Supplementary Online Content

Stengel D, Mutze S, Güthoff C, et al. Association of low-dose whole-body computed tomography with missed injury diagnoses and radiation exposure in patients with blunt multiple trauma. *JAMA Surg*. Published online January 15, 2020. doi:10.1001/jamasurg.2019.5468

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This supplementary material has been provided by the authors to give readers additional information about their work.
**eTable 1. CT Scanning Parameters**

| Parameter                                      | Standard-Dose WBCT | Low-Dose WBCT |
|------------------------------------------------|--------------------|---------------|
| Slice thickness, mm                            |                    |               |
| Axial                                          | 5.0 (0.20) + 0.6 (0.02) | 5.0 (0.20) + 0.6 (0.02) |
| Coronal and sagittal reconstruction            | 3.0 (0.12)         | 3.0 (0.12)    |
| BMI <35                                        |                    |               |
| Tube voltage, kVp                              | 120                | 120           |
| Effective tube current rotation time           |                    |               |
| normalized to helical pitch, mAs               | 180                | 90            |
| Pitch factor                                   | 0.9                | 0.9           |
| BMI ≥35                                        |                    |               |
| Tube voltage, kVp                              | 120                | 120           |
| Effective tube current rotation time           |                    |               |
| normalized to helical pitch, mAs               | 270                | 135           |
| Pitch factor                                   | 0.9                | 0.9           |
| Reconstructed slice thickness, mm              | 128 x 0.625        | 128 x 0.625   |
| Reconstruction kernel                          | C                  | D             |
| Reconstruction kernel                          |                    |               |
| BMI ≥35                                        |                    |               |
| Tube voltage, kVp                              | 120                | 120           |
| Effective tube current rotation time           |                    |               |
| normalized to helical pitch, mAs               | 270                | 135           |
| Pitch factor                                   | 0.9                | 0.9           |
| Reconstructed slice thickness, mm              | 128 x 0.625        | 128 x 0.625   |
| Reconstruction kernel                          | C                  | C             |

Data are mean (SD). Tube settings include peak kilovoltage (kVP) and milliampere-seconds (mAs). BMI denotes Body Mass Index.
| Consequence          | AIS Region (n = 468) | No. (% [95% CI]) of Patients | AIS Region (n = 503) |
|----------------------|----------------------|------------------------------|----------------------|
|                      | Head and Neck        | Face                         | Thorax               | Abdomen | Pelvic Ring | Head and Neck | Face | Thorax | Abdomen | Pelvic Ring |
| Immediate surgery    |                      |                              |                      |         |             | 44 (40 [30 to 49]) | 39 (31 [23 to 40]) | 43 (37 [28 to 47]) | 28 (31 [22 to 42]) | 16 (36 [22 to 52]) | 38 (33 [25 to 43]) | 32 (24 [17 to 32]) | 43 (32 [24 to 41]) | 25 (26 [17 to 36]) | 10 (25 [13 to 41]) |
| Admission to ICU     | 45 (41 [31 to 50])   | 51 (41 [32 to 50])           | 39 (34 [25 to 43])   | 38 (42 [32 to 53]) | 22 (50 [35 to 65]) | 52 (46 [36 to 55]) | 58 (44 [35 to 52]) | 55 (41 [33 to 50]) | 38 (39 [29 to 50]) | 24 (60 [43 to 75]) |
| Admission to ward    | 22 (20 [13 to 28])   | 30 (24 [17 to 33])           | 33 (28 [20 to 38])   | 24 (27 [18 to 37]) | 6 (14 [5 to 27]) | 24 (21 [14 to 30]) | 41 (31 [23 to 39]) | 32 (24 [17 to 32]) | 33 (34 [25 to 44]) | 6 (15 [6 to 30]) |
| Discharge            | 0 (0 [0 to 0])       | 4 (3 [1 to 8])               | 1 (1 [0 to 1])       | 0 (0 [0 to 0]) | 0 (0 [0 to 1]) | 0 (0 [0 to 0]) | 2 (2 [0 to 5]) | 4 (3 [1 to 7]) | 1 (1 [0 to 6]) | 0 (0 [0 to 9]) |
# Table 3. Diagnostic Accuracy Among Different Anatomical Regions

| AIS region                  | Standard-Dose WBCT |                     | Low-Dose WBCT    |                     |
|-----------------------------|--------------------|---------------------|------------------|-------------------|
|                             | Prevalence, %      | Sensitivity, % (95% CI) | Specificity, % (95% CI) | Prevalence, % | Sensitivity, % (95% CI) | Specificity, % (95% CI) |
| Head and Neck               | 26.7               | 79.2 (71.0 to 85.9) | 96.5 (94.0 to 98.2) | 22.9          | 85.2 (77.4 to 91.1) | 95.9 (93.4 to 97.6) |
| Face                        | 13.7               | 81.3 (69.5 to 89.9) | 82.2 (78.1 to 85.8) | 17.5          | 72.7 (62.2 to 81.7) | 83.4 (79.4 to 86.8) |
| Thorax                      | 26.3               | 79.7 (71.5 to 86.4) | 94.8 (91.9 to 96.9) | 25.5          | 93.8 (88.1 to 97.3) | 96.3 (93.8 to 97.9) |
| Abdomen                     | 17.3               | 84.0 (74.1 to 91.2) | 94.1 (91.2 to 96.2) | 17.9          | 87.8 (79.2 to 93.7) | 95.6 (93.2 to 97.4) |
| Pelvic Ring (Extremities)   | 9.0                | 85.7 (71.5 to 94.6) | 98.1 (96.3 to 99.2) | 9.1           | 84.8 (71.1 to 93.7) | 99.8 (98.8 to 100)  |
## eTable 4. Accuracy of WBCT in Diagnosing Individual Injuries

| Injury                    | Prevalence, % | Prevalence, % | Prevalence, % | Prevalence, % | Prevalence, % | Prevalence, % | Prevalence, % |
|---------------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| Skull fractures           | 8.5           | 86.8          | 13           | 68.8          | 80.0          | 78.0          | 3.4           |
| Brain injury              | 16.7          | 52.0          | 3.7          | 92.0          | 82.1          | 83.0          | 12.0          |
| BCVI                      | 2.4           | 100.0         | 0.0          | 48.4          | 72.7          | 79.0          | 9.6           |
| Cervical spine injury     | 10.7          | 83.3          | 1.4          | 98.0          | 88.0          | 84.0          | 12.0          |
| Thoracic spine injury     | 12.6          | 83.3          | 1.4          | 98.0          | 78.0          | 79.0          | 12.0          |
| Serial rib fractures      | 12.0          | 80.0          | 1.4          | 98.0          | 75.0          | 75.0          | 12.0          |
| Lung contusion            | 4.9           | 63.3          | 1.4          | 98.0          | 69.6          | 69.0          | 12.0          |
| Pneumothorax              | 9.6           | 83.3          | 1.4          | 98.0          | 84.4          | 84.0          | 12.0          |
| Hemotorax                 | 3.4           | 60.0          | 1.4          | 98.0          | 31.3          | 31.0          | 12.0          |
| Aortic or cardiac tear    | 1.5           | 100.0         | 0.0          | 98.0          | 42.9          | 42.0          | 12.0          |
| Lumbar spine injury       | 14.3          | 93.9          | 1.4          | 98.0          | 86.6          | 86.0          | 12.0          |
| Hepatic rupture           | 0.6           | 69.2          | 1.4          | 98.0          | 0.0           | 0.0           | 12.0          |
| Splenic rupture           | 2.6           | 64.7          | 1.4          | 98.0          | 85.7          | 85.0          | 12.0          |
| Hollow visceral tear      | 1.1           | 99.2          | 1.4          | 98.0          | 80.0          | 80.0          | 12.0          |
| Hemoperitoneum            | 2.6           | 99.2          | 1.4          | 98.0          | 50.0          | 50.0          | 12.0          |
| Retroperitoneum           | 1.7           | 33.3          | 1.4          | 98.0          | 50.0          | 50.0          | 12.0          |
| Kidney laceration         | 0.6           | 44.4          | 1.4          | 98.0          | 33.3          | 33.0          | 12.0          |
| Pelvic fracture           | 8.3           | 80.5          | 1.4          | 98.0          | 89.7          | 89.0          | 12.0          |
| Acetabular fracture       | 3.6           | 83.3          | 1.4          | 98.0          | 82.4          | 82.0          | 12.0          |

BCVI denotes blunt carotid and vertebral vessel injury
eFigure 1. Meta-analysis of Studies Reporting on Missed Injuries With WBCT

| Study       | Effect Size (95% CI) | % Weight |
|-------------|----------------------|----------|
| Eurin (2012)| 0.48 (0.41 to 0.55)  | 31.6     |
| Stengel (2012)| 0.06 (0.05 to 0.08) | 34.4     |
| Geyer (2013)| 0.10 (0.08 to 0.14)  | 34.0     |
| Overall     | 0.21 (0.07 to 0.35)  | 100.0    |

I²=98.3%, p <.001

Proportion of Missed Injury Diagnoses with WBCT
eFigure 2. Sample Size Calculation With Different Clinical Scenarios

Risk Difference, Upper 97.5% Confidence Limit

Sample size (n) per group

Baseline Risk 4%   Baseline Risk 2%   Baseline Risk 1%
eFigure 3. Incidence of Missed Injury Diagnoses Over Time

- **Participants With Any Delayed Diagnosis, %**
- **Recruitment Period**
- **Standard-Dose WBCT**
- **Low-Dose WBCT**

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eFigure 4. Subjective Rating of Image Quality by 2 Independent Observers Using a 100-mm Visual Analog Scale (VAS)
eFigure 5. Contrast-to-Noise Ratio (CNR) in Different Regions of Interest (ROI)

| Region of Interest (ROI) | Standard-Dose WBCT | Low-Dose WBCT |
|--------------------------|--------------------|---------------|
| Carotid Artery           |                    |               |
| Aortic Arch              |                    |               |
| Liver                    |                    |               |
| Kidney                   |                    |               |
| Aorta                    |                    |               |
| 7th Cervical Vertebral   |                    |               |
| 1st Lumbar Vertebral     |                    |               |