

# Risk factors for infections in the elderly

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# Infections in the elderly

High frequency

- ▶ Immunosenescence
- ▶ Anatomic and physiological modifications
- ▶ Comorbidities
- ▶ Functional limitations
- ▶ High devices use
- ▶ Frequent hospitalizations

# Health care-associated infections

- ▶ Persons > 65 years hospitalised more than 3 times the rate for persons of all ages
- ▶ Risk of HCAI increases with advancing age
- ▶ Consequent high risk of MDR-bacterial infections
- ▶ Time spent in long term care facilities (LTCFs)

## LTCF residency known risk factor for MDR-infection

Factors independently associated with MDR-Gram-negative BSI in pts > 65:

- ▶ residency in a long-term care facility (OR 4.9)
- ▶ presence of an invasive device (OR 6.0)
- ▶ severe sepsis (OR 7.9)
- ▶ delayed initiation of effective therapy (OR 12.8)

# LTCFs

- ▶ Risk of MRSA, ESBL-Gram-negative increased up to 8-times
- ▶ **Contributing factors:**
  - high device utilisation rate
  - admission from other healthcare facilities
  - accommodation in rooms with multiple beds
  - sharing common eating and living areas
  - cognitive deficits complicating personal hygiene
  - functional impairments (faecal and urinary incontinence)
  - antibiotics overuse



# HEALTHCARE ASSOCIATED INFECTIONS IN LONG-TERM CARE FACILITIES

RESULTS OF THE PILOT POINT PREVALENCE SURVEY

NOVEMBER 2009

Latour K, Jans B and the HALT management team

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IPH/Epi-report number: 2011-006

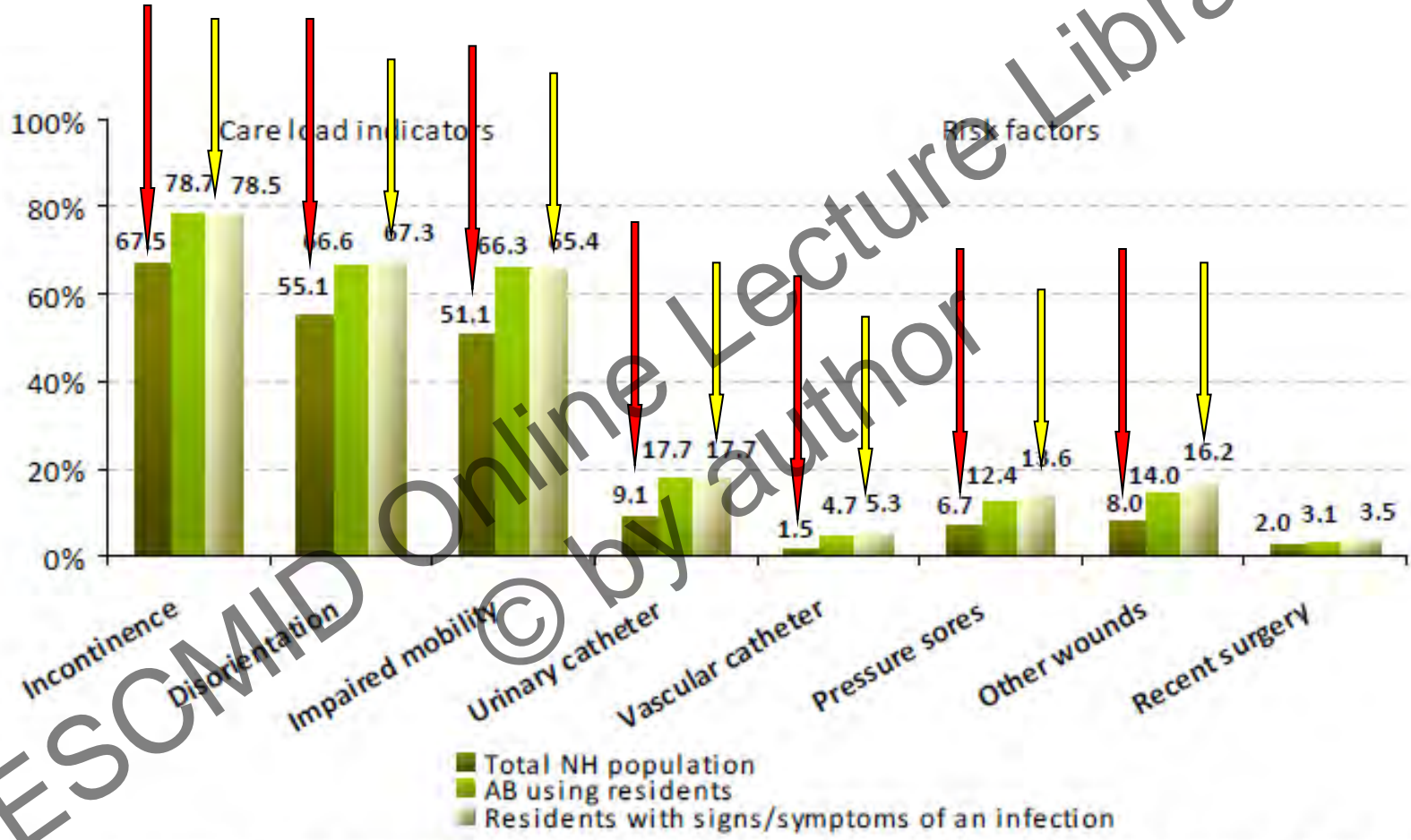


Prevalence of care load indicators and risk factors in the eligible NH population per country

Country	Care load indicators												Risk factors			
	Incontinence (faecal and/or urinary)				Disorientation (in time and/or space)				Impaired mobility (wheelchair or bedridden)				Urinary catheter			
	Me	Md	Min	Max	Me	Md	Min	Max	Me	Md	Min	Max	Me	Md	Min	Max
Belgium	61.1	60.1	22.5	95.9	49.4	50.0	18.2	80.6	43.1	45.6	7.9	77.3	2.4	2.1	0.0	8.2
Bulgaria	51.0	51.0	20.7	81.3	70.6	70.6	68.8	72.4	50.5	50.5	44.8	56.3	11.1	11.1	3.4	18.8
Croatia	35.7	36.9	10.5	58.9	26.3	26.8	11.5	46.7	21.2	17.2	14.2	34.6	1.6	2.0	0.3	2.5
England	84.6	84.6	78.6	90.7	40.2	40.2	20.9	59.5	77.5	77.5	69.0	86.0	15.8	15.8	10.7	20.9
Finland	78.8	80.1	58.3	96.7	70.6	69.1	48.3	95.0	53.2	42.8	33.3	100.0	3.5	3.2	1.4	6.7
France	72.1	72.1	71.2	73.0	80.2	80.2	69.9	90.5	48.3	48.3	21.9	74.6	0.7	0.7	0.0	1.4
Germany	69.8	69.8	50.0	83.0	58.4	61.3	39.3	66.0	50.0	51.4	32.1	58.8	5.6	6.6	3.6	7.5
Hungary	80.6	81.8	73.1	85.9	55.1	56.3	43.8	64.1	55.8	55.9	42.5	68.8	8.9	4.8	0.0	26.0
Italy	82.0	86.3	41.2	99.5	65.5	65.0	27.5	98.3	69.5	75.0	11.3	92.5	26.1	18.4	0.0	73.3
Lithuania	44.3	44.0	15.2	73.6	39.7	33.3	16.2	69.6	44.8	44.4	41.9	48.0	1.0	1.0	0.0	2.1
Netherlands	69.1	67.5	65.8	75.4	57.9	56.6	41.5	77.0	55.5	54.6	50.7	62.3	8.1	7.4	4.1	13.4
Norway	71.7	71.7	71.7	71.7	70.7	70.7	70.7	70.7	34.8	34.8	34.8	34.8	6.5	6.5	6.5	6.5
Poland	58.7	67.1	30.8	84.7	47.0	51.2	36.4	55.1	41.8	46.2	28.2	59.6	5.2	0.0	0.0	24.0
<b>Total</b>	<b>67.5</b>	<b>70.1</b>	<b>10.5</b>	<b>99.5</b>	<b>55.1</b>	<b>55.6</b>	<b>11.5</b>	<b>98.3</b>	<b>51.1</b>	<b>51.4</b>	<b>7.9</b>	<b>100.0</b>	<b>9.1</b>	<b>3.2</b>	<b>0.0</b>	<b>73.3</b>

Country	Risk factors (continued)															
	Vascular catheter				Pressure sores				Other wounds				Surgery in the previous 30 days			
	Me	Md	Min	Max	Me	Md	Min	Max	Me	Md	Min	Max	Me	Md	Min	Max
Belgium	0.1	0.0	0.0	2.8	3.4	2.9	0.0	11.5	7.8	7.3	0.0	20.6	1.0	0.7	0.0	4.1
Bulgaria	3.1	3.1	0.0	6.3	5.2	5.2	0.0	10.3	6.3	6.3	0.0	12.5	6.3	6.3	0.0	12.5
Croatia	0.2	0.0	0.0	0.8	1.7	0.9	0.3	5.7	2.6	2.5	0.9	4.2	0.7	0.7	0.0	1.1
England	2.3	2.3	0.0	4.7	10.0	10.0	6.0	14.0	37.9	37.9	10.7	65.1	2.4	2.4	2.3	2.4
Finland	0.0	0.0	0.0	0.4	2.6	2.7	0.4	5.0	6.5	7.7	0.4	11.8	1.0	0.6	0.0	4.0
France	1.4	1.4	0.0	2.7	42.6	42.6	1.6	83.6	14.1	14.1	12.3	15.9	0.7	0.7	0.0	1.4
Germany	0.1	0.0	0.0	0.5	3.2	2.8	1.9	5.7	6.4	6.6	3.6	9.4	0.8	0.9	0.0	1.9
Hungary	0.0	0.0	0.0	0.0	5.9	5.0	1.0	12.5	4.1	5.1	0.0	6.3	0.0	0.0	0.0	0.0
Italy	5.5	2.4	0.0	45.2	12.9	12.5	4.5	26.7	9.3	6.2	0.0	52.9	4.4	0.0	0.0	40.0
Lithuania	0.0	0.0	0.0	0.0	3.7	4.0	2.1	5.1	1.9	1.6	0.0	4.0	2.8	2.1	0.8	5.6
Netherlands	0.0	0.0	0.0	0.0	8.6	8.0	6.1	12.3	8.4	7.8	6.8	11.0	3.9	3.8	0.7	7.4
Norway	0.0	0.0	0.0	0.0	5.4	5.4	4.4	5.4	9.8	9.8	9.8	9.8	0.0	0.0	0.0	0.0
Poland	1.2	0.0	0.0	6.2	3.4	2.6	0.0	10.5	4.2	2.6	0.0	9.4	2.4	0.0	0.0	10.5
<b>Total</b>	<b>1.5</b>	<b>0.0</b>	<b>0.0</b>	<b>45.2</b>	<b>6.7</b>	<b>4.0</b>	<b>0.0</b>	<b>83.6</b>	<b>8.0</b>	<b>6.7</b>	<b>0.0</b>	<b>65.1</b>	<b>2.0</b>	<b>0.6</b>	<b>0.0</b>	<b>40.0</b>

Total population    Pts with sign/symptoms

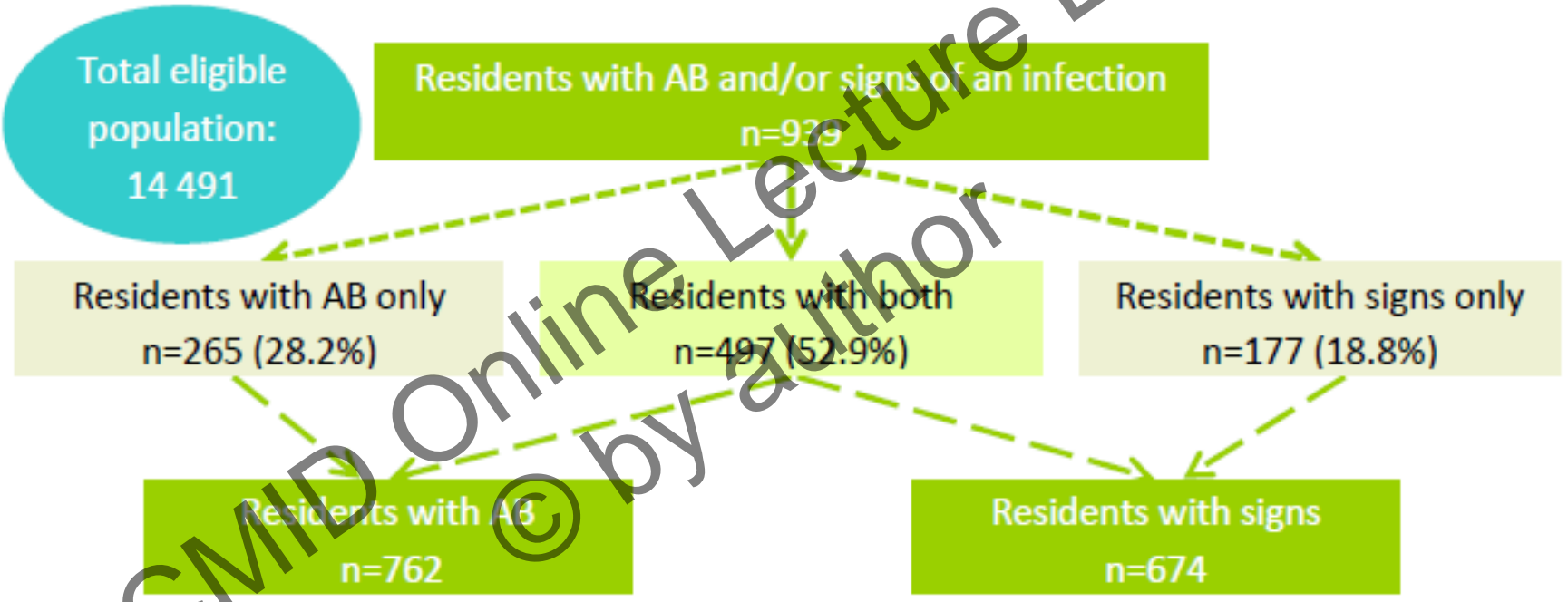


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Presence of care load indicators and risk factors in the total NH population, among the AB users and among the residents with signs/symptoms of an infection



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Overview of antimicrobial use and healthcare associated infections among the eligible residents

*J Antimicrob Chemother* 2012; **67**: 2982–2987  
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**Journal of  
Antimicrobial  
Chemotherapy**

**Epidemiology and genetic characteristics of extended-spectrum  
 $\beta$ -lactamase-producing Gram-negative bacteria causing  
urinary tract infections in long-term care facilities**

Marco Tinelli<sup>1</sup>, Maria Adriana Cataldo<sup>2\*</sup>, Elisabetta Mantengoli<sup>3</sup>, Chiara Cadeddu<sup>4</sup>, Ettore Cunietti<sup>5</sup>,  
Francesco Luzzaro<sup>6</sup>, Gian Maria Rossolini<sup>3,7</sup> and Evelina Tacconelli<sup>8</sup>

# Logistic regression analysis

## Risk factors for ESBL+ GN UTIs

- ▶ Previous antibiotic therapy (OR 4)
- ▶ Presence of a urinary catheter (OR 15)
- ▶ **Highest risk:** exposure to  $\geq 7$  days of quinolones and cephalosporins (OR 7), after adjusting for type, dosage and duration of antibiotic

## Risk factors for ESBL- GN UTIs

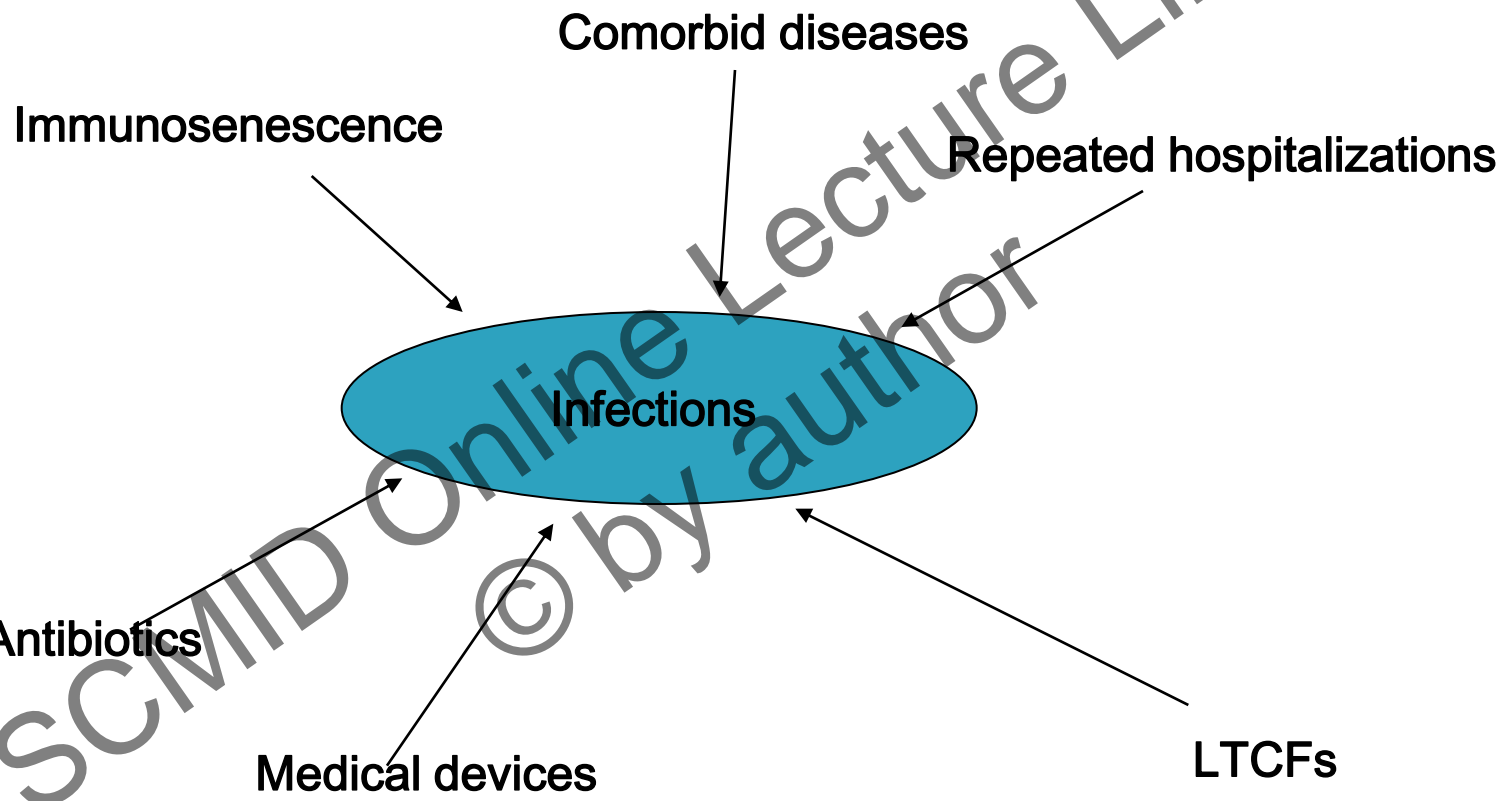
- ▶ Previous surgical procedures (OR 2)
- ▶ Presence of a urinary catheter (OR 8)
- ▶ No specific antibiotics significant risk for UTIs after adjusting for demographic and clinical risk factors

# Risk Factors for Becoming Colonized or Infected with Antibiotic-Resistant Organisms in LTCFs

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Risk factor	No. of Articles in Which Reported
Resident factors	
Prior antibiotic treatment	35
Presence of invasive devices (eg, urinary catheter, feeding tube)	29
Lower functional status	26
Prior hospitalization	18
Presence of decubitus ulcers	15
Presence of wounds	14
Prior colonization by antibiotic-resistant organisms <sup>†</sup>	10
Urinary incontinence	7
Presence of comorbidities	
- Diabetes mellitus and/or peripheral vascular disease	7
- "Underlying illness"	4
- Renal disease/ insufficiency	3
- Comorbidities in general	3
- Prior pneumonia	3
- Inflammatory bowel disease	2

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Number and severity of comorbidities

Cognitive impairment



Infections

?????

Malnutrition

Dependency level

JAMDA 13 (2012) 760.e7–760.e12



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JAMDA

journal homepage: [www.jamda.com](http://www.jamda.com)



Original Study

## Impact of Comorbidities on Hospital-Acquired Infections in a Geriatric Rehabilitation Unit: Prospective Study of 252 Patients

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Prospective cohort study to determine:

- ▶ prevalence of HAI in rehabilitation-unit patients  $\geq 75$  years
- ▶ risk factors for HAI
  - emphasis on those most relevant to the elderly
- ▶ relationship between comorbidity (in terms of number, severity, and nature of chronic diseases) and HAI

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# Comorbidities assessment

- ▶ Cumulative Illness Rating Scale (CIRS): number and severity of the chronic diseases
- ▶ Scale for Geriatrics (CIRS-G): CIRS revised to reflect common problems of elderly people

# Assessed risk factors

- ▶ cognitive impairment (Mini-Mental State Examination score <24)
  - ▶ epilepsy
  - ▶ Parkinson's disease
  - ▶ stroke
  - ▶ thromboembolic disease
  - ▶ diabetes mellitus
  - ▶ congestive heart failure (New York Heart Association classes III and IV)
  - ▶ chronic obstructive pulmonary disease
  - ▶ cirrhosis
  - ▶ alcohol abuse
  - ▶ corticosteroid therapy
  - ▶ chronic renal failure
  - ▶ urinary and fecal incontinence
  - ▶ pressure sores
  - ▶ difficulty with oropharyngeal secretions
  - ▶ recent surgery (within the past month),
  - ▶ nutritional status (based on the Mini- Nutritional Assessment score)
- 
- Dependency level (Activities of Daily Living scale, ADL)
  - Invasive procedures

Univariate Comparison of Cumulative Illness Rating Scale (CIRS-g) Scores in Elderly Patients With and Without HAIs

	HAI+ (n = 97)	HAI- (n = 155)	P Value*
Global CIRS-G, median (interquartile range)	13 (11–16)	10 (8–13)	<.001
Number of patients with CIRS-G score $\geq 2$ in each disease category, n (%)			
Cardiovascular/respiratory system:			
1. Heart diseases	68 (70)	104 (67)	.68
2. Hypertension	67 (69)	117 (75)	.31
3. Vascular/hematological diseases	32 (33)	41 (26)	.32
4. Respiratory diseases	42 (43)	20 (13)	<.001
5. Eye, ear, nose, and larynx diseases	28 (29)	41 (26)	.77
Gastrointestinal system:			
6. Upper gastrointestinal diseases	10 (10)	7 (5)	.12
7. Lower gastrointestinal diseases	14 (14)	14 (9)	.22
8. Hepatic diseases	2 (2)	1 (1)	.56
Genitourinary system:			
9. Renal diseases	53 (55)	54 (35)	.002
10. Other urogenital diseases	30 (31)	28 (18)	.02
Musculoskeletal/integumentary system:			
11. Muscle, bone, and skin diseases	65 (67)	87 (56)	.11
Neuropsychiatric system:			
12. Neurological diseases	28 (29)	41 (26)	.77
13. Psychiatric diseases	78 (80)	120 (77)	.63
General system:			
14. Endocrine and metabolic diseases	33 (34)	37 (24)	.08
Comorbidity index, median (interquartile range)	6 (4–8)	4 (3–6)	<.001
Severity index, median (interquartile range)	2.3 (2.2–2.6)	2.4 (2.2–2.7)	.68

Univariate Comparison of Functional Status, Specific Diseases, and Invasive Procedures between Elderly Patients With and Without HAI

	HAI+ n = 97	HAI- n = 155	OR (95% CI)	P Value*
Functional status, n (%)				
- ADL score <10	73 (76)	98 (63)	1.84 (1.04–3.26)	.03
Specific diseases				
Cardiovascular/respiratory system, n (%)				
- Thromboembolic disease	7 (7)	10 (6)	1.12 (0.41–3.06)	.81
- Heart failure	23 (24)	25 (16)	1.75 (0.95–3.23)	.07
- Chronic obstructive pulmonary disease	14 (14)	13 (8)	1.84 (0.83–4.11)	.14
Gastrointestinal system, n (%)				
- Swallowing impairment	19 (20)	6 (4)	6.12 (2.53–15.97)	<.001
Urogenital system, n (%)				
- Renal insufficiency <sup>†</sup>	26 (27)	36 (23)	1.20 (0.67–2.15)	.54
- Urinary/fecal incontinence	60 (62)	71 (46)	1.91 (1.43–3.21)	.01
Musculoskeletal/integumentary system:				
- Pressure sores, n (%)	19 (20)	11 (7)	3.18 (1.44–7.04)	.004
Neuropsychiatric system, n (%)				
- Epilepsy	9 (9)	15 (10)	0.95 (0.40–2.27)	.91
- Parkinson's disease	2 (2)	6 (4)	0.52 (0.10–2.64)	.43
- Stroke	13 (13)	17 (11)	1.25 (0.58–2.71)	.58
- Cognitive impairment <sup>‡</sup>	66 (70)	90 (60)	1.54 (0.89–2.67)	.12
General system, n (%)				
- Malnutrition <sup>§</sup>	33 (34)	23 (15)	2.96 (1.60–3.26)	<.001
- Diabetes	18 (19)	24 (15)	1.24 (0.63–2.43)	.52
Invasive procedures, n (%)				
- At least 1 invasive procedure:				
- Surgery within the past month	4 (4.1)	9 (5.8)	0.70 (0.21–2.33)	.56
- Intravenous catheter	28 (29)	7 (4.5)	8.58 (3.57–20.60)	<.001
- Urinary catheter	23 (24)	11 (7)	4.07 (1.88–8.79)	<.001
- Gastrointestinal endoscopy	13 (13)	5 (3)	4.64 (1.59–13.47)	<.001

- ▶ To identify factors independently associated with HAIs: 2 multivariate models
- ▶ First model: functional status (ADL score  $< 10$ ), CIRS-G, and having at least 1 invasive procedure
- ▶ Second model: ADL score  $< 10$ , specific diseases, and specific invasive procedures (ie, intravenous catheter, urinary catheter, and gastrointestinal endoscopy)

Multivariate Analyses (Unconditional Logistic Regression Models) Comparing Patients With (n = 97) and Without (n = 155) Hospital-Acquired Infections

	OR (95% CI)	P Value*
<u>Model 1</u>		
Invasive procedure, yes/no	5.18 (2.77–9.71)	<.001
Global CIRS-G <sup>†</sup>	1.55 (1.13–2.11)	.005
<u>Model 2</u>		
Intravenous catheter	7.39 (2.94–18.56)	<.001
Urinary catheter	3.33 (1.40–7.88)	.006
Gastrointestinal endoscopy	3.69 (1.12–12.16)	.03
Pressure sores	2.52 (1.04–6.10)	.03
Swallowing impairment	3.37 (1.16–9.74)	.02

- ▶ Functional status: no independent factor for HAI
  - strongly associated with global CIRS–G, urinary catheter, and swallowing impairment

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- “Health care associated risk factors” most important for infections
- Need for measures aimed at reducing the prevalence of modifiable health care associated risk factors

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# Do we know enough?

- Need for studies assessing the risk of MDR-infections in patients living in different types of LTCFs
  - What is the risk of MDR-infection in a patient living in LTCFs with low level of acuity i.e. facilities that are more similar to “homes for aged persons”?
- Need for further studies on risk factors for “real infections” in LTCFs
  - Most studies on MDR-bacteria in LTCFs residents did not distinguish colonization and infection
- Need for studies assessing the risk of MDR-infections in patients living in the community, never hospitalised, without medical devices but with a history of antibiotic use

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EDITORIALS

## **Functional Status**

The Sixth Vital Sign

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# Functional status

*“An individual's ability to perform normal daily activities required to meet basic needs, fulfil usual roles, and maintain health and well-being”*

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# Functional status

- ▶ Some studies demonstrated that functional status has an important impact on the risk of infections in the elderly
- ▶ Generally measured using the ADL score
- ▶ Influenced by several factors
- ▶ Reliable tools to evaluate functional status in the elderly?
- ▶ Rarely assessed in research studies and in clinical practice

↓ prevalence of modifiable risk factors

↑ functional status

↓ incidence of infections



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