

**Supplemental file 2:** Validations studies describing performance of Injury severity measures to predict mortality

| Injury severity measure | Country     | Year | Number of hospital | Specific injury mechanism                    | Study population   | Age included          | Sample size | % mortality | Missing data % | Performance |               | Calibration |         |
|-------------------------|-------------|------|--------------------|--|--|-----------------------|-------------|-------------|----------------|-------------|---------------|-------------|---------|
|                         |             |      |                    |  |  |                       |             |             |                | AUROC       | 95% CI        | H-L         | p-value |
| APACHE II               | Turkey[1]   | 2011 | 1                  | All injuries                                 | Injury patients admitted to ICU in a tertiary referral hospital  | >=15                  | 100         | 14%         | NR*            | 0.92        | NA‡           | NA          | NA      |
|                         | Thailand[2] | 2012 | 1                  | All injuries                                 | Injury patients admitted to surgical ICU, neurosurgical ICU or burn unit in a tertiary referral hospital | Adult (not specified) | 132         | 20%         | NR             | 0.89        | NA            | NA          | NA      |
|                         | Iran[3]     | 2012 | 1                  | Head injuries                                | Head injury associated with systemic trauma admitted to neurosurgical ICU                                | >=14                  | 93          | 19.5%       | NR             | 0.892       | NA            | NA          | NA      |
|                         | Morocco[4]  | 2014 | 1                  | Moderate and severe traumatic brain injuries | Injury patients admitted to medical and surgical ICU due to TBI  | >=16                  | 225         | 40.0%       | 7.6%           | 0.92        | (0.837-0.982) | NA          | NA      |

|            |           |      |   |  |  |      |      |       |                        |  |   |                                       |                                       |
|------------|-----------|------|---|--|--|------|------|-------|------------------------|--|---|---------------------------------------|---------------------------------------|
|            | Brazil[5] | 2014 | 1 | All injuries                                 | Injury patients admitted for more than 24 hours in ER or ICU at a regional reference hospital          | >12  | 163  | 10.4% | 15.5%                  | 0.777  | (0.705-0.838)                                       | NA                                    | NA                                    |
|            | China[6]  | 2014 | 1 | All injuries                                 | Emergency ICU patients arrived within 24 h of injury, with ISS >16 in a university hospital            | >18  | 81   | 30.9% | NR                     | Day 1: 0.926;<br>day 3: 0.967;<br>day 7: 0.936 | NA  | NA                                    | NA                                    |
| APACHE III | Iran[7]   | 2016 | 2 | Multiple injuries from road traffic injuries | Injury patients admitted to ICU and survived for at least 4 hours upon arrival in ICU in two hospitals | >14  | 152  | 31.6% | NR                     | 0.797  | (0.652-0.901)                                       | NA                                    | NA                                    |
| EISS       | China[8]  | 2014 | 2 | Moderate and severe injuries                 | Injury patients admitted to two tertiary hospitals   | >=15 | 8040 | 6.2%  | Excluded from analysis | Zhejiang: 0.949;<br>Liaoning: 0.942            | Zhejiang: (0.937-0.961);<br>Liaoning: (0.930-0.955) | Zhejiang: : 13.52;<br>Liaoning: 15.55 | Zhejiang: 0.0604;<br>Liaoning: 0.0164 |

|     |               |      |   |  |   |      |      |       |                        |       |               |    |    |
|-----|---------------|------|---|--|---|------|------|-------|------------------------|-------|---------------|----|----|
| GAP | India[9]      | 2015 | 1 | life- or limb-threatening injuries                 | Severely injured presented at the urban Level I trauma center   | All  | 1117 | 32%   | 27%                    | 0.85  | (0.80-0.90)   | NA | NA |
|     | Turkey[10]    | 2006 | 1 | Falls  | Injury pediatric patients due to specified mechanism admitted to ER in a university hospital                          | <14  | 749  | 3.6%  | 1.74%                  | 0.975 | (0.961-0.985) | NA | NA |
| GCS | Indonesia[11] | 2009 | 1 | Traumatic brain injury with severe or multi-trauma | Injury patients of specified mechanism with severe or multi-trauma to the university hospital (level 2 trauma center) | >=12 | 48   | 37.0% | Excluded from analysis | 0.756 | NA            | NA | NA |

|              |      |   |  |   |      |  |       |       |  |  |    |    |
|--------------|------|---|--|---|------|--|-------|-------|--|--|----|----|
| Brazil[12]   | 2011 | 1 | Blunt traumatic brain injury                         | Injury patients of specified mechanism hospitalized at a trauma referral center | >14  | 277                                      | 19.1% | NR    | First care: 0.747; best score: 0.791; worst score: 0.782 | First care: (0.675-0.819); best score: (0.735-0.848); worst score: (0.724-0.839) | NA | NA |
| Iran[3]      | 2012 | 1 | Head injuries  | Head injury associated with systemic trauma admitted to neurosurgical ICU       | >=14 | 93                                       | 19.5% | NR    | 0.621  | NA   | NA | NA |
| Morocco[4]   | 2014 | 1 | Moderate and severe traumatic brain injuries         | Injury patients admitted to medical and surgical ICU due to TBI                 | >=16 | 225                                      | 40.0% | 7.6%  | 0.862  | (0.823-0.893)  | NA | NA |
| Cameroon[13] | 2014 | 1 | All injuries (separate analysis for severe injuries) | Injury patients admitted to ER at the teaching and referral hospital            | All  | All injuries: 2855; severe injuries: 244 | 0.6%  | 13.4% | All injuries: 0.7525; severe injuries: 0.9658            | All injuries: (0.6184-0.8866); severe injuries: (0.9301-1.000)                   | NA | NA |

|     |             |      |   |                |  |      |      |       |       |       |               |       |                           |
|-----|-------------|------|---|----------------|--|------|------|-------|-------|-------|---------------|-------|---------------------------|
|     | Turkey[10]  | 2006 | 1 | Falls          | Injury pediatric patients due to specified mechanism admitted to ER in a university hospital | <14  | 749  | 3.6%  | 1.74% | 0.962 | (0.945-0.974) | NA    | 0.37                      |
|     | Iran[14]    | 2007 | 3 | All injuries   | Injury patients admitted to the hospitals  | All  | 4096 | 6%    | NR    | >0.93 | NA            | NA    | NA                        |
| ISS | Lebanon[15] | 2008 | 1 | All injuries   | Injury patients admitted in a major tertiary care referral hospital                          | All  | 891  | 3.6%  | NR    | 0.881 | (0.816-0.945) | 2.97  | 0.70                      |
|     | China[16]   | 2008 | 1 | All injuries   | Patients with multiple injuries admitted to Emergency ICU in a university hospital           | >=16 | 2110 | NR    | NR    | 0.943 | (0.922-0.949) | 6.25  | Compared with NISS: 0.052 |
|     | Turkey[17]  | 2009 | 1 | Firearm injury | Firearm Injury patients admitted to ER in a level-1 trauma center                            | All  | 135  | 12.6% | NR    | 0.964 | NA            | 1.908 | 0.965                     |

|              |      |   |  |  |      |  |       |       |   |  |    |       |
|--------------|------|---|--|--|------|--|-------|-------|---|--|----|-------|
| Brazil[18]   | 2009 | 1 | All injuries   | Injury patients hospitalized at ICU for >24 hours and within 48 hours in a university hospital | >=18 | 185                                      | 21.1% | NR    | 0.63  | (0.52-0.72)  | NA | 0.636 |
| Turkey[1]    | 2011 | 1 | All injuries   | Injury patients admitted to ICU in a tertiary referral hospital                                | >=15 | 100                                      | 14%   | NR    | 0.878   | NA   | NA | NA    |
| China[6]     | 2014 | 1 | All injuries   | Emergency ICU patients arrived within 24 h of injury, with ISS >16 in a university hospital    | >18  | 81                                       | 30.9% | NR    | 0.804   | NA   | NA | NA    |
| Cameroon[13] | 2014 | 1 | All injuries (separate analysis for severe injuries) | Injury patients admitted to ER at the teaching and referral hospital                           | All  | All injuries: 2855; severe injuries: 244 | 0.6%  | 13.4% | All injuries: 0.7183; severe injuries: 0.7521 | All injuries: (0.5491-0.8885); Severe injuries: (0.4925-1.000) | NA | NA    |

|              |      |   |  |  |                        |  |       |                        |  |  |    |    |
|--------------|------|---|--|--|------------------------|--|-------|------------------------|--|--|----|----|
| Pakistan[19] | 2015 | 1 | Abdominal gunshot injury                             | Injury patients admitted to a university hospital with the specified mechanism | >=16                   | 70                                       | 15.7% | Excluded from analysis | 0.952  | (0.902-1.000)  | NA | NA |
| India[9]     | 2015 | 1 | life- or limb-threatening injuries                   | Severely injured presented at the urban Level I trauma center                  | All                    | 1117                                     | 32%   | 27%                    | 0.69   | (0.62-0.76)  | NA | NA |
| Cameroon[13] | 2014 | 1 | All injuries (separate analysis for severe injuries) | Injury patients admitted to ER at the teaching and referral hospital           | All                    | All injuries: 2855; severe injuries: 244 | 0.6%  | 13.4%                  | All injuries: 0.7784; severe injuries: 0.9820    | All injuries: (0.6285-0.9212), severe injuries: (0.9585-1.000) | NA | NA |
| India[9]     | 2015 | 1 | life- or limb-threatening injuries                   | Severely injured presented at the urban Level I trauma center                  | All                    | 1117                                     | 32%   | 27%                    | 0.86   | (0.81-0.91)  | NA | NA |
| Malawi[20]   | 2015 | 1 | All injuries   | Injury patients treated in a tertiary care referral hospital                   | Adults (not specified) | All: 15617; admitted: 2811               | 5%    | Excluded from analysis | All patients: 0.6904; admitted patients: 0.5929; | NA   | NA | NA |

|      |            |      |   |                                    |  |      |  |       |     |   |   |  |   |
|------|------------|------|---|------------------------------------|--|------|--|-------|-----|---|---|--|---|
| MGAP | India[9]   | 2015 | 1 | life- or limb-threatening injuries | Severely injured presented at the urban Level I trauma center                                  | All  | 1117                                     | 32%   | 27% | 0.84  | (0.79-0.89)   | NA   | NA  |
| LISS | China[21]  | 2012 | 3 | Major injuries                     | Patients with major injury (AIS>3 in a single body region) admitted in tertiary hospitals      | >=15 | 12238 (3,784, 4,436, and 4,018 patients) | 5.9%  | NR  | Hangzhou : 0.949; Zhejiang: 0.935; Shenyang : 0.936 | Hangzhou : (0.938-0.959); Zhejiang: (0.921-0.953); Shenyang : (0.921-0.953) | Hangzhou: 13.79; Zhejiang : 18.43; Shenyang: 17.45 | Hangzhou: 0.055; Zhejiang: 0.005; Shenyang: 0.008 |
| LODS | Brazil[18] | 2009 | 1 | All injuries                       | Injury patients hospitalized at ICU for >24 hours and within 48 hours in a university hospital | >=18 | 185                                      | 21.1% | NR  | 0.83  | (0.72-0.89)   | NA   | 0.0596  |
| NISS | China[16]  | 2008 | 1 | All injuries                       | Patients with multiple injuries admitted to Emergency ICU in a university hospital             | >=16 | 2110                                     | NR    | NR  | 0.938   | (0.922-0.949)   | 7.36   | Compared with ISS: 0.052                          |



|            |      |   |  |  |      |  |       |    |   |   |  |  |
|------------|------|---|--|--|------|--|-------|----|---|---|--|--|
| Turkey[17] | 2009 | 1 | Firearm injury   | Firearm Injury patients admitted to ER in a level-1 trauma center university hospital          | All  | 135                                      | 12.6% | NR | 0.98  | NA  | 1.4  | 0.994  |
| Brazil[18] | 2009 | 1 | All injuries   | Injury patients hospitalized at ICU for >24 hours and within 48 hours in a university hospital | >=18 | 185                                      | 21.1% | NR | 0.58  | (0.47-0.67)   | NA   | 0.1683   |
| China[21]  | 2012 | 3 | Major injuries   | Patients with major injury (AIS>3 in a single body region) admitted in tertiary hospitals      | >=15 | 12238 (3,784, 4,436, and 4,018 patients) | 5.9%  | NR | Hangzhou : 0.931; Zhejiang: 0.911; Shenyang : 0.918 | Hangzhou : (0.918-0.944); Zhejiang: (0.890-0.931); Shenyang : (0.904-0.932) | Hangzhou: 15.76; Zhejiang : 22.70; Shenyang: 28.97 | Hangzhou: 0.027; Zhejiang: 0.001; Shenyang: <0.001 |
| China[22]  | 2015 | 2 | Serious injury (exclude isolated minor or moderate injuries to a single body region) | Injury patients except those with minor injury, admitted to two level-3 first-class hospitals  | >18  | 8079                                     | 6%    | NR | Hangzhou : 0.929; Shenyang : 0.924                  | Hangzhou : (0.916-0.943); Shenyang : (0.910-0.938)                          | Hangzhou: 29.71; Shenyang: 33.49                   | Hangzhou: <0.001; Shenyang: <0.001                 |

|      |              |      |   |  |   |     |  |       |       |   |  |    |    |
|------|--------------|------|---|--|---|-----|--|-------|-------|---|--|----|----|
| RAPS | Brazil[5]    | 2014 | 1 | All injuries   | Injury patients admitted for > 24 hours in ER or ICU at regional reference hospital           | >12 | 163                                      | 10.4% | 15.5% | 0.806   | (0.737-0.864)  | NA | NA |
| REMS | Brazil[5]    | 2014 | 1 | All injuries   | Injury patients admitted for more than 24 hours in ER or ICU at a regional reference hospital | >12 | 163                                      | 10.4% | 15.5% | 0.761   | (0.688-0.824)  | NA | NA |
| RTS  | Cameroon[13] | 2014 | 1 | All injuries (separate analysis for severe injuries) | Injury patients admitted to ER at the teaching and referral hospital                          | All | All injuries: 2855; severe injuries: 244 | 0.6%  | 13.4% | All injuries: 0.7341; severe injuries: 0.9674 | All injuries: (0.5896-0.8786); severe injuries: (0.9330-1.000) | NA | NA |
|      | India[9]     | 2015 | 1 | life- or limb-threatening injuries                   | Severely injured presented at the urban Level I trauma center                                 | All | 1117                                     | 32%   | 27%   | 0.85  | (0.80-0.90)  | NA | NA |

|             |            |      |   |  |   |                            |                            |       |                        |   |               |    |       |
|-------------|------------|------|---|--|---|----------------------------|----------------------------|-------|------------------------|---|---------------|----|-------|
|             | Malawi[20] | 2015 | 1 | All injuries                                 | Injury patients treated in a tertiary care referral hospital                                  | Adults (age not specified) | All: 15617; admitted: 2811 | 5%    | Excluded from analysis | All patients: 0.6703; admitted patients: 0.6371 | NA            | NA | NA    |
| SAPS II     | Brazil[18] | 2009 | 1 | All injuries                                 | Injury patients hospitalized at ICU >24 hours and <48 hours in a university hospital          | >=18                       | 185                        | 21.1% | NR                     | 0.85  | (0.76-0.91)   | NA | 0.887 |
|             | Morocco[4] | 2014 | 1 | Moderate and severe traumatic brain injuries | Injury patients admitted to medical and surgical ICU due to TBI                               | >=16                       | 225                        | 40.0% | 7.6%                   | 0.843   | (0.795-0.898) | NA | NA    |
| s-APACHE II | Brazil[5]  | 2014 | 1 | All injuries                                 | Injury patients admitted for more than 24 hours in ER or ICU at a regional reference hospital | >12                        | 163                        | 10.4% | 15.5%                  | 0.788   | (0.717-0.848) | NA | NA    |

|       |               |      |   |  |   |      |      |       |                        |                                    |  |                                  |                                  |
|-------|---------------|------|---|--|---|------|------|-------|------------------------|------------------------------------|--|----------------------------------|----------------------------------|
| TISS  | China[22]     | 2015 | 2 | Serious injury (exclude isolated minor or moderate injuries to a single body region) | Injury patients except those with minor injury, admitted to two level-3 first-class hospitals                         | >18  | 8079 | 6%    | NR                     | Hangzhou : 0.949; Shenyang : 0.942 | Hangzhou : (0.939-0.959); Shenyang : (0.931-0.954) | Hangzhou: 19.59; Shenyang: 21.19 | Hangzhou: 0.003; Shenyang: 0.002 |
|       | Indonesia[11] | 2009 | 1 | Traumatic brain injury with severe or multi-trauma                                   | Injury patients of specified mechanism with severe or multi-trauma to the university hospital (level 2 trauma center) | >=12 | 48   | 37.0% | Excluded from analysis | 0.796                              | NA   | NA                               | NA                               |
| TRISS | Trinidad[23]  | 2009 | 3 | All injuries   | Injury patients admitted in the three tertiary care teaching hospitals  | All  | 326  | 4.30% | NR                     | 0.82                               | (0.69-0.96)  | NA                               | NA                               |
|       | Turkey[1]     | 2011 | 1 | All injuries   | Injury patients admitted to ICU in a tertiary referral hospital   | >=15 | 100  | 14%   | NR                     | 0.926                              | NA   | NA                               | NA                               |

|              |      |   |                |  |                       |      |       |                        |  |    |  |        |
|--------------|------|---|----------------|--|-----------------------|------|-------|------------------------|--|----|--|--------|
| Brazil[24]   | 2011 | 1 | All injuries   | Injury patients admitted to ER at the level I trauma center  | >=18                  | 533  | 24.1% | 2.8%                   | TRISS: 0.9; NTRISS: 0.92   | NA | 0.0000 for the TRISS; 0.0002 for NTRISS. | 0.0012 |
| Thailand[25] | 2012 | 1 | Blunt injuries | Injury patients registered in the Regional Hospital  | All                   | 6411 | 4.1%  | Excluded from analysis | Modified version 1: 0.9619, version 2: 0.9601, version 3: 0.9115 | NA | NA                                       | NA     |
| Thailand[2]  | 2012 | 1 | All injuries   | Injury patients admitted to surgical ICU, neurosurgical ICU or burn unit in tertiary referral hospital | Adult (not specified) | 132  | 20%   | NR                     | 0.83   | NA | NA                                       | NA     |
| China[6]     | 2014 | 1 | All injuries   | Emergency ICU patients arrived within 24 h of injury, with ISS >16 in a university hospital            | >18                   | 81   | 30.9% | NR                     | 0.974  | NA | NA                                       | NA     |

|              |      |   |  |  |     |  |       |       |   |  |      |      |
|--------------|------|---|--|--|-----|--|-------|-------|---|--|------|------|
| Cameroon[13] | 2014 | 1 | All injuries (separate analysis for severe injuries) | Injury patients admitted to ER at the teaching and referral hospital                                   | All | All injuries: 2855; severe injuries: 244 | 0.6%  | 13.4% | All injuries: 0.7117; severe injuries: 0.9386 | All injuries: (0.5346-0.8888); severe injuries: (0.8566-1.000) | 6.17 | 0.62 |
| Iran[7]      | 2016 | 2 | Multiple injuries from road traffic injuries         | Injury patients admitted to ICU and survived for at least 4 hours upon arrival in ICU in two hospitals | >14 | 152                                      | 31.6% | NR    | 0.806   | (0.663-0.908)  | NA   | NA   |

\*Not reported; ‡Not applicable

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