

the analyses, because these data were only available for a limited number of patients. Using these limited albuminuria and proteinuria data would have caused substantial selection bias. Second, not all creatinine values were measured by the same laboratory or by the same creatinine assay due to the design of the database, which collects data from practices throughout Flanders. However, all Belgian laboratories are subject to quality control measures ([http://www.iph.fgov.be/ClinBiol/bckb33/activities/external\\_quality/rapports/\\_down/klinische\\_chemie/2003/2\\_CHIMIE.pdf](http://www.iph.fgov.be/ClinBiol/bckb33/activities/external_quality/rapports/_down/klinische_chemie/2003/2_CHIMIE.pdf), 2009), which diminished the analytical differences among the laboratories. In the period between 1994 and 2008, most laboratories in Belgium used a kinetic Jaffe method without IDMS standardisation. Finally, we used the four variable MDRD equations for the estimation of the GFR. This equation is currently the most used equation but is originally [3] constructed in a population with renal diseases aged younger than 70 years and the number of studies validating this formula in patients aged 70 and over remains limited until now [8].

To conclude the prevalence of CKD in general practice increases with ageing but the prevalence of stages 4 and 5 CKD is limited, even in the oldest of the old. In the subgroup of patients aged 90 years and older more than 40% of the patients had an eGFR  $\geq 60$  ml/min. So a large group of patients show no decline or no clinically relevant decline in eGFR with ageing.

## Key points

- The prevalence of CKD increases with age.
- Despite the decline of the mean eGFR with ageing almost half of the oldest old has an eGFR  $>60$  ml/min.
- The prevalence of stages 4 and 5 CKD is limited, even in the oldest of the old.

## Funding

The Intego project is supported by the Government of Flanders and commissioned by its Minister responsible for Health Policy. G.V.P. is a fellow of the Research Foundation-Flanders (FWO).

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doi: 10.1093/ageing/afr154

Published electronically 2 December 2011

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## Extended-spectrum beta-lactamase-producing *Enterobacteriaceae*: unexpected low prevalence of carriage in elderly French residents

SIR—Extended-spectrum  $\beta$ -lactamases (ESBLs) are the major cause of resistance to cephalosporins. Since 2000, CTX-M enzymes have become the most prevalent, particularly in *Escherichia coli* [1, 2]. CTX-M-15-producing *E. coli* of the ST131 lineage has become endemic worldwide [3, 4]. The epidemiology of ESBL-producing *Enterobacteriaceae* (ESBLE) is complex, involving spread in the community, nosocomial acquisition and plasmid transfer between *Enterobacteriaceae*. It has been suggested that nursing homes (NHs) and long-term care facilities (LTCFs) may be significant to the epidemiology of ESBLE [5–8]. Elderly patients cumulate risk factors for carriage of multidrug-resistant (MDR) bacteria and residents have been recently shown to be reservoirs of ESBLE [9, 10]. A group of experts appointed by the French Ministry of Health to establish suggestions to tackle ESBLE recently recommended monitoring the

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prevalence of ESBLE carriage in elderly patients by rectal or urinary screening [11].

To increase our knowledge concerning the epidemiology of ESBLE carriage and associated risk factors in elderly French residents of care facilities, we conducted a multicentre point-prevalence study. In particular, we evaluated colonisation of residents at 40 institutions in two distant French regions.

## Methods

### Study population

Three LTCFs in the Franche-Comté region (LTCF-A: 150 beds, LTCF-B: 254 beds, LTCF-T: 143 beds)—, and 37 NHs in the centre region (NH-01 to NH-37 with 40–307 beds per NH, total beds 5,141) participated in the study. All the residents at the participating institutions between February and June 2010 were eligible for recruitment into the study. The residents of one of the units of LTCF-A and all residents at LTCF-B and LTCF-T were enrolled. More than one of every five NH residents was randomly selected for participation. All residents or their relatives were individually approached for consent to access their medical records and to culture a single sample (either faecal or urine) to test for ESBLE.

### Study design

The study was carried-out over a 4-month period. Each patient was included only once. Microbiological samples were collected from all residents included; two different approaches were used to investigate ESBLE carriage. LTCF residents were screened for ESBLE carriage with rectal swabbing. Swabs were suspended in 0.5 ml of sterile water and 0.1 ml of the suspension was streaked on Drigalski agar (Bio-Rad, Marnes-la-Coquette, France). A 20 µg cefotaxim disk (Bio-Rad, Marnes-la-Coquette, France) was then applied, and the plated incubated for 18 h at 35°C. Bacteria growing around the cefotaxim disk were identified and tested for ESBL production using the double disk synergy test according to the recommendations of the Antibioqram Committee of the French Society for Microbiology [12]. Urine samples from NH residents were used for screening for ESBLE carriage. Ten microlitre samples of the first morning urine were plated within 1 h of collection on a ChromID ESBL selective agar plate (bioMérieux, Marcy l'Etoile, France), and the plates were incubated at 37°C for 48 h. Bacteria forming colonies were identified using Vitek<sup>®</sup>2 Gram-negative Identification Cards (bioMérieux, Marcy l'Etoile, France) and studied for ESBL production as described above.

### Data collection

Data were collected in a standardised questionnaire and included demographic data (age and sex), physical disability,

urinary and faecal incontinence and significant comorbidities (diabetes mellitus, renal disease, chronic renal insufficiency). Various risk factors for ESBLE carriage were also recorded: hospitalisation and antibiotic use (cephalosporin and fluoroquinolones) within the 6 months prior to inclusion in the study.

### Statistical analysis

All variables were examined by univariable analysis using the  $\chi^2$  or Fisher's exact test, as appropriate. All statistical tests were two-tailed.  $P < 0.05$  was considered to be statistically significant. Epi info software, version 6, was used for statistical analysis.

### Confidentiality and ethical aspects

This prevalence study was run in accordance with the French healthcare recommendations for prevention of infection, as an inter-regional study and as such did not require ethical approval. It was managed jointly with the heads of all participating institutions and the physicians responsible for caring for the residents.

## Results

Eight-hundred and seventy-seven residents (412 from LTCFs, 465 from NHs) were enrolled, including 621 women (70.8%) and 256 men (29.2%) aged between 49 and 108 years (mean 84; SD 9). Most characteristics were similar for the two populations (see Supplementary data available in *Age and Ageing* online, Appendix 1). LTCF and NH residents did not differ for age, physical disability, incontinence, diabetes mellitus, recent antibiotic use or recent urinary catheterisation. The only significant differences were the proportion of men (22% for LTCF versus 37% for NHs;  $P < 0.001$ ), and the incidences of urinary pathology (6% for LTCFs versus 12% for NHs;  $P = 0.002$ ) and recent hospitalisation (31% for LTCFs versus 22% for NHs;  $P = 0.003$ ).

Seventeen of the 877 enrolled residents were ESBLE carriers (1.9%): 11 of the 412 (2.7%) LTCF residents and six of 465 (1.3%) NH residents. Carriage rates obtained by faecal or urine screening did not differ significantly ( $P = 0.209$ ). The 17 ESBLE isolates were 10 *E. coli*, three *Enterobacter cloacae*, two *Klebsiella pneumoniae*, one *Proteus mirabilis* and one *Citrobacter koseri*. Most of these strains were resistant to fluoroquinolones (14/17, 82%) and to trimethoprim-sulfamethoxazole (10/17, 59%); all were susceptible to carbapenems.

ESBLE carriers were significantly older and in a poorer state of health than non-carriers ( $P = 0.011$ ) (Table 1). ESBLE colonisation was significantly associated with urinary and/or faecal incontinence ( $P = 0.049$ ), recent urinary catheterisation ( $P = 0.021$ ) and antibiotic treatment ( $P = 0.002$ ). Our data showed that if the residents were

**Table 1.** Demographic and clinical characteristics of residents positive for ESBLE carriage ( $n = 17$ ) and those who were not ( $n = 860$ ) in the three LTCFs and the 37 NHs

Characteristics of residents	Positive, $n$ (%)	Negative, $n$ (%)	$P$ -value
Male sex	7 (43.7)	256 (29.7)	NS
Age > 85 years	12 (70.6)	489 (56.9)	NS
Physical disability	11 (68.7)	301 (35.0)	0.011
Co-morbidities			
Diabetes mellitus	1 (6.2)	152 (17.6)	NS
Urinary pathology	3 (18.7)	74 (8.6)	NS
Incontinence urinary and/or faecal	12 (70.6)	400 (46.5)	0.049
Urinary catheter in the previous 7 days	3 (18.7)	29 (3.4)	0.021
Hospitalisation in the previous 6 months	5 (31.2)	223 (25.9)	NS
Antibiotic use in the previous 6 months	11 (68.8)	295 (34.3)	0.002
Cephalosporins	4 (25)	73 (8.5)	NS
Fluoroquinolones	2 (12.5)	43 (5.0)	NS

**Table 2.** Performance of ESBLE carriage detection according to the number of risk factors and risk score (results for faecal and urine swabs)

Number of risk factors <sup>a</sup>	Score (cumulated number of risk factors) <sup>a</sup>		Sensitivity	Residents to be screened
	Carriers, $n$	Non-carriers, $n$		
<b>ESBL faecal</b>				
0	0	102	≥ 0	100% (11/11)
1	4	154	≥ 1	100% (11/11)
2	2	110	≥ 2	64% (7/11)
3	4	35	≥ 3	45% (5/11)
4	1	0	4	9% (1/11)
<b>ESBL urine</b>				
0	0	156	≥ 0	100% (6/6)
1	1	134	≥ 1	100% (6/6)
2	2	101	≥ 2	83% (5/6)
3	2	61	≥ 3	50% (3/6)
4	1	7	4	17% (1/6)

<sup>a</sup>Risk factors considered: physical disability, urinary and/or faecal incontinence, urinary catheter in the previous 7 days, antibiotic use in the previous 6 months.

stratified according to the number of these four risk factors they present, screening the one-third of all residents with at least two of the four risk factors would identify a large proportion of carriers (64% and 83% by faecal and urine screening, respectively; Table 2).

## Discussion

Data on ESBLE carriage among LTCF and NH residents remain scarce despite these settings being frequently cited as potential reservoirs for these MDR bacteria [5, 6, 8, 9].

Recently, ESBLE carriage was assessed using diverse study designs in various patient populations [5, 7–9, 13–17]. Carriage rates varied from 5.5% for ambulatory patients in Spain [16] and 8% for patients at admission [17] to 40.5% for NH residents in Northern Ireland [9]. Our study revealed a lower ESBLE carriage among residents. The rate observed (1.9%) was close to that found by nationwide surveillance in France in 2006 in a community setting (1.1%) [18, 19]; note that the prevalence of ESBLE increased constantly in France between 2006 and 2010 [13].

One possible explanation of the low prevalence we report is poor sensitivity of our carriage detection procedure. Although we used established ESBLE detection procedures routinely applied in our university hospitals [11, 12], each subject was only tested once at only one colonisation site; most authors test multiple sites [8].

Consistently with previous studies [1, 13, 16, 17], the ESBLE we isolated were mostly *E. coli* and mostly resistant to multiple antibiotic classes, especially fluoroquinolones.

The low carriage rate of ESBLE observed here among elderly patients at French NHs and LTCFs could evolve rapidly. In the context of substantial concerns about the spread of MDR bacteria, local, regional, nationwide and worldwide survey studies should be routinely conducted to monitor the phenomenon and to provide information for adapting educational preventive strategies in these settings. Our findings indicate that a carriage detection strategy using urine and/or faecal swabs from residents presenting at least two of the four identified risk factors appears to allow detection of a large proportion of ESBLE carriers. This observation may be used as the basis for an easy and low cost approach to optimise ESBLE control.

Asymptomatic carriage of ESBLE is an important risk factor for the development of outbreaks involving resident-to-resident transmission. Knowledge about the clinical data associated with ESBLE carriage may facilitate identification of residents at risk and the development of preventive strategies to restrict the dissemination of ESBLE and the progress of outbreaks in NHs. Our study confirmed that many residents carrying ESBLE presented numerous major co-morbidities and well-established potential risk factors, such as prior antibiotic exposure, urinary catheterisation and prior hospitalisation [7–9, 15, 17, 20, 21]. Unfortunately, these co-morbidities and risk factors are frequent and often severe among residents. Nevertheless, our findings indicate that ESBLE carriage was most frequent among the oldest residents and those presenting the greatest disabilities. As transient carriage on the hands of healthcare workers is a route of transfer from patient-to-patient, we stress the need for stringent infection-control precautions for the most dependent residents. In particular, a high level of compliance with standard precautions should be obligatory, focusing on urinary management and the manipulation of used absorbent products employed for containing faecal and urinary incontinence.

### Conclusion

In the community, ESBLE carriage ranges from 0.6 [19] to 3.7% [16], but can be much more prevalent during outbreaks [7, 8, 22]. To our knowledge, no large-scale surveillance data are yet available concerning elderly populations in Europe. The carriage rates we report for LTCF and NH residents were very similar and close to that in the general population [15, 18, 19]. Our results suggest that the French NHs and LTCFs studied are unlikely to be major reservoirs for ESBLE.

### Key points

- Three long-term-care facilities and 37 nursing homes.
- 877 residents screened for ESBLE carriage.
- Low prevalence rate (1.9%).
- Four risk factors associated with ESBLE carriage.
- Strategy for ESBLE detection at residents into long-term care facilities and nursing homes.

### Supplementary data

Supplementary data mentioned in the text is available to subscribers in *Age and Ageing* online.

### Acknowledgements

Participating physicians and nurses: P. AMIRAULT (Vierzon), M. AUDIBERT (Gien), V. BACLE (Richelieu), B. BAUDRON (Montoire sur le Loir), M. BEAUVAIS (Chateauroux), F. BERJAMY (Avanne) J. BLEUET (Luyes), M. BOUCHER (Chateaudun), M. BOULANGER (Chateaudun), N. BOURSIER (Nogent le Rotrou), L. BUCQUET (Orléans), P. CADIC (Meung sur Loire), B. CATTIER (Amboise), J. CELOTTO (Besançon), P. CHEMIN (Nogent le Rotrou), I. CHENU (Loches), I. CLOAREC (Sainte Maure de Touraine), G. COUROUBLE (Chateauroux), MC COURTIN (Amboise), Y. CRETON (Valencay), G. DELAPORTE (Gien), C. DENIS (Loches), F. DEPERROIS (Chinon), P. DEPERSON (Sully sur Loire), R. DEREUX (Richelieu), MC . DES GARETS (La Chatre), B. DONCE (Beaugency), P. DURAND (Saint Aignan sur Cher), P. FOLOPPE (Loches), I. FRAISSE (Notre Dame d'Oé), P. GARNIER (Abilly), F. GAUCHER (Sancerre), F. GROBOST (La Ferté Bernard), F. GUILLEMONT (Beaune la Rolande), M. HETROY (Ligueil), M. IEHL-ROBERT (Besançon), D. IMBAULT (Vendome), J. ISHAC (Vendome), A. JACQUINOT (Villeloin Coulangé), M. JOLLIVET (Beaugency), S. JOUANNEAU (Saint Aignan sur Cher), E. KOFFY (Aigurande), MJ. KOURTA (Chateaudun), C. LABOUTE (Montoire sur le Loir), F. LAUBUS (Buzancais), P. LAUDAT (Tours), P. LEFEBVRE (Gien), O. LEHIANI (Vierzon), H. LEMAITRE (Tours), A. LEMORE (Montoire sur le Loir), C. LEROY (Romorantin-Lanthenay), AC.

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### Funding

This work was supported by the Agence Régionale de Santé of the region Centre, the Centre Hospitalier Universitaire of Tours, France, the *Centre de Coordination de la Lutte contre les Infections Nosocomiales de l'Ouest* and the Centre Hospitalier Universitaire of Besançon, France.

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doi: 10.1093/ageing/afr173

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### Physical performance, sarcopenia and respiratory function in older patients with chronic obstructive pulmonary disease

SIR—The aging process is characterised by a progressive decline of skeletal muscle (or sarcopenia) which, by closely interacting with chronic diseases, may predispose to the onset of physical disability [1]. Chronic obstructive pulmonary disease (COPD) is a highly prevalent condition associated with both depleted lean mass and impaired overall health status in older persons [2, 3]. Furthermore, lean mass has shown to be inversely associated with the Medical Research Council dyspnoea score [4] and the Activity component of the Saint George Respiratory Questionnaire [5], and directly related to pulmonary function parameters (including Forced Expiratory Volume in 1 second [FEV1]) [4].

Recently, Spruit *et al.* [6] reported the absence of relationship between fat-free mass and 6-minute walking test (6mWT) results in the Evaluation of COPD Longitudinally to Identify Predictive Surrogate Endpoints (ECLIPSE) study. On the other hand, Ischaki *et al.* [4] previously reported a positive correlation between results at the 6mWT (the most commonly adopted and reliable physical performance measure in COPD [7]) and fat-free mass. The ECLIPSE investigators [6] explained their negative results by their analytical choices and the evaluation of a higher number of potential confounders.

To our knowledge, besides of these sparse data, the relationships existing among respiratory function, sarcopenia and physical performance have never been formally