

**Table S1** Image acquisition parameters

| Variable                 | Value   | Count |
|--------------------------|---------|-------|
| CT slice thickness (mm)  | 5       | 17    |
|                          | 4       | 8     |
|                          | 3.75    | 125   |
|                          | 3       | 16    |
|                          | 2.5     | 1     |
| Scanner vendor           | GE      | 128   |
|                          | Siemens | 36    |
|                          | Philips | 3     |
| Institution acquired     | MSKCC   | 100   |
|                          | Other   | 67    |
| PET slice thickness (mm) | 2.78    | 12    |
|                          | 2.8     | 3     |
|                          | 3       | 12    |
|                          | 3.26    | 4     |
|                          | 3.27    | 107   |
|                          | 3.375   | 2     |
|                          | 4       | 11    |
|                          | 4.25    | 1     |
|                          | 5       | 14    |
|                          | 5.46875 | 1     |
| Year acquired            | 2016    | 5     |
|                          | 2017    | 50    |
|                          | 2018    | 28    |
|                          | 2019    | 40    |
|                          | 2020    | 44    |

**Table S2** Automatic versus manual metastasis correlation

| Pearson correlation | automatic_n_mets | manual_number_mets |
|---------------------|------------------|--------------------|
| automatic_n_mets    | 1                | 0.838767           |
| manual_number_mets  | 0.838767         | 1                  |

**Table S3** Associations of radiomic features with confounders

| Confound                | P        | feat                                            | stat  | Test         |
|-------------------------|----------|-------------------------------------------------|-------|--------------|
| ct_acquisition_year     | 6.24E-08 | original_firstorder_Minimum                     | 39.23 | Kruskal      |
| ct_acquisition_year     | 1.07E-07 | original_firstorder_Energy                      | 38.09 | Kruskal      |
| ct_acquisition_year     | 2.62E-07 | original_firstorder_TotalEnergy                 | 36.21 | Kruskal      |
| ct_acquisition_year     | 1.11E-06 | original_glszm_SmallAreaHighGrayLevelEmphasis   | 33.15 | Kruskal      |
| ct_acquisition_year     | 1.19E-06 | original_glszm_ZoneEntropy                      | 33.00 | Kruskal      |
| ct_acquisition_year     | 1.43E-06 | original_glszm_HighGrayLevelZoneEmphasis        | 32.63 | Kruskal      |
| ct_acquisition_year     | 2.15E-05 | original_glszm_LowGrayLevelZoneEmphasis         | 26.83 | Kruskal      |
| ct_acquisition_year     | 1.04E-03 | original_firstorder_Maximum                     | 18.38 | Kruskal      |
| ct_acquisition_year     | 1.13E-03 | original_shape_MeshVolume                       | 18.19 | Kruskal      |
| ct_acquisition_year     | 1.14E-03 | original_shape_VoxelVolume                      | 18.18 | Kruskal      |
| ct_acquisition_year     | 2.09E-03 | original_shape_Maximum2DDiameterSlice           | 16.83 | Kruskal      |
| ct_acquisition_year     | 2.70E-03 | original_shape_LeastAxisLength                  | 16.25 | Kruskal      |
| ct_acquisition_year     | 4.07E-03 | original_shape_SurfaceArea                      | 15.33 | Kruskal      |
| ct_acquisition_year     | 5.20E-03 | original_firstorder_Variance                    | 14.77 | Kruskal      |
| ct_vendor               | 5.94E-03 | original_glszm_SmallAreaEmphasis                | 10.25 | Kruskal      |
| ct_acquisition_year     | 1.39E-02 | original_glszm_GrayLevelNonUniformityNormalized | 12.51 | Kruskal      |
| ct_acquisition_year     | 1.42E-02 | original_glszm_LargeAreaHighGrayLevelEmphasis   | 12.47 | Kruskal      |
| ct_acquisition_year     | 1.71E-02 | original_shape_Maximum2DDiameterColumn          | 12.03 | Kruskal      |
| ct_slice_thickness      | 2.24E-02 | original_firstorder_90Percentile                | 11.41 | Kruskal      |
| ct_acquisition_year     | 2.43E-02 | original_firstorder_RootMeanSquared             | 11.21 | Kruskal      |
| ct_slice_thickness      | 2.67E-02 | original_glszm_SizeZoneNonUniformityNormalized  | 10.99 | Kruskal      |
| ct_institution_acquired | 2.96E-02 | original_firstorder_Skewness                    | 6.04  | Mann-Whitney |
| ct_institution_acquired | 2.99E-02 | original_glszm_ZoneVariance                     | 6.04  | Mann-Whitney |
| ct_institution_acquired | 3.17E-02 | original_glszm_LargeAreaEmphasis                | 6.04  | Mann-Whitney |
| ct_acquisition_year     | 3.53E-02 | original_shape_Elongation                       | 10.32 | Kruskal      |
| ct_acquisition_year     | 6.19E-02 | original_firstorder_Mean                        | 8.97  | Kruskal      |
| ct_acquisition_year     | 6.97E-02 | original_shape_Sphericity                       | 8.68  | Kruskal      |
| ct_slice_thickness      | 8.55E-02 | original_firstorder_Maximum                     | 8.17  | Kruskal      |
| ct_vendor               | 1.10E-01 | original_firstorder_Maximum                     | 4.42  | Kruskal      |
| ct_institution_acquired | 1.48E-01 | original_glszm_ZonePercentage                   | 6.04  | Mann-Whitney |
| ct_vendor               | 1.62E-01 | original_shape_Flatness                         | 3.64  | Kruskal      |
| ct_slice_thickness      | 1.71E-01 | original_firstorder_Median                      | 6.40  | Kruskal      |
| ct_vendor               | 1.74E-01 | original_firstorder_Median                      | 3.49  | Kruskal      |
| ct_slice_thickness      | 1.91E-01 | original_shape_Maximum2DDiameterRow             | 6.11  | Kruskal      |
| ct_acquisition_year     | 1.96E-01 | original_glszm_ZoneVariance                     | 6.04  | Kruskal      |

**Table S3** (continued)

Table S3 (continued)

| Confound                | P        | feat                                            | stat | Test         |
|-------------------------|----------|-------------------------------------------------|------|--------------|
| ct_institution_acquired | 2.03E-01 | original_shape_SurfaceVolumeRatio               | 6.04 | Mann-Whitney |
| ct_institution_acquired | 2.03E-01 | original_firstorder_Kurtosis                    | 6.04 | Mann-Whitney |
| ct_slice_thickness      | 2.06E-01 | original_shape_Flatness                         | 5.91 | Kruskal      |
| ct_institution_acquired | 2.11E-01 | original_glszm_GrayLevelVariance                | 6.04 | Mann-Whitney |
| ct_acquisition_year     | 2.55E-01 | original_firstorder_Median                      | 5.33 | Kruskal      |
| ct_slice_thickness      | 2.59E-01 | original_shape_LeastAxisLength                  | 5.29 | Kruskal      |
| ct_vendor               | 2.73E-01 | original_firstorder_Mean                        | 2.60 | Kruskal      |
| ct_slice_thickness      | 2.83E-01 | original_shape_Maximum3DDiameter                | 5.05 | Kruskal      |
| ct_institution_acquired | 2.93E-01 | original_firstorder_Entropy                     | 6.04 | Mann-Whitney |
| ct_slice_thickness      | 2.99E-01 | original_shape_MajorAxisLength                  | 4.89 | Kruskal      |
| ct_vendor               | 3.01E-01 | original_shape_Elongation                       | 2.40 | Kruskal      |
| ct_institution_acquired | 3.10E-01 | original_shape_Flatness                         | 6.04 | Mann-Whitney |
| ct_slice_thickness      | 3.13E-01 | original_glszm_ZoneEntropy                      | 4.76 | Kruskal      |
| ct_slice_thickness      | 3.38E-01 | original_shape_SurfaceArea                      | 4.54 | Kruskal      |
| ct_institution_acquired | 3.44E-01 | original_firstorder_InterquartileRange          | 6.04 | Mann-Whitney |
| ct_vendor               | 3.45E-01 | original_firstorder_Uniformity                  | 2.13 | Kruskal      |
| ct_slice_thickness      | 3.51E-01 | original_shape_MinorAxisLength                  | 4.43 | Kruskal      |
| ct_slice_thickness      | 3.56E-01 | original_shape_Maximum2DDiameterColumn          | 4.39 | Kruskal      |
| ct_slice_thickness      | 3.68E-01 | original_shape_Maximum2DDiameterSlice           | 4.29 | Kruskal      |
| ct_slice_thickness      | 3.85E-01 | original_firstorder_Range                       | 4.16 | Kruskal      |
| ct_slice_thickness      | 3.86E-01 | original_glszm_LargeAreaHighGrayLevelEmphasis   | 4.15 | Kruskal      |
| ct_vendor               | 3.88E-01 | original_shape_Sphericity                       | 1.89 | Kruskal      |
| ct_vendor               | 3.88E-01 | original_firstorder_Range                       | 1.89 | Kruskal      |
| ct_slice_thickness      | 3.88E-01 | original_firstorder_TotalEnergy                 | 4.13 | Kruskal      |
| ct_vendor               | 3.94E-01 | original_glszm_ZoneEntropy                      | 1.86 | Kruskal      |
| ct_vendor               | 3.95E-01 | original_firstorder_Skewness                    | 1.86 | Kruskal      |
| ct_slice_thickness      | 4.05E-01 | original_glszm_GrayLevelVariance                | 4.01 | Kruskal      |
| ct_slice_thickness      | 4.19E-01 | original_shape_Elongation                       | 3.90 | Kruskal      |
| ct_vendor               | 4.21E-01 | original_glszm_GrayLevelNonUniformityNormalized | 1.73 | Kruskal      |
| ct_acquisition_year     | 4.43E-01 | original_firstorder_Kurtosis                    | 3.73 | Kruskal      |
| ct_acquisition_year     | 4.45E-01 | original_firstorder_RobustMeanAbsoluteDeviation | 3.72 | Kruskal      |
| ct_slice_thickness      | 4.68E-01 | original_glszm_ZoneVariance                     | 3.57 | Kruskal      |
| ct_institution_acquired | 4.68E-01 | original_shape_MinorAxisLength                  | 6.04 | Mann-Whitney |
| ct_vendor               | 4.69E-01 | original_firstorder_10Percentile                | 1.51 | Kruskal      |
| ct_slice_thickness      | 4.74E-01 | original_firstorder_Mean                        | 3.53 | Kruskal      |

Table S3 (continued)

Table S3 (continued)

| Confound                | P        | feat                                            | stat | Test         |
|-------------------------|----------|-------------------------------------------------|------|--------------|
| ct_vendor               | 4.74E-01 | original_firstorder_Entropy                     | 1.49 | Kruskal      |
| ct_vendor               | 4.74E-01 | original_shape_LeastAxisLength                  | 1.49 | Kruskal      |
| ct_slice_thickness      | 4.75E-01 | original_glszm_LargeAreaEmphasis                | 3.52 | Kruskal      |
| ct_vendor               | 4.82E-01 | original_firstorder_Energy                      | 1.46 | Kruskal      |
| ct_slice_thickness      | 4.87E-01 | original_shape_MeshVolume                       | 3.44 | Kruskal      |
| ct_slice_thickness      | 4.93E-01 | original_shape_VoxelVolume                      | 3.40 | Kruskal      |
| ct_institution_acquired | 4.94E-01 | original_firstorder_RobustMeanAbsoluteDeviation | 6.04 | Mann-Whitney |
| ct_slice_thickness      | 5.05E-01 | original_firstorder_Skewness                    | 3.32 | Kruskal      |
| ct_institution_acquired | 5.06E-01 | original_glszm_SizeZoneNonUniformity            | 6.04 | Mann-Whitney |
| ct_institution_acquired | 5.06E-01 | original_shape_Maximum3DDiameter                | 6.04 | Mann-Whitney |
| ct_institution_acquired | 5.15E-01 | original_glszm_SmallAreaLowGrayLevelEmphasis    | 6.04 | Mann-Whitney |
| ct_institution_acquired | 5.30E-01 | original_shape_MajorAxisLength                  | 6.04 | Mann-Whitney |
| ct_slice_thickness      | 5.31E-01 | original_shape_Sphericity                       | 3.16 | Kruskal      |
| ct_vendor               | 5.35E-01 | original_shape_Maximum2DDiameterRow             | 1.25 | Kruskal      |
| ct_vendor               | 5.37E-01 | original_firstorder_MeanAbsoluteDeviation       | 1.24 | Kruskal      |
| ct_slice_thickness      | 5.44E-01 | original_glszm_SmallAreaLowGrayLevelEmphasis    | 3.08 | Kruskal      |
| ct_vendor               | 5.55E-01 | original_firstorder_Variance                    | 1.18 | Kruskal      |
| ct_vendor               | 5.56E-01 | original_firstorder_RootMeanSquared             | 1.17 | Kruskal      |
| ct_slice_thickness      | 5.61E-01 | original_glszm_SizeZoneNonUniformity            | 2.98 | Kruskal      |
| ct_slice_thickness      | 5.66E-01 | original_shape_SurfaceVolumeRatio               | 2.95 | Kruskal      |
| ct_slice_thickness      | 5.77E-01 | original_glszm_SmallAreaHighGrayLevelEmphasis   | 2.89 | Kruskal      |
| ct_slice_thickness      | 5.86E-01 | original_glszm_LowGrayLevelZoneEmphasis         | 2.83 | Kruskal      |
| ct_slice_thickness      | 5.87E-01 | original_glszm_GrayLevelNonUniformity           | 2.83 | Kruskal      |
| ct_slice_thickness      | 5.87E-01 | original_firstorder_Minimum                     | 2.83 | Kruskal      |
| ct_vendor               | 5.97E-01 | original_glszm_GrayLevelVariance                | 1.03 | Kruskal      |
| ct_vendor               | 6.00E-01 | original_shape_Maximum3DDiameter                | 1.02 | Kruskal      |
| ct_slice_thickness      | 6.05E-01 | original_glszm_HighGrayLevelZoneEmphasis        | 2.73 | Kruskal      |
| ct_acquisition_year     | 6.07E-01 | original_firstorder_InterquartileRange          | 2.71 | Kruskal      |
| ct_vendor               | 6.11E-01 | original_firstorder_RobustMeanAbsoluteDeviation | 0.99 | Kruskal      |
| ct_vendor               | 6.16E-01 | original_shape_SurfaceArea                      | 0.97 | Kruskal      |
| ct_vendor               | 6.30E-01 | original_glszm_GrayLevelNonUniformity           | 0.93 | Kruskal      |
| ct_vendor               | 6.37E-01 | original_firstorder_InterquartileRange          | 0.90 | Kruskal      |
| ct_institution_acquired | 6.49E-01 | original_firstorder_Range                       | 6.04 | Mann-Whitney |
| ct_slice_thickness      | 6.66E-01 | original_glszm_LargeAreaLowGrayLevelEmphasis    | 2.38 | Kruskal      |
| ct_institution_acquired | 6.67E-01 | original_shape_Maximum2DDiameterRow             | 6.04 | Mann-Whitney |

Table S3 (continued)

Table S3 (continued)

| Confound                | P        | feat                                            | stat | Test         |
|-------------------------|----------|-------------------------------------------------|------|--------------|
| ct_vendor               | 6.72E-01 | original_shape_Maximum2DDiameterColumn          | 0.80 | Kruskal      |
| ct_slice_thickness      | 6.72E-01 | original_firstorder_Variance                    | 2.35 | Kruskal      |
| ct_slice_thickness      | 6.74E-01 | original_firstorder_10Percentile                | 2.34 | Kruskal      |
| ct_vendor               | 6.78E-01 | original_shape_MinorAxisLength                  | 0.78 | Kruskal      |
| ct_vendor               | 6.81E-01 | original_glszm_LargeAreaHighGrayLevelEmphasis   | 0.77 | Kruskal      |
| ct_slice_thickness      | 6.82E-01 | original_glszm_GrayLevelNonUniformityNormalized | 2.29 | Kruskal      |
| ct_vendor               | 6.86E-01 | original_shape_Maximum2DDiameterSlice           | 0.75 | Kruskal      |
| ct_slice_thickness      | 6.97E-01 | original_glszm_ZonePercentage                   | 2.21 | Kruskal      |
| ct_vendor               | 7.04E-01 | original_shape_MajorAxisLength                  | 0.70 | Kruskal      |
| ct_vendor               | 7.13E-01 | original_firstorder_Minimum                     | 0.68 | Kruskal      |
| ct_slice_thickness      | 7.15E-01 | original_firstorder_RobustMeanAbsoluteDeviation | 2.11 | Kruskal      |
| ct_vendor               | 7.17E-01 | original_shape_MeshVolume                       | 0.67 | Kruskal      |
| ct_slice_thickness      | 7.19E-01 | original_firstorder_MeanAbsoluteDeviation       | 2.09 | Kruskal      |
| ct_vendor               | 7.21E-01 | original_shape_VoxelVolume                      | 0.65 | Kruskal      |
| ct_vendor               | 7.21E-01 | original_glszm_ZonePercentage                   | 0.65 | Kruskal      |
| ct_institution_acquired | 7.21E-01 | original_glszm_GrayLevelNonUniformity           | 6.04 | Mann-Whitney |
| ct_vendor               | 7.27E-01 | original_glszm_SmallAreaLowGrayLevelEmphasis    | 0.64 | Kruskal      |
| ct_slice_thickness      | 7.28E-01 | original_firstorder_Kurtosis                    | 2.04 | Kruskal      |
| ct_slice_thickness      | 7.28E-01 | original_firstorder_InterquartileRange          | 2.04 | Kruskal      |
| ct_vendor               | 7.51E-01 | original_glszm_SizeZoneNonUniformity            | 0.57 | Kruskal      |
| ct_slice_thickness      | 7.56E-01 | original_firstorder_Uniformity                  | 1.89 | Kruskal      |
| ct_slice_thickness      | 8.03E-01 | original_firstorder_Entropy                     | 1.63 | Kruskal      |
| ct_slice_thickness      | 8.03E-01 | original_firstorder_RootMeanSquared             | 1.63 | Kruskal      |
| ct_vendor               | 8.25E-01 | original_firstorder_Kurtosis                    | 0.38 | Kruskal      |
| ct_vendor               | 8.44E-01 | original_glszm_LowGrayLevelZoneEmphasis         | 0.34 | Kruskal      |
| ct_vendor               | 8.49E-01 | original_glszm_ZoneVariance                     | 0.33 | Kruskal      |
| ct_vendor               | 8.55E-01 | original_glszm_LargeAreaEmphasis                | 0.31 | Kruskal      |
| ct_institution_acquired | 8.67E-01 | original_firstorder_Mean                        | 6.04 | Mann-Whitney |
| ct_vendor               | 8.75E-01 | original_glszm_HighGrayLevelZoneEmphasis        | 0.27 | Kruskal      |
| ct_vendor               | 9.02E-01 | original_glszm_LargeAreaLowGrayLevelEmphasis    | 0.21 | Kruskal      |
| ct_vendor               | 9.09E-01 | original_shape_SurfaceVolumeRatio               | 0.19 | Kruskal      |
| ct_institution_acquired | 9.39E-01 | original_firstorder_Median                      | 6.04 | Mann-Whitney |
| ct_vendor               | 9.49E-01 | original_firstorder_TotalEnergy                 | 0.11 | Kruskal      |
| ct_institution_acquired | 9.50E-01 | original_firstorder_10Percentile                | 6.04 | Mann-Whitney |

Table S3 (continued)

Table S3 (continued)

| Confound                 | P        | feat                                            | stat  | Test         |
|--------------------------|----------|-------------------------------------------------|-------|--------------|
| ct_institution_acquired  | 9.50E-01 | original_shape_Sphericity                       | 6.04  | Mann-Whitney |
| ct_institution_acquired  | 9.98E-01 | original_firstorder_MeanAbsoluteDeviation       | 6.04  | Mann-Whitney |
| pet_acquisition_year     | 6.78E-08 | original_glszm_LargeAreaLowGrayLevelEmphasis    | 39.06 | Kruskal      |
| pet_acquisition_year     | 8.64E-08 | original_glszm_ZonePercentage                   | 38.55 | Kruskal      |
| pet_acquisition_year     | 5.36E-07 | original_glszm_LargeAreaEmphasis                | 34.70 | Kruskal      |
| pet_acquisition_year     | 8.96E-07 | original_firstorder_Minimum                     | 33.61 | Kruskal      |
| pet_acquisition_year     | 1.91E-04 | original_firstorder_Skewness                    | 22.11 | Kruskal      |
| pet_acquisition_year     | 1.13E-03 | original_shape_MeshVolume                       | 18.19 | Kruskal      |
| pet_acquisition_year     | 1.14E-03 | original_shape_VoxelVolume                      | 18.18 | Kruskal      |
| pet_acquisition_year     | 2.09E-03 | original_shape_Maximum2DDiameterSlice           | 16.83 | Kruskal      |
| pet_acquisition_year     | 2.70E-03 | original_shape_LeastAxisLength                  | 16.25 | Kruskal      |
| pet_acquisition_year     | 3.81E-03 | original_glszm_SizeZoneNonUniformityNormalized  | 15.47 | Kruskal      |
| pet_acquisition_year     | 4.07E-03 | original_shape_SurfaceArea                      | 15.33 | Kruskal      |
| pet_acquisition_year     | 1.71E-02 | original_shape_Maximum2DDiameterColumn          | 12.03 | Kruskal      |
| pet_acquisition_year     | 2.63E-02 | original_firstorder_Mean                        | 11.02 | Kruskal      |
| pet_institution_acquired | 3.03E-02 | original_glszm_SmallAreaEmphasis                | 38.55 | Mann-Whitney |
| pet_acquisition_year     | 3.53E-02 | original_shape_Elongation                       | 10.32 | Kruskal      |
| pet_slice_thickness      | 6.22E-02 | original_firstorder_10Percentile                | 14.85 | Kruskal      |
| pet_institution_acquired | 6.72E-02 | original_firstorder_InterquartileRange          | 38.55 | Mann-Whitney |
| pet_acquisition_year     | 6.97E-02 | original_shape_Sphericity                       | 8.68  | Kruskal      |
| pet_institution_acquired | 7.59E-02 | original_firstorder_RobustMeanAbsoluteDeviation | 38.55 | Mann-Whitney |
| pet_acquisition_year     | 7.72E-02 | original_firstorder_RootMeanSquared             | 8.42  | Kruskal      |
| pet_institution_acquired | 9.33E-02 | original_firstorder_MeanAbsoluteDeviation       | 38.55 | Mann-Whitney |
| pet_institution_acquired | 1.10E-01 | original_firstorder_Variance                    | 38.55 | Mann-Whitney |
| pet_slice_thickness      | 1.24E-01 | original_glszm_ZonePercentage                   | 12.67 | Kruskal      |
| pet_institution_acquired | 1.37E-01 | original_glszm_SizeZoneNonUniformity            | 38.55 | Mann-Whitney |
| pet_institution_acquired | 1.46E-01 | original_firstorder_Uniformity                  | 38.55 | Mann-Whitney |
| pet_vendor               | 1.50E-01 | original_shape_Flatness                         | 5.31  | Kruskal      |
| pet_acquisition_year     | 1.51E-01 | original_glszm_GrayLevelNonUniformityNormalized | 6.73  | Kruskal      |
| pet_institution_acquired | 1.52E-01 | original_firstorder_Entropy                     | 38.55 | Mann-Whitney |
| pet_acquisition_year     | 1.56E-01 | original_firstorder_Kurtosis                    | 6.63  | Kruskal      |
| pet_acquisition_year     | 1.63E-01 | original_firstorder_Energy                      | 6.53  | Kruskal      |
| pet_slice_thickness      | 1.78E-01 | original_glszm_LargeAreaEmphasis                | 11.43 | Kruskal      |
| pet_slice_thickness      | 1.85E-01 | original_shape_LeastAxisLength                  | 11.31 | Kruskal      |

Table S3 (continued)

Table S3 (continued)

| Confound                 | P        | feat                                          | stat  | Test         |
|--------------------------|----------|-----------------------------------------------|-------|--------------|
| pet_slice_thickness      | 1.92E-01 | original_glszm_ZoneVariance                   | 11.18 | Kruskal      |
| pet_institution_acquired | 2.03E-01 | original_shape_SurfaceVolumeRatio             | 38.55 | Mann-Whitney |
| pet_institution_acquired | 2.08E-01 | original_firstorder_90Percentile              | 38.55 | Mann-Whitney |
| pet_slice_thickness      | 2.13E-01 | original_glszm_LargeAreaLowGrayLevelEmphasis  | 10.80 | Kruskal      |
| pet_slice_thickness      | 2.28E-01 | original_glszm_LargeAreaHighGrayLevelEmphasis | 10.56 | Kruskal      |
| pet_slice_thickness      | 2.29E-01 | original_shape_SurfaceVolumeRatio             | 10.54 | Kruskal      |
| pet_acquisition_year     | 2.29E-01 | original_glszm_SmallAreaHighGrayLevelEmphasis | 5.62  | Kruskal      |
| pet_slice_thickness      | 2.43E-01 | original_firstorder_Minimum                   | 10.33 | Kruskal      |
| pet_slice_thickness      | 2.52E-01 | original_shape_Flatness                       | 10.19 | Kruskal      |
| pet_acquisition_year     | 2.75E-01 | original_glszm_GrayLevelVariance              | 5.12  | Kruskal      |
| pet_institution_acquired | 2.91E-01 | original_glszm_SmallAreaLowGrayLevelEmphasis  | 38.55 | Mann-Whitney |
| pet_institution_acquired | 3.10E-01 | original_shape_Flatness                       | 38.55 | Mann-Whitney |
| pet_institution_acquired | 3.27E-01 | original_glszm_LowGrayLevelZoneEmphasis       | 38.55 | Mann-Whitney |
| pet_institution_acquired | 3.30E-01 | original_firstorder_Range                     | 38.55 | Mann-Whitney |
| pet_slice_thickness      | 3.34E-01 | original_firstorder_Median                    | 9.10  | Kruskal      |
| pet_slice_thickness      | 3.37E-01 | original_firstorder_Mean                      | 9.07  | Kruskal      |
| pet_institution_acquired | 3.45E-01 | original_glszm_HighGrayLevelZoneEmphasis      | 38.55 | Mann-Whitney |
| pet_slice_thickness      | 3.60E-01 | original_glszm_SmallAreaEmphasis              | 8.79  | Kruskal      |
| pet_acquisition_year     | 3.65E-01 | original_glszm_SizeZoneNonUniformity          | 4.32  | Kruskal      |
| pet_slice_thickness      | 3.76E-01 | original_shape_MeshVolume                     | 8.61  | Kruskal      |
| pet_slice_thickness      | 3.77E-01 | original_shape_VoxelVolume                    | 8.60  | Kruskal      |
| pet_institution_acquired | 3.93E-01 | original_glszm_ZoneVariance                   | 38.55 | Mann-Whitney |
| pet_slice_thickness      | 3.94E-01 | original_shape_Sphericity                     | 8.42  | Kruskal      |
| pet_acquisition_year     | 3.98E-01 | original_firstorder_90Percentile              | 4.06  | Kruskal      |
| pet_institution_acquired | 4.11E-01 | original_firstorder_TotalEnergy               | 38.55 | Mann-Whitney |
| pet_institution_acquired | 4.19E-01 | original_firstorder_RootMeanSquared           | 38.55 | Mann-Whitney |
| pet_institution_acquired | 4.23E-01 | original_glszm_ZoneEntropy                    | 38.55 | Mann-Whitney |
| pet_slice_thickness      | 4.34E-01 | original_firstorder_RootMeanSquared           | 8.00  | Kruskal      |
| pet_institution_acquired | 4.38E-01 | original_firstorder_Maximum                   | 38.55 | Mann-Whitney |
| pet_acquisition_year     | 4.39E-01 | original_glszm_SmallAreaLowGrayLevelEmphasis  | 3.77  | Kruskal      |
| pet_institution_acquired | 4.39E-01 | original_glszm_GrayLevelVariance              | 38.55 | Mann-Whitney |
| pet_slice_thickness      | 4.41E-01 | original_shape_Maximum2DDiameterRow           | 7.92  | Kruskal      |
| pet_acquisition_year     | 4.45E-01 | original_glszm_HighGrayLevelZoneEmphasis      | 3.72  | Kruskal      |
| pet_institution_acquired | 4.49E-01 | original_glszm_GrayLevelNonUniformity         | 38.55 | Mann-Whitney |

Table S3 (continued)

Table S3 (continued)

| Confound                 | P        | feat                                            | stat  | Test         |
|--------------------------|----------|-------------------------------------------------|-------|--------------|
| pet_institution_acquired | 4.49E-01 | original_firstorder_Energy                      | 38.55 | Mann-Whitney |
| pet_vendor               | 4.51E-01 | original_glszm_SmallAreaLowGrayLevelEmphasis    | 2.64  | Kruskal      |
| pet_institution_acquired | 4.63E-01 | original_glszm_LargeAreaHighGrayLevelEmphasis   | 38.55 | Mann-Whitney |
| pet_institution_acquired | 4.68E-01 | original_shape_MinorAxisLength                  | 38.55 | Mann-Whitney |
| pet_vendor               | 4.76E-01 | original_shape_Elongation                       | 2.50  | Kruskal      |
| pet_slice_thickness      | 4.82E-01 | original_firstorder_Skewness                    | 7.51  | Kruskal      |
| pet_slice_thickness      | 4.88E-01 | original_shape_SurfaceArea                      | 7.46  | Kruskal      |
| pet_institution_acquired | 5.06E-01 | original_firstorder_Kurtosis                    | 38.55 | Mann-Whitney |
| pet_institution_acquired | 5.06E-01 | original_shape_Maximum3DDiameter                | 38.55 | Mann-Whitney |
| pet_institution_acquired | 5.27E-01 | original_glszm_GrayLevelNonUniformityNormalized | 38.55 | Mann-Whitney |
| pet_vendor               | 5.27E-01 | original_glszm_LowGrayLevelZoneEmphasis         | 2.23  | Kruskal      |
| pet_institution_acquired | 5.30E-01 | original_shape_MajorAxisLength                  | 38.55 | Mann-Whitney |
| pet_vendor               | 5.34E-01 | original_shape_Sphericity                       | 2.19  | Kruskal      |
| pet_vendor               | 5.67E-01 | original_glszm_SizeZoneNonUniformityNormalized  | 2.02  | Kruskal      |
| pet_slice_thickness      | 5.70E-01 | original_glszm_SmallAreaLowGrayLevelEmphasis    | 6.70  | Kruskal      |
| pet_institution_acquired | 5.73E-01 | original_firstorder_10Percentile                | 38.55 | Mann-Whitney |
| pet_slice_thickness      | 5.88E-01 | original_shape_Maximum2DDiameterSlice           | 6.53  | Kruskal      |
| pet_slice_thickness      | 5.93E-01 | original_shape_MajorAxisLength                  | 6.49  | Kruskal      |
| pet_slice_thickness      | 6.00E-01 | original_firstorder_90Percentile                | 6.42  | Kruskal      |
| pet_slice_thickness      | 6.01E-01 | original_shape_MinorAxisLength                  | 6.41  | Kruskal      |
| pet_vendor               | 6.03E-01 | original_glszm_GrayLevelNonUniformityNormalized | 1.85  | Kruskal      |
| pet_vendor               | 6.17E-01 | original_glszm_GrayLevelNonUniformity           | 1.79  | Kruskal      |
| pet_vendor               | 6.21E-01 | original_firstorder_InterquartileRange          | 1.77  | Kruskal      |
| pet_slice_thickness      | 6.24E-01 | original_shape_Maximum2DDiameterColumn          | 6.21  | Kruskal      |
| pet_vendor               | 6.28E-01 | original_firstorder_RobustMeanAbsoluteDeviation | 1.74  | Kruskal      |
| pet_slice_thickness      | 6.33E-01 | original_glszm_GrayLevelNonUniformity           | 6.12  | Kruskal      |
| pet_slice_thickness      | 6.36E-01 | original_shape_Maximum3DDiameter                | 6.10  | Kruskal      |
| pet_acquisition_year     | 6.45E-01 | original_glszm_GrayLevelNonUniformity           | 2.50  | Kruskal      |
| pet_acquisition_year     | 6.58E-01 | original_glszm_ZoneEntropy                      | 2.42  | Kruskal      |
| pet_institution_acquired | 6.67E-01 | original_shape_Maximum2DDiameterRow             | 38.55 | Mann-Whitney |
| pet_slice_thickness      | 6.70E-01 | original_glszm_SizeZoneNonUniformityNormalized  | 5.79  | Kruskal      |
| pet_vendor               | 6.73E-01 | original_shape_LeastAxisLength                  | 1.54  | Kruskal      |
| pet_institution_acquired | 6.77E-01 | original_firstorder_Median                      | 38.55 | Mann-Whitney |
| pet_vendor               | 6.85E-01 | original_firstorder_Skewness                    | 1.49  | Kruskal      |

Table S3 (continued)

Table S3 (continued)

| Confound             | P        | feat                                            | stat | Test    |
|----------------------|----------|-------------------------------------------------|------|---------|
| pet_vendor           | 7.00E-01 | original_firstorder_MeanAbsoluteDeviation       | 1.42 | Kruskal |
| pet_vendor           | 7.10E-01 | original_firstorder_Median                      | 1.38 | Kruskal |
| pet_slice_thickness  | 7.16E-01 | original_firstorder_Energy                      | 5.39 | Kruskal |
| pet_vendor           | 7.16E-01 | original_shape_Maximum2DDiameterColumn          | 1.36 | Kruskal |
| pet_vendor           | 7.29E-01 | original_glszm_SmallAreaEmphasis                | 1.30 | Kruskal |
| pet_vendor           | 7.32E-01 | original_firstorder_Variance                    | 1.29 | Kruskal |
| pet_vendor           | 7.32E-01 | original_shape_Maximum2DDiameterRow             | 1.29 | Kruskal |
| pet_vendor           | 7.36E-01 | original_firstorder_10Percentile                | 1.27 | Kruskal |
| pet_slice_thickness  | 7.41E-01 | original_firstorder_TotalEnergy                 | 5.16 | Kruskal |
| pet_vendor           | 7.42E-01 | original_firstorder_Minimum                     | 1.25 | Kruskal |
| pet_vendor           | 7.45E-01 | original_shape_Maximum3DDiameter                | 1.23 | Kruskal |
| pet_vendor           | 7.62E-01 | original_glszm_ZonePercentage                   | 1.16 | Kruskal |
| pet_vendor           | 7.79E-01 | original_glszm_LargeAreaHighGrayLevelEmphasis   | 1.09 | Kruskal |
| pet_slice_thickness  | 7.91E-01 | original_firstorder_InterquartileRange          | 4.69 | Kruskal |
| pet_slice_thickness  | 7.97E-01 | original_firstorder_Kurtosis                    | 4.62 | Kruskal |
| pet_slice_thickness  | 7.98E-01 | original_firstorder_RobustMeanAbsoluteDeviation | 4.61 | Kruskal |
| pet_vendor           | 7.99E-01 | original_glszm_SmallAreaHighGrayLevelEmphasis   | 1.01 | Kruskal |
| pet_vendor           | 8.02E-01 | original_shape_MajorAxisLength                  | 1.00 | Kruskal |
| pet_vendor           | 8.06E-01 | original_shape_SurfaceArea                      | 0.98 | Kruskal |
| pet_vendor           | 8.18E-01 | original_firstorder_Uniformity                  | 0.93 | Kruskal |
| pet_vendor           | 8.19E-01 | original_shape_MinorAxisLength                  | 0.93 | Kruskal |
| pet_acquisition_year | 8.22E-01 | original_firstorder_Maximum                     | 1.53 | Kruskal |
| pet_slice_thickness  | 8.36E-01 | original_glszm_GrayLevelNonUniformityNormalized | 4.23 | Kruskal |
| pet_vendor           | 8.52E-01 | original_glszm_HighGrayLevelZoneEmphasis        | 0.79 | Kruskal |
| pet_vendor           | 8.53E-01 | original_firstorder_Entropy                     | 0.78 | Kruskal |
| pet_vendor           | 8.53E-01 | original_shape_Maximum2DDiameterSlice           | 0.78 | Kruskal |
| pet_acquisition_year | 8.54E-01 | original_firstorder_Uniformity                  | 1.34 | Kruskal |
| pet_vendor           | 8.55E-01 | original_firstorder_Energy                      | 0.78 | Kruskal |
| pet_acquisition_year | 8.57E-01 | original_firstorder_Variance                    | 1.33 | Kruskal |
| pet_vendor           | 8.66E-01 | original_firstorder_Mean                        | 0.73 | Kruskal |
| pet_slice_thickness  | 8.67E-01 | original_firstorder_MeanAbsoluteDeviation       | 3.88 | Kruskal |
| pet_slice_thickness  | 8.68E-01 | original_shape_Elongation                       | 3.87 | Kruskal |
| pet_acquisition_year | 8.72E-01 | original_firstorder_MeanAbsoluteDeviation       | 1.24 | Kruskal |
| pet_vendor           | 8.74E-01 | original_glszm_LargeAreaEmphasis                | 0.70 | Kruskal |
| pet_vendor           | 8.79E-01 | original_shape_MeshVolume                       | 0.67 | Kruskal |

Table S3 (continued)

Table S3 (continued)

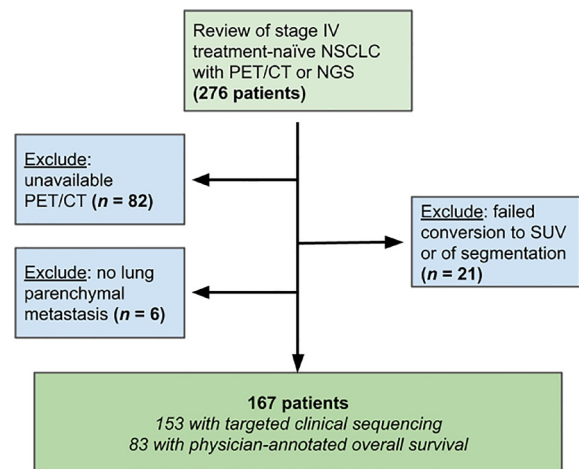
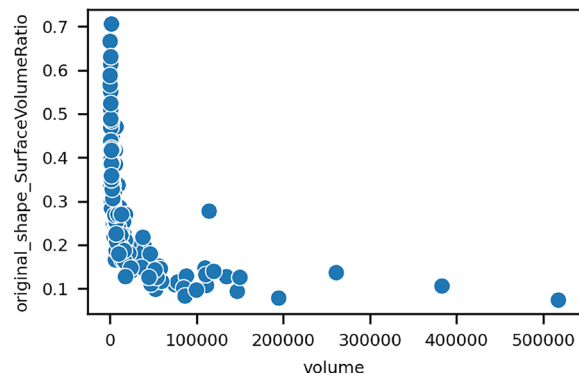
| Confound                 | P        | feat                                            | stat  | Test         |
|--------------------------|----------|-------------------------------------------------|-------|--------------|
| pet_slice_thickness      | 8.81E-01 | original_firstorder_Variance                    | 3.73  | Kruskal      |
| pet_vendor               | 8.82E-01 | original_shape_VoxelVolume                      | 0.66  | Kruskal      |
| pet_slice_thickness      | 8.86E-01 | original_glszm_SizeZoneNonUniformity            | 3.66  | Kruskal      |
| pet_vendor               | 8.87E-01 | original_glszm_ZoneVariance                     | 0.64  | Kruskal      |
| pet_slice_thickness      | 8.94E-01 | original_firstorder_Entropy                     | 3.57  | Kruskal      |
| pet_slice_thickness      | 8.98E-01 | original_firstorder_Uniformity                  | 3.51  | Kruskal      |
| pet_acquisition_year     | 8.99E-01 | original_firstorder_Entropy                     | 1.07  | Kruskal      |
| pet_vendor               | 9.00E-01 | original_firstorder_Kurtosis                    | 0.59  | Kruskal      |
| pet_acquisition_year     | 9.02E-01 | original_firstorder_InterquartileRange          | 1.05  | Kruskal      |
| pet_acquisition_year     | 9.10E-01 | original_firstorder_RobustMeanAbsoluteDeviation | 1.00  | Kruskal      |
| pet_vendor               | 9.12E-01 | original_glszm_SizeZoneNonUniformity            | 0.53  | Kruskal      |
| pet_vendor               | 9.16E-01 | original_firstorder_RootMeanSquared             | 0.51  | Kruskal      |
| pet_slice_thickness      | 9.21E-01 | original_glszm_GrayLevelVariance                | 3.20  | Kruskal      |
| pet_vendor               | 9.25E-01 | original_firstorder_90Percentile                | 0.47  | Kruskal      |
| pet_slice_thickness      | 9.29E-01 | original_glszm_SmallAreaHighGrayLevelEmphasis   | 3.08  | Kruskal      |
| pet_slice_thickness      | 9.30E-01 | original_glszm_LowGrayLevelZoneEmphasis         | 3.06  | Kruskal      |
| pet_slice_thickness      | 9.36E-01 | original_glszm_HighGrayLevelZoneEmphasis        | 2.98  | Kruskal      |
| pet_slice_thickness      | 9.47E-01 | original_glszm_ZoneEntropy                      | 2.79  | Kruskal      |
| pet_institution_acquired | 9.50E-01 | original_shape_Sphericity                       | 38.55 | Mann-Whitney |
| pet_vendor               | 9.52E-01 | original_firstorder_TotalEnergy                 | 0.34  | Kruskal      |
| pet_vendor               | 9.57E-01 | original_glszm_GrayLevelVariance                | 0.31  | Kruskal      |
| pet_slice_thickness      | 9.69E-01 | original_firstorder_Range                       | 2.33  | Kruskal      |
| pet_slice_thickness      | 9.69E-01 | original_firstorder_Maximum                     | 2.33  | Kruskal      |
| pet_vendor               | 9.70E-01 | original_firstorder_Range                       | 0.25  | Kruskal      |
| pet_vendor               | 9.72E-01 | original_glszm_LargeAreaLowGrayLevelEmphasis    | 0.23  | Kruskal      |
| pet_vendor               | 9.78E-01 | original_shape_SurfaceVolumeRatio               | 0.20  | Kruskal      |
| pet_vendor               | 9.82E-01 | original_glszm_ZoneEntropy                      | 0.17  | Kruskal      |
| pet_vendor               | 9.95E-01 | original_firstorder_Maximum                     | 0.07  | Kruskal      |

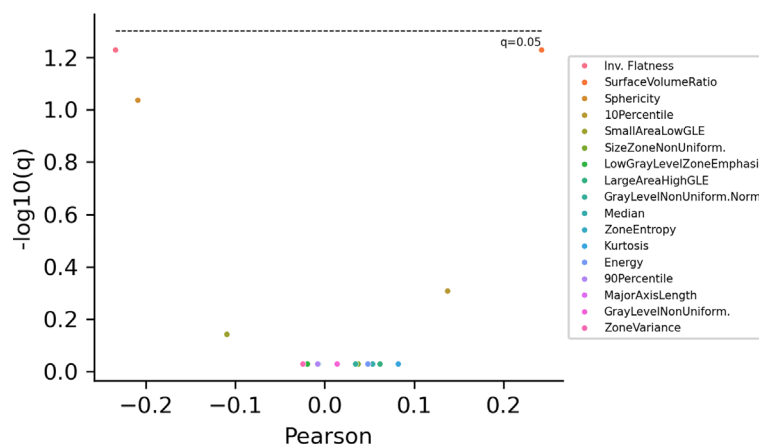
**Table S4** Sites of disease

| Site                       | Count |
|----------------------------|-------|
| Lung                       | 167   |
| Bone                       | 98    |
| Nodes (unspecified)        | 74    |
| Thoracic nodes             | 72    |
| Pleura                     | 40    |
| Adrenal                    | 36    |
| Hepatic                    | 30    |
| Soft tissue                | 28    |
| Abd. nodes                 | 17    |
| Supraclav. nodes           | 15    |
| Ax. nodes                  | 13    |
| Cervical nodes             | 13    |
| Thyroid                    | 3     |
| Submandibular gland        | 1     |
| Heart                      | 1     |
| Renal                      | 1     |
| Spinal cord intramedullary | 1     |
| Pancreas                   | 1     |

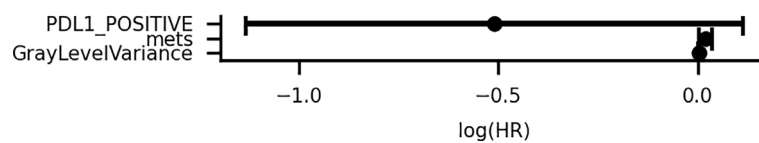
**Table S5** Concordance indices by overall survival for the training and test sets for the radiomic, clinicogenomic, and multimodal models

| Split | Model          | c-index (95% CI)     |
|-------|----------------|----------------------|
| Train | Radiomic       | 0.639 (0.542, 0.741) |
| Train | Clinicogenomic | 0.697 (0.596, 0.800) |
| Train | Multimodal     | 0.722 (0.632, 0.813) |
| Test  | Radiomic       | 0.736 (0.516, 0.896) |
| Test  | Clinicogenomic | 0.634 (0.408, 0.855) |
| Test  | Multimodal     | 0.687 (0.482, 0.875) |

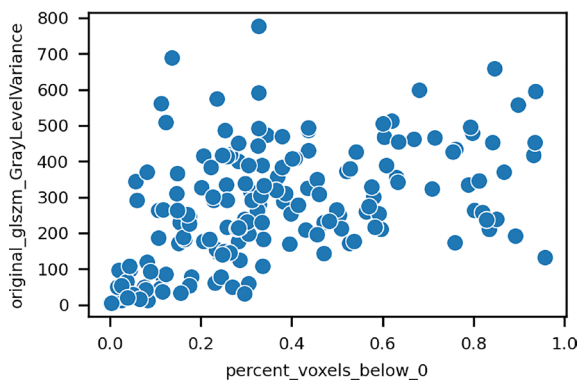
**Figure S1** Cohort selection chart.**Figure S2** Total lesion volume versus surface area-to-volume ratio of the largest lung lesion.



**Figure S3** Association of radiomic features derived from positron emission tomography with number of metastatic lesions.



**Figure S4** Forest plot for multivariate (radiomic and clinicogenomic features) regression of number of metastatic lesions depicting 95% confidence interval for each coefficient.



**Figure S5** Percent voxels with intensities below zero Hounsfield units versus the gray level variance derived from the gray level size zone matrix (GLSZM).