**SUPPLEMENTARY MATERIAL**

**The prevalence of healthcare-associated infections in Mainland China – A systematic review and meta-analysis**

**Supplementary table 1A.** Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) checklist [1](#_ENREF_1)

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameters** | **Item** | **Criteria** | **Yes/No** |
| **Introduction** |  |  |  |
| Background/rationale | 1 | The study explains the specific background and rationale for HAI prevalence |  |
| Objectives | 2 | To assess the HAI prevalence in Chinese hospitals |  |
| **Methods** |  |  |  |
| Study design | 3 | Point prevalence survey/cross-sectional study |  |
| Settings | 4 | General hospitals, children hospitals, hospitals for maternal and child health, and/or oncology hospitals |  |
| Participants | 5 | Hospitalized adults, children and/or neonates |  |
| Variables | 6 | Author, publication year, timescale of study, number of hospitals in the study, patients with HAI, type of infection, \*[isolated pathogens, MDROs, prevalence by department (ICU, internal medicine, surgery, pediatric)] |  |
| Data sources | 7 | Investigator actively collected data from the patient’s (electronic) information system |  |
| Bias | 8 | The study provides information on assessment of bias |  |
| Study sample size | 9 | The study reports sample sizes for the different hospital settings |  |
| Statistical methods | 10 | The study explains applied statistical methods:   * Descriptive analysis of overall prevalence * Distribution of HAIs * Distribution of microorganism isolations |  |
| **Results** |  |  |  |
| Descriptive data | 11 | * Prevalence of HAI prevalence stratified by hospitals (e.g. General hospitals, children hospitals, hospitals for maternal and child health, and oncology hospitals) * Type of infections (URTI, LRTI, UTI, SSI, BSI, GI, IA, STI, OTH) * \*(microorganism pathogens causing HAI) |  |
| **Discussion** |  |  |  |
| Key results | 12 | Key results are summarized with reference to study objectives |  |
| Limitations | 13 | Limitations are sufficiently discussed |  |
| Interpretation | 14 | Overall interpretation of results is based on the findings and in the context of the evidence base |  |
| Generalizability | 15 | Generalizability (external validity) of the study results is discussed |  |
| **Total** |  |  |  |

**Supplementary table 1B.** Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) quality assessment criteria [1](#_ENREF_1)

|  |  |
| --- | --- |
| **Rating** | **Description** |
| High quality | Fulfilled >75% of STROBE criteria |
| Moderate quality | Fulfilled 50-75% of STROBE criteria |
| Low quality | Fulfilled <50% of STROBE criteria |

**Supplementary table 2A.** Summary of quality assessment – Systematic review on healthcare-associated infections in Mainland China, 2006-2016

|  |  |  |  |
| --- | --- | --- | --- |
| Healthcare setting | Level of quality | Studies  (N) | Weighted prevalence  (95%CI) |
| General hospitals | High | 16 | 2.89 (2.52-3.27) |
| Moderate | 26 | 3.11 (2.79-3.43) |
| Children hospitals | High | 1 | 4.60 (3.39-6.09) |
| Moderate | 13 | 4.35 (2.97-5.74) |
| Low | 5 | 4.49 (2.68-6.29) |
| Maternal and child health hospitals | Moderate | 22 | 1.99 (1.53-2.46) |
| Low | 5 | 1.34 (0.57-2.11) |
| Oncology hospitals | Moderate | 23 | 4.28 (3.37-5.20) |
| Low | 4 | 1.94 (1.04-2.84) |

**Supplementary table 2B.** Study quality assessment – Systematic review on healthcare-associated infections in Mainland China, 2006-2016

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Author** | **Year** | **Province** | **Sample size** | **HAI Patients** | **HAI** | **Quality** |
| **General hospitals** |  |  |  |  |  |  |
| Chen L[2](#_ENREF_2) | 2016 | Guizhou | 7799 | 198 | 207 | moderate |
| Chen L[3](#_ENREF_3) | 2016 | Guizhou | 6541 | 120 | 127 | high |
| Chen P[4](#_ENREF_4) | 2011 | Chongqing | 20432 | 985 | 1174 | moderate |
| Cui Y[5](#_ENREF_5) | 2010 | Shanghai | 49458 | 1962 | 2193 | high |
| Fu T[6](#_ENREF_6) | 2016 | Hainan | 3122 | 170 | 170 | moderate |
| Gan Y[7](#_ENREF_7) | 2011 | Guangxi | 8043 | 156 | 156 | moderate |
| Huang H[8](#_ENREF_8) | 2014 | Fujian | 10643 | 358 | 375 | high |
| Huang W[9](#_ENREF_9) | 2016 | Sichuan | 27144 | 691 | 737 | high |
| Ji Z[10](#_ENREF_10) | 2013 | Hebei | 2183 | 27 | 27 | moderate |
| Li H[11](#_ENREF_11) | 2013 | Guangdong | 21242 | 628 | 689 | high |
| Liu J[12](#_ENREF_12) | 2016 | Beijing | 61990 | 1294 | 1389 | high |
| Liu W[13](#_ENREF_13) | 2011 | Inner Mongolia | 18172 | 462 | 474 | moderate |
| Liu W[14](#_ENREF_14) | 2014 | Inner Mongolia | 31504 | 573 | 614 | moderate |
| Liu W[15](#_ENREF_15) | 2014 | Inner Mongolia | 26940 | 553 | 586 | moderate |
| Liu W[16](#_ENREF_16) | 2015 | Inner Mongolia | 43463 | 871 | 919 | high |
| Liu X[17](#_ENREF_17) | 2012 | Hubei | 23441 | 791 | 829 | moderate |
| Shao Y[18](#_ENREF_18) | 2007 | Anhui | 100742 | 1962 | 1962 | moderate |
| Shen Y[19](#_ENREF_19) | 2013 | Shanghai | 148446 | 5748 | 6405 | high |
| Sun S[20](#_ENREF_20) | 2012 | Hubei | 43646 | 1494 | 1756 | moderate |
| Wei X[21](#_ENREF_21) | 2015 | Jiangsu | 21033 | 630 | 657 | moderate |
| Wu X[22](#_ENREF_22) | 2011 | Fujian | 48947 | 1595 | 1739 | high |
| Xiang Q[23](#_ENREF_23) | 2013 | Sichuan | 74457 | 1966 | 2001 | high |
| Xie D[24](#_ENREF_24) | 2010 | Hubei | 20350 | 790 | 833 | high |
| Xiong W[25](#_ENREF_25) | 2010 | Hubei | 7745 | 309 | 331 | moderate |
| Xu C[26](#_ENREF_26) | 2015 | Hubei | 63320 | 1915 | 2051 | high |
| Xu F[27](#_ENREF_27) | 2011 | Shandong | 11493 | 171 | 196 | moderate |
| Xu X[28](#_ENREF_28) | 2014 | Fujian | 144091 | 5216 | 5620 | moderate |
| Yang H[29](#_ENREF_29) | 2015 | Xinjiang | 66208 | 1211 | 1338 | high |
| Yang L[30](#_ENREF_30) | 2012 | Jiangsu | 9691 | 362 | 382 | moderate |
| Yang L[31](#_ENREF_31) | 2015 | Tianjin | 29513 | 996 | 1106 | high |
| Yu L[32](#_ENREF_32) | 2015 | Xinjiang | 12787 | 369 | 392 | moderate |
| Yu W[33](#_ENREF_33) | 2013 | Hebei | 4390 | 238 | 241 | moderate |
| Yu W[34](#_ENREF_34) | 2013 | Hebei | 4879 | 174 | 191 | moderate |
| Zeng B[35](#_ENREF_35) | 2011 | Fujian | 83787 | 2870 | 3099 | high |
| Zhan R[36](#_ENREF_36) | 2009 | Fujian | 34840 | 1275 | 1360 | moderate |
| Zhang J[37](#_ENREF_37) | 2011 | Guizhou | 29358 | 1025 | 1063 | moderate |
| Zhang L[38](#_ENREF_38) | 2013 | Anhui | 10686 | 264 | 281 | moderate |
| Zhang M[39](#_ENREF_39) | 2015 | Guizhou | 65885 | 1546 | 1643 | moderate |
| Zhang M[40](#_ENREF_40) | 2015 | Guizhou | 143342 | 4030 | 4262 | moderate |
| Zhang W[41](#_ENREF_41) | 2015 | Sichuan | 152475 | 3426 | 3426 | high |
| Zhao Y[42](#_ENREF_42) | 2010 | Yunnan | 5514 | 233 | 233 | moderate |
| Zhu W[43](#_ENREF_43) | 2016 | Shanghai | 12419 | 483 | 512 | moderate |
| **Children's hospitals** | | | | | | |
| Geng R[44](#_ENREF_44) | 2015 | Hebei | 924 | 40 | 44 | moderate |
| Guo Q[45](#_ENREF_45) | 2016 | Guangdong | 997 | 30 | 32 | moderate |
| Hao Y[46](#_ENREF_46) | 2009 | Henan | 140 | 10 | 10 | low |
| Hu M[47](#_ENREF_47) | 2010 | Yunnan | 475 | 28 | 29 | low |
| Hu Y[48](#_ENREF_48) | 2010 | Guangdong | 552 | 28 | 28 | moderate |
| Huang K[49](#_ENREF_49) | 2016 | Hunan | 565 | 28 | 40 | moderate |
| Jia Y[50](#_ENREF_50) | 2011 | Shandong | 442 | 15 | 15 | moderate |
| Liu F[51](#_ENREF_51) | 2014 | Beijing | 1127 | 27 | 28 | low |
| Liu H[52](#_ENREF_52) | 2010 | Henan | 372 | 17 | 18 | moderate |
| Sun L[53](#_ENREF_53) | 2010 | Hebei | 464 | 16 | 16 | moderate |
| Wang J[54](#_ENREF_54) | 2008 | Henan | 507 | 38 | 44 | moderate |
| Wang J[55](#_ENREF_55) | 2015 | Hebei | 999 | 46 | 48 | high |
| Wang X[56](#_ENREF_56) | 2011 | Jiangsu | 626 | 41 | 41 | moderate |
| Xu Y[57](#_ENREF_57) | 2013 | Hebei | 241 | 4 | 4 | moderate |
| Yin A[58](#_ENREF_58) | 2015 | Hunan | 3899 | 233 | 243 | moderate |
| Zhang L[59](#_ENREF_59) | 2010 | Henan | 324 | 26 | 26 | low |
| Zhang L[60](#_ENREF_60) | 2015 | Jiangsu | 1368 | 31 | 33 | low |
| Zhang Y[61](#_ENREF_61) | 2015 | Beijing | 1027 | 8 | 10 | moderate |
| Zhao X[62](#_ENREF_62) | 2015 | Jiangxi | 2424 | 145 | 171 | moderate |
| **Maternal and child health hospitals** | | | | | | |
| Chen T[63](#_ENREF_63) | 2014 | Jiangsu | 720 | 15 | 17 | moderate |
| Deng Y[64](#_ENREF_64) | 2013 | Guangxi | 193 | 9 | 9 | moderate |
| Fan D[65](#_ENREF_65) | 2013 | Sichuan | 188 | 5 | 5 | moderate |
| Fu R[66](#_ENREF_66) | 2013 | Henan | 231 | 2 | 2 | moderate |
| Huang G[67](#_ENREF_67) | 2011 | Guangxi | 639 | 16 | 16 | moderate |
| Huang S[68](#_ENREF_68) | 2014 | Hunan | 2404 | 96 | 105 | moderate |
| Huang X[69](#_ENREF_69) | 2015 | Guangdong | 339 | 8 | 8 | moderate |
| Li H[70](#_ENREF_70) | 2012 | Guangdong | 653 | 12 | 12 | moderate |
| Li H[71](#_ENREF_71) | 2013 | Guangdong | 769 | 12 | 12 | moderate |
| Li H[72](#_ENREF_72) | 2015 | Guangdong | 768 | 9 | 9 | moderate |
| Li S[73](#_ENREF_73) | 2008 | Henan | 265 | 6 | 6 | low |
| Li X[74](#_ENREF_74) | 2012 | Sichuan | 109 | 4 | 4 | moderate |
| Liao Z[75](#_ENREF_75) | 2015 | Jiangxi | 700 | 8 | 8 | moderate |
| Liao Z[76](#_ENREF_76) | 2015 | Jiangxi | 165 | 7 | 7 | moderate |
| Liu Y[77](#_ENREF_77) | 2015 | Guangdong | 283 | 2 | 2 | moderate |
| Nie X[78](#_ENREF_78) | 2012 | Yunnan | 433 | 5 | 5 | moderate |
| Qi L[79](#_ENREF_79) | 2013 | Shandong | 652 | 4 | 4 | low |
| Shang H[80](#_ENREF_80) | 2015 | Xinjiang | 1659 | 16 | 17 | moderate |
| Wang X[81](#_ENREF_81) | 2013 | Shanxi | 126 | 1 | 1 | low |
| Wang Y[82](#_ENREF_82) | 2012 | Shandong | 267 | 14 | 14 | moderate |
| Wen Y[83](#_ENREF_83) | 2014 | Guangdong | 1258 | 33 | 33 | moderate |
| Xie J[84](#_ENREF_84) | 2012 | Zhejiang | 658 | 7 | 7 | moderate |
| Xie L[85](#_ENREF_85) | 2010 | Jiangsu | 560 | 8 | 8 | low |
| Xu C[86](#_ENREF_86) | 2014 | Shandong | 320 | 9 | 9 | low |
| Yun R[87](#_ENREF_87) | 2014 | Inner Mongolia | 311 | 4 | 4 | moderate |
| Zhang Q[88](#_ENREF_88) | 2014 | Jiangxi | 401 | 11 | 11 | moderate |
| Zhao D[89](#_ENREF_89) | 2014 | Guangdong | 1461 | 37 | 39 | moderate |
| **Oncology hospitals** | | | | | | |
| Gong G[90](#_ENREF_90) | 2010 | Jiangsu | 739 | 8 | 9 | moderate |
| Gong G[91](#_ENREF_91) | 2015 | Jiangsu | 890 | 7 | 7 | moderate |
| He G[92](#_ENREF_92) | 2009 | Guizhou | 350 | 15 | 16 | moderate |
| Hou J[93](#_ENREF_93) | 2010 | Henan | 794 | 26 | 26 | low |
| Huang Y[94](#_ENREF_94) | 2011 | Zhejiang | 560 | 26 | 27 | moderate |
| Ji Y[95](#_ENREF_95) | 2013 | Jiangsu | 804 | 32 | 37 | moderate |
| Li L[96](#_ENREF_96) | 2009 | Jiangxi | 1031 | 54 | 54 | moderate |
| Li W[97](#_ENREF_97) | 2013 | Sichuan | 1554 | 87 | 97 | moderate |
| Liu S[98](#_ENREF_98) | 2009 | Henan | 1261 | 57 | 65 | moderate |
| Long J[99](#_ENREF_99) | 2013 | Guizhou | 737 | 36 | 36 | moderate |
| Su J[100](#_ENREF_100) | 2012 | Xinjiang | 3824 | 230 | 230 | moderate |
| Wang M[101](#_ENREF_101) | 2013 | Jiangsu | 836 | 8 | 8 | moderate |
| Wang S[102](#_ENREF_102) | 2014 | Shanghai | 1121 | 23 | 30 | moderate |
| Wang Y[103](#_ENREF_103) | 2016 | Zhejiang | 3286 | 138 | 138 | moderate |
| Wu D[104](#_ENREF_104) | 2016 | Shandong | 5131 | 78 | 81 | low |
| Xu X[105](#_ENREF_105) | 2014 | Zhejiang | 1740 | 90 | 91 | moderate |
| Yang X[106](#_ENREF_106) | 2016 | Hebei | 4856 | 324 | 361 | moderate |
| Yang R[107](#_ENREF_107) | 2013 | Shanxi | 294 | 11 | 12 | moderate |
| Zhai R[108](#_ENREF_108) | 2014 | Shanxi | 1558 | 108 | 120 | moderate |
| Zhang M[109](#_ENREF_109) | 2014 | Shandong | 498 | 15 | 15 | low |
| Zhang X[110](#_ENREF_110) | 2012 | Henan | 2053 | 96 | 100 | moderate |
| Zhao L[111](#_ENREF_111) | 2016 | Shanxi | 5333 | 427 | 458 | moderate |
| Zhao X[112](#_ENREF_112) | 2014 | Henan | 6537 | 254 | 274 | moderate |
| Zheng H[113](#_ENREF_113) | 2013 | Shandong | 321 | 15 | 16 | moderate |
| Zhou H[114](#_ENREF_114) | 2012 | Jiangsu | 742 | 6 | 6 | low |
| Zhou Y[115](#_ENREF_115) | 2009 | Hunan | 1602 | 76 | 76 | moderate |
| Zou Y[116](#_ENREF_116) | 2015 | Jiangsu | 3913 | 87 | 89 | moderate |

**Supplementary Table 3.** Information of healthcare-associated infection and GDP by region

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Region** | **Province** | **Hospital setting, N** | | | | **Total, N** | **Patients** | **HAI** | **HAI prevalence** | **GDP per capita** |
|  |  | GH | CH | MCH | OH |  | N | (N | % (95% CI) | CNY |
| Eastern | Shanghai | 3 |  |  | 1 | 4 | 211,444 | 8216 | 3.73 (3.44-4.03) | 103,796 |
| Jiangsu | 2 | 2 | 2 | 6 | 12 | 41,922 | 1235 | 2.26 (1.57-2.95) | 87,995 |
| Zhejiang |  |  | 1 | 3 | 4 | 6244 | 261 | 3.73 (1.74-5.72) | 77,644 |
| Anhui | 2 |  |  |  | 2 | 111,428 | 2226 | 1.99 (1.91-2.07) | 35,997 |
| Fujian | 5 |  |  |  | 5 | 322,308 | 11,314 | 3.47 (3.32-3.63) | 67,966 |
| Jiangxi |  | 1 | 3 | 1 | 5 | 4,721 | 225 | 3.85 (1.52-6.18) | 36,724 |
| Shandong | 1 | 1 | 3 | 3 | 8 | 19,124 | 321 | 2.05 (1.45-2.64) | 64,168 |
| Southern | Guangdong | 1 | 2 | 7 |  | 10 | 28,322 | 799 | 2.28 (1.66-2.90) | 67,503 |
| Guangxi | 1 |  | 2 |  | 3 | 8875 | 181 | 2.34 (1.42-3.25) | 35,190 |
| Hainan | 1 |  |  |  | 1 | 3122 | 170 | 5.45 (4.68-6.30) | 40,818 |
| Central | Henan |  | 4 | 2 | 4 | 10 | 12,484 | 532 | 4.23 (3.21-5.24) | 39,123 |
| Hubei | 5 |  |  |  | 5 | 158,502 | 5299 | 3.51 (3.18-3.84) | 50,654 |
| Hunan |  | 2 | 1 | 1 | 4 | 8470 | 433 | 4.92 (3.88-5.96) | 42,754 |
| Northern | Beijing | 1 | 2 |  |  | 3 | 64,144 | 1329 | 1.73 (0.80-2.66) | 106,497 |
| Tianjin | 1 |  |  |  | 1 | 29,513 | 996 | 3.37 (3.17-3.59) | 107,960 |
| Hebei | 3 | 4 |  | 1 | 8 | 18,936 | 869 | 3.89 (2.34-5.43) | 40,255 |
| Shanxi |  |  | 1 | 3 | 4 | 7311 | 547 | 4.93 (1.69-8.17) | 34,919 |
| Inner Mongolia | 4 |  | 1 |  | 5 | 120,390 | 2463 | 2.06 (1.82-2.31) | 71,101 |
| Western | Chongqing | 1 |  |  |  | 1 | 20,432 | 985 | 4.82 (4.53-5.12) | 52,321 |
| Sichuan | 3 |  | 2 | 1 | 6 | 255,927 | 6179 | 2.72 (2.37-3.08) | 36,775 |
| Guizhou | 5 |  |  | 2 | 7 | 254,012 | 6970 | 2.78 (2.38-3.19) | 29,847 |
| Yunnan | 1 | 1 | 1 |  | 3 | 6422 | 266 | 3.64 (1.20-6.08) | 28,806 |
| Xinjiang | 2 |  | 1 | 1 | 4 | 84,478 | 1826 | 2.87 (1.69-4.05) | 40,036 |
|  | Overall | 42 | 19 | 27 | 27 | 115 | 1,798,531 | 53,642 | 3.12 (2.94-3.29) |  |

GDP: gross domestic product based on the national bureau of statistics of China (2015); GH: General hospitals; CH: Children hospitals; MCH; Maternal and child health hospitals; OH: Oncology hospitals. Note: The data of GDP per capita and indices in China are derived from China Statistical Yearbook 2016, which was compiled by National Bureau of Statistics of China.[117](#_ENREF_117)

**Supplementary Table 4.** Antimicrobials use in general hospitals, children hospitals, maternal and child health hospitals, and oncology hospitals --- Systematic review on healthcare-associated infections in Mainland China, 2006-2016

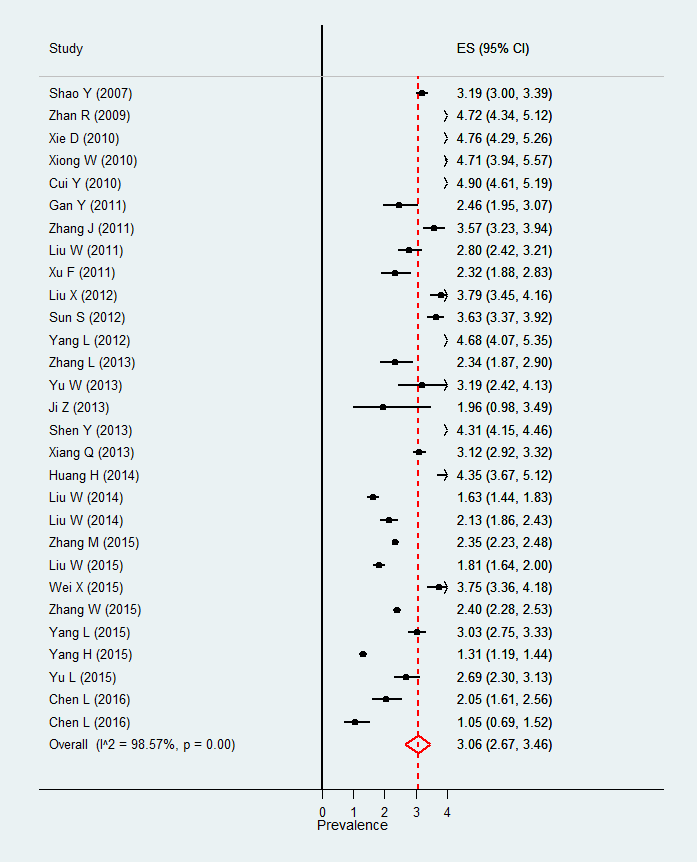
|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Hospital type** | **Publications**  N | **Patients**  N | **Antimicrobial Use**  N | **Proportion**  % |
| General Hospitals | 32 | 1,365,327 | 544,887 | 39.91% |
| Children hospitals | 18 | 13,574 | 9023 | 66.47% |
| Maternal and child health hospitals | 27 | 16,532 | 7381 | 44.65% |
| Oncology hospitals | 26 | 51,334 | 9729 | 18.95% |
| Overall | 103 | 1,446,767 | 571,020 | 39.47% |

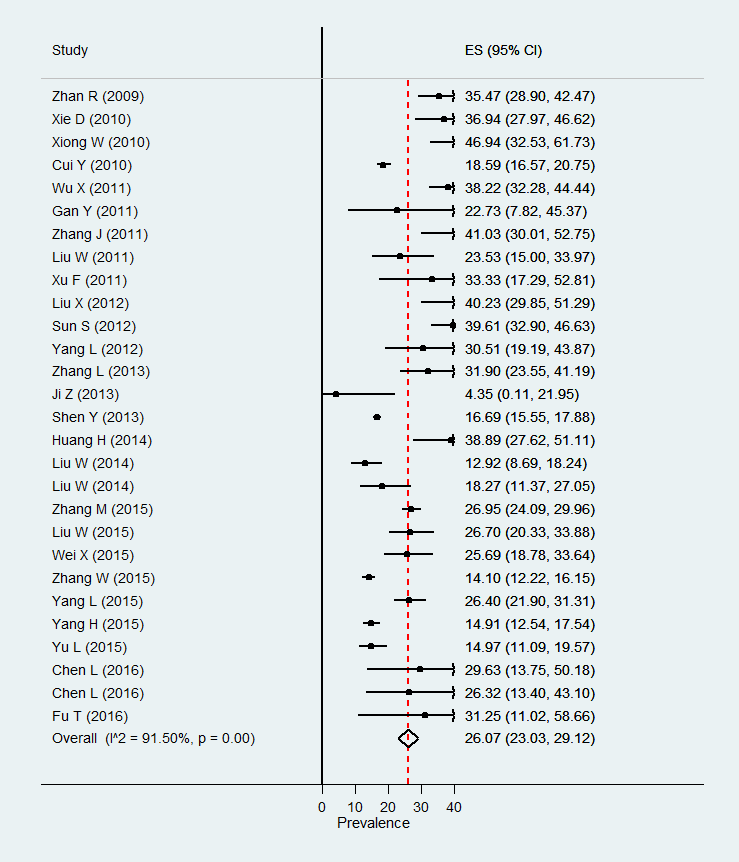
**Supplementary Figure 1.** Weighted prevalence of healthcare-associated infections in the different provinces of China – Systematic review on healthcare-associated infections in Mainland China, 2006-2016

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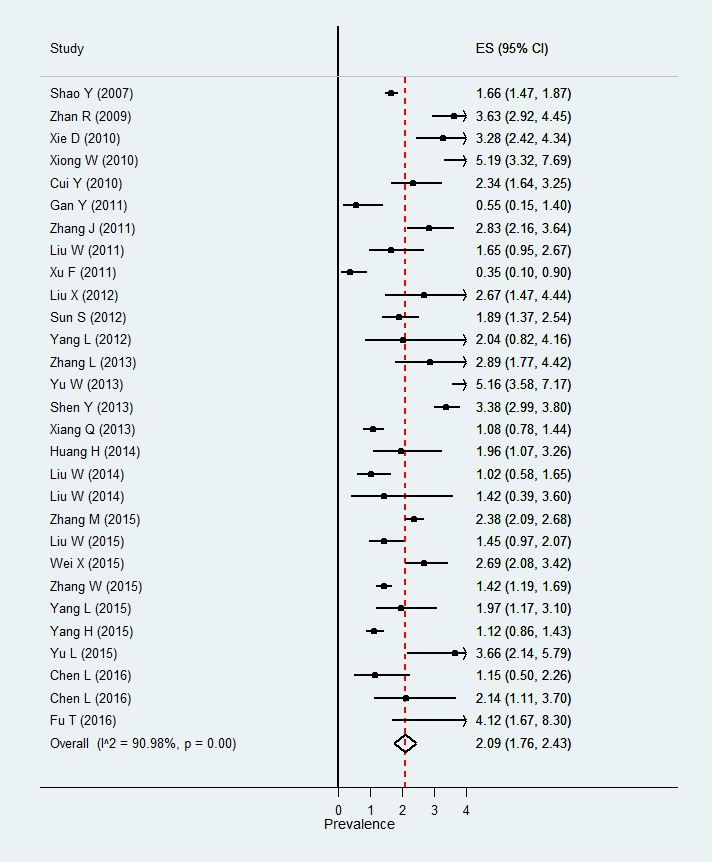
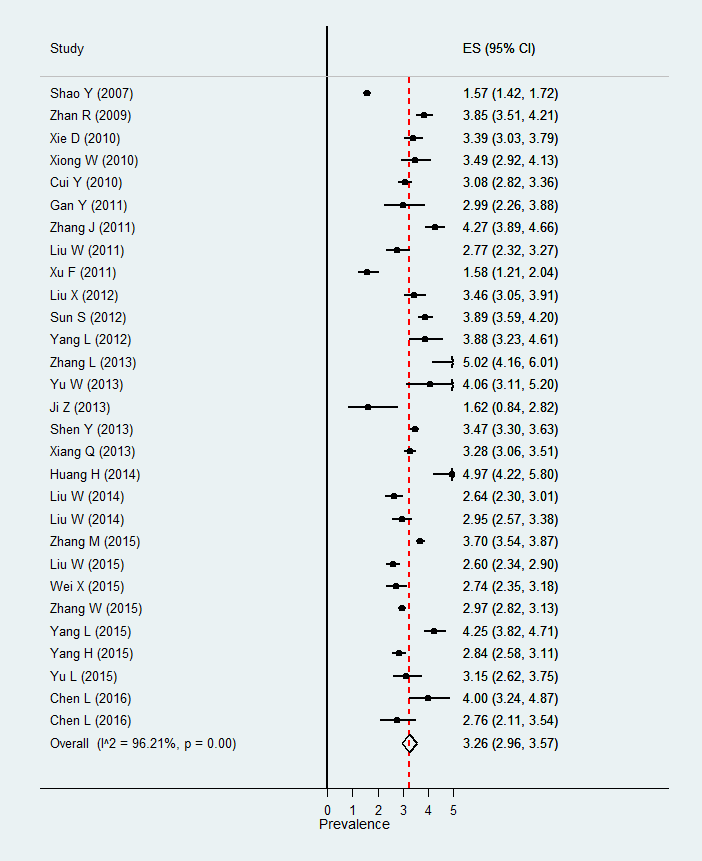
Boxes show prevalence of healthcare associated infections and their 95% confidence intervals. The bars show the 95% CI of the prevalence of healthcare associated infections for the total sample population.

**Supplementary Figure 2.** Weighted point prevalence of healthcare-associated infections in intensive care, internal medicine, surgery, pediatrics, and gynecology and obstetrics in general hospitals – Systematic review on healthcare-associated infections in Mainland China, 2006-2016

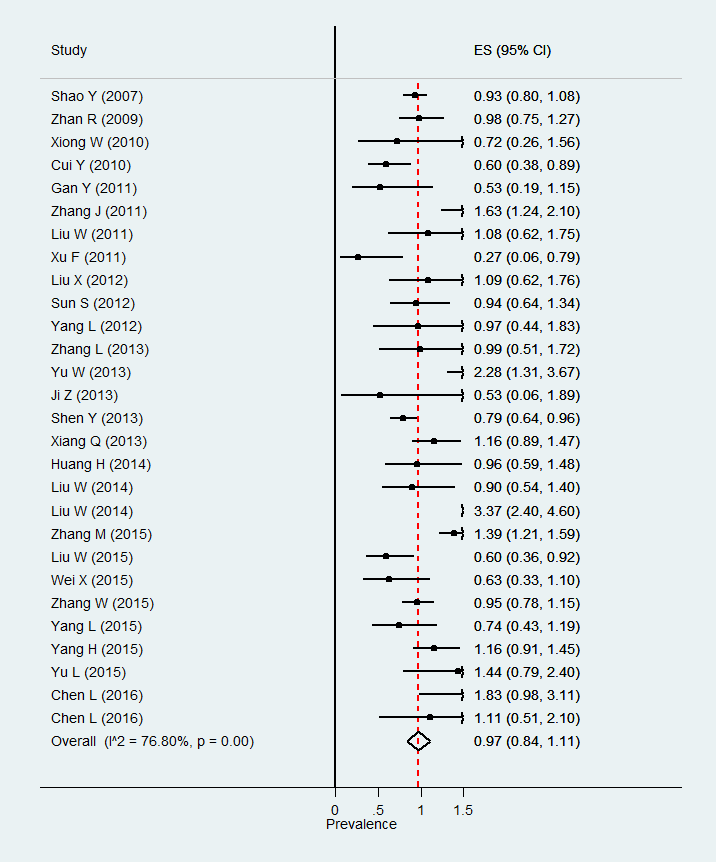
1. Intensive care B. Internal medicine



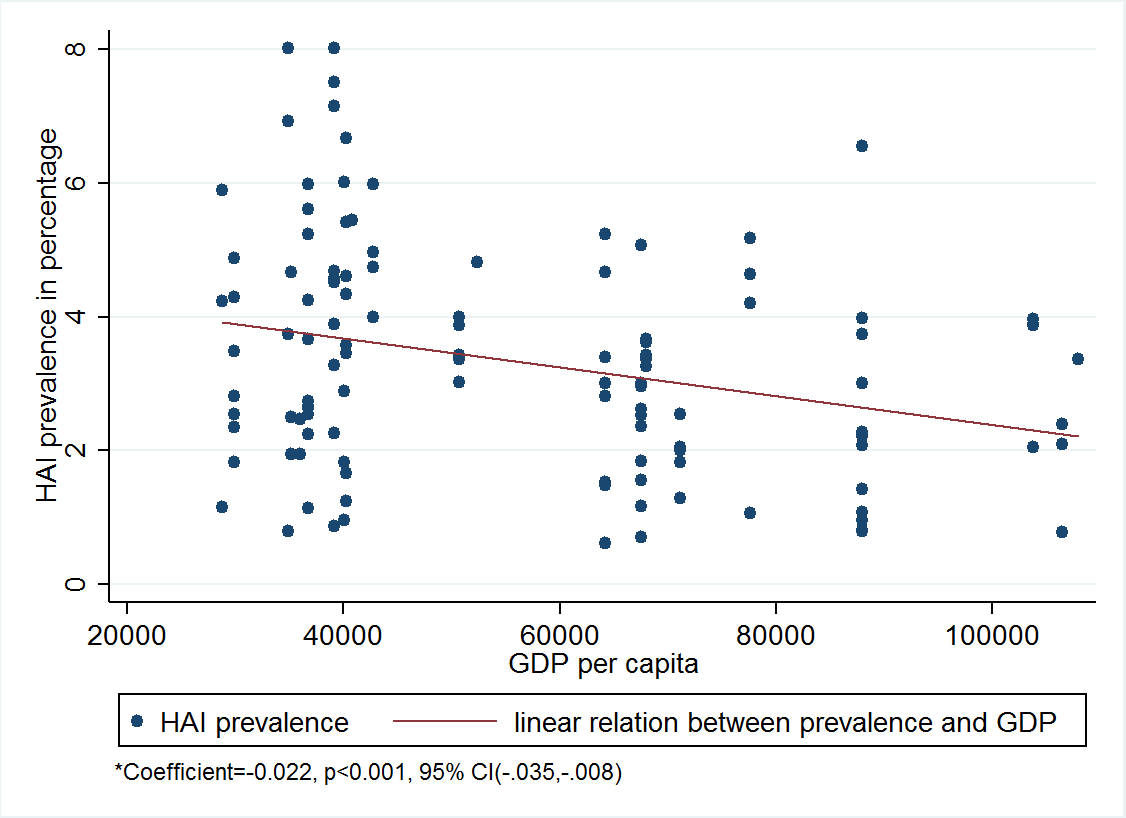
C. Surgery D. Pediatrics



E. Gynecology and obstetrics



**Supplementary Figure 3.** Association of healthcare-associated infection prevalence and gross domestic product per capita in Mainland China – Systematic review on healthcare-associated infections in Mainland China, 2006-2016



\* HAI prevalence decreases by 2.2% with an increase of 1,000 Chinese Yuan (CNY) in GDP per capita.[117](#_ENREF_117)

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