number of infections with *Salmonella* Concord from 2003 to 2007 among mainly Ethiopian adoptees [1, 2]. Isolates associated with patients of Ethiopian origin were all multidrug-resistant to antimicrobials including third generation cephalosporins.

In 2009, we recognised an increase in *S. Concord* infections in Denmark by querying the central *Salmonella* database at Statens Serum Institut. The recent investigation of this upsurge indicates that multidrug-resistant *S. Concord* continues to be imported from Ethiopia and therefore represents a concern for international public health. Additionally, we wanted to compare the upsurge of this specific pheno-/geno-type observed in Denmark with what has been reported in the rest of Europe through data from the European Surveillance System (TESSy) database at the European Centre for Disease Prevention and Control (ECDC).

Methods

A previously published study had indicated that in the US, the occurrence of *S. Concord* followed the number of Ethiopian infants adopted [1]. In 2009, an increased number of Ethiopian children adopted to Denmark were observed why this study was initiated to investigate if the same correlation between Ethiopian adoptees and the number of *S. Concord* cases were present in Denmark. In Denmark, all *Salmonella* cases are notified by the general practitioners to the Statens Serum Institut and archived in a central database; "Det Tarmbakteriobiologiske Register". By querying this

database, the data on *S. Concord* were retrieved and the isolates further characterised. The patients or the parents of patients were interviewed to determine if the patients were adopted from Ethiopia, had travelled internationally or had any association with Ethiopians before onset of illness. Information about adoptions from Ethiopia was sought from national adoption agencies in Denmark [4, 5]. Serotyping and testing for susceptibility to antimicrobial agents was performed at Statens Serum Institut as minimum inhibitory concentration (MIC) determinations according to previously described methods [6], but with resistance (R) cut-off values for cefotaxime at $R \geq 2$ mg/ml. Confirmatory testing for extended-spectrum beta-lactamases (ESBL) was applied on the eight isolates of Danish Ethiopian adoptees conferring resistance to cefotaxime and cefixime [1].

To get an overview of the situation in other European countries, we obtained data from the TESSy database at ECDC for 2006-2008 [3]. Case-based data on *S. Concord* serotype, importation status, probable country of infection and resistance against 11 antimicrobials were analysed from European Union (EU) and European Economic Area (EEA) countries. Country specific details are not included in the study.

Results

In Denmark, the number of *S. Concord* infections increased from none in 2007, two in 2008 and eight in 2009 (Figure).

Eight patients were female and age ranged from less than one year up to 30 years. Eight patients were infants less than one year of age and all were Ethiopian adoptees. The two adult patients were a 30 year old male who had been infected during a visit to Africa (country not specified) and a 23 year old female who had neither history of recent international travel nor contact with children or adults arriving from Ethiopia. General practitioners and parents of seven infants and the two adults were interviewed. Four infant patients were asymptomatic and were examined due to underweight,

relatives with diarrhoea and for general screening purposes. Five patients including both adults were suffering from non-bloody diarrhoea and one infant from urinary tract infection (UTI). Two infants, including the one suffering from a UTI were hospitalised. The link between the Ethiopian adoptees and the respective orphanages were not investigated. However, a previously published study reveal that the adoptees often originate from multiple orphanages or transit centres [1].

Laboratory investigations

The eight *S. Concord* isolates originating from Ethiopian adoptees all conferred resistance to ampicillin, cefotaxime, ceftiofur, chloramphenicol, gentamicin, streptomycin, sulfamethoxazole, tetracycline, and trimethoprim respectively. Additionally, resistance to colistin (n=1), florfenicol (n=6) and reduced susceptibility to ciprofloxacin (n=6) was observed in the samples. The strains were all susceptible to apramycin, amoxicillin+clavulanic acid, nalidixic acid, neomycin and spectinomycin. All eight isolates were confirmed as ESBL-producing according to the phenotypic characterisation.

The two strains belonging to patients older than one year of age and without association to Ethiopia were both pansusceptible.

A total of 256 children were adopted from Ethiopia to Denmark from 2007 to 2009. During this period, the number of Ethiopian adoptees increased by 220% from 39 adoptions in 2007 to 125 in 2009 (Figure).

Data from other European countries

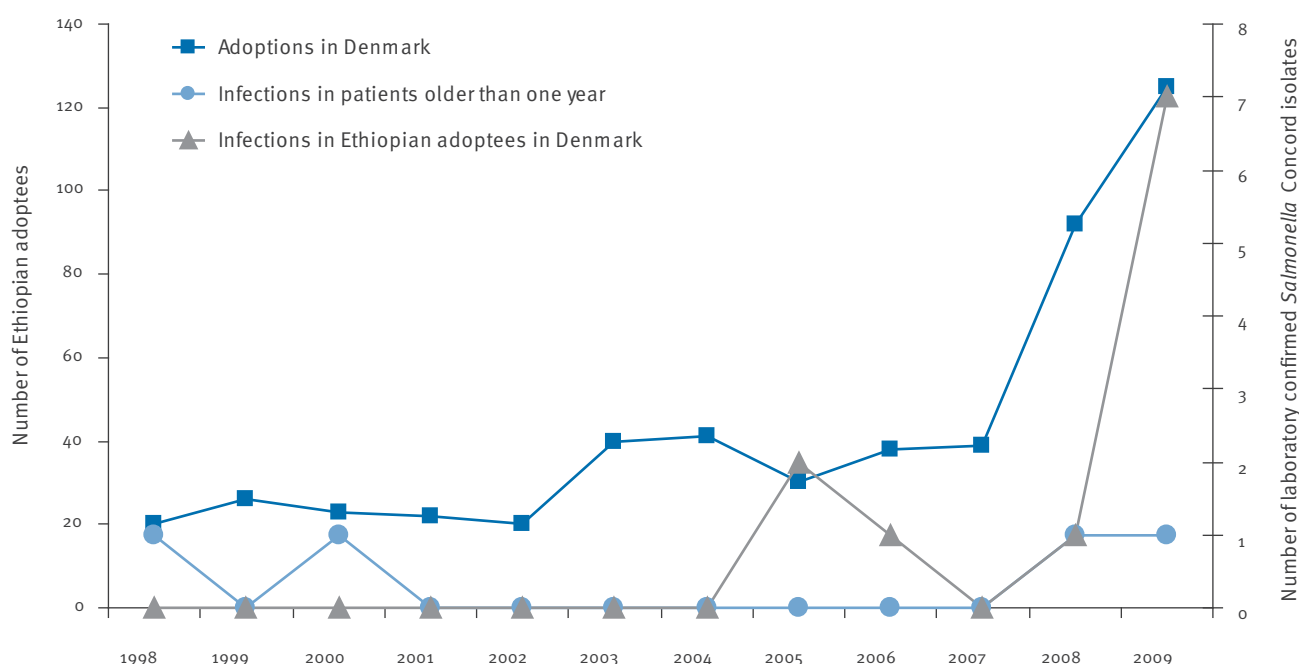
Data for 91 *S. Concord* patients were retrieved, as of 28 July 2009, from the TESSy database (2006: 21 patients from five EU/EEA countries; 2007: 37 from six EU/EEA countries; 2008: 33 from eight EU/EEA countries). In a pooled dataset from 2006-2008, 44 cases (48%) were reported in children under two years of age and 15 (16%) *S. Concord* cases were reported as acquired from outside of EU/EEA countries. The low proportion of isolates acquired from outside of EU/EEA are most likely biased due to the fact that many cases do not have the information on the country where the infection was contracted. Ethiopia was indicated as country of origin for eight cases in four countries and Kenya for one case. All eight cases originating from Ethiopia were below or one year of age. The one case with infection acquired in Kenya was a 24 year old male. Antimicrobial resistance data were available for 10 confirmed cases only, of which seven and four isolates conferred resistance to cefotaxime and ciprofloxacin, respectively; two of these cases were linked to Ethiopia.

Discussion

In Denmark and from a European perspective, *S. Concord* is a rarely reported serotype. From 2007 to 2009, an increased incidence of *S. Concord* infections among Ethiopian adoptees, most likely caused by the same multidrug-resistant clones from Ethiopia, was noted in Denmark [1, 2]. The increasing number of countries reporting cases of *S. Concord* and the suggested link between very young children and Ethiopia may be indicative of a noteworthy health problem in Ethiopia and an important route for the importation of *S. Concord* to Europe.

FIGURE

Number of children adopted from Ethiopia and the number of laboratory confirmed *Salmonella Concord* cases in Denmark, 1998 – 2009



In Denmark, the recent incidence of *S. Concord* has not earlier followed the adoption rate of Ethiopian infants as was described previously in the US [1]. There may be several explanations for this, one of which may be an increased awareness in Denmark of Ethiopian children being infected with *S. Concord* resulting in more testing. Another possibility could be an increased incidence of *S. Concord* in Ethiopian children.

In this study, the antimicrobial susceptibility data are consistent with the multidrug-resistant *S. Concord* widely spread among Ethiopian adoptees, whereas susceptible strains often can be traced to other parts of east Africa. It appears that the Danish strains from year 2009 are more resistant than previously observed, with six of seven strains from Ethiopian adoptees showing reduced susceptibility to fluoroquinolones. Previous studies of *S. Concord* isolates from Ethiopian adoptees have found that the strains harboured the following genes; *bla*_{CTX-M-15} and *bla*_{SHV-12} and *qnrA* and *qnrB*, respectively encoding resistance to third generation cephalosporins and reduced susceptibility to fluoroquinolones. Antimicrobial treatment of *S. Concord* from Ethiopian adoptees is hampered by the nature of the resistance pattern, which limits the options for treatment with traditional antimicrobials - including fluoroquinolones, which are not recommended for children [1].

Conclusions

The present study highlights the emergence of *S. Concord* isolates resistant to third generation cephalosporins among Ethiopian adoptees in Denmark during 2007 to 2009, and suggests that *S. Concord* continues to be a concern for international public health.

We recommend that physicians assess the health status of international adoptees, with special attention to Ethiopian adoptees, on arrival into the country of destination. If the health examination indicates that the child may have salmonellosis, specimens should be submitted for culture and subsequently for antimicrobial susceptibility testing if *Salmonella* is isolated. Unfortunately, it remains poorly understood why this *Salmonella* serovar seems to be linked in particular to Ethiopia, why the problem continues several years after its recognition, and how important this *Salmonella* serovar is for east African public health.

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