

Background: Dutch national guidelines for infection control measures for carriers of Highly Resistant Microorganisms (HRMO) in Long Term Care Facilities (LTCFs) were published late 2014. Recent studies in Amsterdam (2010, 2011) showed a prevalence of extended-spectrum beta-lactamase producing Enterobacteriaceae (ESBL-E) of 10.6% (95% CI: 9.7–11.5) and 8.6% (95% CI: 7.3-10.0) respectively. in patients with gastrointestinal symptoms. Our aim was to study the prevalence and risk-factors of carriage of HRMO among residents of LTCFs in Amsterdam in a cross-sectional study design.

Methods: Swabs from nose (Copan eMRSA™) and faeces (COPAN FecalSwab™) were screened for methicillin-resistant *Staphylococcus aureus* (MRSA) using an enrichment broth and chromID™ MRSA media (bioMérieux). Fecal swabs were additionally screened for 1) multidrug-resistant Gram-negative organisms (MRGN) using an amoxicillin (16mg/L) containing enrichment broth subcultured to MacConkey agar plates with cefotaxime (5ug) and ceftazidim (10 ug) disks and MacConkey agar plates that contain 0.016 mg/L gentamicin with a ciprofloxacin disk (10ug) and 2) vancomycin-resistant enterococci (VRE) using an enrichment broth and chromID™ VRE (bioMérieux) agar plates. Identification and antimicrobial resistance testing of isolates was performed by the VITEK® 2 system (bioMérieux) and confirmation of ESBL by Etest. Resident related risk factors for carriage of HRMO were assessed by a questionnaire filled out by LTCF nursing staff. Institutional risk factors were assessed through a site visit at participating LTCF wards by an expert in infection control and a questionnaire for the LTCF directory board.

Results: From November 2014 to august 2015, 385 residents from 12 LTCFs (range 15-48 residents per LTCF, 1730 residents in total) were enrolled of whom 355 could be analysed for MRSA colonization, 346 for rectal carriage of MRGN and 347 for rectal carriage of VRE. In a subset of 311 residents both fecal swab and questionnaire was obtained and these results were used for analysis of resident related risk factors. Questionnaires for institutional risk factors were obtained from 11 out of 12 LTCF. The mean age of subjects was 82 years (range, 25–101 years), and 200 subjects (65%) were female. 108 (35%) had an psychogeriatric nursing indication, 137 (44%) somatic and 63 (21%) rehabilitation. The median duration of stay before sampling was 107 weeks (interquartile range, 10–160 weeks). Thirty-seven subjects (12%) had received at least 1 antibiotic in the 30 days before sampling. 134 (59%) Residents suffered from either fecal (5%) incontinence, urinary incontinence (10%) or both (44%). 77 (26%) Participants had been admitted to a hospital in the 90 days prior to sampling.

Prevalences for MRSA, MRGN and VRE were 0.8% (range 0-7%), 18.2% (0-47%), and 0% respectively. 47 Out of 346 (13.6%, 10–17.2 95% CI) samples yielded ESBL-E. In total, 68 MRGN strains were cultured from 63 residents; 50 (74%) were ESBL-E, of which 13 strains were as well resistant to fluoroquinolones and aminoglycosides and one strain harboured also carbapenemase. Of the remaining strains 17 were Enterobacteriaceae resistant to the combination of aminoglycosides and fluoroquinolones and one strain was identified as *Pseudomonas aeruginosa* additionally resistant to piperacillin. Transmission based precautions were only applied in 9 out of 59 (15%) carriers of HRMO at the time of sampling.

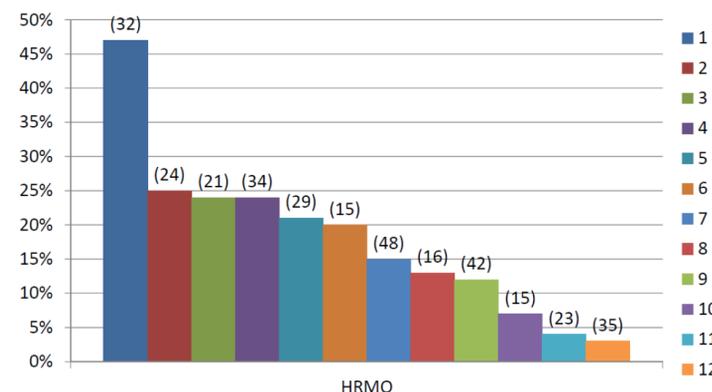
Table 1. Univariate analysis of resident related risk factors for fecal carriage of MRGN

Risk factor	Cases n=56 (%)	Controls n=255 (%)	OR (95% CI)	P-value
HRMO carriage in past year	10 (18)	5 (2)	10.6 (3.5-32.5)	.000
Transmission based precautions applied at the time of sampling	9 (16)	5 (2)	9.5 (3.0-29.5)	.000
Living in a single person room	10 (20)	79 (33)	0.5 (0.24-1.04)	.06
Diabetes mellitus	19 (34)	56 (16)	1.8 (0.97-3.42)	.06
COPD	11 (20)	29 (11)	1.9 (0.89-4.09)	.09
Other	~	~		>.10

Table 2. Univariate analysis of dichotomised institutional related risk factors for carriage of HRMO

Risk factor	% HRMO more than average, n=7 (%)	% HRMO less than average, n=6 (%)	OR (95% CI)	P-value
Infection control protocols absent	3 (43)	0 (0)	1.8 (0.9-3.3)	.12
Risk factor	% HRMO>10, n=10 (%)	% HRMO<10, n=3 (%)	OR (95% CI)	P-value
Disinfectant dispensers absent in bathroom	5 (50)	0 (0)	2.0 (1.1-3.7)	.13
Well working po flusher absent	5 (50)	0 (0)	2.0 (1.1-3.7)	.19
Other	~	~		>.20

Varying prevalences HRMO in different LTCF (residents tested)



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Conclusions: Our data shows that the prevalence of MRSA and VRE in Amsterdam LTCFs is low. The carriage rate of MRGN is slightly higher than in the general population and varies considerably among LTCF. If we take the transmission based precautions applied in patients into account, the majority of MRGN-carriers (85%) are currently undetected. Therefore continuation of transmission based precautions without surveillance or intensified screening for MRGN seems inappropriate.