Faecal carriage of ESBL-producing Enterobacteriaceae in the community

Liège - Belgium

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Introduction

- Infections due to ESBL-producing Enterobacteriaceae (ESBL-E)
  - acute-care hospitals
  - other healthcare facilities (nursing homes…)
  - **community**

- Global programme related to appropriate use of antibiotics in the community in Belgium

  → Prevalence of ESBL-E colonizing the digestive tract

Introduction

- Aim of the study:
  - To determine the carriage rate of ESBL-E in community patients' faecal flora.
  - To characterize the detected ESBLs

Materials and Methods

Samples

- 6 general practitioners from 10 independant surgeries
- 284 patients chosen at random without relation to the reason of their consultation

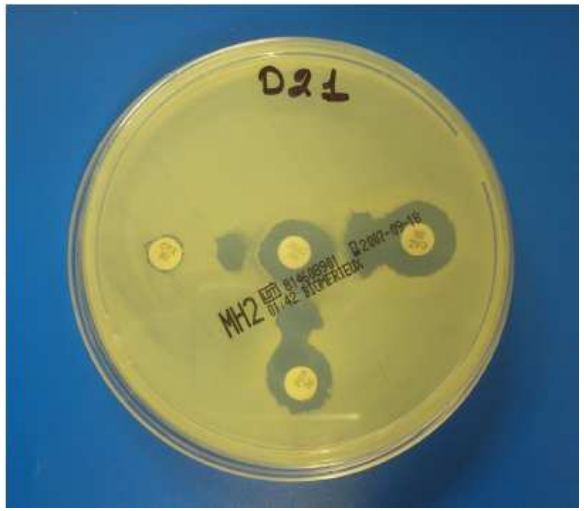
→ Collection of faecal specimens and filling of a case report form.

Inoculation

- Faecal suspension in 1 ml sterile saline
- 50 µl onto 3 different selective culture media:
  - ChromID ESBL agar (bioMérieux)
  - Bi-plate media (AES Chemunex): MacConkey agar with ceftazidime and Drigalski agar with cefotaxime

Identification and detection of ESBL-E

- Identification of all the Enterobacteriaceae performed by Vitek2 (bioMérieux)
- ESBL production screened by the combined double disk synergy method
- Antibiotic susceptibility testings of the ESBL-E performed by Vitek2 (bioMérieux)

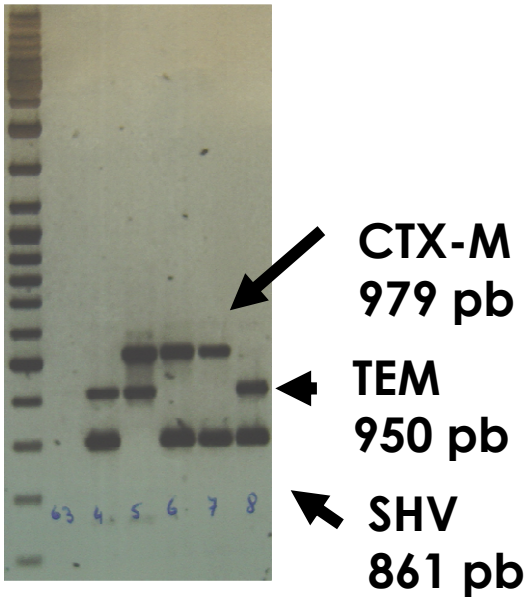


Genotypic characterization (1)

- DNA extraction for each ESBL-E with the QIAamp DNA mini kit (Qiagen)

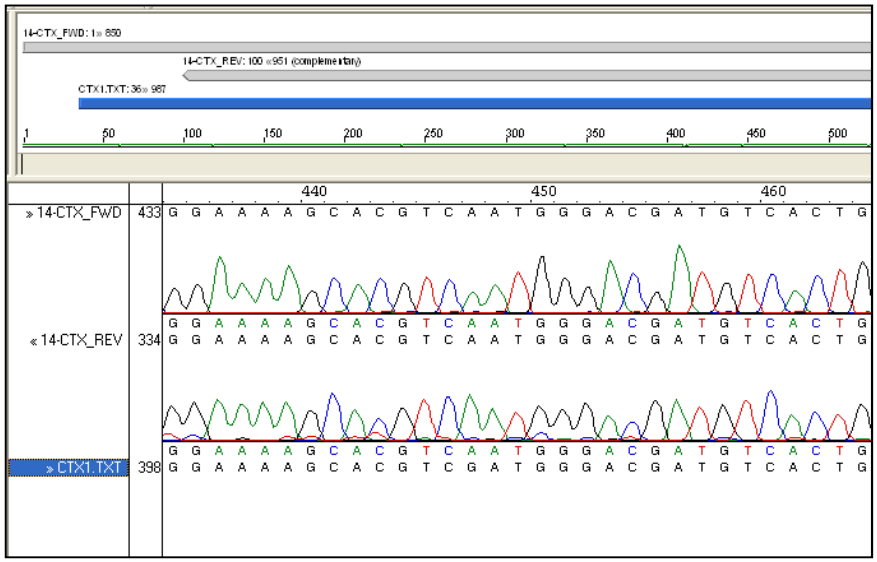
- Molecular detection of *bla*TEM, *bla*SHV and *bla*CTX-M

  but also of beta-lactamase of type BEL, VEB, GES or OXA 1/2/10



Genotypic characterization (2)

- When a PCR was positive:
  - Purification of the amplified DNA
  - Sequencing
  - Analysis of the nucleotid sequence



Genotypic characterization (3)

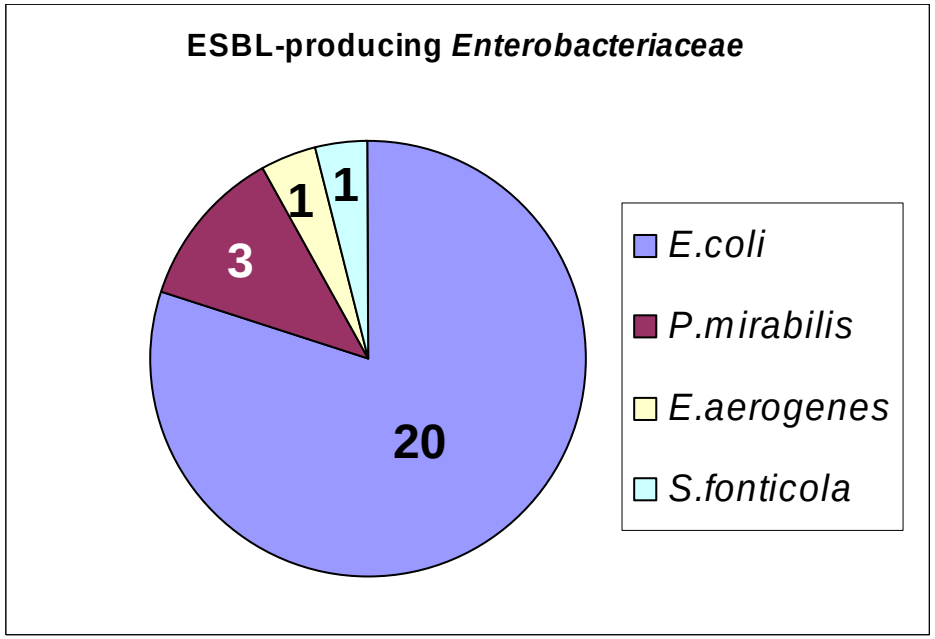
- Deduced amino-acid sequence compared to that present in public database or in the Lahey website (www.lahey.org/studies).
- Identification of the beta-lactamase

Results

Phenotypic results

- 284 faecal samples
- 53 Enterobacteriaceae isolated from 46 samples

- 25 of these: phenotypically characterized as ESBL producers



The 25 ESBL-E originated from 20 patients (7.04%)

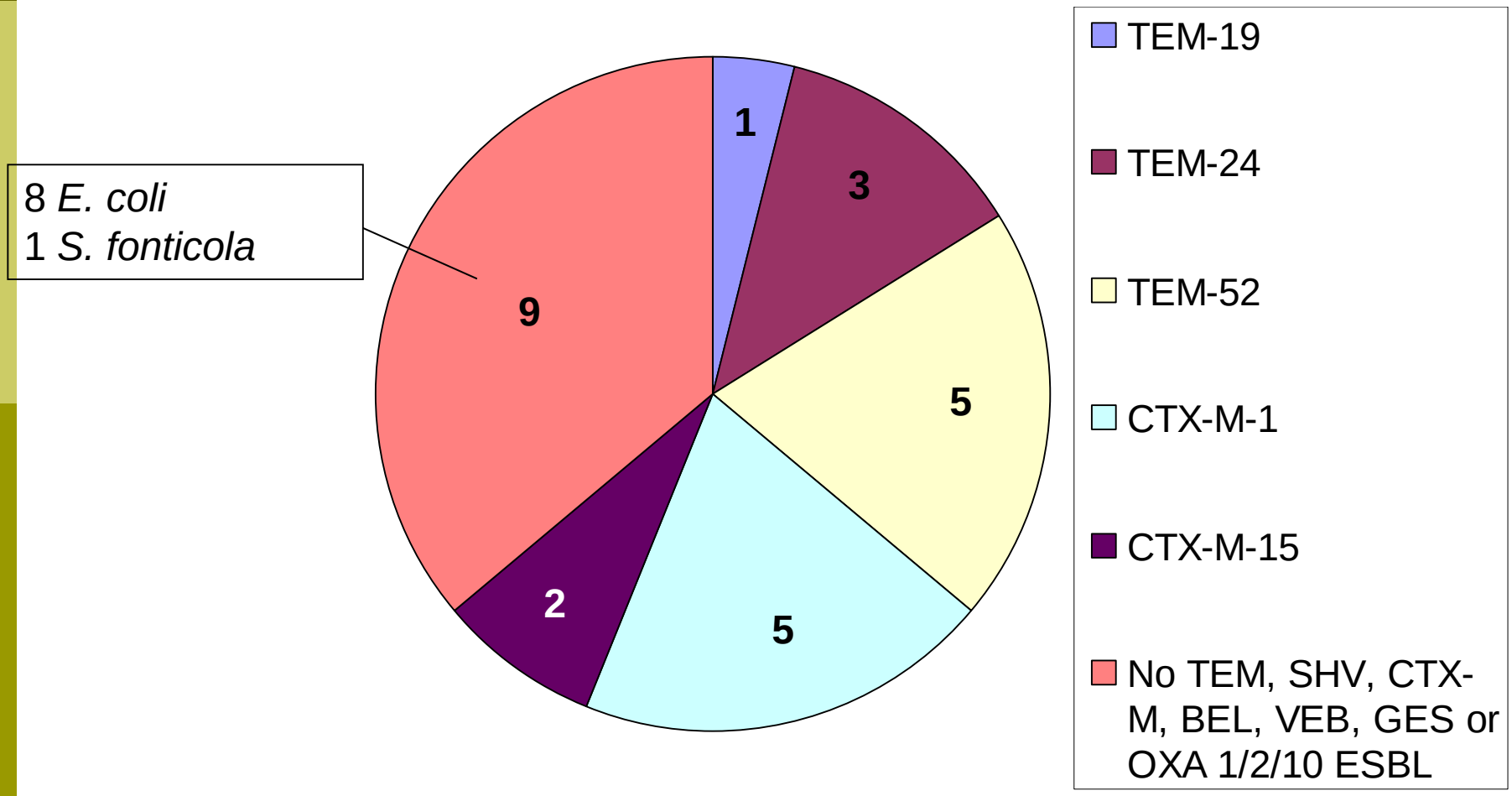
Genotypic results (1)

Results of PCR and sequencing:

Species (Number of isolates)	Type of beta-lactamase			
	TEM	**CTX-M**	**TEM and CTX-M**	**SHV, BEL, VEB, GES or OXA 1/2/10**
***E.coli* (19)**	TEM-1 (7)	CTX-M-1 (4)	TEM-1 and CTX-M-1 (1)	/
	TEM-19 (1)			
	TEM-52 (4)	CTX-M-15 (2)		
***E.aerogenes* (1)**	TEM-52 (1)	/	/	/
***P.mirabilis* (3)**	TEM-24 (3)	/	/	/
***S. fonticola* (1)**	/	/	/	/

Genotypic results (2)

- Distribution of the ESBLs among the 25 ESBL-E



Antibiotic susceptibility profiles

	Resistance to:		
	Trimethoprim-sulfamethoxazole	**Quinolones**	**Aminoglycosides**
***E. coli* (20)**	15 (75%)	6 (30%)	5 (25%)
***P. mirabilis* (3)**	3 (100%)	3 (100%)	0 (0%)
***E. aerogenes* (1)**	0 (0%)	0 (0%)	0 (0%)
***S. fonticola* (1)**	0 (0%)	0 (0%)	0 (0%)

Expected risk factors for ESBL-E carriage

Expected risk factors for ESBL-E carriage	Among ESBL-E carriers (n=20)	Among ESBL-E negative carriers (n=264)	Fischer test
Recent consumption of antibiotics	4	74	p > 0.05
Recent hospitalization	2	15	p > 0.05
Recent trip abroad	1	43	p > 0.05
Pets at home	11	135	p > 0.05
Mean age	57	50	

Discussion and conclusions

Prevalence rate (1)

- Liège, Belgium (2007):
  Unrelated outpatients: 6.7%

  - Rodriguez-Baño *et al.,* Spain (2008):
    Unrelated nonhospitalized persons: 7.4%
  - Tian *et al.*, China (2008): elderly people in community settings: 7%

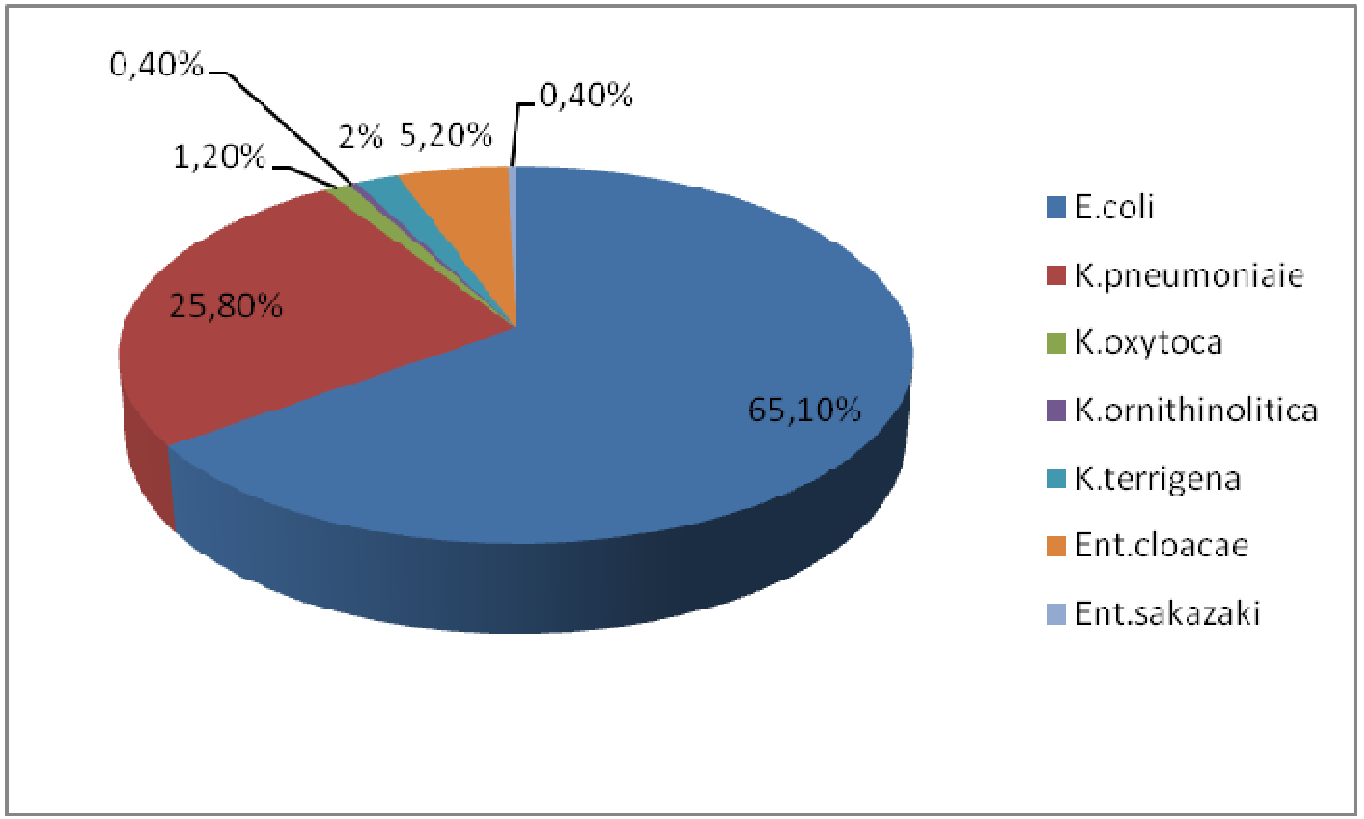
  - Valverde *et al*., Spain (2003): Outpatients: 5.5%

Prevalence rate (2)

- Kinshasa, Congo (2006):
  - Hospitalized patients: 33.1%
  - Non hospitalized persons: 13.1%

Predominant isolated ESBL:

CTX-M-15



Isolated ESBL-E

- *E.coli* accounted for the majority of ESBL-E isolates
- Various ESBL genes were identified
  - TEM- and CTX-M-derived enzymes predominant
- 36 % of the phenotypically characterized ESBL-E did not possess any ESBL of type:
  - TEM, SHV, CTX-M, BEL, VEB, GES or OXA 1/2/10

Antibiotic susceptibility testings

- High level of sulfamethoxazole-trimethoprim resistance among the isolated ESBL-E (72%)
  - All the CTX-M producing Enterobacteriaceae were sulfamethoxazole-trimethoprim resistant.
- Co-resistance with quinolones observed for 9 Enterobacteriaceae (36%)

Conclusions

- ESBL-related antimicrobial resistance mechanism(s) among Enterobacteriaceae in the community is a reality.
- High prevalence of ESBL-E faecal carriage among the non hospitalized population should be taken into account in treatment recommendations in ambulatory medicine.
  - Modification of the empiric antibiotherapy?
  - Patients screening before hospitalization?
- Efforts of vigilance should be made to identify and control spread from these community reservoirs.