# Supplementary Material

## Variables

### Main exposure variable

The main exposure variable was all HAIs diagnosed during hospital stays in patients living in the Brussels-Capital Region, notified by Belgian hospitals with ICD codes through the MHD. The final main exposure variable only included ICD diagnosis codes that were not present on admission, meaning that these infections were acquired during the hospital stay.

Finally, data were sorted to only keep one code per hospital stay to avoid potential duplicates. Sensitivity analyses were performed by adding ICD codes one by one in the analysis to detect possible issues, such as aberrant values or over ascertainment of specific conditions.

### Outcome variables

Post-hospital discharge destinations were initially encoded as a categorical variable with 0 to 9 codes. To detect associations of interest, the values 3, 4, 5, 6, 7, corresponding respectively to transfer to "another non-university hospital", "another university hospital", "another psychiatric hospital", "a nursing home or equivalent", "a psychiatric nursing home" had been recoded as 1 as they represented LTCFs, whereas all other codes, including death and discharged home, were 0.

The secondary outcome, early readmission, had been defined as an unplanned readmission in the same hospital within 30 days. Three dummy variables had to be created as they did not exist in the datasets: date of admission, date of discharge and date of readmission. These variables had been coded using day, the month and the year of admission, discharge, and readmission. The difference between date of discharge and date of admission represented the LOS which was a possible confounder. Then, the date of discharge was the reference date to estimate the number of days until readmission to the same hospital. Eventually, this was also recoded as a binary variable with 0 as no early readmission (≥30 days) and 1 as early readmission (<30 days).

### Possible confounders and effect modifiers

We defined a priori confounders as variables associated with the exposure of interest, while being an independent risk factors for both outcomes, but which were not on the causal pathway between the exposure and outcomes. As this study consists in the analysis of secondary data, the number of potential confounding variables was limited. Among all available variables, age at admission, sex, LOS, ICU stay, disease severity scores, and place of residence were considered as meeting the criteria for confounding. Other variables, such as healthcare insurance, did not fulfil the above definition.

Age was recoded from a continuous variable to a categorical variable, using quartiles from the final database. Sex initially contained a third and a fourth categories ("modified" and "undetermined") with 142 observations that we deleted to maintain a binary variable throughout the analysis. They did not follow a specific pattern and were not likely to introduce any bias. We decided to use the total number of hospital days that have been billed by the hospital as LOS. LOS was transformed from a continuous to a dichotomous variable using the median from all observations. ICU stay was also recoded as a binary variable, by identifying patients that were admitted at least once in an ICU or a burn unit throughout the whole hospital stay. Based on the diagnoses recorded during hospital stays, two severity scores were already estimated in the datasets: Risk of Mortality (ROM) and Severity of Illness (SOI), both ranging from 1 (minor) to 4 (extreme). Preliminary analysis showed that both scores had a strong positive correlation (Spearman's rank correlation coefficient (Rho) = 0.7), thus we kept SOI only as a possible confounder. By definition, the SOI score reflects the disease burden, which seemed more appropriate for this study. SOI scores were not calculated for 232 observations and were encoded as 0. These values have been considered as missing. These admissions did not follow a different pattern than other admissions, so they were omitted during analyses. Places of residence were the places where patients came from before hospital admissions. They were encoded using the same method as for post-hospital discharge destinations.

Among all variables, none of them was considered as a priori effect modifier.

# Table 5. List of hospital-associated infections (HAIs) by International Classification of Diseases (ICD) codes.§

|  |  |  |
| --- | --- | --- |
| HAI | ICD-10-BE | ICD-9-CM |
| Hospital-Associated Urinary Tract Infection (HAUTI) | B37.4\* N10 N15.1 N15.9 N30.\* N34.0 N39.0 N99.89 T83.5\* | 112.2 590.1\* 590.2 590.9 595.0 597.0 599.0 996.64 997.5 |
| Hospital-Associated Bloodstream Infection (HABSI) | A02.1 A39.2 A39.4 A40.\* A41.\* B37.6 B37.7 T80.2\* T82.7 R78.81 | 003.1 036.2 038.\* 112.5 112.81 790.7 995.91 996.62 999.3\*  |
| Surgical Site Infection (SSI) | A46.0 A48.0 G00.\* G01.\* G06.\* H00.0 H04.3 H16.31\* H60.0\* H60.1\* I30.1 I33.\* I40.\* J34.0 J39.0 J39.1 J39.2 J85.\* J95.02 J98.51 K12.2 K61.\* K63.0 K65.\* K67 K68.1\* K75.0 K94.02 K94.12 K94.22 K94.32 L02.\* L03.\* M00.\* M01.\* M46.3\* M60.0 M65.0 M72.6 M86.1\* N41.2 N43.1 N48.21 N48.22 N49.3 N61.1 N73.0 N73.3 N76.4\* N99.511 N99.521 N99.531 O86.0\* T81.4\* T82.6\* T83.6\* T84.5\* T84.6\* T84.7\* T85.7\* T86.03 T86.13 T86.23 T86.33 T86.43 T86.812 T86.822 T86.832 T86.842 T86.852 T86.892 T86.93  | 035 040.0 320.\* 324.\* 370.55 373.1\* 373.4 373.5 380.00 380.01 380.03 380.10 380.11 380.13 380.22 420.90 421.\* 422.92 478.21 478.22 478.24 513.\* 519.01 519.2 528.3 530.86 536.41 566 567.\* 569.5 569.61 572.0 596.81 601.2 603.1 614.3 614.5 616.4 680.\* 681.\* 682.\* 684 686.\* 711.0\* 711.4\* 711.5\* 711.6\* 711.8\* 711.9\* 728.0 728.86 730.0\* 730.8\* 730.9\* 996.6\* (excepted 996.62 996.64) 998.5\*  |
| Hospital-Acquired Pneumonia/ Ventilator-Associated Pneumonia (HAP/VAP) | A48.1 B01.2 B05.2 J10.0\* J11.0\* J12.\* J13 J14 J15.\* J16.\* J17 J18.\* J95.851  | 052.1 055.1 480\* 481 482\* 483\* 484\* 485 486 487\* 997.31 997.32 |
| Other HAIs (including *Clostridioides difficile* infection, bloodborne, gastrointestinal and vaccine preventable diseases) | A02.\* (excepted A02.1) A04.7\* A08.\* A36.\* A37.\* A38.\* A39.\* (excepted A39.2 A39.3 A39.4) A48.8 B01.\* (excepted B01.2) B05.\* (excepted B05.2) B06.\* B15.\* B16.\* B17.\* B20 B34.\* B44.\* B45.\* B48.8 B49 B86.\* B95\* B96.\* B97.\* B99.9 U07.1\* Y95  | 003.\* (excepted 003.1) 008.\* 032.\* 033.\* 034.\* 036.\* (excepted 036.2) 040.89 041.\* 042 052.\* (excepted 052.1) 055.\* (excepted 055.1) 070.0 070.1 070.20 070.21 070.30 070.31 070.41 070.42 070.43 070.51 070.52 070.53 079.\* 117.3 117.5 117.9 118 133.0 136.9 |

§Each code refers to a precise diagnosis or clinical entity.
\*acts as a wildcard character.

## Hospital-associated infections (HAIs) and their matching International Classification of Diseases (ICD) codes

### Hospital-Associated Urinary Tract Infection (HAUTI)

|  |  |  |  |
| --- | --- | --- | --- |
| ICD-10-BE |  | ICD-9-CM |  |
| B37.4 | Candidiasis of other urogenital sites | 112.2 | Candidiasis of other urogenital sites |
| N10 | Acute pyelonephritis | 590.1 | Acute pyelonephritis  |
| N15.1 N15.9 | Renal and perinephric abscessRenal tubule-interstitial disease, unspecified | 590.2 590.9  | Renal and perinephric abscessInfection of kidney, unspecified |
| N30.0 | Acute cystitis | 595.0  | Acute cystitis |
| N34.0 | Urethral abscess | 597.0 | Urethral abscess |
| N39.0 | Urinary tract infection, site not specified | 599.0 | Urinary tract infection, site not specified |
| N99.89 | Other postprocedural complications and disorders of genitourinary system | 997.5 | Urinary complications, not elsewhere classified |
| T83.5 | Infection and inflammatory reaction due to prosthetic device, implant or graft in urinary system | 996.64 | Infection and inflammatory reaction due to indwelling urinary catheter |

### Hospital-Associated Bloodstream Infection (HABSI)

|  |  |  |  |
| --- | --- | --- | --- |
| ICD-10-BE |  | ICD-9-CM |  |
| A02.1 | Salmonella sepsis | 003.1 | Salmonella septicemia |
| A39.2 A39.4 | Acute meningococcemia Meningococcemia, unspecified | 036.2 | Meningococcemia |
| A40 A41 | Streptococcal sepsis Other sepsis | 0.38 995.91 | SepticemiaSepsis |
| B37.6 B37.7 | Candidal endocarditisCandidal sepsis | 112.5 112.81  | Disseminated candidiasisCandidal endocarditis |
| T80.2 T82.7 | Infections following infusion, transfusion and therapeutic injectionInfection and inflammatory reaction due to other cardiac and vascular devices, implants and grafts | 996.62 999.3\* | Infection and inflammatory reaction due to other vascular device, implant, and graft Other infection due to medical care not elsewhere classified |
| R78.81 | Bacteremia | 790.7 | Bacteremia |

### Surgical Site Infection (SSI)

|  |  |  |  |
| --- | --- | --- | --- |
| ICD-10-BE |  | ICD-9-CM |  |
| A46 | Erysipelas | 035 | Erysipelas |
| A48.0 | Gas gangrene | 040.0 | Gas gangrene |
| G00 G01 | Bacterial meningitis, not elsewhere classifiedMeningitis in bacterial diseases classified elsewhere | 320 | Bacterial meningitis |
| G06 | Intracranial and intraspinal abscess and granuloma | 324 | Intracranial and intraspinal abscess |
| H00 | Hordeolum (externum) (internum) of eyelid | 373.1 373.4 373.5 | Hordeolum and other deep inflammation of eyelidInfective dermatitis of eyelid of types resulting in deformityOther infective dermatitis of eyelid |
| H04.3 | Acute and unspecified inflammation of lacrimal passages | No code specific or equivalent enough to allow comparison |  |
| H16.31 | Corneal abscess | 370.55 | Corneal abscess |
| H60.0 H60.1 | Abscess of external ear Cellulitis of external ear | 380.00 380.01 380.03 380.10 380.11 380.13380.22 | Perichondritis of pinna, unspecifiedAcute perichondritis of pinnaChondritis of pinnaInfective otitis externa, unspecifiedAcute infection of pinnaOther acute otitis externa |
| I30.1  | Infective pericarditis  | 420.90 | Acute pericarditis, unspecified |
| I33 | Acute and subacute endocarditis | 421 | Acute and subacute bacterial endocarditis |
| I40.0 | Infective myocarditis | 422.92  | Septic myocarditis |
| J34.0 | Abscess, furuncle and carbuncle of nose | No code specific or equivalent enough to allow comparison  |  |
| J39.0 J39.1 J39.2 | Retropharyngeal and parapharyngeal abscessOther abscess of pharynxOther diseases of pharynx | 478.21 478.22 478.24  | Cellulitis of pharynx or nasopharynxParapharyngeal abscessRetropharyngeal abscess |
| J85 | Abscess of lung and mediastinum | 513 | Abscess of lung and mediastinum |
| J95.02 | Infection of tracheostomy stoma | 519.01 | Infection of tracheostomy |
| J98.51 | Mediastinitis | 519.2 | Mediastinitis |
| K12.2 | Cellulitis and abscess of mouth | 528.3 682.0 | Cellulitis and abscess of oral soft tissuesCellulitis and abscess of face |
| K61 | Abscess of anal and rectal regions | 566 | Abscess of anal and rectal regions |
| K63.0 | Abscess of intestine | 569.5 | Abscess of intestine |
| K65 K67 K68.1 | Peritonitis Disorders of peritoneum in infectious diseases classified elsewhere Retroperitoneal abscess | 567 | Peritonitis and retroperitoneal infections |
| K75.0 | Abscess of liver | 572.0 | Abscess of liver |
| K94.02 K94.12 K94.22 K94.32 | Colostomy infectionEnterostomy infectionGastrostomy infectionEsophagostomy infection | 569.61 536.41 530.86 | Infection of colostomy or enterostomyInfection of gastrostomy Infection of esophagostomy |
| L02 L03 | Cutaneous abscess, furuncle and carbuncle | 680 681 684 686 | Carbuncle and furuncle Cellulitis and abscess of finger and toe Other cellulitis and abscessImpetigoOther local infections of skin and subcutaneous tissue |
| M00 M01 | Pyogenic arthritisDirect infections of joint in infectious and parasitic diseases classified elsewhere | 711.0 711.4 711.5 711.6 711.8 711.9 | Pyogenic arthritis Arthropathy associated with other bacterial diseasesArthropathy associated with other viral diseasesArthropathy associated with mycoses Arthropathy associated with other infectious and parasitic diseasesUnspecified infective arthritis |
| M46.3 | Infection of intervertebral disc (pyogenic) | No code specific or equivalent enough to allow comparison |  |
| M60.0 | Infective myositis | 728.0 | Infective myositis |
| M65.0 | Abscess of tendon sheath | No code specific or equivalent enough to allow comparison |  |
| M72.6 | Necrotizing fasciitis | 728.86  | Necrotizing fasciitis |
| M86.1 | Other acute osteomyelitis | 730.0 730.8 730.9 | Acute osteomyelitisOther infections involving bone in diseases classified elsewhereUnspecified infection of bone |
| N41.2 | Abscess of prostate | 601.2  | Abscess of prostate |
| N43.1 | Infected hydrocele | 603.1 | Infected hydrocele |
| N48.21 N48.22 | Abscess of corpus cavernosum and penisCellulitis of corpus cavernosum and penis | No code specific or equivalent enough to allow comparison |  |
| N49.3 | Fournier gangrene | No code specific or equivalent enough to allow comparison |  |
| N61.1 | Abscess of the breast and nipple | No code specific or equivalent enough to allow comparison |  |
| N73.0 | Acute parametritis and pelvic cellulitis | 614.3 | Acute parametritis and pelvic cellulitis |
| N73.3 | Female acute pelvic peritonitis | 614.5  | Acute or unspecified pelvic peritonitis, female |
| N76.4 | Abscess of vulva | 616.4  | Other abscess of vulva |
| N99.511 | Cystostomy infection | 596.81  | Infection of cystostomy |
| N99.531 | Infection of continent stoma of urinary tract | No code specific or equivalent enough to allow comparison |  |
| O86.0 | Infection of obstetric surgical wound | No code specific or equivalent enough to allow comparison |  |
| T81.4  | Infection following a procedure | 998.5 | Postoperative infection not elsewhere classified |
| T82.6 | Infection and inflammatory reaction due to cardiac valve prosthesis | 996.61 | Infection and inflammatory reaction due to cardiac device, implant, and graft |
| T83.6 | Infection and inflammatory reaction due to other genitourinary device, implant, and graft | 996.65 | Infection and inflammatory reaction due to other genitourinary device, implant, and graft |
| T84.5 | Infection and inflammatory reaction due to internal joint prosthesis | 996.66  | Infection and inflammatory reaction due to internal joint prosthesis |
| T84.6 T84.7 | Infection and inflammatory reaction due to internal fixation device of unspecified site Infection and inflammatory reaction due to other internal orthopaedic prosthetic devices, implants or grafts | 996.67  | Infection and inflammatory reaction due to other internal orthopedic device, implant, and graft |
| T85.7 | Infection and inflammatory reaction due to other internal prosthetic devices, implants and grafts | 996.60 996.63 996.65 996.68 996.99 | Infection and inflammatory reaction due to peritoneal dialysis catheter |
| T86.03 T86.812 T86.13 T86.23 T86.33 T86.43 T86.822 T86.832 T86.842 T86.852 T86.892 T86.93  | Bone marrow transplant infectionLung transplant infection Kidney transplant infectionHeart-lung transplant infectionHeart transplant infectionLiver transplant infectionSkin graft (allograft) (autograft) infection Bone graft infection Corneal transplant infection Intestine transplant infection Other transplanted tissue infection Unspecified transplanted organ and tissue infection | No code specific or equivalent enough to allow comparison |  |

### Hospital-Acquired Pneumonia/Ventilator-Associated Pneumonia (HAP/VAP)

|  |  |  |  |
| --- | --- | --- | --- |
| ICD-10-BE |  | ICD-9-CM |  |
| B01.2  | Varicella pneumonia | 052.1 | Varicella (hemorrhagic) pneumonitis |
| B05.2 | Measles complicated by pneumonia | 055.1 | Postmeasles pneumonia |
| J10 J11 | Influenza due to other identified influenza virusInfluenza due to unidentified influenza virus | 487 | Influenza |
| J12 | Viral pneumonia, not elsewhere classified | 480 | Viral pneumonia |
| J13 | Pneumonia due to streptococcus pneumoniae | 481 | Pneumococcal pneumonia |
| J14 J15 A48.1 | Pneumonia due to Hemophilus influenzae Bacterial pneumonia, not elsewhere classified Legionnaires' disease | 482 | Other bacterial pneumonia |
| J16 | Pneumonia due to other infectious organisms, not elsewhere classified | 483 | Pneumonia due to other specific organism |
| J17 | Pneumonia in diseases classified elsewhere | 484 | Pneumonia in infectious diseases classified elsewhere |
| J18 | Pneumonia, unspecified organism | 485 486 | Bronchopneumonia, organism unspecifiedPneumonia, organism unspecified |
| J95.851 | Ventilator associated pneumonia | 997.31 997.32 | Ventilator associated pneumoniaPostprocedural aspiration pneumonia |

### Other HAIs

|  |  |  |  |
| --- | --- | --- | --- |
| ICD-10-BE |  | ICD-9-CM |  |
| A02 | Other salmonella infections | 003 | Other salmonella infections |
| A04.7 | Enterocolitis due to Clostridium difficile | 008.45 | Intestinal infection due to Clostridium difficile |
| A08 | Viral and other specified intestinal infections | 008 | Viral and other specified intestinal infections |
| A36 | Diphtheria | 032 | Diphtheria |
| A37 | Whooping cough | 033 | Whooping cough |
| A38 | Scarlet fever | 034 | Streptococcal sore throat and scarlet fever |
| A39 | Meningococcal infection | 036 | Meningococcal infection |
| A48.8 B95 B96 | Other specified bacterial diseasesStreptococcus, Staphylococcus, and Enterococcus as the cause of diseases classified elsewhere Other bacterial agents as the cause of diseases classified elsewhere | 040.89 041 | Other specified bacterial diseasesBacterial infection in conditions classified elsewhere and of unspecified site |
| B01 | Varicella  | 052 | Chickenpox |
| B05 | Measles | 055 | Measles |
| B06 | Rubella | 056 | Rubella |
| B15 | Acute hepatitis A | 070.0 070.1 | Viral hepatitis A with hepatic coma Viral hepatitis A without mention of hepatic coma |
| B16 | Acute hepatitis B | 070.20 070.21 070.30 070.31 | Viral hepatitis B with hepatic coma, acute or unspecified, without mention of hepatitis deltaViral hepatitis B with hepatic coma, acute or unspecified, with hepatitis deltaViral hepatitis B without mention of hepatic coma, acute or unspecified, without mention of hepatitis deltaViral hepatitis B without mention of hepatic coma, acute or unspecified, with hepatitis delta |
| B17 | Other acute viral hepatitis | 070.41 070.42 070.43 070.51 070.52 070.53 | Acute hepatitis C with hepatic comaAcute hepatitis C without mention of hepatic comaHepatitis E with hepatic comaAcute hepatitis C without mention of hepatic comaHepatitis delta without mention of active hepatitis B disease or hepatic comaHepatitis E without mention of hepatic coma |
| B20 | Human immunodeficiency virus [HIV] disease | 042 | Human immunodeficiency virus [HIV] disease |
| B34 B97 | Viral infection of unspecified site Viral agents as the cause of diseases classified elsewhere | 079 | Viral and chlamydial infection in conditions classified elsewhere and of unspecified site |
| B44 | Aspergillosis | 117.3 | Aspergillosis |
| B45 | Cryptococcosis | 117.5 | Cryptococcosis |
| B48.8 B49 | Other specified mycosesUnspecified mycosis | 117.9 118 | Other and unspecified mycosesOpportunistic mycoses |
| B86 | Scabies | 133.0 | Scabies |
| B99.9 | Unspecified infectious disease | 136.9 | Unspecified infectious and parasitic diseases |
| U07.1 | COVID-19 | No code specific or equivalent enough to allow comparison |  |
| Y95 | Nosocomial condition | No code specific or equivalent enough to allow comparison |  |

# References for International Classification of Diseases (ICD) codes

### Hospital-Associated Urinary Tract Infection (HAUTI)

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### Surgical Site Infection (SSI)

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### Hospital-Acquired Pneumonia/Ventilator-Associated Pneumonia

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# Figure 3. Flowchart of the data management process leading to the final database.

Yearly datasets including diagnoses codes and admissions details from 2008 to 2020 (2015 excepted)

HOSPITAL ADMISSIONS

F\_DIAGNOSE\_JOUR\_H

F\_DIAGNOSE\_JOUR\_P

F\_DIAGNOSE\_CLASSIC\_P

F\_DIAGNOSE\_CLASSIC\_H

Renaming of variables
Conversion into .dta format
Merging of datasets

Reshaping from wide to long

F\_DIAGNOSE\_CLASSIC\_H and P

Merging of diagnoses and admissions datasets

Dropping observations from people not living in the Brussels-Capital Region

Dropping psychiatric as main cause of admission and new-borns within maternities

Yearly databases (n=12) including diagnoses and admissions

Merging of all yearly databases

Final database including diagnoses and admissions from 2008 to 2020 (2015 excepted)

# Table 6. Characteristics of all hospital stays from people residing in the Brussels-Capital Region, from 2008 to 2020 (2015 excepted).\*

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 2008 n= 151,934 | 2009 n= 156,640 | 2010 n= 158,242 | 2011n= 159,926 | 2012n= 162,690 | 2013 n= 161,227 | 2014 n= 161,708 | 2016 n= 163,277 | 2017n= 163,421 | 2018n= 166,723 | 2019n= 162,931 | 2020 n= 146,853 | TotalN=1,915,572 |
| Sex†, n % |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  Male | 62,770 41.32% | 64,415 41.13% | 65,445 41.36% | 65,888 41.20% | 67,352 41.40% | 67,630 41.95% | 67,633 41.83% | 69,210 42.39% | 69,343 42.44% | 71,714 43.02%  | 70,452 43.24%  | 64,774 44.11% | 806,626 42.11% |
|  Female | 89,154 58.68% | 92,207 58.87% | 92,784 58.64%  | 94,029 58.80% | 95,330 58.60% | 93,589 58.05% | 94,061 58.17% | 94,058 57.61% | 94,058 57.56% | 94,999 56.98% | 92,465 56.76% | 82,070 55.89% | 1,108,804 57.89% |
| Median age (years), IQR | 53 31-73 | 52 31-73 | 52 31-73 | 52 31-73 | 5331-73 | 53 31-73 | 5331-73 | 52 31-72 | 53 31-72 | 52 31-72 | 53 32-73 | 49 27-71 | 52 31-73 |
| Age category (years), n % |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  <31 | 39,937 26.29% | 41,452 26.47% | 41,263 26.08% | 41,899 26.20% | 41,301 25.39% | 41,103 25.50% | 41,082 25.41% | 41,596 25.48% | 41,468 25.38% | 43,842 26.30% | 40,221 24.69% | 45,492 30.98% | 500,656 26.14%  |
|  ≥31 <52 | 35,849 23.60% | 37,536 23.97% | 38,397 24.27% | 38,602 24.14% | 40,003 24.59% | 39,396 24.44% | 39,525 24.44% | 40,051 24.53% | 39,883 24.41% | 40,174 24.10% | 39,936 24.51% | 33,417 22.76% | 462,769 24.16% |
|  ≥52 <73 | 38,581 25.39% | 39,430 25.18% | 40,541 25.62% | 40,682 25.44% | 41,832 25.71% | 41,831 25.95% | 42,084 26.03% | 43,539 26.67% | 43,493 26.62% | 44,108 26.46% | 44,048 27.04% | 36,216 24.66% | 496,385 25.92% |
|  ≥73 | 37,557 24.72% | 38,204 24.39% | 38,028 24.03% | 38,734 24.22% | 39,546 24.31% | 38,889 24.12% | 39,003 24.12% | 38,082 23.32% | 38,557 23.60% | 38,589 23.15% | 38,712 23.76% | 31,719 21.60% | 455,620 23.79% |

\*Some percentages may not add up due to rounding
†"Modified" and "Undetermined" were omitted from the table and subsequent analyses (total: n=142)

Table 6 continued

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2016 | 2017 | 2018 | 2019 | 2020 | Total |
| Median LOS (days), IQR | 4 2-9 | 4 2-9 | 4 2-8 | 4 2-8 | 4 2-8 | 4 2-8 | 4 2-8 | 31-7 | 31-7 | 31-7 | 31-7 | 32-7 | 4 2-8 |
| ICU stay, n % |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  Yes | 10,104 6.65% | 10,473 6.69% | 11,253 7.11% | 11,283 7.06% | 11,440 7.03% | 11,447 7.10% | 11,931 7.38% | 12,737 7.80% | 12,394 7.59% | 11,338 6.80% | 12,368 7.59% | 10,581 7.21% | 137,349 7.17% |
|  No | 141,820 93.35% | 146,149 93.31% | 146,976 92.89% | 148,634 92.94% | 151,242 92.97% | 149,772 92.90% | 149,763 92.62% | 150,531 92.20% | 151,007 92.41% | 155,375 93.20% | 150,549 92.41% | 136,26392.79% | 1,778,081 92.83% |
| SOI score‡, n % |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  1 (Minor)  | 65,489 43.11% | 67,755 43.26% | 66,874 42.27% | 67,898 42.46% | 67,240 41.34% | 75,218 46.66% | 73,558 45.50% | 79,761 48.86% | 78,328 47.94% | 79,508 47.70% | 76,574 47.01% | 71,207 48.50% | 869,410 45.40% |
|  2 | 52,961 34.87% | 55,524 35.45% | 57,476 36.33% | 56,913 35.59% | 58,411 35.91% | 51,995 32.25% | 51,743 32.00% | 52,839 32.37% | 53,961 33.03% | 54,544 32.72% | 53,717 32.97% | 45,334 30.88% | 645,418 33.70% |
|  3 | 24,830 16.35% | 25,002 15.97% | 25,640 16.21% | 26,251 16.42% | 27,706 17.03% | 27,353 16.97% | 29,261 18.10% | 24,257 14.86% | 24,753 15.15% | 25,907 15.54% | 25,595 15.71% | 23,793 16.21% | 310,348 16.20% |
|  4 (Extreme) | 8,617 5.67% | 8,324 5.32% | 8,209 5.19% | 8,841 5.53% | 9,305 5.72% | 6,641 4.12% | 7,120 4.40% | 6,398 3.92% | 6,332 3.88% | 6,732 4.04 % | 7,018 4.31% | 6,485 4.42% | 90,022 4.70% |

‡Scores encoded as 0 were considered as missing (total: n=232)

Table 6 continued

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2016 | 2017 | 2018 | 2019 | 2020 | Total |
| Place of residence, n % |  |  |  |  |   |  |  |  |  |  |  |  |  |
|  LTCF | 13,825 | 13,200 | 13,408 | 13,659 | 13,493 | 13,321 | 14,240 | 13,091 | 13,245 | 13,417 | 12,756 | 10,773 | 158,428 |
|  | 9.10% | 8.43% | 8.47% | 8.54% | 8.29% | 8.26% | 8.81% | 8.02% | 8.11% | 8.05% | 7.83% | 7.34% | 8.27% |
|  No LTCF | 138,099 | 143,422 | 144,821 | 146,258 | 149,189 | 147,898 | 147,454 | 150,177 | 150,156 | 153,296 | 150,161 | 136,071 | 1,757,002 |
|  | 90.90% | 91.57% | 91.53% | 91.46% | 91.71% | 91.74% | 91.19% | 91.98% | 91.89% | 91.95% | 92.17% | 92.66% | 91.73% |

Data Source: Minimal Hospital Dataset (MHD), Belgian Federal Public Service Health Food Chain Safety and Environment.
**Note.** IQR, interquartile range. LOS, length of stay. ICU, intensive care unit. SOI, severity of illness. LTCF, long-term care facility.

# Table 7. Crude prevalences of hospital-associated infections (HAIs) among hospitalized people from the Brussels-Capital Region, from 2008 to 2020 (2015 excepted).

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 2008 n= 151,934 | 2009 n= 156,640 | 2010 n= 158,242 | 2011n= 159,926 | 2012n= 162,690 | 2013 n= 161,227 | 2014 n= 161,708 | 2016 n= 163,277 | 2017n= 163,421 | 2018n= 166,723 | 2019n= 162,931 | 2020 n= 146,853 | TotalN=1,915,572 |
| HAUTI, % (95% CI) | 1.69 (1.63 to 1.76) | 1.57 (1.51 to 1.64) | 1.59 (1.53 to 1.65) | 1.73 (1.67 to 1.80) | 1.62 (1.56 to 1.68) | 1.26 (1.21 to 1.32) | 0.71 (0.67 to 0.76) | 0.86 (0.82 to 0.91) | 0.90 (0.85 to 0.94) | 0.93 (0.88 to 0.97) | 0.84 (0.80 to 0.89) | 0.93 (0.88 to 0.98) | 1.22 (1.20 to 1.23) |
| HABSI, % (95% CI) | 0.59 (0.55 to 0.63) | 0.61 (0.57 to 0.65) | 0.65 (0.61 to 0.69) | 0.67 (0.63 to 0.72) | 0.75 (0.71 to 0.80) | 0.55 (0.52 to 0.59) | 0.28 (0.26 to 0.31) | 0.43 (0.40 to 0.47) | 0.42 (0.39 to 0.46) | 0.48 (0.45 to 0.52) | 0.48 (0.44 to 0.51) | 0.57 (0.54 to 0.61) | 0.54 (0.53 to 0.55) |
| SSI, % (95% CI) | 0.48 (0.44 to 0.51) | 0.51 (0.47 to 0.54) | 0.50 (0.47 to 0.54) | 0.55 (0.52 to 0.59) | 0.59 (0.55 to 0.63) | 0.41 (0.38 to 0.44) | 0.23 (0.21 to 0.25) | 0.36 (0.33 to 0.39) | 0.36 (0.33 to 0.39) | 0.37 (0.34 to 0.40) | 0.38 (0.36 to 0.42) | 0.34 (0.31 to 0.37) | 0.42 (0.41 to 0.43) |
| HAP/VAP, % (95% CI) | 0.73 (0.69 to 0.77) | 0.76 (0.71 to 0.80) | 0.76 (0.72 to 0.81) | 0.70 (0.66 to 0.74) | 0.78 (0.74 to 0.83) | 0.58 (0.55 to 0.62) | 0.34 (0.31 to 0.37) | 0.49 (0.45 to 0.52) | 0.46 (0.43 to 0.49) | 0.52 (0.48 to 0.55) | 0.52 (0.48 to 0.55) | 0.72 (0.68 to 0.77) | 0.61 (0.60 to 0.62) |
| Other HAIs, % (95% CI) | 1.38 (1.33 to 1.44) | 1.26 (1.21 to 1.32)  | 1.34 (1.29 to 1.40) | 1.43 (1.37 to 1.49) | 1.43 (1.37 to 1.48) | 1.08 (1.03 to 1.14) | 0.63 (0.59 to 0.67) | 1.15 (1.10 to 1.21) | 1.19 (1.13 to 1.24) | 1.25 (1.20 to 1.30) | 1.16 (1.11 to 1.21) | 1.50 (1.44 to 1.56) | 1.23 (1.21 to 1.25) |

Data Source: Minimal Hospital Dataset (MHD), Belgian Federal Public Service Health Food Chain Safety and Environment.
**Note.** HAUTI, hospital-associated urinary tract infection. HABSI, hospital-associated bloodstream infection. SSI, surgical site infection. HAP/VAP, hospital-associated pneumonia/ventilator-associated pneumonia. CI, confidence interval.

# Table 8. Length of stay (LOS) according to hospital-associated infection (HAI) status among hospitalized people from the Brussels-Capital Region, from 2008 to 2020 (2015 excepted).

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 2008  | 2009  | 2010  | 2011 | 2012 | 2013  | 2014  | 2016  | 2017 | 2018 | 2019 | 2020  | Total |
| Median LOS (days), IQR |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  HAI | 2614-48  | 2714-48 | 2614-47 | 2715-48 | 2514-46 | 2614-46 | 2715-49 | 2413-43 | 2514-46 | 2514-43 | 2615-45 | 2615-48 | 2614-47 |
|  Without HAI | 42-8 | 42-8 | 42-8 | 42-8 | 42-7 | 42-7 | 42-7 | 31-7 | 31-7 | 31-7 | 31-7 | 31-6 | 3 1-7 |

Data Source: Minimal Hospital Dataset (MHD), Belgian Federal Public Service Health Food Chain Safety and Environment.

**Note.** IQR, interquartile range.

# Table 9. Distribution of post-hospital discharge destinations, and outcomes, according to hospital-associated infection (HAI) status during original hospitalization from people living in the Brussels-Capital Region between 2008 and 2020 (2015 excepted).§

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 2008 n= 151,934 | 2009 n= 156,640 | 2010 n= 158,242 | 2011n= 159,926 | 2012n= 162,690 | 2013 n= 161,227 | 2014 n= 161,708 | 2016 n= 163,277 | 2017n= 163,421 | 2018n= 166,723 | 2019n= 162,931 | 2020 n= 146,853 | TotalN=1,915,572 |
| Discharged home, n |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  HAI | 3,020  | 2,950 | 3,155 | 3,343 | 3,379 | 2,596 | 1,447 | 1,935 | 1,923 | 2,020 | 1,880 | 1,920 | 29,568 |
|  Without HAI | 131,287 | 135,304 | 136,030 | 138,159 | 140,240 | 139,719 | 139,938 | 139,700 | 141,634 | 145,276 | 142,055 | 127,674 | 1,657,016 |
| Death, n  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  HAI | 850 | 891 | 884 | 892 | 1,013 | 737 | 409 | 465 | 456 | 577 | 523 | 759 | 8,456 |
|  Without HAI | 3,980 | 4,174 | 4,122 | 4,040 | 4,139 | 4,274 | 4,394 | 4,218 | 4,336 | 4,113 | 4,013 | 4,638 | 50,441 |
| Admitted to a LTCF, n |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  HAI | 1,301 | 1,268 | 1,232 | 1,347 | 1,402 | 1,060 | 617 | 845  | 881 | 947 | 891 | 822 | 12,613 |
|  Without HAI | 10,447 | 11,199 | 11,256 | 11,128 | 11,512 | 11,941 | 12,797 | 12,134 | 12,489 | 12,212 | 11,914 | 9,482 | 138,511 |
| Other discharge¶, n  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  HAI | 95 | 94 | 136 | 93 | 112 | 67 | 50 | 137 | 85 | 77 | 97 | 104 | 1,147 |
|  Without HAI | 944 | 742 | 1,414 | 915 | 885 | 825 | 2,042 | 3,834 | 1,597 | 1,491 | 1,544 | 1,445 | 17,678 |

Data Source: Minimal Hospital Dataset (MHD), Belgian Federal Public Service Health Food Chain Safety and Environment.
**Note.** LTCF, long-term care facility.
§Excludes 142 observations.
¶Includes prisons, boarding schools, and unknown.

# Table 10. Distribution of early readmissions (readmission within 30 days after discharge), according to hospital-associated infection (HAI) status from people living in the Brussels-Capital Region between 2008 and 2020 (2015 excepted).§

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 2008 n= 151,934 | 2009 n= 156,640 | 2010 n= 158,242 | 2011n= 159,926 | 2012n= 162,690 | 2013 n= 161,227 | 2014 n= 161,708 | 2016 n= 163,277 | 2017n= 163,421 | 2018n= 166,723 | 2019n= 162,931 | 2020 n= 146,853 | TotalN=1,915,572 |
| No early readmission, n |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  HAI | 4,600 | 4,520 | 4,676 | 4,876  | 5,044 | 3,825 | 2,129 | 2,884 | 2,886 | 3,148 | 2,970 | 3,229 | 44,787 |
|  Without HAI | 131,238 | 135,518 | 136,331 | 137,667 | 140,080 | 139,351 | 141,383  | 142,112 | 145,118 | 148,000 | 144,961 | 131,993 | 1,673,752 |
| Early readmission, n |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  HAI | 666 | 683 | 731 | 799 | 862 | 635 | 394 | 498 | 459 | 473 | 421 | 376 | 6,997 |
|  Without HAI | 15,420 | 15,901 | 16,491 | 16,575 | 16,696 | 17,408 | 17,788 | 17,774 | 14,938 | 15,092 | 14,565 | 11,246 | 189,894 |

Data Source: Minimal Hospital Dataset (MHD), Belgian Federal Public Service Health Food Chain Safety and Environment.
§Excludes 142 observations.

# Table 11. Time between discharge and early readmission (unplanned readmission within 30 days after discharge), according to hospital-associated infection (HAI) status from people living in the Brussels-Capital Region between 2008 and 2020 (2015 excepted).

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2016 | 2017 | 2018 | 2019 | 2020 | Total |
| Median interval between discharge and early readmission (days), IQR |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  HAI | 115-20 | 126-19 | 105-19 | 116-19 | 126-19 | 115-19 | 94-17 | 115-18 | 105-18 | 115-19 | 126-19 | 105-17 | 115-19 |
|  Without HAI | 126-20 | 126-20 | 126-20 | 126-20 | 126-20 | 126-20 | 126-20 | 126-20 | 126-20 | 125-20 | 115-19 | 115-19 | 126-20 |

Data Source: Minimal Hospital Dataset (MHD), Belgian Federal Public Service Health Food Chain Safety and Environment.

**Note.** IQR, interquartile range.

# Table 12. Crude association between hospital-associated infections (HAIs), long-term care facility (LTCF) discharge, and potential confounders.1

|  |  |  |  |
| --- | --- | --- | --- |
|  | LTCF discharge | Odds ratio | p valuea |
|  | No (n=1,764,306) | Yes (n=151,124) | (95% CI) |  |
| HAIs |  |  |  | <0.001 |
|  No | 1,725,135 (92.57%) | 138,511 (7.43%) | Reference |  |
|  Yes  | 39,171 (75.64%) | 12,613 (24.36%) | 4.01 (3.93 to 4.09) |  |
| Sex |  |  |  | <0.001 |
|  Male | 749,702 (92.94%) | 56,924 (7.06%) | Reference |  |
|  Female | 1,014,604 (91.50%) | 94,200 (8.50%) | 1.22 (1.21 to 1.24) |  |
| Age category |  |  |  | <0.001<0.001b |
|  <31 | 491,623 (98.20%) | 9,033 (1.80%) | Reference |  |
|  ≥31 <52 | 453,064 (97.90%) | 9,705 (2.10%) | 1.17 (1.13 to 1.20) |  |
|  ≥52 <73 | 467,204 (94.12%) | 29,181 (5.88%) | 3.40 (3.32 to 3.48) |  |
|  ≥73 | 352,415 (77.35%) | 103,205 (22.65%) | 15.94 (15.59 to 16.29) |  |
| LOS |  |  |  | <0.001 |
|  <4 days | 1,110,119 (97.28%) | 31,004 (2.72%) | Reference |  |
|  ≥4 days | 654,187 (84.49%) | 120,120 (15.51%) | 6.57 (6.49 to 6.66) |  |
| ICU stay |  |  |  | <0.001 |
|  No | 1,643,903 (92.45%) | 134,178 (7.55%) | Reference |  |
|  Yes | 120,403 (87.66%) | 16,946 (12.34%) | 1.72 (1.70 to 1.75) |  |
| SOI score† |  |  |  | <0.001<0.001b |
|  1 (Minor) | 847,070 (97.43%) | 22,340 (2.57%) | Reference |  |
|  2 | 593,363 (91.93%) | 52,055 (8.07%) | 3.33 (3.27 to 3.38) |  |
|  3 | 252,991 (81.52%) | 57,357 (18.48%) | 8.60 (8.46 to 8.74) |  |
|  4 (Extreme) | 70,681 (78.52%) | 19,341 (21.48%) | 10.38 (10.16 to 10.59) |  |
| Residence |  |  |  | <0.001 |
|  No LTCF | 1,674,801 (95.32%) | 82,201 (4.68%) | Reference |  |
|  LTCF | 89,505 (56.50%) | 68,923 (43.50%) | 15.69 (15.50 to 15.88) |  |

Data Source: Minimal Hospital Dataset (MHD), Belgian Federal Public Service Health Food Chain Safety and Environment. **Note.** LOS, length of stay. ICU, intensive care unit. SOI, severity of illness.
1Total N=1,915,430 (excludes 142 observations). †Scores encoded as 0 were considered as missing (total: n=232). aFrom chi-square (χ2) test. bFrom test for linear trend of odds.

# Table 13. Crude association between hospital-associated infections (HAIs), early readmission, and potential confounders.1

|  |  |  |  |
| --- | --- | --- | --- |
|  | Early readmission | Odds ratio | p valuea |
|  | No (n=1,718,539) | Yes (n=196,891) | (95% CI) |  |
| HAIs |  |  |  | <0.001 |
|  No | 1,673,752 (89.81%) | 189,894 (10.19%) | Reference |  |
|  Yes  | 44,787 (85.98%) | 6,997 (14.02%) | 1.38 (1.34 to 1.41) |  |
| Sex |  |  |  | <0.001 |
|  Male | 708,973 (87.89%) | 97,653 (12.11%) | Reference |  |
|  Female | 1,009,566 (91.05%) | 99,238 (8.95%) | 0.71 (0.71 to 0.72) |  |
| Age category |  |  |  | <0.001<0.001b |
|  <31 | 461,498 (92.18%) | 39,158 (7.82%) | Reference |  |
|  ≥31 <52 | 422,541 (91.31%) | 40,228 (8.69%) | 1.12 (1.11 to 1.14) |  |
|  ≥52 <73 | 430,687 (86.76%) | 65,698 (13.24%) | 1.80 (1.77 to 1.82) |  |
|  ≥73 | 403,813 (88.63%) | 51,807 (11.37%) | 1.51 (1.49 to 1.53) |  |
| LOS |  |  |  | <0.001 |
|  <4 days | 1,037,737 (90.94%) | 103,386 (9.06%) | Reference |  |
|  ≥4 days | 680,802 (87.92%) | 93,505 (12.08%) | 1.38 (1.37 to 1.39) |  |
| ICU stay |  |  |  | <0.001 |
|  No | 1,597,027 (89.82%) | 181,054 (10.18%) | Reference |  |
|  Yes | 121,512 (88.47%) | 15,837 (11.53%) | 1.15 (1.13 to 1.17) |  |
| SOI score† |  |  |  | <0.001<0.001b |
|  1 | 811,513 (93.34%) | 57,897 (6.66%) | Reference |  |
|  2 | 569,869 (88.29%) | 75,549 (11.71%) | 1.86 (1.84 to 1.88) |  |
|  3 | 261,412 (84.23%) | 48,936 (15.77%) | 2.62 (2.59 to 2.66) |  |
|  4 | 75,533 (83.91%) | 14,489 (16.09%) | 2.69 (2.64 to 2.74) |  |
| Residence |  |  |  | <0.001 |
|  No LTCF | 1,577,420 (89.78%) | 179,582 (10.22%) | Reference |  |
|  LTCF | 141,119 (89.07%) | 17,309 (10.93%) | 1.08 (1.06 to 1.10) |  |

Data Source: Minimal Hospital Dataset (MHD), Belgian Federal Public Service Health Food Chain Safety and Environment. **Note.** LOS, length of stay. SOI, severity of illness. ICU, intensive care unit. LTCF, long-term care facility.
1Total N=1,915,430 (excludes 142 observations). †Scores encoded as 0 were considered as missing (total: n=232). aFrom chi-square (χ2) test. bFrom test for linear trend of odds.

# Table 14. Odds ratios for the association between hospital-associated infections (HAIs) and both outcomes, adjusted for confounders.1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Odds ratio (95% CI) for LTCF discharge | p valuea | Odds ratio (95% CI) for early readmission | p valuea |
| Unadjusted | 4.01 (3.93 to 4.09) | <0.001 | 1.38 (1.34 to 1.41) | <0.001 |
| Sex | 4.04 (3.96 to 4.13) | <0.001 | 1.37 (1.33 to 1.40) | 0.012 |
| Age category | 2.20 (2.15 to 2.25) | <0.001 | 1.23 (1.20 to 1.26) | <0.001 |
| LOS | 1.92 (1.88 to 1.96) | <0.001 | 1.16 (1.13 to 1.19) | <0.001 |
|  <4 days | 3.61 (3.10 to 4.19) | <0.001b | 1.73 (1.53 to 1.96) | <0.001b |
|  ≥4 days | 1.91 (1.87 to 1.95) | <0.001b | 1.14 (1.11 to 1.17) | <0.001b |
| ICU stay | 3.48 (3.41 to 3.55) | <0.001 | 1.34 (1.30 to 1.37) | 0.006 |
| SOI score | 1.63 (1.59 to 1.66) | <0.001 | 0.87 (0.85 to 0.90) | <0.001 |
| Residence | 2.42 (2.36 to 2.47) | <0.001 | 1.36 (1.33 to 1.40) | <0.001 |

Data Source: Minimal Hospital Dataset (MHD), Belgian Federal Public Service Health Food Chain Safety and Environment. **Note.** LOS, length of stay. ICU, intensive care unit. SOI, severity of illness.
1Total N=1,915,430 (excludes 142 observations).
aFrom chi-square (χ2) test of homogeneity of odds ratios.

bFor effect within stratum.