**Supplemental Table S1** Search strategies

|  |  |  |
| --- | --- | --- |
| **OVID Medline** | 1 | (exp Cross Infection/ or ((nosocomial or hospital or ward or 'health care' or healthcare or central-line-associated or catheter-associated or ventilator-associated or 'surgical site') adj3 infection\*).ti,ab. or (nosocomial adj3 acqui\*).ti,ab. or (CLABSI or CAUTI or VAP or SSI).ti,ab.) and (exp Infection Control/ or exp Bacterial Infections/pc or exp Cross Infection/pc or ((infection\* or incidence or nosocomial) adj3 (control or reduc\* or decrease\* or minimi\* or diminish\* or prevent\*)).ti,ab.) and (clinical trial/ or (((intervention\* or 'before) and after') or before-after).ti,ab. or (pre adj6 post).ti,ab. or (education\* adj1 program\*).ti,ab. or (survey\* adj1 infection\*).ti,ab. or (surveillance adj3 (system\* or program\*)).ti,ab) |
|  | 2 | limit 1 to (yr="2005 -2016" and (english or german)) |
| **EMBASE** |  | 'hospital infection'/exp OR ((nosocomial OR hospital OR ward OR 'health care' OR healthcare OR 'central line associated' OR 'catheter associated' OR 'ventilator associated' OR 'surgical site') NEAR/3 infection\*):ti,ab OR (nosocomial NEAR/3 acqui\*):ti,ab OR clabsi:ti,ab OR cauti:ti,ab OR vap:ti,ab OR ssi:ti,ab AND ('infection control'/exp OR 'infection prevention'/exp OR ((infection OR incidence OR nosocomial) NEAR/3 (control OR reduc\* OR decrease\* OR minimi\* OR diminish\* OR prevent\*)):ti,ab) AND ('intervention study'/exp OR 'nursing intervention'/exp OR intervention\*:ti,ab OR 'before and after':ti,ab OR 'before after':ti,ab OR (pre NEAR/6 post):ti,ab OR (education\* NEAR/1 program\*):ti,ab OR (survey\* NEAR/1 infection\*):ti,ab OR (surveillance NEAR/3 (system\* OR program\*)):ti,ab) AND [2005-2016]/py NOT [conference abstract]/lim AND ([english]/lim OR [german]/lim) |
| **CINAHL** | Query | ((MH "Cross Infection+") OR TI ((nosocomial OR hospital OR ward OR 'health care' OR healthcare OR central-line-associated OR catheter-associated OR ventilatorassociated OR 'surgical site') N3 infection\*) OR TI (nosocomial N3 acqui\*) OR TI (CLABSI OR CAUTI OR VAP OR SSI) OR AB ((nosocomial OR hospital OR ward OR 'health care' OR healthcare OR central-lineassociated OR catheter-associated OR ventilator-associated OR 'surgical site') N3 infection\*) OR AB (nosocomial N3 acqui\*) OR AB (CLABSI OR CAUTI OR VAP OR SSI)) AND ((MH "Infection Control+") OR (MH "Cross Infection/PC") OR (MH "Infection/PC") OR TI ((infection\* OR incidence OR nosocomial) N3 (control OR reduc\* OR decrease\* OR minimi\* OR diminish\* OR prevent\*)) OR AB ((infection\* OR incidence OR nosocomial) N3 (control OR reduc\* OR decrease\* OR minimi\* OR diminish\* OR prevent\*)) ) AND ((MH "Nursing Interventions") OR (MH "Intervention Trials") OR TI (intervention\* OR 'before and after' OR before-after) OR AB (intervention\* OR 'before and after' OR before-after) OR TI (pre N6 post) OR TI (education\* N1 program\*) OR TI (survey\* N1 infection\*) OR TI (surveillance N3 (system\* OR program\*)) OR AB (pre N6 post) OR AB (education\* N1 program\*) OR AB (survey\* N1 infection\*) OR AB (surveillance N3 (system\* OR program\*))) |
|  | Limiters/ expanders | Limiters - Published Date: 20050101 - 20161231; Language: English, German; Search modes - Find all my search terms |
| **PubMed** |  | Search (((((((nosocomial[Title/Abstract] OR hospital[Title/Abstract] OR ward[Title/Abstract] OR "health care"[Title/Abstract] OR healthcare[Title/Abstract] OR central-line-associated[Title/Abstract] OR catheter-associated[Title/Abstract] OR ventilator-associated[Title/Abstract] OR "surgical site"[Title/Abstract])) AND (infection[Title/Abstract] OR infections[Title/Abstract]) OR "nosocomial acquired" [Title/Abstract] OR "nosocomial acquisition"[Title/Abstract] OR (CLABSI[Title/Abstract] OR CAUTI[Title/Abstract] OR VAP[Title/Abstract] OR SSI[Title/Abstract])) AND (((infection[Title/Abstract] OR incidence[Title/Abstract] OR nosocomial[Title/Abstract])) AND (control[Title/Abstract] OR reduced[Title/Abstract] OR reduction[Title/Abstract] OR reducing[Title/Abstract] OR decreased[Title/Abstract] OR decrease[Title/Abstract] OR minimized[Title/Abstract] OR minimization[Title/Abstract] OR minimised[Title/Abstract] OR minimisation[Title/Abstract] OR diminish[Title/Abstract] OR diminishing[Title/Abstract] OR diminished[Title/Abstract] OR prevent[Title/Abstract] OR prevention[Title/Abstract] OR prevented[Title/Abstract] OR preventing[Title/Abstract]))) AND ((intervention[Title/Abstract] OR interventions[Title/Abstract] OR interventional[Title/Abstract] OR "before AND after"[Title/Abstract] OR before-after[Title/Abstract] OR "education program" [Title/Abstract] OR "education programs"[Title/Abstract] OR "educational program"[Title/Abstract] OR "educational programs"[Title/Abstract] OR "surveyed infection"[Title/Abstract] OR "surveyed infections"[Title/Abstract] OR "infection survey" [Title/Abstract] OR "infection surveys"[Title/Abstract]) OR (pre[Title/Abstract] AND post[Title/Abstract] ) OR ((surveillance[Title/Abstract]) AND (system[Title/Abstract] OR systems[Title/Abstract] OR program[Title/Abstract] OR programs[Title/Abstract]))))) AND (((inprocess[sb])) OR (publisher[sb] NOT pubstatusnihms NOT pubstatuspmcsd NOT pmcbook)) Filters: Publication date from 2014/01/01; English; German |
| **The Cochrane Library** | #1 | ((nosocomial or hospital or ward or 'health care' or healthcare or central-line-associated or catheterassociated or ventilator-associated or 'surgical site') near/3 infection\*) or (nosocomial near/3 acqui\*) or (CLABSI or CAUTI or VAP or SSI):ti,ab,kw and (infection or incidence or nosocomial) near/3 (control or reduc\* or decrease\* or minimi\* or diminish\* or prevent\*):ti,ab,kw and (intervention\* or 'before and after' or before-after) or (pre near/6 post) or (education\* near/1 program\*) or (survey\* near/1 infection\*) or (surveillance near/3 (system\* or program\*)):ti,ab,kw (Word variations have been searched) |
|  | #2 | #1Publication Year from 2005 to 2016 |

**Supplementary Table S2** Intervention effects in studies on catheter-associated urinary tract infections reporting aggregated data

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **First Author Year** | **Baseline or control infection rate1** | **Intervention infection rate1** | **Change from baseline** | ***P*-value** |
| Apisarnthanarak 2007 | 21.5/1000 | 5.2/1000 | -75.8% | <0.001 |
| Halperin 2016 | 10.85/1000 | 6.2/1000 | -42.9% | Not reported |
| Maric 2014 | 6.5/1000 | 4.1/1000 | -36.9% | 0.067 |
| Martinez-Resendez 2014 | 16.68/1000 | 20.32/1000 | +21.8% | 0.51 |
| Parry 2013 | 4.78/1000 | 1.53/1000 | -68.0% | Not reported |
| Tillekeratne 2014 | 30.4/1000 | 0/1000 | -100% | 0.002 |
| Titsworth 2012 | 13.3/1000 | 4.0/1000 | -69.9% | <0.001 |

1infection rate as per catheter-days or patient-days, whichever was reported

**Supplementary Table S3** Intervention effects in studies on central-line associated bloodstream infections reporting aggregated data

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **First Author** **Year** | **Baseline or control infection rate1** | **Intervention infection rate**  | **Change from baseline** | ***P*-value** |
| Abboud 2016 | 2.84/1000 | 1.66/1000 | -41.5% | Not reported |
| Bukhari 2014 | 10.1/1000 | 6.5/1000 | -35.6% | Not reported |
| Bion2013 | 3.70/1000 | 1.48/1000 | -60% | <0.001 |
| Collignon 2007 | 0.6/1000 | 0.3/1000 | -50.0% | <0.0005 |
| Frankel 2005 | 11/1000 | 1.7/1000 | -84.5% | <0.0001 |
| Galpern 2008 | 5.0/1000 | 0.9/1000 | -82.0% | <0.001 |
| Grigonis 2016 | 1.28/1000 | 0.96/1000 | -25.0% | 0.01 |
| Maric 2014 | 7.5/1000 | 2.5/1000 | -66.7% | 0.017 |
| Marsteller 2012 | 2.16/1000 | 1.33/1000 | -38.4% | 0.003 |
| Martinez-Resendez 2014 | 14.37/1000 | 15.23/1000 | +6.0% | 0.81 |
| Pronovost 2008 | 2.7/1000 | 0/1000 | -100% | <0.002 |
| Reddy 2014 | 2.41/1000 | 1.14/1000 | -52.7% | <0,001 |
| Remington2016 | 1.2/1000 | 0/1000 | -100% | 0.02 |
| Wahl 2010 | 12/1000 | 4/1000 | -66.7% | 0.03 |
| Zingg 2014 | 2.3/1000 | 0.7/1000 | -69.6% | <0,001 for linear trend |

1infection rate as per catheter-days or patient-days, whichever was reported

**Supplementary Table S4** Intervention effects in studies on surgical site infections reporting aggregated data

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **First Author** **Year** | **Baseline or control infection proportion1** | **Intervention infection proportion1** | **Change from baseline** | ***P*-value** |
| Abboud 2016 | 6.5 | 4.5 | -30.8% | Not reported |
| Ceppa 2013 | 24.8 | 15.2 | -38.7% | <0.03 |
| Liau 2010 | 3.1 | 0.5 | -83.9% | <0.001 |
| Ng 2015 | 8.2 | 4.1 | -50.0% | <0.001 for trend |

1proportion in percent

**Supplementary Table S5** Intervention effects in studies on ventilator-associated pneumonia reporting aggregated data

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **First Author** **Year** | **Baseline or control** **infection rate1 or proportion2** | **Intervention** **infection rate1 or proportion2** | **Change from baseline** | ***P*-value** |
| Abboud 2016 | 1.22/1000 | 1.43/1000 | +17.2% | Not reported |
| Alsadat 2012 | 30/1000 (Hospital 1) 24/1000 (Hospital 2)12/1000 (Hospital 3) | 6.4/1000 (Hospital 1) 19/1000 (Hospital 2)4.9/1000 (Hospital 3) | -78.7% (Hospital 1) -20.8% (Hospital 2)-59.2% (Hospital 3) | Not reported |
| Ban 2011 | 17.38/1000 | 11.04/1000 | -36.5% | 0.074 |
| Berenholtz2011 | 5.5/1000 | 0/1000 | -100% | <0.001 |
| Bird 2010 | 10.2/1000 | 3.4/1000 | -66. 7% | Not reported |
| Cachecho2012 | 7.8/1000 | 1.4/1000 | -82.1% | <0.05 |
| Chen 2014 | 1.5 | 0 | -100% | Not reported |
| Khan 2016 | 8.6/1000 | 2.0/1000 | -76.7% | <0.0001 |
| Maric 2014 | 28.4/1000 | 26.5/1000 | -6.7% | 0.055 |
| Martinez-Resendez 2014 | 17.47/1000 | 12.40/1000 | -29.0% | 0.086 |
| Micik 2013 | 13.4/1000 | 7.69/1000 | -42.6% | Not reported |
| Miller2016 | 2.7/1000 | 1.6/1000 | -40.7% | Not reported |
| Mohamed 2014 | 23/1000 | 14/1000 | -39.1% | Not reported |
| Morris 2011 | 32/1000 | 12/1000 | -62.5% | <0.001 |
| Parisi 2016 | 21.6/1000 | 11.6/1000 | -46. 3% | 0.01 |
| Perez-Granda 2014 | 23.92/1000 | 13.49/1000 | -43.6% | 0.005 |
| Rello 2013 | 12.9/1000 | 9.28/1000 | -28. 1% | <0.05 |
| Sen 2016 | 15.4/1000 | 9.1/1000 | -40.9% | ns |
| Shitrit 2015 | 5.97/1000 | 2.34/1000 | -60.8% | <0.001 |
| Viana 2013 | 18.6/1000 | 11.8/1000 | -36.6% | 0.002 |
| Wahl 2010 | 42/1000 | 13/1000 | -69.1% | 0.001 |
| Youngquist2007 | 6.01/1000 (Site 1)2.66/1000 (Site 2) | 2.7/1000 (Site 1)0/1000 (Site 2) | -55.1% (Site 1)-100% (Site 2) | Not reportedNot reported |

1infection rate as per ventilator-days or patient-days, whichever was reported

2proportion in percent

Abbreviation: ns, not significant

**Supplementary Table S6** Risk of bias assessment in included studies with designs other than uncontrolled before-and-after

|  |
| --- |
| **Randomized controlled trials or controlled before-and-after studies** |
| **First Author** **Year** | **Study design** | **Adequate sequence generation?** | **Allocation concealment?** | **Blinding?** | **Incomplete outcome data addressed?** | **Free of selective reporting?** | **Free of other bias?** | **Baseline outcomes similar?** | **Free of contamination?** | **Baseline characteristics similar?** | **Overall risk of bias** |
| Abbasinia2016 | RCT |  |  |  |  |  |  |  |  |  |  |
| Anthony 2011 | RCT |  |  |  |  |  |  |  |  |  |  |
| Chen 2016 | RCT |  |  |  |  |  |  |  |  |  |  |
| Marsteller 2012 | Cluster-RCT |  |  |  |  |  |  |  |  |  |  |
| Mody 2015 | Cluster-RCT |  |  |  |  |  |  |  |  |  |  |
| O'Neil 2016 | CBA |  |  |  |  |  |  |  |  |  |  |
| **Interrupted time-series study** |
| **First Author** **Year** | **Study design** | **Intervention independent?** | **Analyzed appropriately?** | **Shape of effect pre-specified?** | **Unlikely to affect data collection?** | **Blinding?** | **Incomplete outcome data addressed?** | **Free of selective reporting?** | **Free of other bias?** |  | **Overall risk of bias** |
| Ng 2015 | ITS |  |  |  |  |  |  |  |  |  |  |

Abbreviations: RCT, randomized controlled trial; CBA, controlled before-and-after desgn; ITS, interrupted time-series study

Note: red cells indicate high risk of bias, orange cells indicate unknown risk of bias, green cells indicate low risk of bias.