

Outbreak of extended spectrum beta-lactamase producing *E. coli* in a nursing home in Ireland, May 2006

H Pelly¹ (heidi.pelly@mailn.hse.ie), D Morris², E O'Connell¹, B Hanahoe³, C Chambers⁴, K Biernacka², S Gray³, M Cormican^{2,3}

¹Department Public Health, Merlin Park Hospital, Galway, Ireland

²Department of Bacteriology, Clinical Science Institute, National University of Ireland Galway, Galway, Ireland

³Department of Medical Microbiology, Galway University Hospitals, Galway, Ireland

⁴Nursing Home Inspectorate, Community Services, HSE West, Galway, Ireland

In May 2006, a consultant microbiologist noted two isolates of extended spectrum beta-lactamase (ESBL)-producing *Escherichia coli* associated with urinary tract infections in a single week in two residents in a nursing home in Ireland. On review, five additional patients with ESBL-producing *E. coli* positive urine cultures were identified from that the same nursing home in the period January to May 2006. The general practitioners (GP) caring for these patients and the regional department of public health were informed, and a multidisciplinary outbreak team meeting was convened. A case was defined as any resident with significant ESBL-producing *E. coli* bacteriuria ($> 100\,000$ CFU/ml) identified in 2006. In 2005, 56 ESBL producing isolates were detected in the region, but only one of these was from this nursing home, and this case had occurred seven months before January 2006, when the primary case in this outbreak had been reported. The nursing home was visited by members of the outbreak team and data on all residents were collected. Information was provided to residents and consent obtained for collection of rectal swabs to determine the prevalence of colonisation.

In Europe, invasive *E. coli* isolates are reported as part of the European Antimicrobial Resistance Surveillance System (EARSS, <http://www.rivm.nl/earss/>). In Ireland, the proportion of *E. coli* isolates that were tested for presence of ESBL, and tested positive, increased from 1.3% in 2004 (11/861) to 2.7% in 2005 (30/1132 tested) [1,2]. The 2004 EARSS report comments that the proportion of *E. coli* resistant to third generation cephalosporins increased from 1.5% 2001 to 2.9% ($P<0.0001$) in 2004, probably due to increased dissemination of ESBL producers [3]. The increase was consistent across the countries surveyed by EARSS.

Site visit

The nursing home is purpose-built, with 50 beds in a mix of one and two bed units, communal dining and recreational areas, and shared toilet and bathing facilities. At the time of detection of the outbreak there were 44 residents: 18 men and 26 women, ranging in age between 33 and 105 years, with a median age of 87 years. High dependency levels were noted, and 32 residents had urinary incontinence (14 men and 18 women) and 14 had faecal incontinence. Only one resident had a urinary catheter. Ten residents were confined to bed or chair (3 men and 7 women) and 14 residents were described as confused or had a diagnosis of dementia. Hygiene standards, the ratio of carer to residents and the care practices were considered satisfactory according to the local Nursing Home Inspectorate, which had inspected the home during the month before the start of the outbreak.

To date, no resident has been diagnosed with major systemic infection related to this ESBL-producing *E. coli* outbreak and there have been no associated hospital admissions or mortality.

During the first five months of 2006, 41 of the 44 residents had received antimicrobial therapy, predominantly for respiratory and urinary tract infections, and 14 patients had received five or more courses of antimicrobial agents. Ten patients had been treated with one or more courses of third generation cephalosporins and six had received fluoroquinolones. Ceftriaxone was the third generation cephalosporin most commonly prescribed and was generally prescribed below the recommended dose. Two patients were receiving continuous antimicrobial therapy directed at prevention of urinary tract infection. Five GPs were involved in the care of these residents and no specific antibiotic prescribing protocol was in place.

Laboratory investigation and results

Rectal swabs from 44 patients were obtained and more than 22 environmental swabs collected from toilet seats and rims, door handles, call bells, and laundry within the nursing home. All were screened for ESBL-producing *E. coli* on MacConkey agar with cefotaxime at 2mg/L. Suspect ESBL-producing isolates were confirmed by the combination disk method of the Clinical Laboratory Standards Institute [4].

In total, 24 residents were positive for ESBL-producing *E. coli* (see Table). All environmental swabs were negative. Pulsed field gel electrophoresis (PFGE) was performed (in accordance with the PulseNet protocol [5]) on 26 of the 28 isolates. Banding patterns generated were analysed using bionumerics software (Applied Maths, Kortrijk, Belgium). Twenty isolates from 18 patients had indistinguishable PFGE banding patterns, and five of the remaining isolates were similar to (79% similar) but distinguishable from the predominant isolate. The outbreak strain was also resistant to fluoroquinolones, gentamicin and trimethoprim, but susceptible to nitrofurantoin. Plasmid analysis was performed on representatives of the predominant strain, on each variant of the predominant strain and on the single distinct strain suggested a plasmid of similar size shared by isolates with predominant, variant or distinct PFGE patterns. A blaCTX-M group 9 gene was confirmed by PCR in all 14 isolates that have so far been examined. The outbreak strain differs from the 'strain A' associated with a major community outbreak in the United Kingdom in 2003/2004, both in respect of PFGE pattern and CTX-M group enzyme expressed [6].

Table. Residents of the nursing home with positive culture for extended spectrum beta-lactamase-producing *E. coli*

Sex	Urine culture	Rectal	Both
Male (n= 18)	3	11	2
Female (n= 26)	5	11	4
Total (n = 44)	8*	22	6

*An additional isolate of ESBL-producing *E. coli*-associated with urinary tract infection was identified during the outbreak.

Control measures

Control measures were planned to balance the risk to patients (no mortality and limited morbidity have been reported to date), and their need for continuity in their room assignments and the pattern of their communal life. These measures included education for residents, their families and staff, and improving hygiene and infection control efforts. The outbreak team recommended limiting the use of antimicrobial agents, and in particular the use of third generation cephalosporins and fluoroquinolones. Draft guidance for antimicrobial prescribing has been circulated for discussion. GPs caring for patients have been advised that in the event of life threatening invasive infection, only carbapenem agents are reliably effective against ESBL-producing *E. coli*.

Discussion

Standards of facilities and practice in this nursing home were found to be satisfactory by the Nursing Home Inspectorate and management, and staff were very cooperative with all control measures recommended. There is no reason to believe this nursing home is uniquely at risk for an outbreak of ESBL-producing *E. coli*. Recognition of this outbreak is a consequence of

- a policy in this nursing home of routine submission of urine for culture before starting antimicrobial therapy;
- routine screening of *E. coli* from urine for ESBL production; and
- under the Infectious Diseases (Amendment) Regulation 2003, unusual clusters of illness are now notifiable in Ireland and this allows for their notification and thus facilitates full investigation [7].

A review of ESBL-producing *E. coli* isolates from the regional laboratory has identified 19 other nursing homes (out of the approximately 90 nursing homes in the region) where one or more patients was found to have ESBL-producing *E. coli* in the first half of 2006. It is quite possible that ESBL-producing *E. coli* has also disseminated in similar facilities

Conclusions

This report highlights the potential for transmission of ESBL-producing *E. coli* and other antimicrobial resistant bacteria in nursing homes. A dependent and vulnerable group of residents live in close proximity in a setting where strict source isolation is frequently not practical with respect to the overall needs of the residents. Residents of nursing homes are prone to both respiratory and urinary tract infections, and so antimicrobial use may be high. Residents frequently come to these facilities directly from hospitals, and this poses a continuing risk for introduction of antimicrobial resistant bacteria into the facilities. The increasing population of dependent and vulnerable residents of long stay facilities across Europe presents an increasing potential for dissemination, maintenance and amplification of antimicrobial resistant pathogens and other infectious diseases, and deserves a high priority in strategies to control spread of infection.

Acknowledgments: Ajay Oza, Robert Cunney and Stephen Murchan, Health Protection Surveillance Centre, Dublin.

References:

1. Data summarised from the European Antimicrobial Resistance Surveillance System (EARSS) quarterly reports, 2005. Dublin: Health Protection Surveillance Centre; 2005-2006. (<http://www.ndsc.ie/hpsc/A-Z/MicrobiologyAntimicrobialResistance/EuropeanAntimicrobialResistanceSurveillanceSystemEARSS/EARSSSI>)
2. Ireland. In: EARSS. *EARSS Annual Report 2004*. Bilthoven: RIVM; 2005. (http://www.rivm.nl/earss/Images/IE_tcm61-25437.pdf)
3. EARSS. *EARSS Annual Report 2004*. Bilthoven: RIVM; 2005. (http://www.rivm.nl/earss/Images/EARSS%20annual%20report%202004%20webversie_tcm61-25345.pdf)
4. Clinical and Laboratory Standards Institute. *Performance Standards for Antimicrobial Disk Susceptibility Tests; Approved Standard*. 9th ed. Clinical and Laboratory Standards Institute document M2-A9 (ISBN 1-56238-586-0). Wayne [PA]: Clinical and Laboratory Standards Institute; 2006. (<http://www.clsi.org/source/orders/free/m2-a9F.pdf>)
5. Swaminathan B, Barrett TJ, Hunter SB, Tauxe RV; CDC PulseNet Task Force. PulseNet: the molecular subtyping network for foodborne bacterial disease surveillance, United States. *Emerg Infect Dis*. 2001 May-Jun; **7**(3):382-9. (<http://www.cdc.gov/ncidod/eid/vol7no3/swaminathan.htm>)
6. Woodford N, Ward ME, Kaufmann ME, Turtton J, Fagan EJ, James D, et al. Community and hospital spread of *Escherichia coli* producing CTX-M extended-spectrum beta-lactamases in the UK. *J Antimicrob Chemother*. 2004 Oct; **54**(4):735-43. Epub 2004 Sep 3. (<http://jac.oxfordjournals.org/cgi/content/full/54/4/735>)
7. Case Definitions for Notifiable Disease. In: *Infectious Diseases (Amendment) (No. 3) Regulations 2003 (SI No. 707 of 2003)*. Dublin: Stationery Office; 2003. (<http://www.irishstatutebook.ie/ZZSI707Y2003.html>)