**Supplementary Online Content**

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**Methods**

***Details on multiple segmented mixed-effect Poisson regression models***

To analyse the relationship between the infection control programme (intervention) and the primary outcome, we applied multiple segmented mixed-effect Poisson regression models with a random slope. We included the wards on which the HAI was acquired as a random effect. The response was the weekly aggregated and ward-stratified number of observed HAIs. The offset was the similarly aggregated number of patient days at risk. The fixed effects included the binary surveillance period and the segmenting components (time since study initiation [week] and time since intervention [week]; both linear). Note that the effects of the multifaceted infection control programme, if present, were reflected by the surveillance period indicator and/or the time since intervention variable. The time since study initiation variable reflects the effects of the study conduct if present. Further covariates were the characteristics of the patients at risk (mean Charlson comorbidity index, ratio of males to females, mean age; all linear), external factors (season; categorical) and quality indicators of infection diagnosis (number of blood cultures; linear). We built five nested regression models with an increasing number of independent variables: (I) model of the surveillance period and segmenting components; (II-IV) model (I) extended by one of the other covariate groups (characteristics of the patients at risk, external factors, and quality indicators); and (V) complete model with all covariates. To analyse the secondary outcome of severe HAIs, we applied a similar Poisson regression modelling approach. However, because of fewer events, the data were aggregated monthly. We reported the adjusted incidence rate ratios (aIRR) together with the 95% confidence intervals (CI) and corresponding p-values (unadjusted for multiple testing).

***Surveillance***

HAIs were defined as infections not present or incubating upon admission to the JUH. Infections present upon admission were only considered HAIs if they were surgical site infections (SSIs) related to surgery performed at the JUH within the preceding 30 days (or within 1 year if an implant was placed). The patients in general wards were pre-screened based on the initiation of antimicrobial therapy**.** In detail, the patients were electronically reported on a daily basis if they had a new onset of antimicrobial therapy ≥ 48 hours (excluding antimicrobial prophylaxis for any reason) after hospital admission and displayed at least one risk factor for HAI during their current hospital stay (i.e., intravenous catheter, indwelling urinary tract catheter, or surgical procedure). In contrast, all patients in the ICUs were screened for HAIs.

**Baseline**

***Infection prevention activities prior study initiation***

Until the beginning of the study, infection control professionals (one physician and four nurses) focused primarily on non-patient-centred hospital hygiene. Main focus was set on environmental cleaning and disinfection, including water and environmental hygiene sampling. There was no systematic surveillance and feedback for HAIs. Alcohol handrub solution was available throughout the hospital (1 dispenser at point of care per 2.5-3 patients). Hand hygiene training, promotion or compliance observations were not performed. For the prevention of the most common HAIs each hospital department already performed single items of the later recommended infection prevention bundles (for details see table S2).**Table S1.** Departments under surveillance for healthcare-associated infections.

|  |  |
| --- | --- |
| **Department** | **Number of beds** |
| Cardiology, Angiology, and Pneumology  Ward No.1  Ward No.2  Ward No.3 | 108  36  39  33 |
| Nephrology, Rheumatology  Ward No.1  Ward No.2  Ward No.3 | 85  27  27  31 |
| Gastroenterology, Hepatology, Infectiology  Ward No.1  Ward No.2 | 59  31  28 |
| Haematology/Oncology (without Bone Marrow Transplant Unit)  Ward No.1  Ward No.2  Ward No.3 | 84  30  27  27 |
| Intensive Care Units (ICU)/ Intermediate Critical Care Unit (IMCU)  Ward No.1 (Anaesthesiologic ICU)  Ward No.2 (Anaesthesiologic ICU)  Ward No.3 (Internal Medicine ICU)  Ward No.4 (Neurological ICU)  Ward No.5 (Anaesthesiologic/Internal Medicine IMCU)\* | 91  26  24  12  10  19 |
| General, Visceral and Vascular Surgery  Ward No.1  Ward No.2  Ward No.3 | 90  36  36  18 |
| Cardiothoracic Surgery  Ward No.1  Ward No.2 | 54  36  18 |
| Trauma and Reconstructive Surgery  Ward No.1  Ward No.2 | 58  36  22 |
| Neurosurgery  Ward No.1  Ward No.2 | 48  38  10 |
| Gynaecology  Ward No.1  Ward No.2  Ward No.3 | 51  10  23  18 |
| Geriatrics  Ward No.1  Ward No.2 | 39  19  20 |
| Neurology  Ward No.1  Ward No.2 | 50  14  36 |

\* only in second surveillance period

**Table S2.** Characterization of interventions, including the start and stop dates of active implementation. VAP – ventilator associated pneumonia; CAUTI – catheter-related urinary tract infection; SSI – surgical site infection; CLABSI – central line-associated bloodstream infections; ICU – intensive care unit.

| **Bundle** | **Intervention** | **from - to** | **Comment** |
| --- | --- | --- | --- |
| Hand- hygiene  promotion | * Staff training & education * Promotion of hand hygiene / poster campaign * Improvement of product accessibility * Feedback of performance indicators | 10/2012 – 08/2014 | * Mandatory training (45-60 min) of approximately 2500 healthcare workers * A1-size colour posters that emphasize the importance of hand cleansing, particularly hand disinfection (n = 500). The posters were displayed in 100 strategic areas within the institution (available at <http://www.aktion-sauberehaende.de/ash/global/aktionstage/>) * Promotion of hand hygiene through newsletters, newspaper articles, promotional items, and hand hygiene awareness events * Distribution of individual bottles of handrub solution and mounting of custom-made holders on all beds (Availability before intervention: 1 dispenser at point of care per 2.5-3 patients; after intervention: 1.0 dispensers per patient at point of care) * Results of direct hand hygiene compliance observations were reported using coloured posters displayed on each ward, through hospital newsletters and during personal communication * Amount of alcohol-based handrub solution distributed in the hospital as monitored by the Pharmacy Department was documented * ICU (n = 1): electronic hand hygiene monitoring with feedback |
| VAP bundle | * Implementation of care protocol * pocket card * staff training & education | 03/2013 – 08/2014 | * Bundle items:   + Aseptic technique during endotracheal suctioning, including hand hygiene and sterile gloves   + An endotracheal cuff pressure of at least 20 cm H2O should be checked every 8 hours   + Avoid supine position. Aim to have the head of the bed elevated to at least 30°   + Use chlorhexidine as part of daily oral care (0.12% applied every 8 hours)   Avoid unnecessary manipulation of the endotracheal tube and suctioning   * + Review sedation and stop each day if appropriate   + Assessment for weaning and extubation each day   + Critical assessment of stress ulcer prophylaxis (1° choice: ranitidine)   + Aspiration of subglottic secretions (SSD) should be considered in patients who are expected to be mechanically ventilated for more than 48 hours. * *Comment: All the items in the bundle except SSD were already part of daily care before the study. In the context of the study, these items were strengthened, improved and trained. SSD could not be realized during the study primarily because of financial restrictions.* |
| CAUTI bundle | * Implementation of care protocol * Poster campaign * Staff training & education * Reminder system to remove urinary catheter (paper based in patient’s chart) | 03/2013 – 08/2014 | * Bundle items:   + Use indwelling catheters only when medically necessary. Consider alternatives to indwelling urethral catheters.   + Use aseptic insertion technique with appropriate hand hygiene and gloves.   + Maintain drainage bag below level of bladder at all times.   + Remove catheters when no longer needed.   + Use portable ultrasound bladder scans to detect residual urine amounts   + Maintain good hygiene at the catheter-urethral interface * *Comment: All the items in the bundle except the emphasis on the use of bladder scans were already part of daily care before the study. In the context of the study these items were however strengthened, improved and trained. Sterile closed drainage systems were already in regular use for several years.* |
| SSI bundle | * Re-evaluation of antimicrobial prophylaxis   Pre-operative decolonization with nasal octenidine and octenidine full body wash   * Implementation of clippers for pre-operative hair removal | 03/2013 – 08/2014  01/2014 – 08/2014  08/2013 – 08/2014 | * In all the surgical departments, the current standard for perioperative antimicrobial prophylaxis (PAP) was re-evaluated and the timing of PAP was evaluated. Nevertheless, in the context of the study, the importance of adequate PAP was strengthened. * All the patients undergoing elective cardio-thoracic procedure were instructed to apply octenidine ointment in both nares (every 8 hours) beginning on the day before surgery and shower the night before and on the day of surgery with octenidine liquid soap (for details see) * Hair removal with clippers instead of razors was introduced in all surgical departments. |
| CLABSI bundle | * Implementation of care protocol * Staff training & education * Reminder system to remove vascular catheter (paper based in patient’s chart) | 12/2013 – 08/2014 | * Bundle items:   + Use central lines only when medically necessary. Perform daily audits to assess whether each central line is still needed.   + Follow proper insertion practices (e.g., hand hygiene, adhere to aseptic insertion technique, use maximal sterile precautions, perform proper skin antisepsis (50% 2-propranolol with 1% Povidon-Iodine, avoid femoral site)   + Cover the site with sterile, transparent, semipermeable dressings (1°choice)   + Handle and maintain central lines appropriately (e.g., perform dressing changes using an aseptic technique with clean or sterile gloves and scrub the access port or hub immediately prior to each use with 70% alcohol)   + *Comment: In addition to the use of a sterile full-body drape and sterile, transparent, semipermeable dressings, all other mentioned items of the bundle were already exercised in daily patient care (Instead of a full body drape, a small drape of 70 x 90 cm was previously utilized). In the context of the study, these items were strengthened, improved and trained.* |

**Table S3.** Segmented mixed Poisson regression analyses for the adjusted incidence rate ratios (aIRRs) of healthcare-associated infections in general wards (upper part) and intensive care units (lower part). aIRRs are listed with 95% confidence intervals (CI) and corresponding *P*-values.

| Variables included in the regresssion model | (I) Segments only | | | | (II) Patient characteristics added | | | | (III) External factors added | | | | (IV) Quality indicators added | | | | (V) Complete model | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| aIRR | 95% CI | | *P*-value | aIRR | 95% CI | | *P*-value | aIRR | 95% CI | | *P*-value | aIRR | 95% CI | | *P*-  value | aIRR | 95% CI | | *P-*value |
| *General wards* |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| period [ref.: period 1] | 1.324 | 0.897 | 1.953 | 0.157 | 1.325 | 0.854 | 2.057 | 0.210 | 1.242 | 0.793 | 1.946 | 0.344 | 1.273 | 0.852 | 1.901 | 0.239 | 1.296 | 0.784 | 2.145 | 0.312 |
| time after intervention [week] | 1.009 | 1.003 | 1.015 | 0.002 | 1.009 | 1.003 | 1.016 | 0.004 | 1.008 | 1.002 | 1.014 | 0.014 | 1.008 | 1.002 | 1.014 | 0.011 | 1.009 | 1.002 | 1.017 | 0.018 |
| time since study initiation [week] | 0.994 | 0.988 | 0.999 | 0.018 | 0.993 | 0.988 | 0.999 | 0.031 | 0.995 | 0.989 | 1.001 | 0.099 | 0.995 | 0.989 | 1.000 | 0.071 | 0.994 | 0.986 | 1.001 | 0.079 |
| mean Charlson comorbidity index |  |  |  |  | 1.122 | 1.022 | 1.231 | 0.016 |  |  |  |  | 1.000 | 0.999 | 1.000 | 0.496 | 1.127 | 1.030 | 1.232 | 0.009 |
| ratio male:female |  |  |  |  | 1.136 | 0.947 | 1.364 | 0.170 |  |  |  |  |  |  |  |  | 1.157 | 0.965 | 1.388 | 0.116 |
| mean age [year] |  |  |  |  | 0.991 | 0.954 | 1.029 | 0.631 |  |  |  |  |  |  |  |  | 0.990 | 0.954 | 1.027 | 0.591 |
| season [ref.: summer] |  |  |  |  |  |  |  |  |  |  |  | 0.262 |  |  |  |  |  |  |  | 0.069 |
| autumn |  |  |  |  |  |  |  |  | 1.082 | 0.937 | 1.251 | 0.283 |  |  |  |  | 1.111 | 0.960 | 1.286 | 0.158 |
| winter |  |  |  |  |  |  |  |  | 1.138 | 1.001 | 1.292 | 0.048 |  |  |  |  | 1.211 | 1.042 | 1.408 | 0.013 |
| spring |  |  |  |  |  |  |  |  | 1.040 | 0.933 | 1.160 | 0.477 |  |  |  |  | 1.078 | 0.952 | 1.221 | 0.235 |
| number of blood cultures |  |  |  |  |  |  |  |  |  |  |  |  | 1.000 | 0.999 | 1.000 | 0.496 | 1.000 | 0.999 | 1.001 | 0.570 |
| *Intensive care units* |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| period [ref.: period 1] | 0.666 | 0.363 | 1.223 | 0.190 | 0.618 | 0.332 | 1.150 | 0.129 | 0.688 | 0.383 | 1.237 | 0.212 | 0.694 | 0.326 | 1.473 | 0.341 | 0.592 | 0.267 | 1.310 | 0.196 |
| time after intervention [week] | 0.985 | 0.975 | 0.996 | 0.009 | 0.985 | 0.974 | 0.996 | 0.006 | 0.986 | 0.975 | 0.997 | 0.011 | 0.987 | 0.972 | 1.002 | 0.084 | 0.983 | 0.967 | 0.999 | 0.037 |
| time since study initiation [week] | 1.011 | 1.003 | 1.020 | 0.006 | 1.013 | 1.004 | 1.021 | 0.004 | 1.011 | 1.003 | 1.019 | 0.008 | 1.010 | 0.997 | 1.023 | 0.122 | 1.014 | 1.000 | 1.029 | 0.057 |
| mean Charlson comorbidity index |  |  |  |  | 1.070 | 0.995 | 1.151 | 0.069 |  |  |  |  |  |  |  |  | 1.062 | 0.992 | 1.136 | 0.084 |
| ratio male:female |  |  |  |  | 0.950 | 0.844 | 1.070 | 0.399 |  |  |  |  |  |  |  |  | 0.961 | 0.856 | 1.079 | 0.500 |
| mean age [year] |  |  |  |  | 0.985 | 0.955 | 1.015 | 0.318 |  |  |  |  |  |  |  |  | 0.983 | 0.944 | 1.024 | 0.415 |
| season [ref.: summer] |  |  |  |  |  |  |  |  |  |  |  | <0.001 |  |  |  |  |  |  |  | 0.006 |
| autumn |  |  |  |  |  |  |  |  | 0.921 | 0.840 | 1.010 | 0.082 |  |  |  |  | 0.917 | 0.810 | 1.038 | 0.168 |
| winter |  |  |  |  |  |  |  |  | 0.946 | 0.824 | 1.085 | 0.427 |  |  |  |  | 0.939 | 0.877 | 1.006 | 0.074 |
| spring |  |  |  |  |  |  |  |  | 0.875 | 0.824 | 0.929 | <0.001 |  |  |  |  | 0.855 | 0.767 | 0.954 | 0.005 |
| number of blood cultures |  |  |  |  |  |  |  |  |  |  |  |  | 1.000 | 0.999 | 1.001 | 0.699 | 1.000 | 0.999 | 1.001 | 0.533 |

**Table S4.** Segmented mixed Poisson regression analyses for the adjusted incidence rate ratios (aIRRs) of severe healthcare-associated infections (HAI) in general wards (upper part) and intensive care units (ICUs, lower part). aIRRs are listed with the 95% confidence intervals (CI) and corresponding *P*-values.

| Variables included in the regresssion model | (I) Segments only | | | | (II) Patient characteristics added | | | | (III) External factors added | | | | (IV) Quality indicators added | | | | (V) Complete model | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| aIRR | 95% CI | | *P-*value | aIRR | 95% CI | | *P-*value | aIRR | 95% CI | | *P-*value | aIRR | 95% CI | | *P-*value | aIRR | 95% CI | | *P-*value |
| *General wards* |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| period [ref.: period 1] | 0.822 | 0.329 | 2.052 | 0.675 | 0.891 | 0.357 | 2.221 | 0.804 | 0.557 | 0.199 | 1.561 | 0.266 | 0.841 | 0.365 | 1.938 | 0.684 | 0.862 | 0.353 | 2.102 | 0.744 |
| time after intervention [month] | 1.066 | 1.016 | 1.119 | 0.009 | 1.072 | 1.023 | 1.123 | 0.003 | 1.044 | 0.992 | 1.099 | 0.097 | 1.069 | 1.020 | 1.121 | 0.005 | 1.100 | 1.027 | 1.177 | 0.006 |
| time since study initiation [month] | 0.985 | 0.937 | 1.035 | 0.557 | 0.980 | 0.934 | 1.028 | 0.410 | 1.013 | 0.958 | 1.071 | 0.658 | 0.982 | 0.939 | 1.028 | 0.439 | 0.959 | 0.905 | 1.016 | 0.152 |
| mean Charlson comorbidity index |  |  |  |  | 1.040 | 0.872 | 1.241 | 0.662 |  |  |  |  |  |  |  |  | 1.040 | 0.888 | 1.219 | 0.627 |
| ratio male:female |  |  |  |  | 1.275 | 1.053 | 1.543 | 0.013 |  |  |  |  |  |  |  |  | 1.365 | 1.126 | 1.656 | 0.002 |
| mean age [year] |  |  |  |  | 0.999 | 0.965 | 1.034 | 0.952 |  |  |  |  |  |  |  |  | 0.999 | 0.966 | 1.032 | 0.930 |
| season [ref.: summer] |  |  |  |  |  |  |  |  |  |  |  | 0.067 |  |  |  |  |  |  |  | 0.013 |
| autumn |  |  |  |  |  |  |  |  | 1.509 | 1.082 | 2.105 | 0.015 |  |  |  |  | 1.795 | 1.251 | 2.577 | 0.001 |
| winter |  |  |  |  |  |  |  |  | 1.498 | 1.011 | 2.218 | 0.044 |  |  |  |  | 1.946 | 1.187 | 3.190 | 0.008 |
| spring |  |  |  |  |  |  |  |  | 1.183 | 0.939 | 1.491 | 0.154 |  |  |  |  | 1.483 | 1.063 | 2.069 | 0.020 |
| number of blood cultures |  |  |  |  |  |  |  |  |  |  |  |  | 1.000 | 0.999 | 1.001 | 0.870 | 1.002 | 1.000 | 1.004 | 0.065 |
| *Intensive care units* |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| period [ref.: period 1] | 0.221 | 0.118 | 0.415 | <0.001 | 0.207 | 0.116 | 0.369 | <0.001 | 0.184 | 0.089 | 0.381 | <0.001 | 0.192 | 0.077 | 0.484 | <0.001 | 0.125 | 0.049 | 0.315 | <0.001 |
| time after intervention [month] | 0.895 | 0.864 | 0.928 | <0.001 | 0.891 | 0.862 | 0.921 | <0.001 | 0.881 | 0.854 | 0.909 | <0.001 | 0.881 | 0.835 | 0.929 | <0.001 | 0.847 | 0.815 | 0.880 | <0.001 |
| time since study initiation [month] | 1.111 | 1.083 | 1.141 | <0.001 | 1.118 | 1.094 | 1.143 | <0.001 | 1.129 | 1.100 | 1.158 | <0.001 | 1.131 | 1.072 | 1.193 | <0.001 | 1.176 | 1.112 | 1.244 | <0.001 |
| mean Charlson comorbidity index |  |  |  |  | 1.059 | 0.809 | 1.386 | 0.675 |  |  |  |  |  |  |  |  | 1.250 | 1.046 | 1.493 | 0.014 |
| ratio male:female |  |  |  |  | 0.917 | 0.821 | 1.025 | 0.128 |  |  |  |  |  |  |  |  | 0.976 | 0.773 | 1.232 | 0.838 |
| mean age [year] |  |  |  |  | 0.936 | 0.885 | 0.989 | 0.019 |  |  |  |  |  |  |  |  | 0.870 | 0.833 | 0.909 | <0.001 |
| season [ref.: summer] |  |  |  |  |  |  |  |  |  |  |  | 0.006 |  |  |  |  |  |  |  | <0.001 |
| autumn |  |  |  |  |  |  |  |  | 1.172 | 0.886 | 1.552 | 0.267 |  |  |  |  | 1.286 | 1.115 | 1.484 | 0.001 |
| winter |  |  |  |  |  |  |  |  | 1.207 | 0.960 | 1.519 | 0.108 |  |  |  |  | 1.396 | 1.248 | 1.561 | <0.001 |
| spring |  |  |  |  |  |  |  |  | 1.061 | 0.831 | 1.356 | 0.634 |  |  |  |  | 1.017 | 0.831 | 1.246 | 0.868 |
| number of blood cultures |  |  |  |  |  |  |  |  |  |  |  |  | 0.999 | 0.998 | 1.001 | 0.471 | 0.999 | 0.998 | 1.001 | 0.422 |

**Table S5.** Adjusted hazard ratios with 95% confidence intervals for the surveillance periods in the adjusted multistate model with five states.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **state** |  | **period [ref.: 1]** | **Charlson comorbidity**  **index** | **sex [ref.: male]** | **age [years]** |
| **from** | **to** |
| *general wards* a |  |  |  |  |  |
| hospital admission | acquisition of HAI | 1.083 (0.991, 1.185) | 1.041 (1.030, 1.052) | 0.897 (0.820, 0.981) | 1.008 (1.004, 1.011) |
| hospital admission | hospital discharge alive | 1.022 (1.004, 1.039) | 0.921 (0.917, 0.925) | 1.018 (1.001, 1.036) | 0.999 (0.998, 0.999) |
| hospital admission | in-hospital death due to other cause | 0.921 (0.812, 1.044) | 1.044 (1.029, 1.060) | 0.779 (0.685, 0.885) | 1.036 (1.030, 1.041) |
| acquisition of HAI | hospital discharge alive | 0.971 (0.876, 1.076) | 0.999 (0.980, 1.017) | 1.090 (0.985, 1.208) | 1.007 (1.003, 1.011) |
| acquisition of HAI | in-hospital death due to HAI | 1.274 (0.942, 1.723) | 1.032 (0.982, 1.083) | 0.649 (0.479, 0.878) | 1.017 (1.005, 1.029) |
| acquisition of HAI | in-hospital death due to other cause | 0.962 (0.726, 1.276) | 0.994 (0.942, 1.048) | 0.914 (0.689, 1.212) | 1.024 (1.012, 1.036) |
| *intensive care units* |  |  |  |  |  |
| hospital admission | acquisition of HAI | 1.047 (0.889, 1.233) | 1.010 (0.978, 1.044) | 0.979 (0.833, 1.152) | 1.006 (1.000, 1.011) |
| hospital admission | hospital discharge alive | 1.066 (0.995, 1.142) | 0.977 (0.962, 0.992) | 0.955 (0.892, 1.023) | 1.001 (0.998, 1.003) |
| hospital admission | in-hospital death due to other cause | 0.939 (0.776, 1.136) | 0.920 (0.877, 0.965) | 0.938 (0.775, 1.136) | 1.044 (1.035, 1.052) |
| acquisition of HAI | hospital discharge alive | 1.050 (0.866, 1.273) | 1.024 (0.990, 1.059) | 1.067 (0.886, 1.285) | 1.000 (0.993, 1.006) |
| acquisition of HAI | in-hospital death due to HAI | 0.556 (0.310, 0.996) | 0.910 (0.782, 1.058) | 0.812 (0.436, 1.511) | 1.039 (1.011, 1.067) |
| acquisition of HAI | in-hospital death due to other cause | 0.743 (0.469, 1.177) | 0.953 (0.859, 1.057) | 1.010 (0.634, 1.608) | 1.034 (1.013, 1.054) |

aOne outlier was excluded (a patient with a HAI who was diagnosed extremely late) because the computations could not be run otherwise

**Table S6.**Prevalence and distribution of pathogens in general wards and intensive care units (absolute numbers, %).

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Characteristic** | **General wards** | | | **Intensive care units** | | |
| **Period 1 & 2**  **(28 months)** | **Period 1 (12 months)** | **Period 2 (16 months)** | **Period 1 & 2**  **(28 months)** | **Period 1 (12 months)** | **Period 2 (16 months)** |
| HAIs with positive microbiology | 1,738 (75.7) | 717 (73.3) | 1,021 (77.5) | 1,275 (79.2) | 489 (82.9) | 786 (77.1) |
| among them a |  |  |  |  |  |  |
| *Staphylococcus aureus* | 231 (13.3) | 103 (14.4) | 128 (12.5) | 140 (11.0) | 49 (10.0) | 91 (11.6) |
| Coagulase-negative staphylococci | 306 (17.6) | 112 (15.6) | 194 (19.0) | 263 (20.6) | 106 (21.7) | 157 (20.0) |
| *Enterococcus faecalis* | 288 (16.6) | 118 (16.5) | 170 (16.7) | 222 (17.4) | 98 (20.0) | 124 (15.8) |
| *Enterococcus faecium* (non-VRE) | 204 (11.7) | 75 (10.5) | 129 (12.6) | 179 (14.0) | 80 (16.4) | 99 (12.6) |
| *Enterococcus faecium* (VRE) | 75 (4.3) | 26 (3.6) | 49 (4.8) | 101 (7.9) | 36 (7.4) | 65 (8.3) |
| other Streptococci | 70 (4.0) | 32 (4.5) | 38 (3.7) | 39 (3.1) | 12 (2.5) | 27 (3.4) |
| *Streptococcus pneumoniae* | 6 (0.3) | 2 (0.3) | 4 (0.4) | 9 (0.7) | 5 (1.0) | 4 (0.5) |
| other gram-positive | 90 (5.2) | 37 (5.2) | 53 (5.2) | 81 (6.4) | 33 (6.7) | 48 (6.1) |
| *Escherichia coli* | 487 (28.0) | 198 (27.6) | 289 (28.3) | 248 (19.5) | 86 (17.6) | 162 (20.6) |
| *Enterobacter spp.* | 103 (5.9) | 35 (4.9) | 68 (6.7) | 77 (6.0) | 30 (6.1) | 47 (6.0) |
| *Klebsiella (pneumoniae/oxytoca)* | 209 (12.0) | 74 (10.3) | 135 (13.2) | 171 (13.4) | 55 (11.2) | 116 (14.8) |
| *Proteus spp.* | 105 (6.0) | 36 (5.0) | 69 (6.8) | 64 (5.0) | 22 (4.5) | 42 (5.3) |
| *Moraxella* | 1 (0.1) | 0 (0.0) | 1 (0.1) | 0 (0.0) | 0 (0.0) | 0 (0.0) |
| *Serratia spp.* | 41 (2.4) | 22 (3.1) | 19 (1.9) | 46 (3.6) | 16 (3.3) | 30 (3.8) |
| *Citrobacter spp.* | 46 (2.6) | 11 (1.5) | 35 (3.4) | 32 (2.5) | 15 (3.1) | 17 (2.2) |
| *Pseudomonas aeruginosa* | 126 (7.2) | 53 (7.4) | 73 (7.1) | 151 (11.8) | 60 (12.3) | 91 (11.6) |
| *Pseudomonas other* | 7 (0.4) | 3 (0.4) | 4 (0.4) | 11 (0.9) | 4 (0.8) | 7 (0.9) |
| *Acinetobacter spp.* | 22 (1.3) | 8 (1.1) | 14 (1.4) | 25 (2.0) | 4 (0.8) | 21 (2.7) |
| other gram-negative | 50 (2.9) | 19 (2.6) | 31 (3.0) | 39 (3.1) | 14 (2.9) | 25 (3.2) |
| Anaerobes | 51 (2.9) | 23 (3.2) | 28 (2.7) | 31 (2.4) | 9 (1.8) | 22 (2.8) |
| *Candida albicans* | 114 (6.6) | 42 (5.9) | 72 (7.1) | 186 (14.6) | 70 (14.3) | 116 (14.8) |
| other Candida | 37 (2.1) | 23 (3.2) | 14 (1.4) | 75 (5.9) | 47 (9.6) | 28 (3.6) |
| *Aspergillus spp.* | 12 (0.7) | 4 (0.6) | 8 (0.8) | 29 (2.3) | 14 (2.9) | 15 (1.9) |
| *Norwalk virus* | 83 (4.8) | 49 (6.8) | 34 (3.3) | 24 (1.9) | 13 (2.7) | 11 (1.4) |

a Multiple pathogens per HAI possible

**Surveillance Period 1**

Patients at risk

n = 26,943

Patients reported with electronic surveillance in general wards

n = 4,930

Patients with individual assessments for HAI

n = 9,729

Patients discharged from the ICU or IMCU

n = 4,799

**Surveillance Period 2**

Patients at risk

n = 35,211

Patients reported with electronic surveillance in general wards

n = 5,246

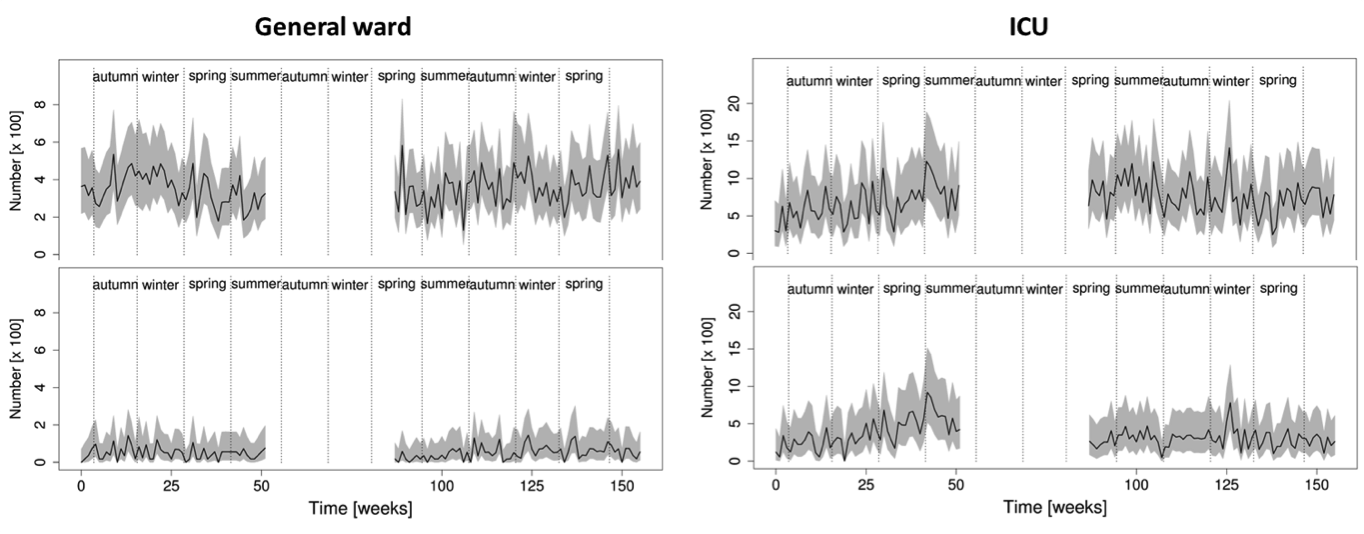
Patients with individual assessments for HAIs

n = 12,400

Patients discharged from the ICU or IMCU

n = 7,154

Figure S1. Flow chart of surveillance of healthcare-associated infections (HAIs). Surveillance period 1 was from 09/2011 to 08/2012 and period 2 was from 05/2013 to 08/2014.



**Figure S2.** Incidence rates of healthcare-associated infections (HAIs) (upper panels) and severe HAIs (lower panels) in general wards and intensive care units (ICUs). Incidence rates are shown as the number per 100,000 patient days at risk. The 95% confidence intervals are shown as grey regions.

**Reference**

[1] Reiser M, Scherag A, Forstner C, Brunkhorst FM, Harbarth S, Doenst T, et al. Effect of pre-operative octenidine nasal ointment and showering on surgical site infections in patients undergoing cardiac surgery. J Hosp Infect 2017;95:137–43.