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Original article

Trends in point-prevalence studies of healthcare associated infections in long-term care facilities: A nationwide surveillance program in Catalonia, Spain (2013–2022)

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ABSTRACT

Introduction: From 2013 to 2022, annual point-prevalence studies (PPS) of healthcare-associated infections (HAIs) were conducted in 97 long-term care facilities (LTCF) within the VINCat Program in Catalonia, Spain. The objective was to analyze trends in HAIs and antibiotic use to evaluate the burden of HAIs in this setting.
Methods: We compare PPS data from two 5-year periods. Period 1 (2013–2017) involving 50,378 residents and period 2 (2018–2022) involving 65,997 residents. Variables included demographic characteristics, patient conditions, medical devices on the day of PPS and recent surgery. Source of HAI, causative microorganisms, antibiotics and indication were recorded. HAIs were defined according to ECDC criteria.
Results: A total of 116,375 residents were included, median age of 82 years (range: 73–88), 56.7% female. Although severe dependency was more common in period 1, the presence of vascular and urinary catheters increased in period 2. Overall, 9943 (8.5%) residents had one or more HAIs. The HAI prevalence rate significantly decreased from 9.3% in period 1 to 8% in period 2, being urinary tract infections the most prevalent HAI in both periods, followed by respiratory tract infections. *Escherichia coli* was the most frequently identified microorganism. No significant differences in the prevalence of antibiotic use between periods (11.8 vs 12.1 respectively) were found, although there was a shift toward more targeted prescriptions.
Conclusion: Despite a significant reduction over the study period, the prevalence of HAIs remains high in LTCFs of Catalonia, affecting 8% of residents. Implementation of infection prevention and control interventions are highly required.

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◊ The members of this VINCat Programme Long-Term Care Facilities Prevalence Point Survey group appear in Appendix 1.

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Tendencias en los estudios de prevalencia puntual de infecciones relacionadas con la atención sanitaria en centros sociosanitarios. Un programa de vigilancia a nivel nacional en Cataluña, España (2013-2022)

Palabras clave:
Infecciones asociadas a la atención sanitaria
Estudios de prevalencia puntual
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R E S U M E N

Introducción: Durante el periodo 2013-2022, se realizaron cortes anuales de prevalencia de infecciones relacionadas con la atención sanitaria (IRAS) en 97 centros sociosanitarios (CSS) adheridos al Programa VINCat. El objetivo fue analizar las tendencias de las IRAS y el uso de antibióticos en este entorno.
Métodos: Se compararon los datos de prevalencia anual agrupados en dos periodos de 5 años.
El periodo 1 (2013-2017) incluyó 50.378 residentes y el periodo 2 (2018-2022) a 65.997. Se incluyeron características demográficas, situación del residente, dispositivos invasivos, cirugía reciente, foco de la IRAS, microorganismos causantes, uso de antibióticos e indicación.
Resultados: Se incluyeron un total de 116.375 residentes, con una edad media de 82 años (rango: 73-88); el 56,7% eran mujeres. Aunque la dependencia severa fue más frecuente en el periodo 1, la presencia de catéteres vasculares y urinarios aumentó en el periodo 2. Globalmente, 9.943 (8,5%) residentes presentaban una o más IRAS. La tasa de prevalencia de IRAS disminuyó significativamente del 9,3% en el periodo 1 al 8% en el periodo 2, siendo la infección urinaria la más prevalente en ambos periodos, seguidas de la infección respiratoria. *Escherichia coli* fue el patógeno identificado con mayor frecuencia. No se encontraron diferencias en el uso de antibióticos entre ambos periodos, aunque se detectó un cambio hacia prescripciones más dirigidas.
Conclusión: A pesar de una reducción significativa, la prevalencia de IRAS sigue siendo muy elevada en los CSS de Cataluña, afectando alrededor del 8% de los residentes. Es necesaria la implementación de intervenciones de prevención y control más efectivas.

Introduction

Healthcare-associated infections (HAIs) are a common cause of death in older people admitted to long-term care facilities (LTCF). Over the last two decades, the number of people aged 65 and older in Catalonia has increased significantly. In 2000, the population aged 65 and over was around 1.1 million. By 2023, this number had risen to approximately 1.6 million, representing a significant growth in the elderly population. This increase is attributed to higher life expectancy and lower birth rates, which have resulted in an aging population in the region. In Catalonia, patients requiring long-term care may be admitted to diverse units based on their specific health problems and social conditions.[1] A LTCF provides extended care for individuals with chronic illnesses, disabilities, or age-related conditions, offering comprehensive supervision and specialized medical and nursing care.[2] Some residents with complex medical needs may remain in LTCFs for extended periods, potentially spanning months to years or until the end of life. In comparison, Centers for Intermediate Care (CIC) focus on specialized geriatric and palliative care, promoting clinical stabilization and autonomy in activities of daily living. The aim is to enable residents to return to their usual environments or to provide end-of-life care. Both LTCFs and CICs are integral components of the service portfolio of the Catalan Health Service for older people. For the purposes of this study, they will collectively be referred to as LTCFs.

The LTCFs in Catalonia have evolved significantly over the past decade. There has been a notable increase in the flow of patients between acute hospital units and LTCFs, with patients often being transferred earlier from hospitals to these facilities. Consequently, LTCFs now manage more complex medical cases, including acute illnesses and infections that previously required hospital referrals.[3] This shift has led to an increased risk of HAIs in LTCFs, as patients often undergo invasive procedures, such as urinary or vascular catheters, require intensive care, and may develop complications related to their underlying conditions.[4]

From 2013 to 2022, annual Point Prevalence Studies (PPS) for HAIs were conducted in LTCF as a part of the VINCat Program. These surveys aimed to assess the prevalence trends of HAIs within these facilities.[5]

Methods

This descriptive observational study examined the prevalence of HAIs in LTCFs in Catalonia. The study covered years between 2013 and 2022, comparing two periods: Period 1 (from 2013 to 2017) and Period 2 (from 2018 to 2022). The methodology included two annual PPS, one in May and another in November.

Patient medical records underwent reviews in each participating facility. Simultaneous PPSs were conducted across all facilities to ensure consistency and minimize discrepancies in data collection. While the optimal method would have been to review all admitted patients simultaneously across all participating centers on a specific day, logistical constraints rendered this impractical. Consequently, a 15-day window was designated for data collection. The recommendation was to gather data for each hospital unit within a single day, covering all admitted patients. Each bed in the facility underwent evaluation once, omitting empty beds without revisitation.

Trained healthcare professionals within the facilities conducted the surveillance process. Data collection followed the definitions and methodology outlined in the HALT study from European Center for Disease Control (ECDC).[6,7] To identify HAIs, the adapted McGeer definitions for LTCF surveillance were used.[8] Healthcare personnel collected HAI source (respiratory, urinary, skin and soft tissue, gastrointestinal, others), antimicrobial treatment, and whether it was empirically initiated or guided by microbiological findings. All administered antibiotics were recorded, including those initiated in acute care units, those for prophylactic purposes (medical or surgical), or others. To define the patient's situation, the Barthel Index, measuring the degree of autonomy in basic activities of daily living (BADL), the Global Deterioration Scale (GDS) of Reisberg, providing a staging of the patient's cognitive status, and the Charlson Index, quantifying comorbidity, were chosen as data points.[9–11]

Table 1
Patients' characteristics.

Characteristics	Overall (N = 116,375)	Period 1 (N = 50,378)	Period 2 (N = 65,997)	p-Value[a]
Number of facilities, *n*	97	86	96	
Patient data				
Age, median (IQR)	82 (72–88)	82 (73–87)	82 (72–88)	<0.001
Female sex, n (%)	65,996 (56.7)	29,018 (57.6)	36,978 (56.0)	<0.001
Patient conditions				
Barthel scale				<0.001
Mean (SD)	42.0 (29.6)	41.2 (30.1)	42.5 (29.3)	
Median (IQR)	40 (15–65)	40 (15–65)	40 (15–65)	
GDS				<0.001
Mean (SD)	4.49 (1.63)	4.64 (1.64)	4.42 (1.62)	
Median (IQR)	5 (3–6)	5 (3–6)	4 (3–6)	
Charlson				<0.001
Mean (SD)	4.52 (2.44)	4.24 (2.25)	4.66 (2.52)	
Median (IQR)	4 (3–6)	4 (2–6)	4 (3–6)	
Temporal and spatial disorientation, n (%)	51,360 (44.1)	23,235 (46.1)	28,125 (42.6)	<0.001
Severe dependency, n (%)	50,391 (43.3)	22,834 (45.3)	27,557 (41.8)	<0.001
Dysphagia, n (%)	27,517 (23.6)	11,716 (23.3)	15,801 (23.9)	0.007
Pressure ulcers, n (%)	16,697 (14.3)	6829 (13.6)	9868 (15.0)	<0.001
Fecal/urinary Incontinence, n (%)	66,578 (57.2)	28,893 (57.4)	37,685 (57.1)	0.394
Medical cares and device				
VC, n (%)	13,249 (11.4)	4753 (9.4)	8496 (12.9)	<0.001
CVC, n (%)	1505 (1.3)	548 (1.1)	957 (1.5)	<0.001
PVC, n (%)	11,481 (9.9)	4063 (8.1)	7418 (11.2)	<0.001
UC, n (%)	10,781 (9.3)	4499 (8.9)	6282 (9.5)	<0.001
NGT, n (%)	789 (0.7)	392 (0.8)	397 (0.6)	<0.001
Tracheotomy, n (%)	1103 (0.9)	529 (1.1)	574 (0.9)	0.002
PEG, n (%)	2519 (2.2)	1198 (2.4)	1321 (2)	<0.001
Antibiotic use, n (%)	13,939 (12)	5956 (11.8)	7983 (12.1)	0.157
Recent surgical intervention, n (%)	12,809 (11.0)	5517 (11.0)	7292 (11.0)	0.604
Patients with HAI				
HAI prevalence, n (%)	9943 (8.5)	4679 (9.3)	5264 (8.0)	<0.001
Days to NI[b], median (IQR)	22 (8–55)	23 (8–56)	22 (8–54)	0.162

VC: vascular catheter; CVC: central vascular catheter; PVC: peripheral vascular catheter; UC: urinary catheter; NGT: nasogastric tube; PEG: percutaneous endoscopic gastrostomy; Q1: first quartile; Q3: third quartile; HAI: healthcare-associated infection.
[a] Student's *t*-test or Wilcoxon rank-sum test; Pearson Chi-squared test.
[b] Days from admission to nosocomial infection (NI) calculated for actual admissions.

Both intrinsic and extrinsic infection risk factors were collected. Intrinsic risk factors included severe dependence in performing BADL, defined as a Barthel index below 40 points, temporal and/or spatial disorientation, the presence of pressure ulcers, dysphagia, and urinary and/or fecal incontinence. Extrinsic risk factors encompassed the use of a vascular catheter, a feeding tube (nasogastric tube or percutaneous endoscopic gastrostomy), urinary catheter, tracheotomy, as well as recent surgery within the last month before the prevalence assessment. COVID-19 was not reported as HAI during the pandemic period. This exclusion was due to the unique and widespread nature of the virus, which posed challenges in distinguishing between community-acquired and healthcare-acquired cases in LTCFs. The focus of our HAIs surveillance remained on traditional infections, such as UTIs and respiratory tract infections unrelated to COVID-19. This decision ensures the consistency and comparability of data with previous years, providing a clear analysis of non-COVID HAIs over time.[12]

Ethical issues

The study complied with the principles of the Declaration of Helsinki, with international human rights, and with the legislation regulating biomedicine and personal data protection. All data were treated as confidential, and records were accessed anonymously. This study was approved by the Ethics Committee of Bellvitge Hospital (Ref. PR066/18). Patient data was anonymized, and so the requirement for informed consent was waived by the Ethics Committee for Clinical Research.

Statistical analysis

The data were summarized using frequencies and proportions for categorical variables. For continuous variables, we presented medians and interquartile ranges (IQR) or means and standard deviations, depending on the distribution. To assess differences in percentages, we conducted Chi-square tests or Fisher's tests, as deemed suitable. For continuous variables, comparisons were performed using Two-sample *T*-test or Wilcoxon Rank-Sum test, as appropriate. To evaluate the strength and direction of the monotonic relationship between prevalences over the years, we performed a Spearman correlation (rho). A significance level of 0.05 was applied to all statistical tests. Additionally, LOESS smoothing was applied to the graphs to enhance the clarity in depicting data trends. The results were analyzed using the R statistical software version 4.2.2, developed by The R Foundation in Vienna, Austria

Results

Population

The number of centers participating in the prevalence assessments increased during the study period, rising from 86 to 96 centers. A total of 116,375 residents were included in the study, with 50,378 in Period 1 and 65,997 in Period 2. Additionally, 4772 HAIs were identified in Period 1, and 5321 in Period 2. Characteristics of the population are shown in Table 1.

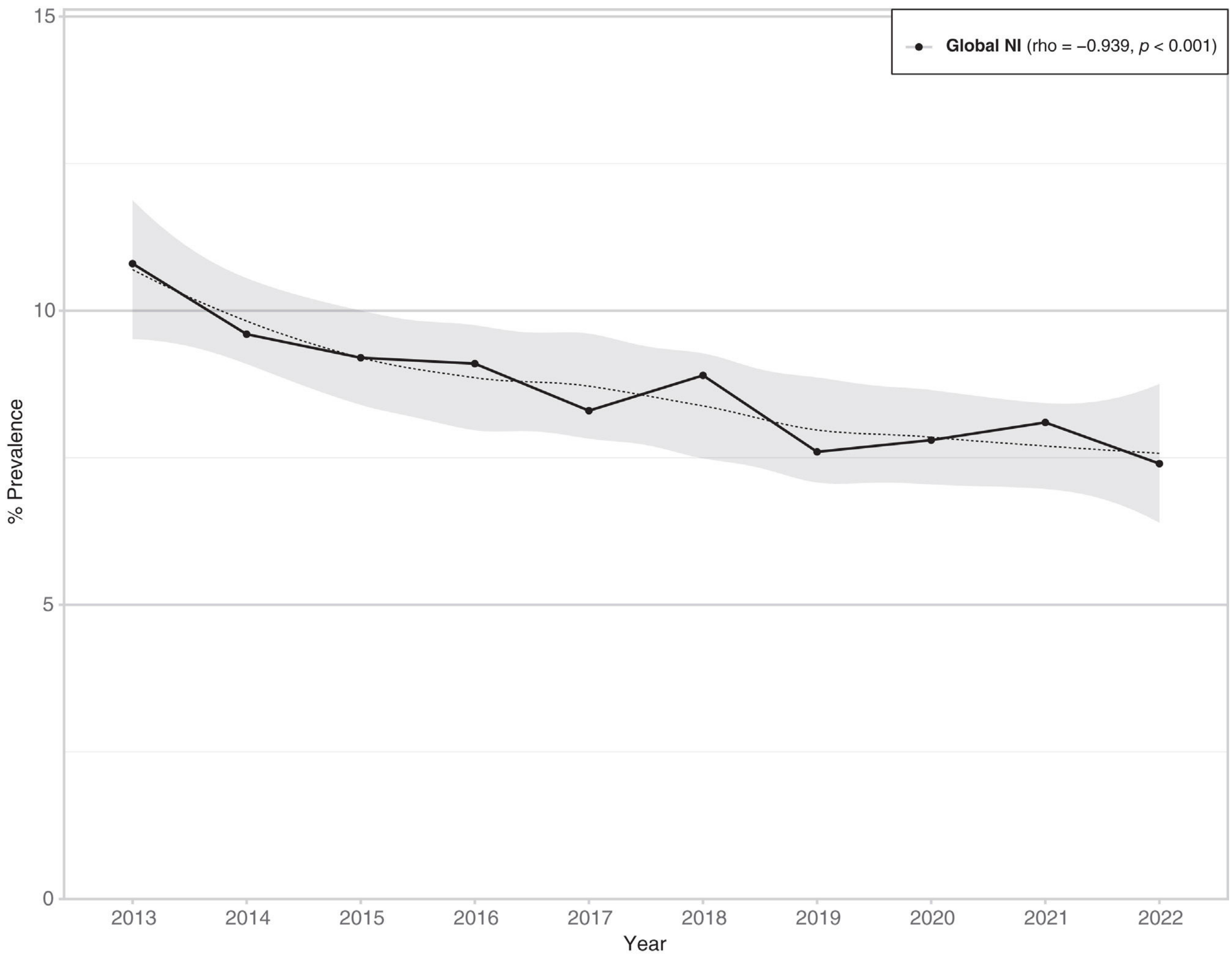

Fig. 1. Trends in the prevalence of HAIs. VINCat program (2013–2022).

The study population had a global median age of 82 (IQR: 72.8–88.0) years, with 56.7% of the cohort being women. The median Barthel Index was 40 (IQR: 15–65), indicating a moderate to severe dependence on assistance for BADL. The median GDS score was 5 (IQR: 3–6), suggesting mild to moderate cognitive impairment. The median Charlson Comorbidity Index was 4 (IQR: 3–6). Temporal and/or spatial disorientation was observed in 44.1% of patients, while 43.3% exhibited severe dependence on BADLs. Dysphagia was present in 23.6% of the patients, 14.3% had pressure ulcers, and 57.2% experienced urinary and/or fecal incontinence. Among invasive procedures, 11.4% of patients had vascular catheters, with peripheral catheters being more prevalent (9.9%) compared to central catheters (1.3%). Urinary catheters were present in 9.3% of residents. Additional interventions included nasogastric tubes in 0.7% of residents, gastrostomies in 2.2%, tracheotomies in 0.9% and recent surgeries in 11%. Residents receiving antibiotic therapy were 12% of the population. Statistically significant differences were observed between the two periods for all factors, except for urinary and/or fecal incontinence, recent surgery, and antibiotic use (Table 1).

Prevalence of HAIs

The prevalence of HAIs decreased from 9.3% (95% CI 9.0–9.5) in Period 1 to 8% (95% CI 7.8–8.2) in Period 2, with an overall prevalence of 8.5% (95% CI 8.3–8.7) (Table 1). The prevalence demonstrated a consistently decreasing trend over time, displaying a monotonically decreasing pattern, which was statistically significant (rho = −0.939; $p < 0.001$) (Fig. 1).

The data showing the prevalence rate by unit type is presented in Table 2. The overall prevalence of HAIs varied across different units, with rates ranging from 13.7% in Subacute Units to 5.6% in AIDS Units. A significant reduction in HAI prevalence was observed from Period 1 to Period 2 in subacute, palliative, and convalescent Units. Although decreases were noted in long-term care and AIDS units during Period 2, the changes were not statistically significant. Conversely, psychogeriatric units experienced a non-significant increase in HAI prevalence during Period 2.

Table 3 shows the prevalence of HAIs according to the source of infection. All HAIs were recorded for each resident at the time of the PPS. Thus, the number of infections reported exceeds the number of patients with infections. In both periods, urinary tract infections (UTIs) were the most prevalent, followed by respiratory infections. Skin and soft tissue infections consistently ranked third. In Period 2, there was a significant decrease in the prevalence of respiratory and soft tissue infections. However, the prevalence of UTIs remained unchanged (3.6%) between the two periods.

Regarding the etiology of HAIs, the majority were caused by Gram-negative bacilli (GNB), which accounted for 72.06% of isolates. Gram-positive cocci (GPC) followed, comprising 18.36%. Among GNB, *Escherichia coli* was the most prevalent, representing 29.4% of all isolates, followed by *Pseudomonas aeruginosa* (12.34%), *Klebsiella pneumoniae* (11.85%), and *Proteus mirabilis* (6.99%). For GPC, *Staphylococcus aureus* was the leading pathogen, account-

Table 2
Prevalence of HAIs according to unit.

Type of unit	Overall (N = 116,375)			Period 1 (N = 50,378)			Period 2 (N = 65,997)			p-Value[a]
	Number of units	Residents	Residents with NI (%)	Number of units	Residents	Residents with NI (%)	Number of units	Residents	Residents with NI (%)	
Subacute care unit	50	5192	711 (13.7)	35	1850	293 (15.8)	48	3342	418 (12.5)	<0.001
Palliative care unit	70	5877	726 (12.4)	53	2672	389 (14.6)	61	3205	337 (10.5)	<0.001
General care unit	37	3207	347 (10.8)	21	1576	205 (13)	26	1631	142 (8.7)	<0.001
Convalescent care unit	87	37,351	3329 (8.9)	70	14,998	1525 (10.2)	82	22,353	1804 (8.1)	<0.001
Long-term care unit	86	55,014	4296 (7.8)	76	24,342	2000 (8.2)	83	30,672	2296 (7.5)	0.002
Psychogeriatric unit	28	5274	322 (6.1)	23	2847	159 (5.6)	22	2427	163 (6.7)	0.098
AIDS unit	18	450	25 (5.6)	14	174	16 (9.2)	12	276	9 (3.3)	0.014
Other	39	4010	187 (4.7)	24	1919	92 (4.8)	30	2091	95 (4.5)	0.763

Table 3
Prevalence of HAIs by source of infection.

Location of NI	Overall (N = 116,375)	Period 1 (N = 50,378)	Period 2 (N = 65,997)	p-Value[a]
Urinary	4190 (3.6)	1796 (3.6)	2394 (3.6)	0.948
Respiratory	3277 (2.8)	1739 (3.4)	1538 (2.3)	<0.001
Skin and soft tissue	1597 (1.4)	761 (1.5)	836 (1.3)	<0.001
Other	759 (0.7)	341 (0.7)	418 (0.6)	0.284
Gastrointestinal tract	270 (0.2)	135 (0.3)	135 (0.2)	0.022
Total[b]	10,093 (8.7)	4772 (9.4)	5321 (8.0)	<0.001

NI: nosocomial infection.
[a] Pearson Chi-squared test.
[b] The total number of infections exceeds the count of residents with infections, since a resident could have more than one infection.

ing for 8.17% of all isolates, followed by *Enterococcus* spp. (6.78%). Additionally, fungi were identified in 2.1% of isolates, while anaerobes accounted for 2.62%. Significant differences were observed between the two study periods. There was a notable reduction in the prevalence of *S. aureus*, *P. aeruginosa*, *E. coli*, and *Morganella morganii* in Period 2, while the prevalence of *Enterococcus* spp. increased. The prevalence of *Clostridioides difficile* remained stable, representing 0.9% of isolates in both periods (Table 4).

Prevalence of antimicrobial use by indication

The prevalence use of antibiotics at the time of PPS was 12% with no significant differences between the two periods (Table 1). However, the rate of empirical antibiotic use decreased significantly from 62.8% in Period 1 to 54.9% in Period 2. Overall, the most prevalent families were penicillins (38.7%), quinolones (23.3%), and cephalosporins (15.4%). In Period 2, the use of quinolones decreased while the use of cephalosporins increased. In targeted treatments, the most used families were quinolones (20.8%), penicillins (17.8%), cephalosporins (15.7%), and carbapenems (9.6%) and similarly, the use of quinolones decreased in Period 2, while the use of carbapenems significantly increased (Table 5).

Discussion

Our study provides a comprehensive analysis of HAIs in LTCFs in Catalonia, Spain, over a nearly decade-long period. An overall reduction in HAI prevalence was observed during the study period, highlighting the efforts to implement infection prevention and control measures over the years by LTCFs.

The comparison of data from the VINCat Program, the ECDC's PPS, and a systematic review and meta-analysis of PPS of HAIs in LTCFs recently published, revealed significant differences in resident baseline conditions, invasive procedures, and HAI rates.[7,13] Although the systematic review did not provide detailed information on invasive devices or specific comorbidities, the VINCat program reported a higher use of urinary and vascular catheters compared to the ECDC's PPS. This could be attributed to the higher complexity of cases managed in Catalonian LTCFs, where post-acute care is more commonly provided. Additionally, the overall HAI prevalence in the VINCat study (8.5%) was notably higher than that reported by the ECDC (3.7%) and the systematic review (3.5%). Despite the differences in HAI prevalence rates, the frequency of infection types was similar across the three studies; in the VINCat study and the meta-analysis, urinary tract infections were the most frequent, followed by respiratory tract infections and skin and soft tissue infections. In contrast, the ECDC PPS identified respiratory tract infections as the most common type of HAI. These results suggest that differences in the type of LTCFs included in the studies affect the use of invasive devices, comorbidities and HAI rates. The detailed study of patient characteristics, their requirements, and HAI rates according to units of admission represents a very important field of research, for which there is currently limited data.

Similarly to the ECDC's PPS and the data from the systematic review, the predominant pathogens causing HAIs in Catalonian LTCFs were GNB (72%). The most frequently identified species was *E. coli*, followed by *P. aeruginosa*, *K. pneumoniae*, and *P. mirabilis*. Gram-positive cocci accounted for 18.3% of the isolates, with *S. aureus* and *Enterococcus* spp. being the most common. In contrast to the VINCat data, the ECDC PPS reported a slightly lower prevalence of *P. aeruginosa*. While GNB were primarily associated with UTIs, *S. aureus* and other GPC were frequently related to respiratory and skin infections. Notably, the prevalence of *Enterococcus* spp. increased in the second period of the VINCat study, suggesting a potential shift in the etiology of HAIs. Additionally, the prevalence of *C. difficile* infections remained stable over the study period, accounting for 0.9% of the total isolates in both periods. In comparison, the ECDC PPS reported a median prevalence of 1.0% for *C. difficile* across European LTCFs, with considerable variability between countries, ranging from 0.4% in Ireland to 2.8% in Italy and up to 4.4% in Spain.[7]

We observed a stable antibiotic use rate of 12% in our facilities, being the most common antibiotics penicillins, quinolones, and cephalosporins. There was a noticeable shift toward more targeted treatments, with a decrease in quinolone use and an increase

Table 4
Etiology of infections.

Family/microorganism	Overall n (%)	Period 1 n (%)	Period 2 n (%)	p-Value[a]
Number of isolates, N	4465	1891	2574	
Gram-negative bacilli	3218 (72.06)	1354 (71.6)	1864 (72.39)	0.586
Escherichia coli	1314 (29.42)	536 (28.34)	778 (30.21)	0.187
Pseudomonas aeruginosa	551 (12.34)	259 (13.7)	292 (11.34)	0.020
Klebsiella pneumoniae	529 (11.85)	202 (10.68)	327 (12.7)	0.044
Proteus mirabilis	312 (6.99)	121 (6.4)	191 (7.42)	0.208
Other GNB	150 (3.36)	70 (3.7)	80 (3.11)	0.314
Enterobacter cloacae	73 (1.63)	35 (1.85)	38 (1.48)	0.391
Morganella morganii	59 (1.32)	33 (1.75)	26 (1.01)	0.046
Klebsiella spp.	56 (1.25)	14 (0.74)	42 (1.63)	0.012
Pseudomonas spp.	49 (1.1)	27 (1.43)	22 (0.85)	0.094
Klebsiella oxytoca	42 (0.94)	21 (1.11)	21 (0.82)	0.394
Proteus spp.	24 (0.54)	10 (0.53)	14 (0.54)	1.000
K. aerogenes	23 (0.52)	7 (0.37)	16 (0.62)	0.344
Serratia marcescens	15 (0.34)	10 (0.53)	5 (0.19)	0.099
Proteus vulgaris	11 (0.25)	6 (0.32)	5 (0.19)	0.607
Enterobacter spp.	5 (0.11)	1 (0.05)	4 (0.16)	0.404
Serratia spp.	3 (0.07)	1 (0.05)	2 (0.08)	1.000
Enterobacter agglomerans	2 (0.04)	1 (0.05)	1 (0.04)	1.000
Gram-positive cocci	820 (18.36)	359 (18.98)	461 (17.9)	0.377
S. aureus	365 (8.17)	185 (9.78)	180 (6.99)	<0.001
Enterococcus spp.	303 (6.78)	112 (5.92)	191 (7.42)	0.057
CoNS	108 (2.42)	46 (2.43)	62 (2.41)	1.000
Other *Streptococcus* species	34 (0.76)	12 (0.63)	22 (0.85)	0.509
Streptococcus (*viridans* group)	10 (0.22)	4 (0.21)	6 (0.23)	1.000
Anaerobes	117 (2.62)	46 (2.43)	71 (2.76)	0.564
Clostridioides difficile	100 (2.24)	39 (2.06)	61 (2.37)	0.561
Bacteroides fragilis group	5 (0.11)	1 (0.05)	4 (0.16)	0.404
Clostridium spp.	4 (0.09)	2 (0.11)	2 (0.08)	1.000
Fusobacterium spp.	4 (0.09)	2 (0.11)	2 (0.08)	1.000
Clostridium perfringens	3 (0.07)	1 (0.05)	2 (0.08)	1.000
Bacteroides spp.	1 (0.02)	1 (0.05)	–	–
Yeasts	94 (2.1)	45 (2.38)	49 (1.9)	0.322
Candida albicans	69 (1.55)	36 (1.9)	33 (1.28)	0.123
Candida spp.	24 (0.54)	9 (0.48)	15 (0.58)	0.784
Scedosporium spp.	1 (0.02)	–	1 (0.04)	–
Others	216 (4.84)	87 (4.6)	129 (5.01)	0.576

CoNS: coagulase-negative Staphylococci; GPC: gram-positive cocci; GNB: gram-negative bacilli.
[a] Pearson Chi-squared test or Fisher exact test.

in cephalosporin prescriptions, suggesting better diagnostic practices and antimicrobial stewardship. In contrast, the European PPS reported a lower average antibiotic use rate of 4.9%.[7] This difference might be due again to varying patient populations and prescription practices, with our facilities handling more complex cases.

Addressing the prevention of HAI in LTCF is essential. Reducing the use of urinary catheters and ensuring proper catheter care is crucial for preventing UTIs, the most frequent cause of HAIs in these settings. UTIs are often linked to the presence of indwelling catheters. By minimizing catheter use and adhering to strict hygiene protocols, including proper insertion techniques, regular monitoring, and timely removal, LTCFs can significantly reduce the incidence of UTIs.[14] This not only enhances the quality of life for residents but also decreases the overall burden of HAIs, improving patient outcomes and reducing healthcare costs. Lower respiratory tract infections, frequently caused by aspiration, are the second leading cause of HAI. This condition is especially prevalent among residents with swallowing difficulties, cognitive impairments, or severe physical disabilities. The consequences of aspiration can be severe, often resulting in prolonged illness, increased mortality, and extended hospital stays. Preventive measures are essential to mitigate these risks, including regular assessment of swallowing function, positioning residents properly during feeding, implementing dietary modifications, and maintaining oral hygiene.[15] Additionally, staff training on early recognition and management of aspiration events can further reduce the incidence of aspiration-related HAIs. A recently published cluster-randomized trial involving universal decolonization as compared with routine-care bathing performed in 28 USA nursing homes, resulted in a significant reduction in infection-related hospitalizations and a relative reduction in MDRO carriage by 30.9%.[16] The USA study's focus on decolonization resulted in clear benefits, particularly in reducing MDRO-related infections and hospitalizations. The higher overall HAI prevalence in Catalonia suggests a potential area for improvement, possibly through more targeted interventions.

The study's long duration and large sample size provide a robust dataset for analyzing trends, with consistent methodologies enhancing comparability and reliability. The inclusion of various unit types within LTCFs offers valuable insights into infection patterns. However, the study has limitations, such as the lack of data on microorganism resistance mechanisms, specific pathology-related antimicrobial use, and the impact of nosocomial COVID-19 on HAI rates. The reliance on PPS may miss year-round variations in HAIs, and differences in data collection practices across facilities could affect results. Additionally, seasonal variations were not addressed, which might influence prevalence rates

In conclusion, while our study demonstrates a moderate reduction in the prevalence of HAIs in Catalonia's LTCFs, the rates remain higher than those reported in other European studies. This underscores the need for continuous improvement in infection prevention and control strategies, particularly in managing more complex medical cases in LTCFs. Future research should focus on incorporating data on antimicrobial resistance and examining antimicrobial use by specific pathologies to further enhance

Table 5
Percentage of antibiotic family usage by indication.

ATB indication/ATB family	Overall (N = 15,485)	Period 1 (N = 6662)	Period 2 (N = 8823)	p-Value[a]
Empirical treatment	9022 (58.3)	4181 (62.8)	4841 (54.9)	<0.001
Penicillins	3492 (38.7)	1631 (39.0)	1861 (38.4)	0.596
Quinolones	2101 (23.3)	1168 (27.9)	933 (19.3)	<0.001
Cephalosporins	1392 (15.4)	533 (12.7)	859 (17.7)	<0.001
Targeted treatment	5435 (35.1)	2209 (33.2)	3226 (36.6)	<0.001
Quinolones	1129 (20.8)	509 (23.0)	620 (19.2)	<0.001
Penicillins	959 (17.6)	404 (18.3)	555 (17.2)	0.320
Other antibacterials	911 (16.8)	353 (16.0)	558 (17.3)	0.215
Cephalosporins	852 (15.7)	322 (14.6)	530 (16.4)	0.071
Carbapenems	520 (9.6)	135 (6.1)	385 (11.9)	<0.001
Sulfonamides and trimethoprim	455 (8.4)	212 (9.6)	243 (7.5)	0.008
Medical prophylaxis	734 (4.7)	143 (2.1)	591 (6.7)	<0.001
Sulfonamides and trimethoprim	272 (37.1)	30 (21)	242 (40.9)	<0.001
Macrolides, lincosamides, and streptogramins	146 (19.9)	23 (16.1)	123 (20.8)	0.248
Quinolones	102 (13.9)	37 (25.9)	65 (11.0)	<0.001
Other antibacterials	73 (9.9)	31 (21.7)	42 (7.1)	<0.001
Penicillins	72 (9.8)	12 (8.4)	60 (10.2)	0.632
Surgical prophylaxis or other	137 (0.9)	67 (1.0)	70 (0.8)	0.190
Quinolones	41 (29.9)	24 (35.8)	17 (24.3)	0.198
Penicillins	31 (22.6)	18 (26.9)	13 (18.6)	0.339
Sulfonamides and trimethoprim	22 (16.1)	6 (9.0)	16 (22.9)	0.047
Macrolides, lincosamides, and streptogramins	18 (13.1)	9 (13.4)	9 (12.9)	1.000
Aminoglycosides	8 (5.8)	3 (4.5)	5 (7.1)	0.719
Other indications	101 (0.7)	27 (0.4)	74 (0.8)	0.001
Penicillins	21 (20.8)	5 (18.5)	16 (21.6)	0.950
Quinolones	19 (18.8)	4 (14.8)	15 (20.3)	0.774
Macrolides, lincosamides, and streptogramins	17 (16.8)	2 (7.4)	15 (20.3)	0.227
Cephalosporins	14 (13.9)	4 (14.8)	10 (13.5)	1.000
Other antibacterials	9 (8.9)	4 (14.8)	5 (6.8)	0.243
Sulfonamides and trimethoprim	8 (7.9)	3 (11.1)	5 (6.8)	0.438
Unknown indication	56 (0.4)	35 (0.5)	21 (0.2)	0.005
Quinolones	18 (32.1)	10 (28.6)	8 (38.1)	0.658
Penicillins	15 (26.8)	8 (22.9)	7 (33.3)	0.585
Sulfonamides and trimethoprim	8 (14.3)	7 (20.0)	1 (4.8)	0.235
Other antibacterials	4 (7.1)	2 (5.7)	2 (9.5)	0.626
Cephalosporins	3 (5.4)	2 (5.7)	1 (4.8)	1.000
Systemic antifungals	3 (5.4)	2 (5.7)	1 (4.8)	1000

ATB: antibiotic. Antibiotic families with a percentage below 5% in all three periods (overall) have been omitted from the table results.
[a] Pearson Chi-squared test.

infection control efforts in these settings. The findings contribute valuable insights to the broader understanding of HAIs in LTCFs, offering a benchmark for future comparisons and improvements.

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Conflicts of interest

The authors declare no conflicts of interest.

Data availability statement

Restrictions apply to the availability of these data, which belong to a national database and are not publicly available. Data was obtained from VINCat and are only available with the permission of the VINCat Technical Committee.

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Appendix 1. Members of VINCat Programme Long-Term Care Facilities Prevalence Point Survey group and Infection Control Teams participating in the programme:

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