**S2 File: Supplementary results**

 **Results from a second review of incorrectly coded sepsis cases – Identification of reasons for incorrect coding**

A) Implicit coding strategy

False-positive cases identified by implicit sepsis coding (infection and organ dysfunction) resulted from concurrence of infection and organ dysfunction without causality (51%) or that infection or organ dysfunctions were not identifiable retrospectively from manual patient chart review (40%). 9% were SIRS-negative and were not classified as severe sepsis according to our clinical criteria. In false-negative patients, organ dysfunction, infection or both were not coded in 67%, 14% and 17%, respectively. Encephalopathy, respiratory failure and hypotension were coded in 10.5%, 56.1% and 36.7% of cases, respectively.

B) Explicit coding strategy

In cases identified by the explicit coding strategy that were coded false positive (n=13), organ dysfunction was not caused by infection (n=3), infection or organ dysfunction were not identifiable by manual patient chart review (n=7) or patients were SIRS negative and thus not classified as sepsis (n=3). **Supplementary tables**

Table A: Hospital cases ≥18y in Germany per year by ICD code abstraction strategies

|  |  |  |
| --- | --- | --- |
| Characteristic | **ICD abstraction strategies for sepsis** | **ICD abstraction strategies for severe sepsis** |
|  | R codes (R65.0!, R65.1!, R57.2)  | explicit sepsis coding | R codes (R65.1!, R57.2)  | explicit sepsis coding +odf | implicit sepsis coding (inf+odf) |
| 2007 | 105.797 | 181.440 | 52.213 | 98.587 | 474.094 |
| 2008 | 113.810 | 184.849 | 60.811 | 106.216 | 520.856 |
| 2009 | 134.792 | 197.827 | 70.006 | 119.221 | 605.201 |
| 2010 | 156.435 | 214.533 | 86.223 | 136.444 | 688.562 |
| 2011 | 176.111 | 225.335 | 94.661 | 145.746 | 749.146 |
| 2012 | 194.736 | 242.535 | 103.327 | 159.136 | 818.361 |
| 2013 | 216.541 | 264.991 | 113.537 | 176.607 | 929.291 |

Table B: Hospital deaths ≥18y in Germany per year by ICD code abstraction strategies

|  |  |  |
| --- | --- | --- |
| Characteristic | **ICD abstraction strategies for sepsis** | **ICD abstraction strategies for severe sepsis** |
|  | R codes (R65.0!, R65.1!, R57.2)  | explicit sepsis coding | R codes (R65.1!, R57.2)  | explicit sepsis coding +odf | implicit sepsis coding (inf+odf) |
| 2007 | 35.799 | 53.504 | 26.380 | 42.530 | 105.820 |
| 2008 | 37.937 | 54.202 | 30.454 | 45.022 | 114.544 |
| 2009 | 43.561 | 56.436 | 34.018 | 48.387 | 127.332 |
| 2010 | 50.294 | 60.441 | 41.766 | 53.790 | 139.040 |
| 2011 | 53.204 | 60.628 | 44.156 | 54.975 | 143.476 |
| 2012 | 56.153 | 62.898 | 46.373 | 57.451 | 151.617 |
| 2013 | 60.790 | 67.310 | 50.036 | 62.097 | 167.687 |

Table C: Hospital mortality rate of patients ≥18y in Germany per year by ICD code abstraction strategies

|  |  |  |
| --- | --- | --- |
| Characteristic | **ICD abstraction strategies for sepsis** | **ICD abstraction strategies for severe sepsis** |
|  | R codes (R65.0!, R65.1!, R57.2)  | explicit sepsis coding | R codes (R65.1!, R57.2)  | explicit sepsis coding +odf | implicit sepsis coding (inf+odf) |
| 2007 | 34% | 29% | 51% | 43% | 22% |
| 2008 | 33% | 29% | 50% | 42% | 22% |
| 2009 | 32% | 29% | 49% | 41% | 21% |
| 2010 | 32% | 28% | 48% | 39% | 20% |
| 2011 | 30% | 27% | 47% | 38% | 19% |
| 2012 | 29% | 26% | 45% | 36% | 19% |
| 2013 | 28% | 25% | 44% | 35% | 18% |

Table D: Hospital incidence ≥18y in Germany per 100 000 persons ≥18y per year by ICD code abstraction strategies

|  |  |  |
| --- | --- | --- |
| Characteristic | **ICD abstraction strategies for sepsis** | **ICD abstraction strategies for severe sepsis** |
|  | R codes (R65.0!, R65.1!, R57.2) | explicit sepsis coding | R codes (R65.1!, R57.2) | explicit sepsis coding +odf | implicit sepsis coding (inf+odf) |
| 2007 | 155 | 266 | 77 | 144 | 695 |
| 2008 | 167 | 271 | 89 | 155 | 762 |
| 2009 | 197 | 290 | 102 | 175 | 886 |
| 2010 | 229 | 314 | 126 | 199 | 1007 |
| 2011 | 262 | 335 | 141 | 217 | 1115 |
| 2012 | 289 | 360 | 153 | 236 | 1214 |
| 2013 | 320 | 391 | 168 | 261 | 1372 |

Table E: Hospital deaths ≥18y in Germany per 100 000 persons ≥18y per year of discharge by different ICD code abstraction strategies

|  |  |  |
| --- | --- | --- |
| Characteristic | **ICD abstraction strategies for sepsis** | **ICD abstraction strategies for severe sepsis** |
|  | R codes (R65.0!, R65.1!, R57.2) | explicit sepsis coding | R codes (R65.1!, R57.2) | explicit sepsis coding +odf | implicit sepsis coding (inf+odf) |
| 2007 | 52 | 78 | 39 | 62 | 155 |
| 2008 | 56 | 79 | 45 | 66 | 168 |
| 2009 | 64 | 83 | 50 | 71 | 186 |
| 2010 | 74 | 88 | 61 | 79 | 203 |
| 2011 | 79 | 90 | 66 | 82 | 214 |
| 2012 | 83 | 93 | 69 | 85 | 225 |
| 2013 | 90 | 99 | 74 | 92 | 248 |

Table F: Hospital incidence ≥18y in Germany per 100 000 persons ≥18y per year by ICD code abstraction strategies, adjusted to the German population ≥18y in 2010

|  |  |  |
| --- | --- | --- |
| Characteristic | **ICD abstraction strategies for sepsis** | **ICD abstraction strategies for severe sepsis** |
|  | R codes (R65.0!, R65.1!, R57.2)  | explicit sepsis coding | R codes (R65.1!, R57.2)  | explicit sepsis coding +odf | implicit sepsis coding (inf+odf) |
| 2007 | 162 | 279 | 80 | 151 | 733 |
| 2008 | 172 | 280 | 92 | 161 | 792 |
| 2009 | 200 | 294 | 104 | 177 | 902 |
| 2010 | 229 | 314 | 126 | 199 | 1007 |
| 2011 | 259 | 331 | 139 | 214 | 1099 |
| 2012 | 282 | 351 | 149 | 230 | 1181 |
| 2013 | 309 | 379 | 162 | 252 | 1322 |

Table G: Hospital deaths ≥18y in Germany per 100 000 persons ≥18y per year of discharge by different ICD code abstraction strategies, adjusted to the German population ≥18y in 2010

|  |  |  |
| --- | --- | --- |
| Characteristic | **ICD abstraction strategies for sepsis** | **ICD abstraction strategies for severe sepsis** |
|  | R codes (R65.0!, R65.1!, R57.2)  | explicit sepsis coding | R codes (R65.1!, R57.2)  | explicit sepsis coding +odf | implicit sepsis coding (inf+odf) |
| 2007 | 56 | 83 | 41 | 66 | 166 |
| 2008 | 58 | 83 | 46 | 69 | 176 |
| 2009 | 65 | 84 | 51 | 72 | 191 |
| 2010 | 74 | 88 | 61 | 79 | 203 |
| 2011 | 78 | 89 | 65 | 81 | 210 |
| 2012 | 81 | 91 | 67 | 83 | 218 |
| 2013 | 86 | 95 | 71 | 88 | 237 |

Table H: Comparison of clinical sepsis diagnosis according to ACCP/SCCM consensus criteria [1, 2] vs. “sepsis-3” [3] criteria by retrospective chart review

|  |  |  |
| --- | --- | --- |
|  |  | Sepsis 3 Definitions  |
|  | Characteristic | Infection (w/o ODF) | Sepsis | Septic Shock |
| Consensus Definitions  | Infection (w/o SIRS) | 132 | 3 | 0 |
| Sepsis | 6 | 64 | 0 |
| Severe Sepsis | 0 | 17 | 0 |
| Septic Shock | 0 | 5 | 59 |

 **Supplementary figures**

Figure A

Hospital deaths ≥18y in Germany per 100 000 persons ≥18y per year of discharge by different ICD code abstraction strategies, adjusted to the German population ≥18y in 2010

Figure B



Intersecting sets of all reviewed cases with at least a single positive result from ICD code abstraction strategies or at least a diagnosis of infection in chart review; **horizontal bars represent the numbers of patients identified by a specific coding strategy or diagnosed by chart review to have infection with or without (severe) sepsis; vertical bars represent the number of patients diagnosed by only one or several coding strategies and/or chart review indicated by dots with connecting lines;
e.g. 29 patients had infection without sepsis on chart review but coding for infection&ODF but no R-codes or explicit sepsis codes (generated with UpSetR[4])**

**References**

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