Supplementary Table 1**. Search terms used to identify studies in PubMed and Cochrane databases**

|  |  |  |
| --- | --- | --- |
| **Procedure** | **Recommended drug** | **Search terms used** |
| Colorectal surgery | Cefoxitin | Colorectal surgery AND prophylaxis AND cefoxitin |
|  | Cefotetan | Colorectal surgery AND prophylaxis AND cefotetan |
|  | Cefazolin + metronidazole | Colorectal surgery AND prophylaxis AND cefazolin AND metronidazole |
| Caesarean section | Cefazolin | Caesarean section surgery OR cesarean section AND prophylaxis AND cefazolin |
| Appendectomy | Cefoxitin  | Appendectomy AND prophylaxis AND cefoxitin |
|  | Cefotetan | Appendectomy AND prophylaxis AND cefotetan |
|  | Cefazolin + metronidazole | Appendectomy AND prophylaxis AND cefazolin AND metronidazole |
| Transrectal prostate biopsy | Fluoroquinolones  | Transrectal prostate biopsy OR Transrectal ultrasound-guided prostate biopsy AND prophylaxis AND fluoroquinolones OR quinolones OR ciprofloxacin OR levofloxacin OR ofloxacin OR norfloxacin OR pefloxacin |

Supplementary Table 2. **Multilevel logistic regression model with random intercept for appendectomy**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Odds Ratio | Std. Err. | z | P > z | [95% Conf. | Interval] |
|   |   |   |   |   |   |   |
| year | 1.034358 | 0.06193 | 0.56 | 0.573 | 0.919829 | 1.163147 |
|   |   |   |   |   |   |   |
| loc |   |   |   |   |   |   |
| Australia | 3.140107 | 2.00952 | 1.79 | 0.074 | 0.89581 | 11.0071 |
| Denmark | 1 | (base) |   |   |   |   |
| Korea | 1 | (empty) |   |   |   |   |
| New Zealand | 3.702646 | 1.773568 | 2.73 | 0.006 | 1.44806 | 9.467556 |
| UAE | 0.749729 | 0.520843 | –0.41 | 0.678 | 0.192118 | 2.925775 |
| UK | 1.170925 | 1.248754 | 0.15 | 0.882 | 0.144794 | 9.469094 |
| USA | 1.066902 | 0.553374 | 0.12 | 0.901 | 0.386037 | 2.948632 |

Supplementary Table 3. **Multilevel logistic regression model with random intercept for cesarean section**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Odds Ratio | Std. Err. | z | P > z | [95% Conf. | Interval] |
|   |   |   |   |   |   |   |
| Year | 1.005936 | 0.023835 | 0.25 | 0.803 | 0.960289 | 1.053753 |
|   |   |   |   |   |   |   |
| Location |   |   |   |   |   |   |
| Austria | 0.487528 | 0.251515 | –1.39 | 0.164 | 0.177364 | 1.34009 |
| Canada | 2.290286 | 1.955577 | 0.97 | 0.332 | 0.429621 | 12.2094 |
| Egypt | 1.092498 | 0.810958 | 0.12 | 0.905 | 0.255021 | 4.680209 |
| India | 0.221521 | 0.126874 | –2.63 | 0.008 | 0.072094 | 0.680665 |
| Rwanda | 0.81916 | 0.598458 | –0.27 | 0.785 | 0.19566 | 3.429534 |
| Turkey | 1.069562 | 0.528827 | 0.14 | 0.892 | 0.40583 | 2.818828 |
| USA | 1 | (base) |   |   |   |   |

Supplementary Table 4. **Multilevel logistic regression model with random intercept for colorectal surgery**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Odds Ratio | Std. Err. | z | P > z | [95% Conf. | Interval] |
|   |   |   |   |   |   |   |
| Year | 1.049067 | 0.008954 | 5.61 | <0.001 | 1.031663 | 1.066765 |
|   |   |   |   |   |   |   |
| Location |   |   |   |   |   |   |
| Australia | 0.438834 | 0.10039 | –3.6 | <0.001 | 0.280268 | 0.687109 |
| Canada | 1.599626 | 0.580242 | 1.3 | 0.195 | 0.7857 | 3.256715 |
| Denmark | 0.70535 | 0.187458 | –1.31 | 0.189 | 0.418972 | 1.187476 |
| France | 0.692509 | 0.289565 | –0.88 | 0.38 | 0.305144 | 1.571612 |
| Germany | 0.538729 | 0.152924 | –2.18 | 0.029 | 0.308849 | 0.939709 |
| Greece | 0.760551 | 0.415419 | –0.5 | 0.616 | 0.260732 | 2.21851 |
| Italy | 0.725483 | 0.103129 | –2.26 | 0.024 | 0.54907 | 0.958578 |
| Netherlands | 0.583115 | 0.31473 | –1 | 0.318 | 0.202454 | 1.679504 |
| New Zealand | 2.012331 | 1.354736 | 1.04 | 0.299 | 0.537843 | 7.529098 |
| South Africa | 1.111828 | 0.620656 | 0.19 | 0.849 | 0.372281 | 3.320505 |
| Spain | 0.418491 | 0.11668 | –3.12 | 0.002 | 0.242304 | 0.722787 |
| Sweden | 1.640341 | 0.62566 | 1.3 | 0.194 | 0.776727 | 3.464176 |
| UK | 1.512174 | 0.306151 | 2.04 | 0.041 | 1.01688 | 2.248711 |
| USA | 1 | (base) |   |   |   |   |

Supplementary Table 5. **Multilevel logistic regression model with random intercept for colorectal surgery excluding study in reference [46]**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Odds Ratio | Std. Err. | z | P > z | [95% Conf. | Interval] |
|   |   |   |   |   |   |   |
| Year | 1.035629 | 0.016325 | 2.22 | 0.026 | 1.004121 | 1.068125 |
|   |   |   |   |   |   |   |
| Location |   |   |   |   |   |   |
| Australia | 0.644314 | 0.173991 | –1.63 | 0.104 | 0.379524 | 1.093848 |
| Canada | 2.510564 | 1.044675 | 2.21 | 0.027 | 1.110648 | 5.675006 |
| Denmark | 0.983978 | 0.303392 | –0.05 | 0.958 | 0.537691 | 1.800686 |
| France | 0.949748 | 0.416065 | –0.12 | 0.906 | 0.402453 | 2.24131 |
| Germany | 0.783261 | 0.251489 | –0.76 | 0.447 | 0.417448 | 1.469636 |
| Greece | 0.993471 | 0.566929 | –0.01 | 0.991 | 0.324649 | 3.040165 |
| Italy | 1 | (base) |   |   |   |   |
| Netherlands | 0.771398 | 0.434491 | –0.46 | 0.645 | 0.255764 | 2.326584 |
| New Zealand | 2.667361 | 1.848163 | 1.42 | 0.157 | 0.685963 | 10.37201 |
| South Africa | 1.491274 | 0.865593 | 0.69 | 0.491 | 0.478066 | 4.651869 |
| Spain | 0.708211 | 0.247913 | –0.99 | 0.324 | 0.356612 | 1.406467 |
| Sweden | 2.118386 | 0.884902 | 1.8 | 0.072 | 0.934195 | 4.803666 |
| UK | 2.190153 | 0.46065 | 3.73 | <0.001 | 1.45025 | 3.307545 |
| USA | 1.346661 | 0.233991 | 1.71 | 0.087 | 0.95798 | 1.893041 |

Supplementary Table 6. **Multilevel logistic regression model with random intercept for colorectal surgery adjusting for type of surgery and prophylactic antibiotic**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Odds Ratio | Std. Err. | z | P > z | [95% Conf. | Interval] |
|   |   |   |   |   |   |   |
| Year | 1.045897 | 0.013168 | 3.56 | <0.001 | 1.020405 | 1.072026 |
|   |   |   |   |   |   |   |
| Location |   |   |   |   |   |   |
| Australia | 0.448774 | 0.135313 | –2.66 | 0.008 | 0.248528 | 0.810363 |
| Canada | 1.614271 | 0.640446 | 1.21 | 0.227 | 0.741772 | 3.513034 |
| Denmark | 0.691862 | 0.199643 | –1.28 | 0.202 | 0.393004 | 1.217985 |
| France | 0.53693 | 0.270498 | –1.23 | 0.217 | 0.200029 | 1.441257 |
| Germany | 0.533454 | 0.163861 | –2.05 | 0.041 | 0.292169 | 0.974004 |
| Greece | 0.734381 | 0.408786 | –0.55 | 0.579 | 0.246665 | 2.186424 |
| Italy | 0.626785 | 0.136058 | –2.15 | 0.031 | 0.409586 | 0.959162 |
| Netherlands | 0.43749 | 0.27313 | –1.32 | 0.185 | 0.128693 | 1.487244 |
| New Zealand | 1.511548 | 1.12217 | 0.56 | 0.578 | 0.35277 | 6.476672 |
| South Africa | 1.080519 | 0.614246 | 0.14 | 0.892 | 0.354607 | 3.29244 |
| Spain | 0.435443 | 0.144133 | –2.51 | 0.012 | 0.227605 | 0.833071 |
| Sweden | 1.580385 | 0.626483 | 1.15 | 0.248 | 0.726669 | 3.437073 |
| UK | 1.598919 | 0.34446 | 2.18 | 0.029 | 1.048213 | 2.438952 |
| USA | 1 | (base) |   |   |   |   |
|   |   |   |   |   |   |   |
| Antibiotic |   |   |   |   |   |   |
| Cefazolin + metronidazole | 0.593021 | 0.227784 | –1.36 | 0.174 | 0.27933 | 1.258991 |
| Cefotetan | 0.980362 | 0.161351 | –0.12 | 0.904 | 0.710057 | 1.353567 |
| Cefoxitin | 1 | (base) |   |   |   |   |
|   |   |   |   |   |   |   |
| Surgery type |   |   |   |   |   |   |
| Both | 1.603014 | 0.793229 | 0.95 | 0.34 | 0.60776 | 4.228073 |
| Elective | 1 | (base) |   |   |   |   |
| Nonelective | 1.084867 | 0.333126 | 0.27 | 0.791 | 0.594293 | 1.980396 |
| Unknown | 1.290723 | 0.360408 | 0.91 | 0.361 | 0.746711 | 2.231072 |

Supplementary Table 7. **Multilevel logistic regression model with random intercept for transrectal prostate biopsy**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Odds Ratio | Std. Err. | z | P>z | [95% Conf. | Interval] |
|   |   |   |   |   |   |   |
| year | 0.954512 | 0.105564 | -0.42 | 0.674 | 0.768499 | 1.185549 |
|   |   |   |   |   |   |   |
| loc |   |   |   |   |   |   |
| Brazil | 3.64E-07 | . | . | . | . | . |
| Canada | 0.200293 | 0.271919 | -1.18 | 0.236 | 0.013998 | 2.865905 |
| France | 0.329725 | 0.583254 | -0.63 | 0.531 | 0.010291 | 10.56459 |
| Germany | 3.64E-07 | . | . | . | . | . |
| Greece | 0.138651 | 0.220888 | -1.24 | 0.215 | 0.006107 | 3.147713 |
| Italy | 0.804982 | 1.076862 | -0.16 | 0.871 | 0.058492 | 11.07843 |
| Japan | 0.552912 | 1.290972 | -0.25 | 0.8 | 0.005691 | 53.71469 |
| Multi country | 2.384669 | 3.031495 | 0.68 | 0.494 | 0.197398 | 28.80798 |
| Spain | 2.63E-07 | . | . | . | . | . |
| Sweden | 1 | (base) |   |   |   |   |
| Thailand | 2.02231 | 3.288371 | 0.43 | 0.665 | 0.083513 | 48.97127 |
| Turkey | 0.453561 | 0.567239 | -0.63 | 0.527 | 0.039093 | 5.262319 |
| USA | 0.847628 | 0.375303 | -0.37 | 0.709 | 0.355894 | 2.018785 |

Supplementary Table 8. Multilevel logistic regression model with random interceptfor colorectal surgery including only the 22 studies 37,39,42,43,45,47-49,52,53,55,56,61,62,65,67-70,73,74

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Odds Ratio | Std. Err. | z | P>z | [95% Conf. | Interval] |
|   |   |   |   |   |   |   |
| year | 1.036266 | 0.014981 | 2.46 | 0.014 | 1.007316 | 1.066048 |
|   |   |   |   |   |   |   |
| loc |   |   |   |   |   |   |
| Australia | 4.71E-08 | . | . | . | . | . |
| Canada | 1.675278 | 0.699419 | 1.24 | 0.216 | 0.73912 | 3.79716 |
| Denmark | 0.659849 | 0.224791 | -1.22 | 0.222 | 0.338428 | 1.28654 |
| France | 0.30548 | 0.234897 | -1.54 | 0.123 | 0.067679 | 1.378827 |
| Germany | 0.522861 | 0.177373 | -1.91 | 0.056 | 0.268924 | 1.016586 |
| Italy | 0.302112 | 0.233244 | -1.55 | 0.121 | 0.066528 | 1.371933 |
| South Africa | 1.000987 | 0.603506 | 0 | 0.999 | 0.307064 | 3.263077 |
| Spain | 0.478362 | 0.162168 | -2.18 | 0.03 | 0.246147 | 0.929649 |
| UK | 1.416795 | 0.336059 | 1.47 | 0.142 | 0.890031 | 2.255326 |
| USA | 1 | (base) |   |   |   |   |

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