



# ESBL-producing *Enterobacteriaceae* in nursing homes rapid increasing trend of carriage rate among residents

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**Background:** In 2010, we conducted a multicentre prevalence study of ESBL carriage in 37 nursing homes (NHs). This study revealed low rates of carriage among residents (2%). By contrast, since 2011, there have been several ESBL outbreaks in NHs in our region, suggesting that the epidemiology of ESBL in the NHs has changed.

**Methods:** We conducted a similar study into 38 NHs during the first quarter of 2013, evaluated ESBL and EPC colonisation of 1155 residents and assessed resident-to-resident transmission by RAPD typing of the colonizing isolates.

**Results:** 114 residents were ESBL carriers (10%); 83% of the ESBL were *E. coli*. ESBL colonisation was associated with poor health status ( $p=0.002$ ), malignancy ( $p=0.006$ ), urinary incontinence ( $p=0.007$ ), faecal incontinence ( $p=0.002$ ), prior hospitalisation ( $p=0.033$ ) and carbapenem treatment ( $p=0.040$ ). Resident-to-resident ESBL transmission was demonstrated in 15 NHs, and was associated with high ESBL carriage rates ( $p<0.001$ ).

**Conclusions:** We demonstrate a higher rate of ESBL carriage among the residents than that observed in 2010. The results indicate an increasing trend and a rapid spread of ESBL in the NHs. However, the overall rate of 10% of residents carrying ESBL masks different situations. Similar to observations in most NHs participating in the study in 2010, the ESBL carriage rate among residents of 1/3 of the NHs participating in the present study was low. In these NHs, the combination of a low rate of ESBL carriage by residents and the absence of similar isolates shared by different residents argue that the spread of ESBL spread in these NHs is controlled. By contrast, the carriage rates among the residents of the other NHs were between 10 and 30 %, similar to those observed during ESBL-associated outbreaks in NHs. In most of these NHs, intra-NH spread of ESBL was demonstrated. Thus, many of the NHs have to be now considered to be potential reservoirs for ESBL. We suggest that the combination point-prevalence studies of carriage and RAPD typing of the ESBL identified can be used to provide benchmarking data for participating NHs.

## ESBL colonising the residents according to NH, and intra-NH spread of ESBL based on RAPD typing

Nursing Home	ESBL carriage (prevalence rate)	ESBL carried by residents				Clonal relationship between ESBL within NH*
		<i>Escherichia coli</i>	<i>Klebsiella sp.</i>	<i>Citrobacter sp.</i>	<i>Enterobacter cloacae</i>	
1	0					
2	0					
3	0					
4	1 (3.4)	1				
5	1 (3.4)	1				
6	1 (3.6)	1				
7	1 (3.6)	1				
8	1 (3.7)	1				
9	1 (3.7)	1				
10	1 (4.0)	1				
11	2 (4.4)	2				
12	1 (4.8)				1	
13	3 (6.3)	1	2			
14	2 (6.7)	2				•
15	2 (6.7)	2				
16	2 (6.7)	2				
17	2 (6.7)	2				
18	2 (6.7)	1	1			
19	2 (6.7)	2				
20	2 (6.9)	1	1			
21	2 (7.4)	1		1		
22	2 (7.7)	2				•
23	3 (9.4)	1	1	1		•
24	3 (10.0)	3				•
25	8 (10.8)	6		1	1	•
26	3 (12.0)	3				•
27	4 (13.8)	4				•
28	4 (13.8)	4				•
29	4 (13.8)	4				•
30	4 (14.8)	3	1			•
31	3 (15.0)	3				•
32	3 (17.6)	3				•
33	3 (21.4)	3				•
34	8 (19.5)	8				•
35	9 (22.5)	9				•
36	7 (23.3)	7			1	•
37	9 (25.7)	9				•
38	8 (28.6)		8			•
All	114 (9.9)	95	14	3	3	15 NHs /38

## Clinical data & ESBL carriage for the 1055 residents enrolled in the point-prevalence study

Nursing Home (NHs)	Nursing Home (NHs)	Number of		Age (y)		Clinical data : number of residents with (%)										Signs of infection			Anti-infectious treatment			ESBL screening		Clonal relationship between ESBL within NH				
		beds	residents included	<65	>65	Poor state of health	Diabetes mellitus	Cancer	Mc CABE 1 or 2	Incontinence		Hospitalisation	Antibiotic treatment	Recent Fluoroquinolones	Gentamicins	Carbapenem	on the day of the study	Fluoroquinolones	Fluoroquinolones	Research on fecal	ESBL carriage (prevalence rate)							
RC049	1	158	24	2	22	1 (4.5)	3 (13.6)	8 (36.4)	5 (22.7)	6 (27.3)	14 (63.6)	7 (31.8)	6 (27.3)	5 (22.7)	11 (50.0)	1 (4.5)	4 (18.2)	0	0	0	0	0	16	6	0			
RC047	2	280	33	0	33	5 (15.2)	4 (12.1)	22 (66.7)	7 (21.2)	7 (21.2)	33 (100)	23 (69.7)	14 (42.4)	6 (18.2)	1 (3.0)	1 (3.0)	0	0	0	0	0	14	19	0				
RC009	3	83	30	0	30	12 (40.0)	2 (6.7)	7 (23.3)	4 (13.3)	2 (6.7)	7 (23.3)	18 (60.0)	7 (23.3)	5 (16.7)	11 (36.7)	0	3 (10.0)	0	0	0	0	20	10	0				
RC011	4	117	30	1	29	6 (20.7)	4 (13.8)	7 (24.1)	5 (17.2)	6 (20.7)	7 (24.1)	21 (72.4)	16 (55.2)	5 (17.2)	18 (62.1)	5 (17.2)	11 (37.9)	0	0	0	0	14	15	1 (3.4)				
RC082	5	85	30	1	29	2 (6.9)	5 (17.2)	22 (75.9)	2 (6.9)	0	2 (6.9)	28 (96.6)	26 (89.7)	6 (20.7)	11 (37.9)	0	9 (31.0)	0	0	0	3 (10.3)	3 (10.3)	2	27	1 (3.4)			
RC012	6	147	30	2	28	0	4 (14.3)	15 (53.6)	3 (10.7)	3 (10.7)	4 (14.3)	18 (64.3)	13 (46.4)	4 (14.3)	15 (53.6)	4 (14.3)	2 (7.1)	0	0	0	4 (14.3)	0	12	16	1 (3.6)			
RC084	7	123	30	2	28	0	3 (10.7)	18 (64.3)	0	0	0	28 (100.0)	12 (42.9)	5 (17.9)	10 (35.7)	3 (10.7)	7 (25.0)	0	0	0	1 (3.6)	4 (14.3)	3 (10.3)	0	28	1 (3.6)		
115	8	170	30	3	27	2 (7.4)	0	12 (44.4)	0	0	4 (14.8)	19 (70.4)	16 (59.3)	0	2 (7.4)	1 (3.7)	1 (3.7)	0	0	0	1 (3.7)	0	13	14	1 (3.7)			
RC037	9	149	30	3	27	4 (14.8)	3 (11.1)	19 (70.4)	7 (25.9)	5 (18.5)	5 (18.5)	18 (66.7)	12 (44.4)	5 (18.5)	13 (48.1)	0	5 (18.5)	0	0	0	1 (3.7)	0	12	15	1 (3.7)			
RC089	10	29	29	4	25	4 (16.0)	5 (20.0)	17 (68.0)	4 (16.0)	2 (8.0)	4 (16.0)	15 (60.0)	15 (60.0)	2 (8.0)	11 (44.0)	0	11 (44.0)	0	0	0	0	0	0	25	1 (4.0)			
RC019	11	184	45	0	45	7 (15.6)	5 (11.1)	28 (62.2)	2 (4.4)	1 (2.2)	5 (11.1)	40 (88.9)	37 (82.2)	8 (17.8)	15 (33.3)	4 (8.9)	5 (11.1)	8 (17.8)	0	0	0	0	8	37	2 (4.4)			
RC036	12	25	25	4	21	2 (9.5)	4 (19.0)	9 (42.9)	7 (33.3)	2 (9.5)	12 (57.1)	14 (66.7)	10 (47.6)	1 (4.8)	9 (42.9)	3 (14.3)	5 (23.8)	0	0	0	0	0	1	20	1 (4.0)			
2492	13	110	48	0	48	6 (12.5)	8 (16.7)	29 (60.4)	9 (18.8)	3 (6.3)	29 (60.4)	36 (75.0)	20 (41.7)	9 (18.8)	17 (35.4)	3 (6.3)	6 (12.5)	1 (2.1)	0	0	0	2 (4.2)	2 (4.2)	0	14	34	3 (6.8)	
RC074	14	115	30	0	30	2 (6.7)	4 (13.3)	19 (63.3)	6 (20.0)	0	2 (6.7)	23 (76.7)	13 (43.3)	4 (13.3)	12 (40.0)	2 (6.7)	0	0	0	0	0	2 (6.7)	4 (13.3)	0	5	25	2 (6.7)	
RC020	15	43	30	0	30	6 (20.0)	5 (16.7)	18 (60.0)	0	0	17 (56.7)	26 (86.7)	26 (86.7)	3 (10.0)	6 (20.0)	0	0	0	0	0	0	2 (6.7)	1 (3.3)	0	4	26	2 (6.7)	
RC026	16	200	30	0	30	3 (10.0)	4 (13.3)	19 (63.3)	5 (16.7)	3 (10.0)	27 (90.0)	24 (80.0)	19 (63.3)	2 (6.7)	14 (46.7)	3 (10.0)	11 (36.7)	0	0	0	0	0	2 (6.7)	1 (3.3)	0	10	20	2 (6.7)
116	17	121	30	0	30	3 (10.0)	0	19 (63.3)	4 (13.3)	6 (20.0)	10 (33.3)	30 (100.0)	29 (96.7)	1 (3.3)	18 (60.0)	5 (16.7)	5 (16.7)	0	0	0	0	0	0	1	30	2 (6.7)		
135	18	66	30	0	30	1 (3.3)	5 (16.7)	10 (33.3)	4 (13.3)	0	27 (90.0)	16 (53.3)	4 (13.3)	4 (13.3)	14 (46.7)	2 (6.7)	0	0	0	0	0	0	0	0	0	30	2 (6.7)	
RC034	19	82	30	0	30	5 (16.7)	3 (10.0)	17 (56.7)	8 (26.7)	4 (13.3)	17 (56.7)	25 (83.3)	25 (83.3)	4 (13.3)	8 (26.7)	1 (3.3)	0	0	0	0	0	0	1 (3.3)	0	5	25	2 (6.7)	
RC083	20	619	30	1	29	0	4 (13.8)	14 (48.3)	4 (13.8)	1 (3.4)	12 (41.4)	20 (69.0)	13 (44.8)	7 (24.1)	12 (41.4)	0	1 (3.4)	0	0	0	0	0	1 (3.4)	0	8	21	2 (6.9)	
RC008	21	127	30	3	27	2 (7.4)	4 (14.8)	13 (48.1)	3 (11.1)	5 (18.5)	6 (22.2)	15 (55.6)	13 (48.1)	7 (25.9)	19 (70.4)	6 (22.2)	6 (22.2)	0	0	0	4 (14.8)	3 (11.1)	2 (7.4)	1 (3.7)	14	13	2 (6.9)	
RC087	22	64	29	3	26	1 (3.8)	1 (3.8)	8 (30.8)	1 (3.8)	0	2 (7.7)	10 (38.5)	9 (34.6)	3 (11.5)	7 (26.9)	0	0	0	0	0	0	0	0	0	19	7	2 (7.7)	
138SLD	23	124	35	3	32	0	23 (71.9)	31 (96.9)	5 (15.6)	4 (12.5)	7 (21.9)	30 (93.8)	23 (71.9)	3 (9.4)	9 (28.1)	5 (15.6)	4 (12.5)	0	0	0	3 (9.4)	3 (9.4)	0	2	30	3 (9.4)		
RC043	24	84	30	0	30	0	5 (16.7)	16 (53.3)	0	0	3 (10.0)	22 (73.3)	20 (66.7)	3 (10.0)	2 (6.7)	0	1 (3.3)	0	0	0	7 (23.3)	4 (13.3)	0	3	27	3 (10.0)		
2723	25	82	74	0	74	6 (8.1)	11 (14.9)	40 (54.1)	11 (14.9)	11 (14.9)	46 (62.2)	43 (58.1)	23 (31.1)	21 (28.4)	22 (29.7)	4 (5.4)	13 (17.6)	0	0	0	4 (5.4)	3 (4.1)	1 (1.4)	0	39	35	8 (10.0)	
RC073	26	125	30	5	25	13 (20.0)	11 (44.0)	16 (64.0)	5 (20.0)	4 (16.0)	18 (72.0)	17 (68.0)	3 (12.0)	13 (52.0)	4 (16.0)	5 (20.0)	0	0	0	0	0	1 (4.0)	0	0	0	25	3 (12.0)	
RC029	27	90	30	0	30	2 (6.7)	2 (6.7)	25 (83.3)	7 (23.3)	1 (3.3)	9 (30.0)	29 (96.7)	15 (50.0)	6 (20.0)	9 (30.0)	4 (13.3)	0	0	0	0	0	1 (3.3)	1 (3.3)	0	0	30	4 (13.3)	
RC014	28	193	30	1	29	6 (20.7)	4 (13.8)	5 (17.2)	4 (13.8)	5 (17.2)	17 (58.6)	13 (44.8)	5 (17.2)	2 (6.9)	11 (37.9)	2 (6.9)	4 (13.8)	0	0	0	0	0	0	0	0	29	4 (13.8)	
RC003	29	83	30	1	29	7 (24.1)	4 (13.8)	7 (24.1)	5 (17.2)	3 (10.3)	1 (3.4)	14 (48.3)	11 (37.9)	4 (13.8)	11 (37.9)	2 (6.9)	4 (13.8)	0	0	0	2 (6.9)	3 (10.3)	0	0	18	11	4 (13.8)	
RC013	30	299	30	3	27	5 (18.5)	2 (7.4)	9 (33.3)	2 (7.4)	1 (3.7)	21 (77.8)	15 (55.6)	4 (14.8)	6 (22.2)	13 (48.1)	2 (7.4)	6 (22.2)	0	0	0	0	1 (3.7)	0	0	0	17	10	4 (14.8)
RC027	31	162	20	0	20	2 (10.0)	2 (10.0)	12 (60.0)	0	0	18 (90.0)	14 (70.0)	10 (50.0)	2 (10.0)	11 (55.0)	0	0	0	0	0	0	0	0	0	0	17	3	3 (15.0)
115SLD	32	100	17	0	17	4 (23.5)	7 (41.2)	10 (58.8)	2 (11.8)	1 (5.9)	7 (41.2)	13 (76.5)	12 (70.6)	0	3 (17.6)	1 (5.9)	1 (5.9)	0	0	0	4 (23.5)	1 (5.9)	0	0	4	13	3 (15.0)	
RC044	33	61	14	0	14	4 (28.6)	2 (14.3)	10 (71.4)	0	0	7 (50.0)	14 (100.0)	13 (92.9)	0	1 (7.1)	0	0	0	0	0	0	0	0	0	0	0	14	3 (21.4)
RC071	34	42	42	1	41	4 (9.8)	7 (17.1)	19 (46.3)	7 (17.1)	2 (4.9)	0	31 (75.6)	20 (48.8)	10 (24.4)	12 (29.3)	3 (7.3)	4 (9.8)	1 (2.4)	0	0	0	0	1 (2.4)	0	1	40	8 (19.5)	
RC069	35	78	40	0	40	2 (5.0)	2 (5.0)	26 (65.0)	4 (10.0)	7 (17.5)	3 (7.5)	40 (100.0)	33 (82.5)	5 (12.5)	16 (40.0)	2 (5.0)	7 (17.5)	10 (25.0)	0	0	0	0	1 (2.5)	0	5	35	9 (22.5)	
RC033	36	60	30	0	30	3 (10.0)	2 (6.7)	27 (90.0)	6 (20.0)	2 (6.7)	28 (93.3)	28 (93.3)	25 (83.3)	1 (3.3)	11 (36.7)	1 (3.3)	1 (3.3)	0	0	0	1 (3.3)	1 (3.3)	0	0	3	27	7 (23.3)	
RC007	37	89	35	0	35	0	4 (11.4)	22 (62.9)	0	0	7 (20.0)	30 (85.7)	29 (82.9)	2 (5.7)	0	0	0	0	0	0	0	1 (						