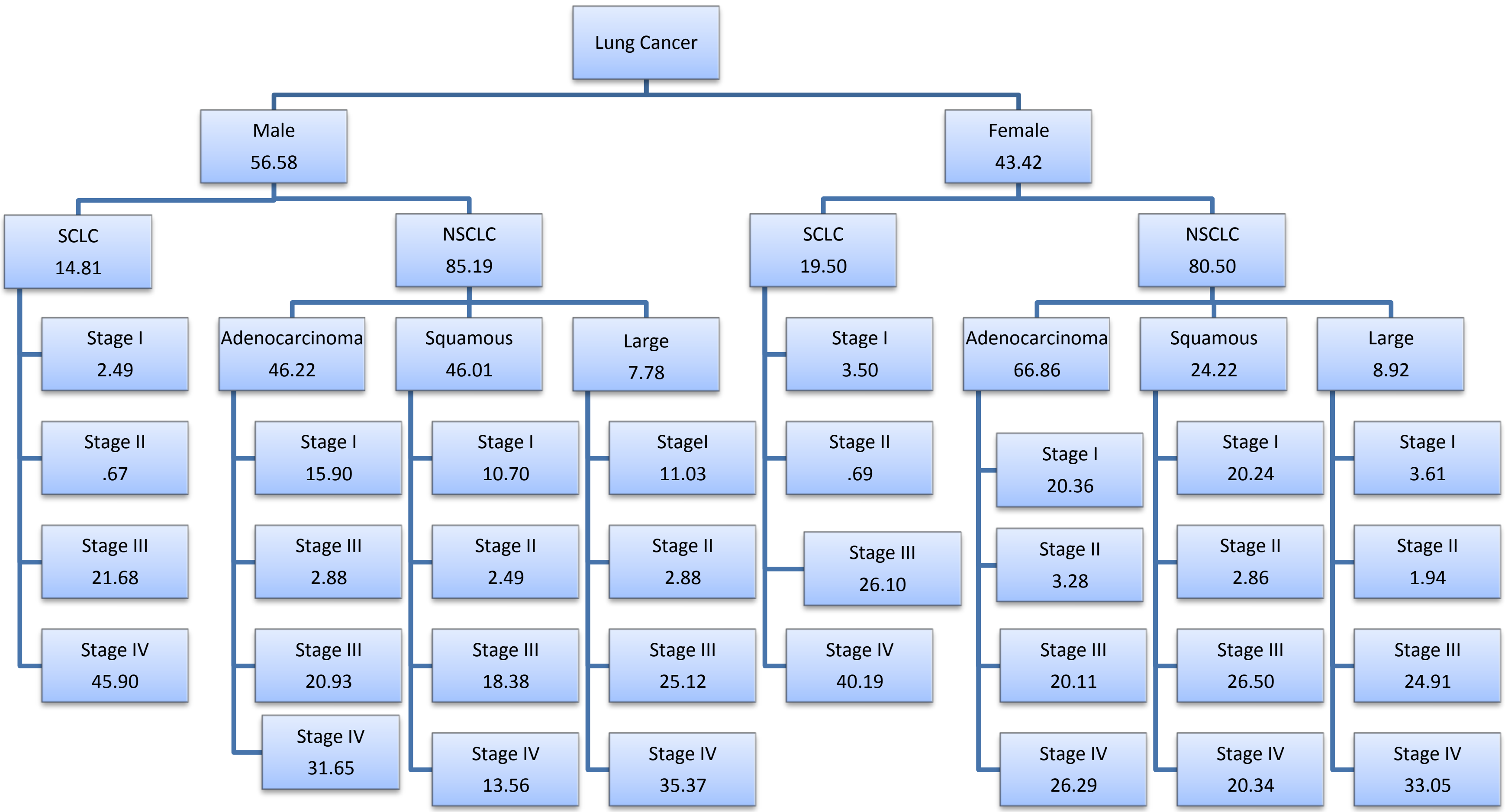
# Lung Cancer

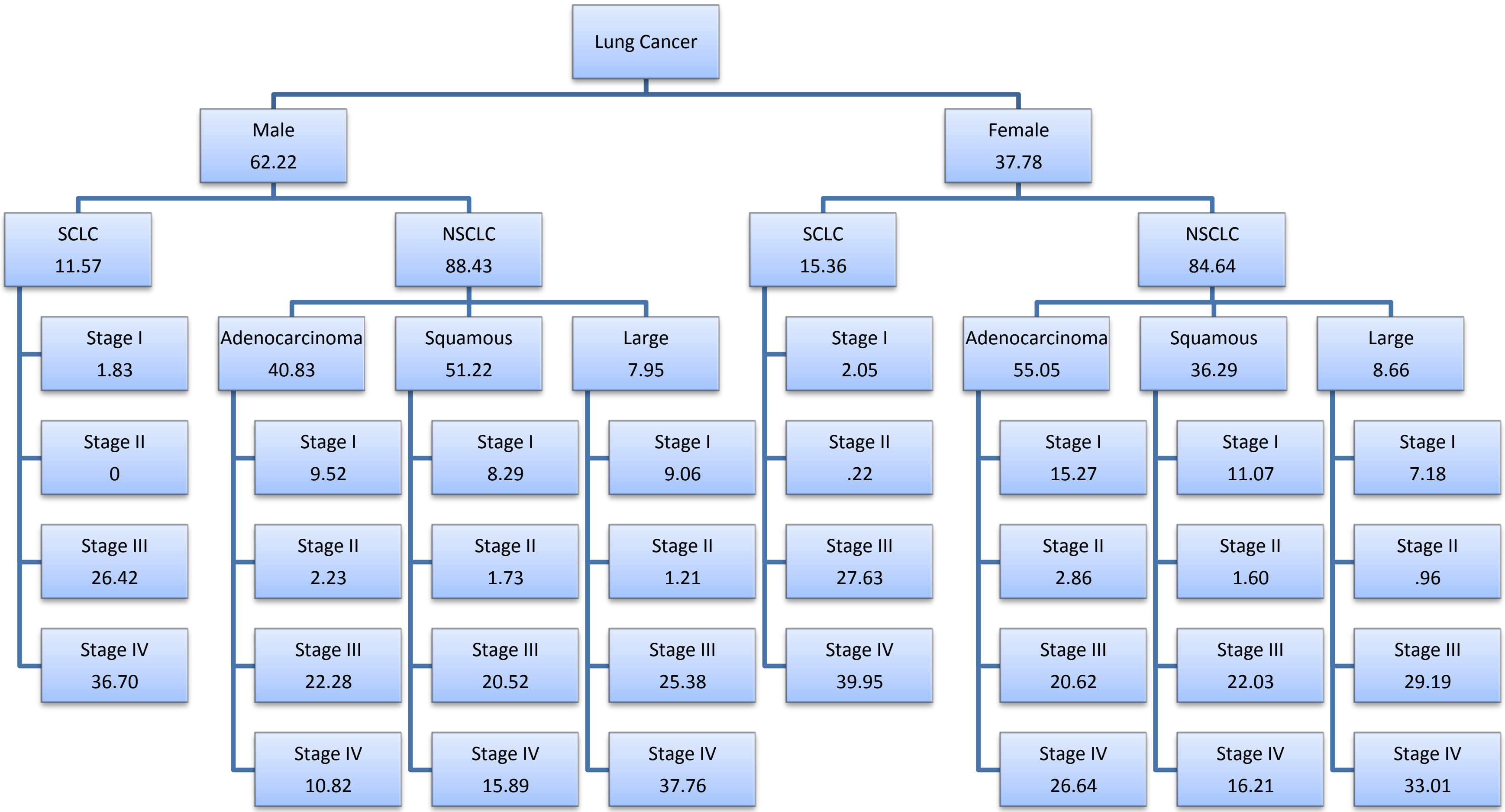
I s there any significant difference of tumor size with respect to:

- Gender?
- Race?
- Stages?
- Age?

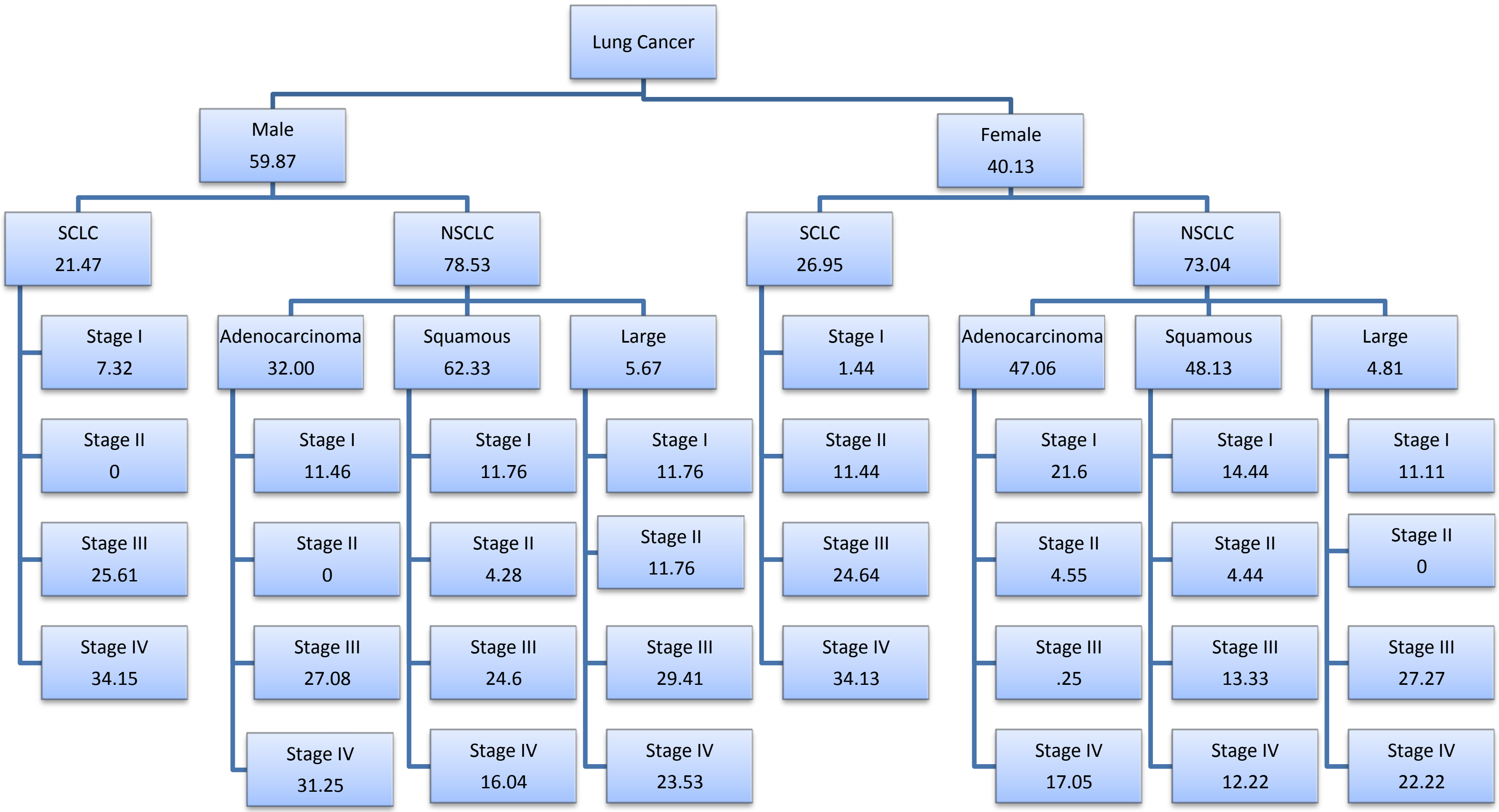
# Schematic Data White Race tree Diagram%

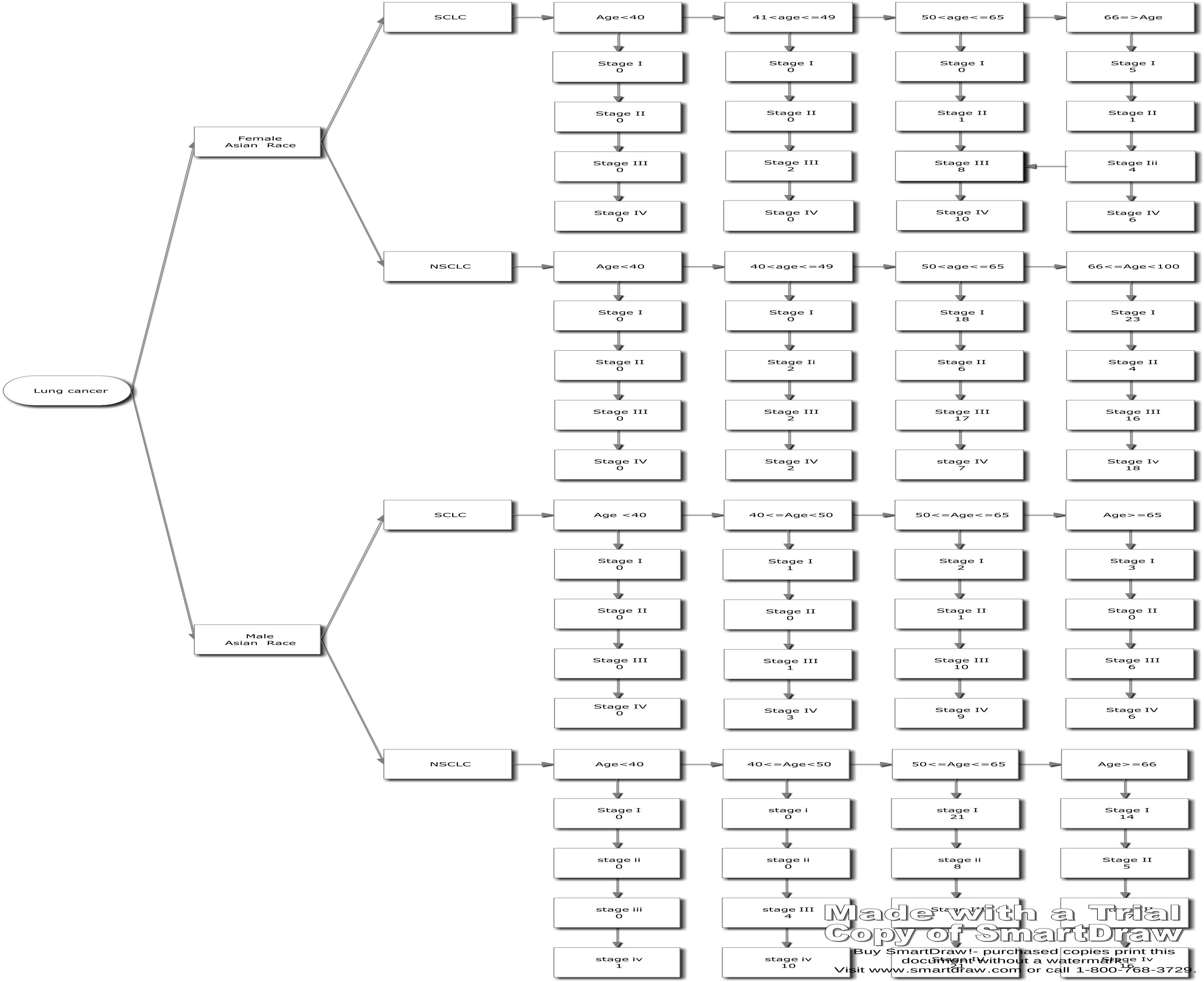


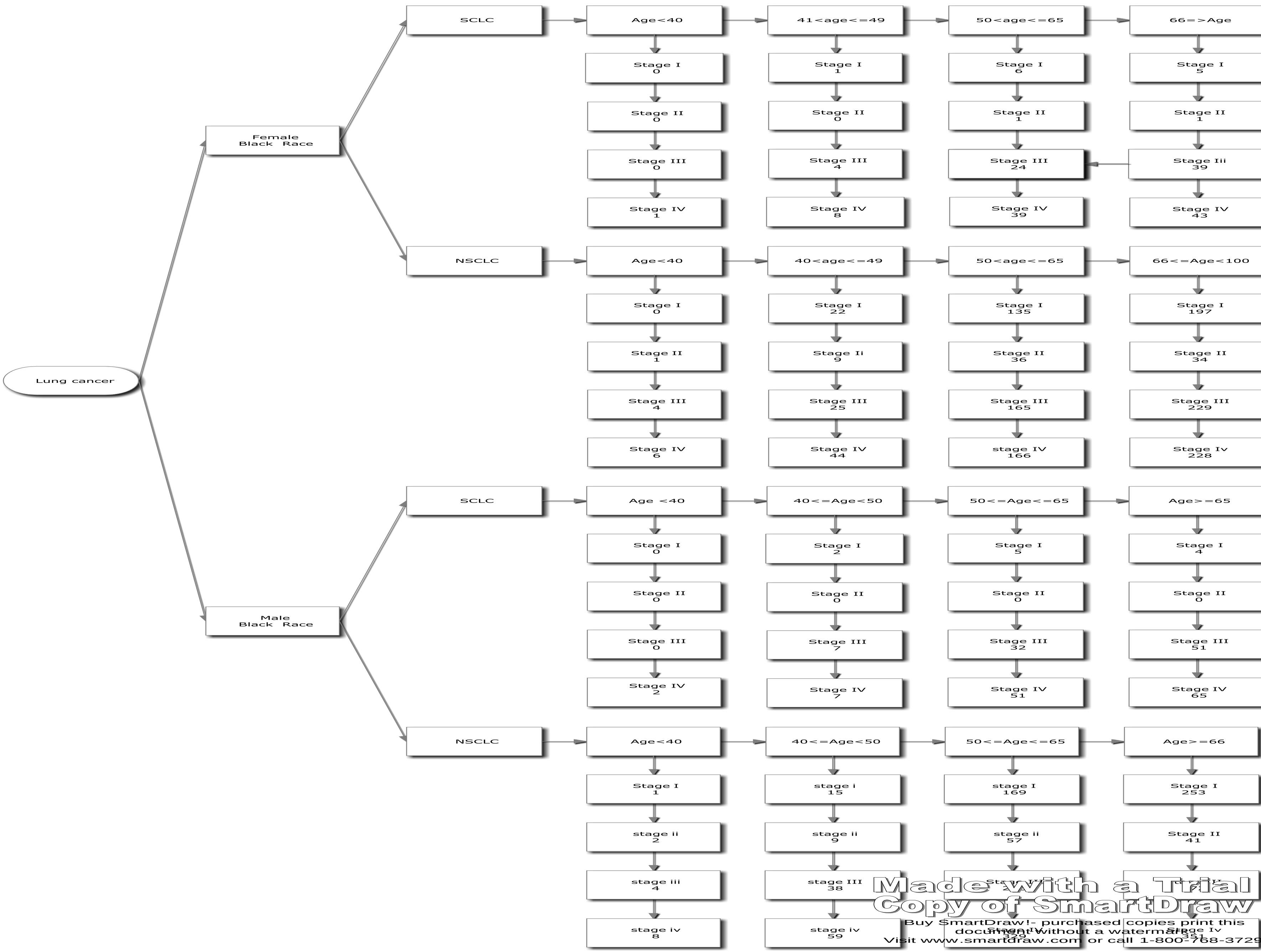
# Schematic Data tree Diagram % Of Black Race

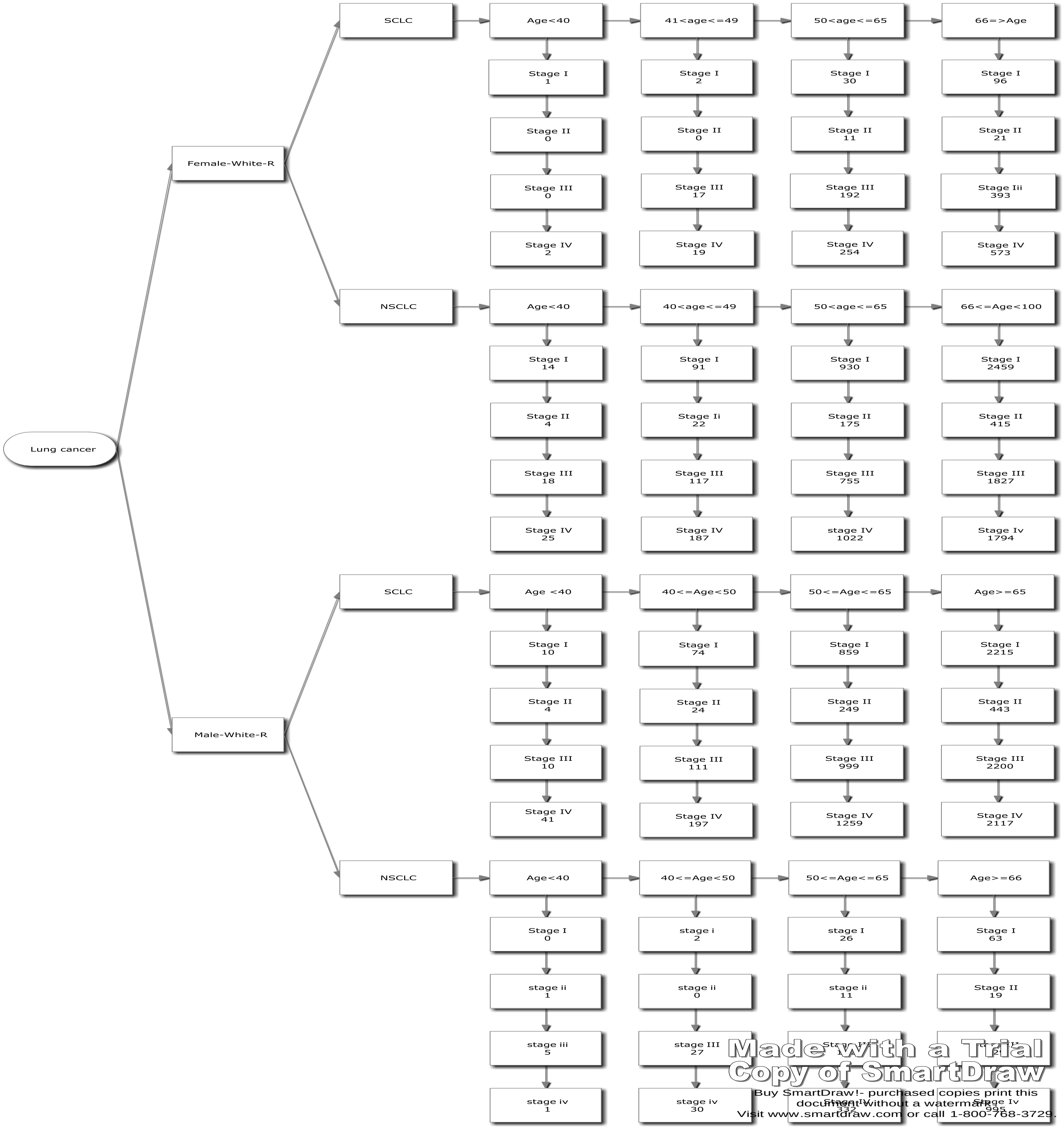


# schematic Data tree Diagram% of Asian Race




Lung cancer
Female
Asian Race
SCLC
Age<40
Stage I
0
Stage II
0
Stage III
0
Stage IV
0
41<age<=49
Stage I
0
Stage II
0
Stage III
2
Stage IV
0
50<age<=65
Stage I
0
Stage II
1
Stage III
8
Stage IV
10
66=>Age
Stage I
5
Stage II
1
Stage Iii
4
Stage IV
6
NSCLC
Age<40
Stage I
0
Stage II
0
Stage III
0
Stage IV
0
40<age<=49
Stage I
0
Stage Ii
2
Stage III
2
Stage IV
2
50<age<=65
Stage I
18
Stage II
6
Stage III
17
stage IV
7
66<=Age<100
Stage I
23
Stage II
4
Stage III
16
Stage Iv
18
Male
Asian Race
SCLC
Age <40
Stage I
0
Stage II
0
Stage III
0
Stage IV
0
40<=Age<50
Stage I
1
Stage II
0
Stage III
1
Stage IV
3
50<=Age<=65
Stage I
2
Stage II
1
Stage III
10
Stage IV
9
Age>=65
Stage I
3
Stage II
0
Stage III
6
Stage IV
6
NSCLC
Age<40
Stage I
0
stage ii
0
stage iii
0
stage iv
1
40<=Age<50
stage i
0
stage ii
0
stage III
4
stage iv
10
50<=Age<=65
stage I
21
stage ii
8
Stage IV
21
Age>=66
Stage I
14
Stage II
5
Stage Iv
16


Lung cancer
Female Black Race
SCLC
Age<40
Stage I 0
Stage II 0
Stage III 0
Stage IV 1
41<age<=49
Stage I 1
Stage II 0
Stage III 4
Stage IV 8
50<age<=65
Stage I 6
Stage II 1
Stage III 24
Stage IV 39
66=>Age
Stage I 5
Stage II 1
Stage Iii 39
Stage IV 43
NSCLC
Age<40
Stage I 0
Stage II 1
Stage III 4
Stage IV 6
40<age<=49
Stage I 22
Stage Ii 9
Stage III 25
Stage IV 44
50<age<=65
Stage I 135
Stage II 36
Stage III 165
stage IV 166
66<=Age<100
Stage I 197
Stage II 34
Stage III 229
Stage Iv 228
Male Black Race
SCLC
Age <40
Stage I 0
Stage II 0
Stage III 0
Stage IV 2
40<=Age<50
Stage I 2
Stage II 0
Stage III 7
Stage IV 7
50<=Age<=65
Stage I 5
Stage II 0
Stage III 32
Stage IV 51
Age>=65
Stage I 4
Stage II 0
Stage III 51
Stage IV 65
NSCLC
Age<40
Stage I 1
stage ii 2
stage iii 4
stage iv 8
40<=Age<50
stage i 15
stage ii 9
stage III 38
stage iv 59
50<=Age<=65
stage I 169
stage ii 57
Stage IV 329
Age>=66
Stage I 253
Stage II 41
Stage Iv 351


Lung cancer
Female-White-R
SCLC
Age<40
Stage I 1
Stage II 0
Stage III 0
Stage IV 2
41<age<=49
Stage I 2
Stage II 0
Stage III 17
Stage IV 19
50<age<=65
Stage I 30
Stage II 11
Stage III 192
Stage IV 254
66=>Age
Stage I 96
Stage II 21
Stage Iii 393
Stage IV 573
NSCLC
Age<40
Stage I 14
Stage II 4
Stage III 18
Stage IV 25
40<age<=49
Stage I 91
Stage Ii 22
Stage III 117
Stage IV 187
50<age<=65
Stage I 930
Stage II 175
Stage III 755
stage IV 1022
66<=Age<100
Stage I 2459
Stage II 415
Stage III 1827
Stage Iv 1794
Male-White-R
SCLC
Age <40
Stage I 10
Stage II 4
Stage III 10
Stage IV 41
40<=Age<50
Stage I 74
Stage II 24
Stage III 111
Stage IV 197
50<=Age<=65
Stage I 859
Stage II 249
Stage III 999
Stage IV 1259
Age>=65
Stage I 2215
Stage II 443
Stage III 2200
Stage IV 2117
NSCLC
Age<40
Stage I 0
stage ii 1
stage iii 5
stage iv 1
40<=Age<50
stage i 2
stage ii 0
stage III 27
stage iv 30
50<=Age<=65
stage I 26
stage ii 11
Stage IV 332
Age>=66
Stage I 63
Stage II 19
Stage Iv 995

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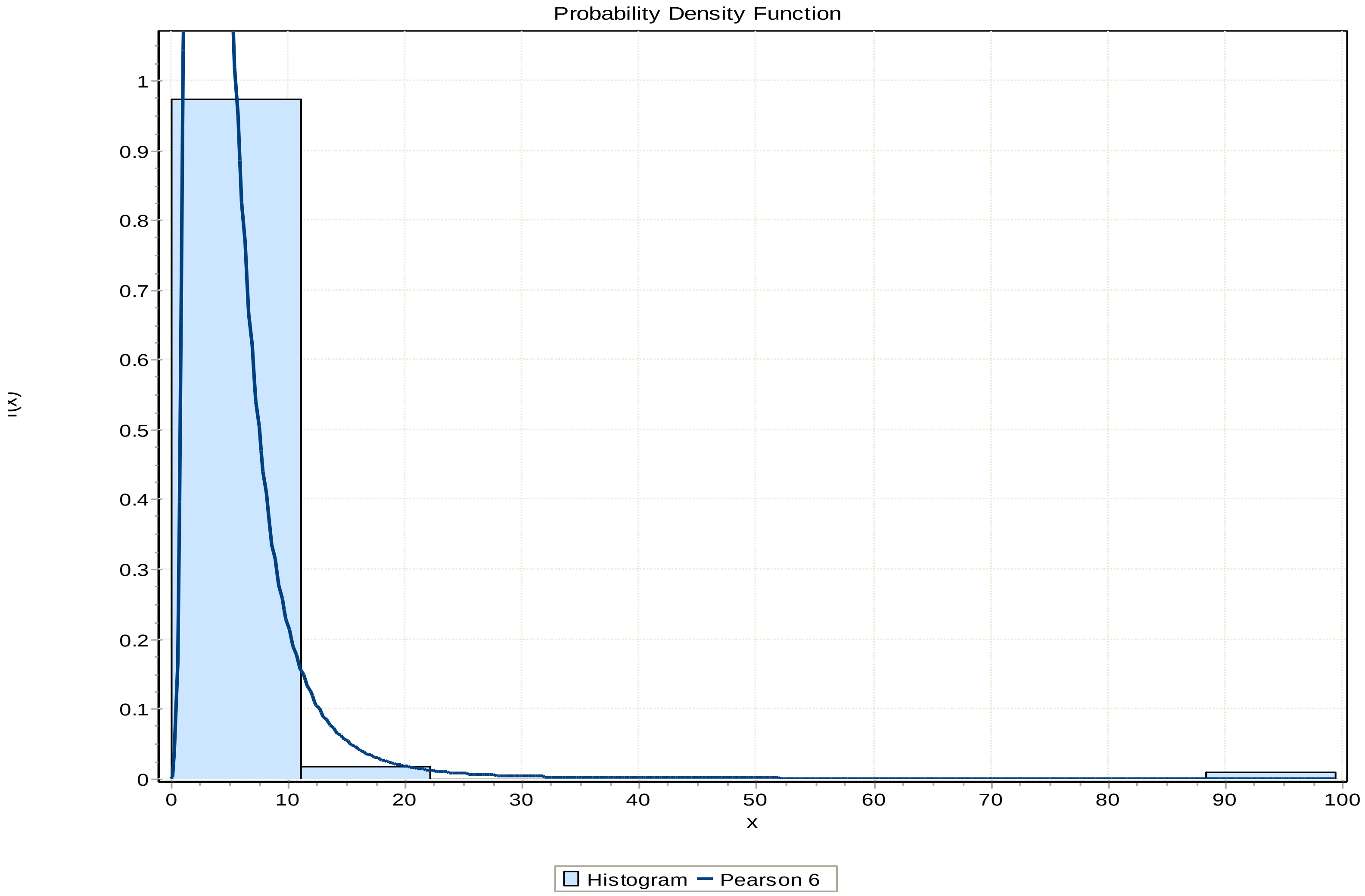
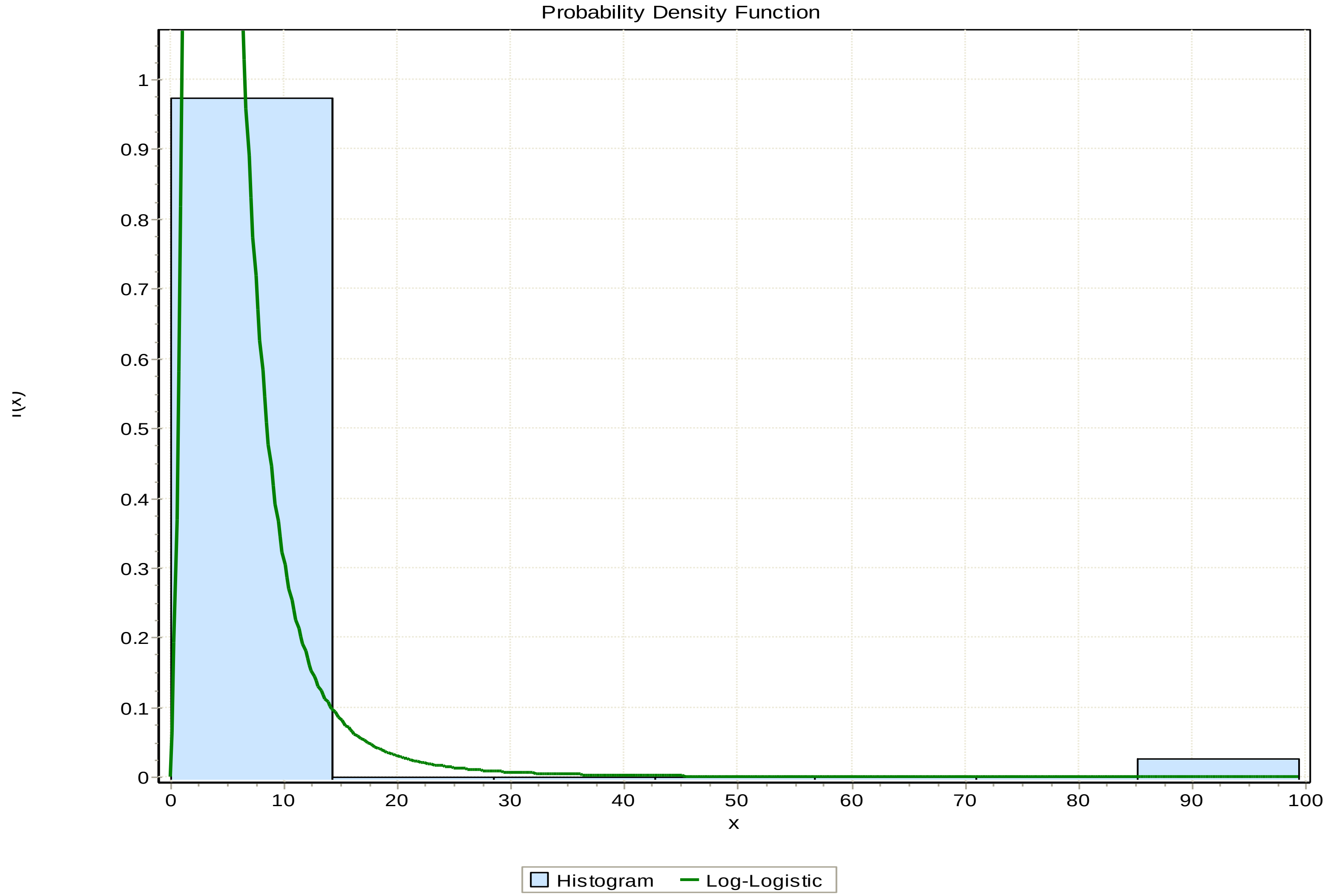
Lung Distribution (NSCLC and SCLC) Asian Race:




$\widehat{\alpha_1} = 6.284$ $\widehat{\alpha_2} = 4.353$ $\widehat{\beta} = 2.597$

| | |
|---|---|
| Probability density function : | $f(x) = \frac{1}{\beta B(\alpha_1, \alpha_2)} \frac{(x/\beta)^{\alpha_1 - 1}}{\left(1 + \frac{x}{\beta}\right)^{\alpha_1 + \alpha_2}}$ <br> *where* $B(\alpha_1, \alpha_2)$ *is a Beta function* |
| Cumulative distribution function : | *No closed form* |
| Parameter restriction : | $\alpha_1 > 0, \alpha_2 > 0, \beta > 0$ |
| Domain : | $0 \le x < +\infty$ |
| Mean : | $\frac{\beta \alpha_1}{\alpha_2 - 1}$ *for* $\alpha_2 > 1$ |
| Mode : | $\frac{\beta(\alpha_1 - 1)}{\alpha_2 + 1}$ *for* $\alpha_1 > 1$ <br> $0$ *otherwise* |
| Variance : | $\frac{\beta^2 \alpha_1 (\alpha_1 + \alpha_2 - 1)}{(\alpha_2 - 1)^2 (\alpha_2 - 2)}$ *for* $\alpha_2 > 2$ |
| Skewness : | $2\sqrt{\frac{\alpha_2 - 2}{\alpha_1(\alpha_1 + \alpha_2 - 1)}}\left[\frac{2\alpha_1 + \alpha_2 - 1}{\alpha_2 - 3}\right]$ *for* $\alpha_2 > 3$ |
| Kurtosis : | $\frac{3(\alpha_2 - 2)}{(\alpha_2 - 3)(\alpha_2 - 4)}\left[\frac{2(\alpha_2 - 1)^2}{\alpha_1(\alpha_1 + \alpha_2 - 1)} + (\alpha_2 + 5)\right]$ <br> *for* $\alpha_2 > 4$ |

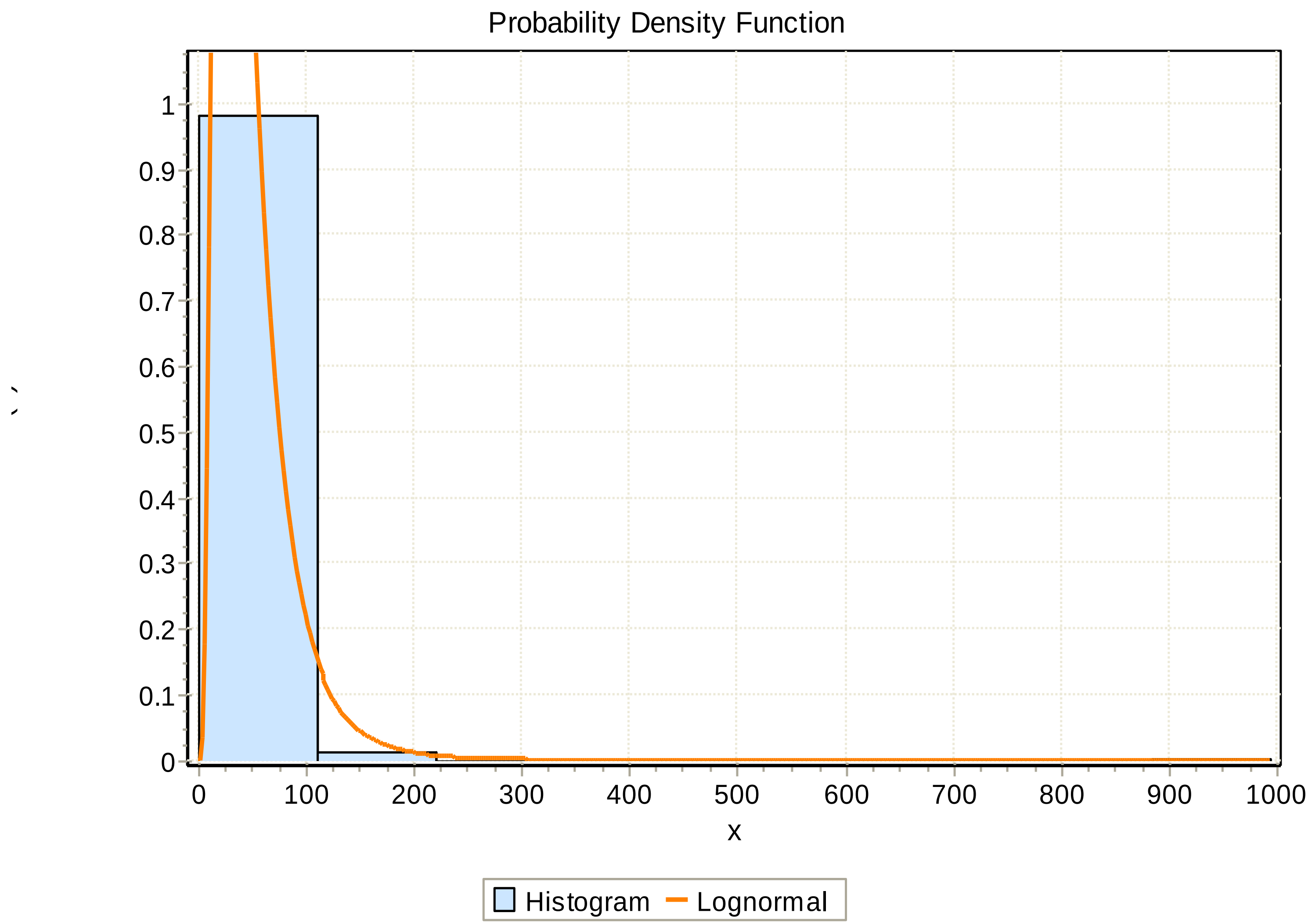
SCLC Distribution Asian –Race:




$$\widehat{\alpha} = 2.618, \widehat{\beta} = 4.21$$

| | |
|---|---|
| Probability density function : | $f(x) = \frac{z}{\beta(1+z)^2}$ *where* $z = \exp\left(-\frac{x-\alpha}{\beta}\right)$ |
| Cumulative distribution function : | $F(x) = \frac{1}{1+z}$ |
| Parameter restriction : | $\beta > 0$ |
| Domain : | $-\infty < x < +\infty$ |
| Mean : | $\alpha$ |
| Mode : | $\alpha$ |
| Variance : | $\frac{\beta^2\pi^2}{3}$ |
| Skewness : | 0 |
| Kurtosis : | 4.2 |

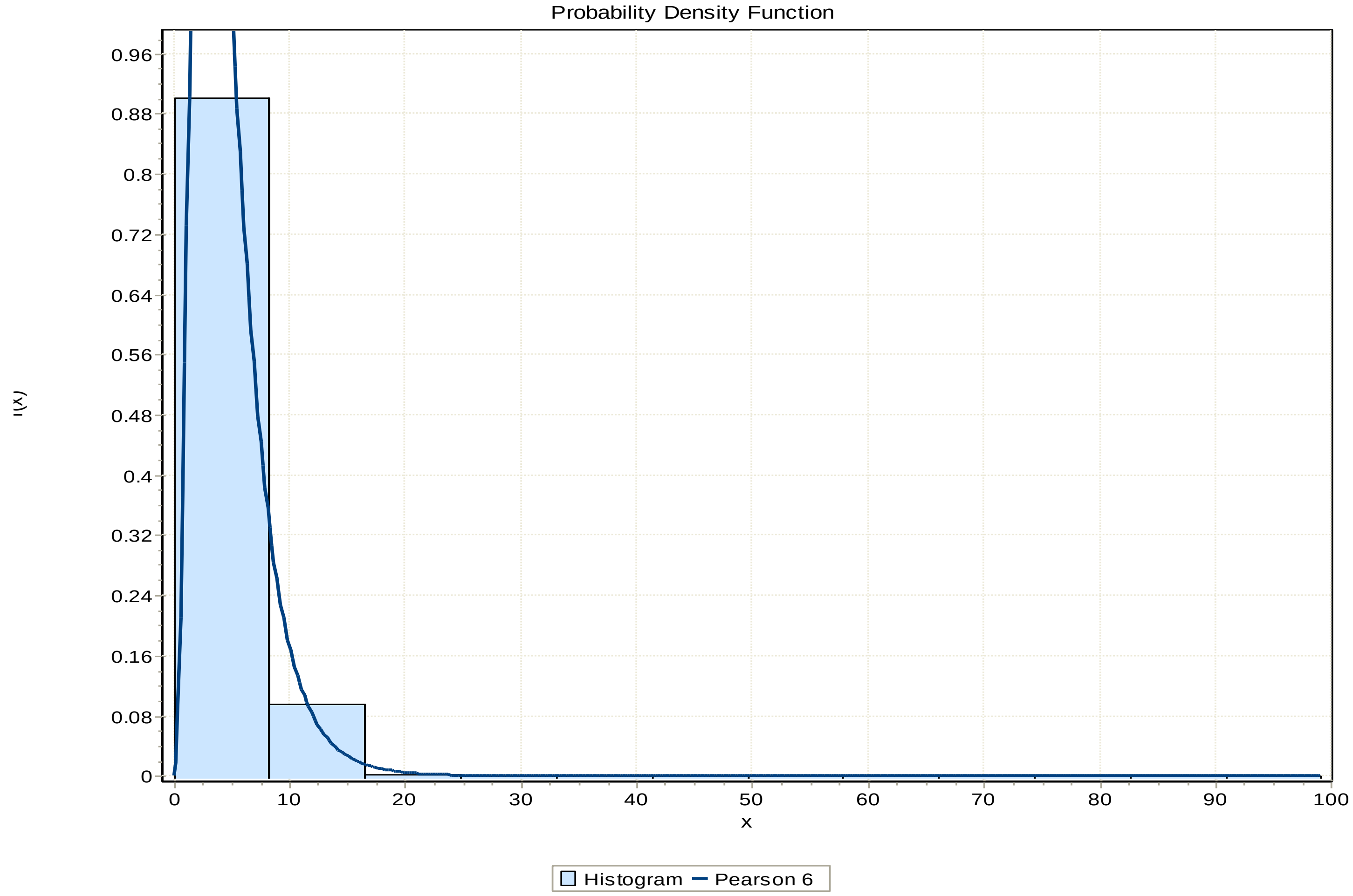
NSCLC Distribution –Asian Race:




$$\widehat{\mu} = 3.631, \widehat{\sigma} = 0.63388$$

| | |
|---|---|
| Probability density function : | $f(x) = \frac{1}{x\sqrt{2\pi\sigma_1^2}} \exp\left[-\frac{\left(\ln[x] - \mu_1^2\right)}{2\sigma_1^2}\right]$ <br> *where* $\mu_1 = \ln\left[\frac{\mu^2}{\sqrt{\sigma^2 + \mu^2}}\right]$ *and* $\sigma_1 = \sqrt{\ln\left[\frac{\sigma^2 + \mu^2}{\mu^2}\right]}$ |
| Cumulative distribution function : | *No closed form* |
| Parameter restriction : | $\sigma > 0, \mu > 0$ |
| Domain : | $x \geq 0$ |
| Mean : | $\mu$ |
| Mode : | $\exp\left(\mu_1 - \sigma_1^2\right)$ |
| Variance : | $\sigma^2$ |
| Skewness : | $\left(\frac{\sigma}{\mu}\right)^3 + 3\left(\frac{\sigma}{\mu}\right)$ |
| Kurtosis : | $z^4 + 2z^3 + 3z^2 - 3$ *where* $z = 1 + \frac{\sigma^2}{\mu^2}$ |

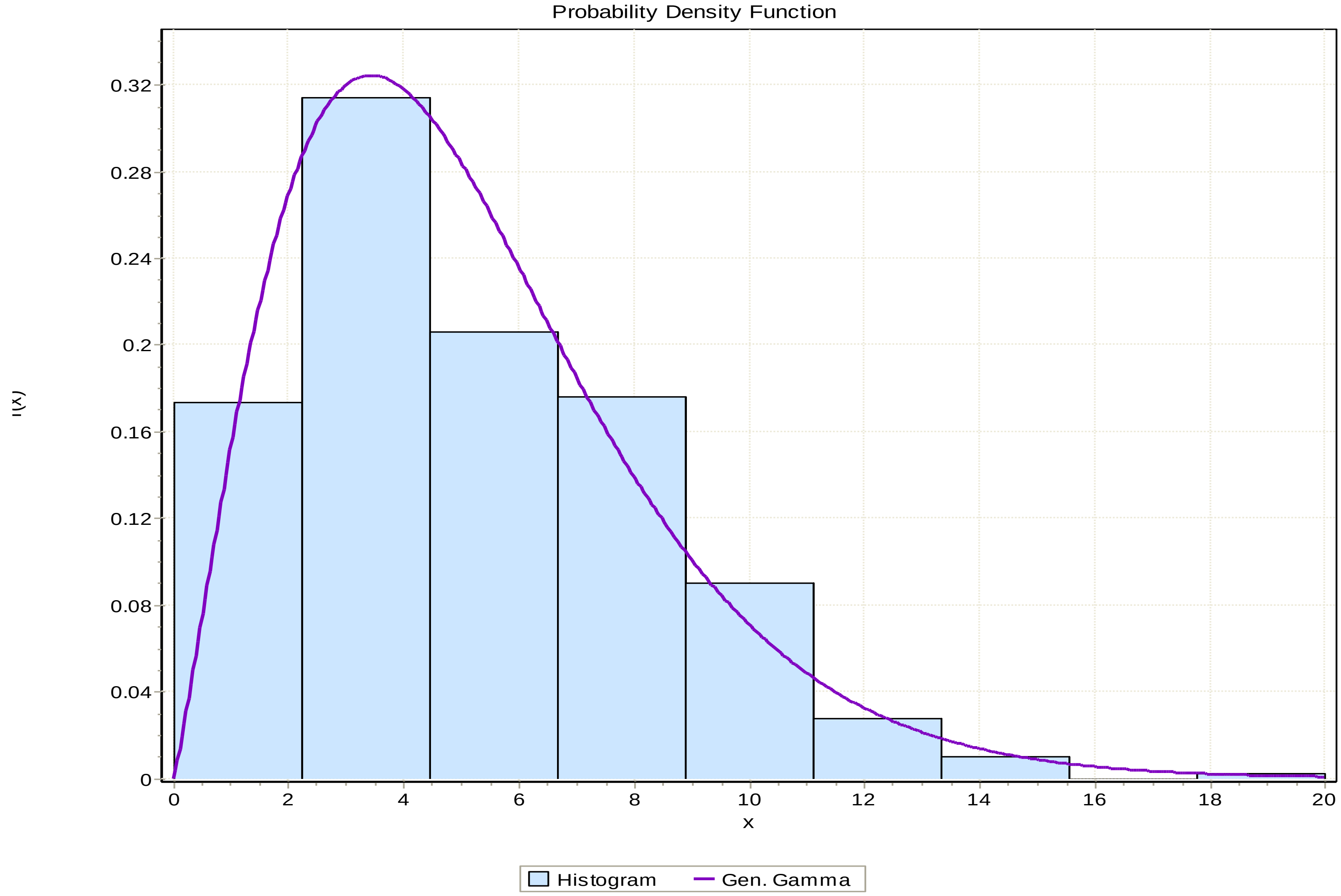
African American Race- Distribution Lung (NSCLC and SCLC):




$$\widehat{\alpha_1} = 3.71, \widehat{\alpha_2} = 11.7, \widehat{\beta} = 13.6$$

| | |
|---|---|
| Probability density function : | $f(x)=\dfrac{1}{\beta\,B(\alpha_1,\alpha_2)}\dfrac{(x/\beta)^{\alpha_1-1}}{\left(1+\dfrac{x}{\beta}\right)^{\alpha_1+\alpha_2}}$ <br> *where* $B(\alpha_1,\alpha_2)$ *is a Beta function* |
| Cumulative distribution function : | *No closed form* |
| Parameter restriction : | $\alpha_1>0\,,\alpha_2>0\,,\beta>0$ |
| Domain : | $0\le x<+\infty$ |
| Mean : | $\dfrac{\beta\alpha_1}{\alpha_2-1}$ *for* $\alpha_2>1$ |
| Mode : | $\dfrac{\beta(\alpha_1-1)}{\alpha_2+1}$ *for* $\alpha_1>1$ <br> $0$ *otherwise* |
| Variance : | $\dfrac{\beta^2\alpha_1(\alpha_1+\alpha_2-1)}{(\alpha_2-1)^2(\alpha_2-2)}$ *for* $\alpha_2>2$ |
| Skewness : | $2\sqrt{\dfrac{\alpha_2-2}{\alpha_1(\alpha_1+\alpha_2-1)}}\left[\dfrac{2\alpha_1+\alpha_2-1}{\alpha_2-3}\right]$ *for* $\alpha_2>3$ |
| Kurtosis : | $\dfrac{3(\alpha_2-2)}{(\alpha_2-3)(\alpha_2-4)}\left[\dfrac{2(\alpha_2-1)^2}{\alpha_1(\alpha_1+\alpha_2-1)}+(\alpha_2+5)\right]$ <br> *for* $\alpha_2>4$ |

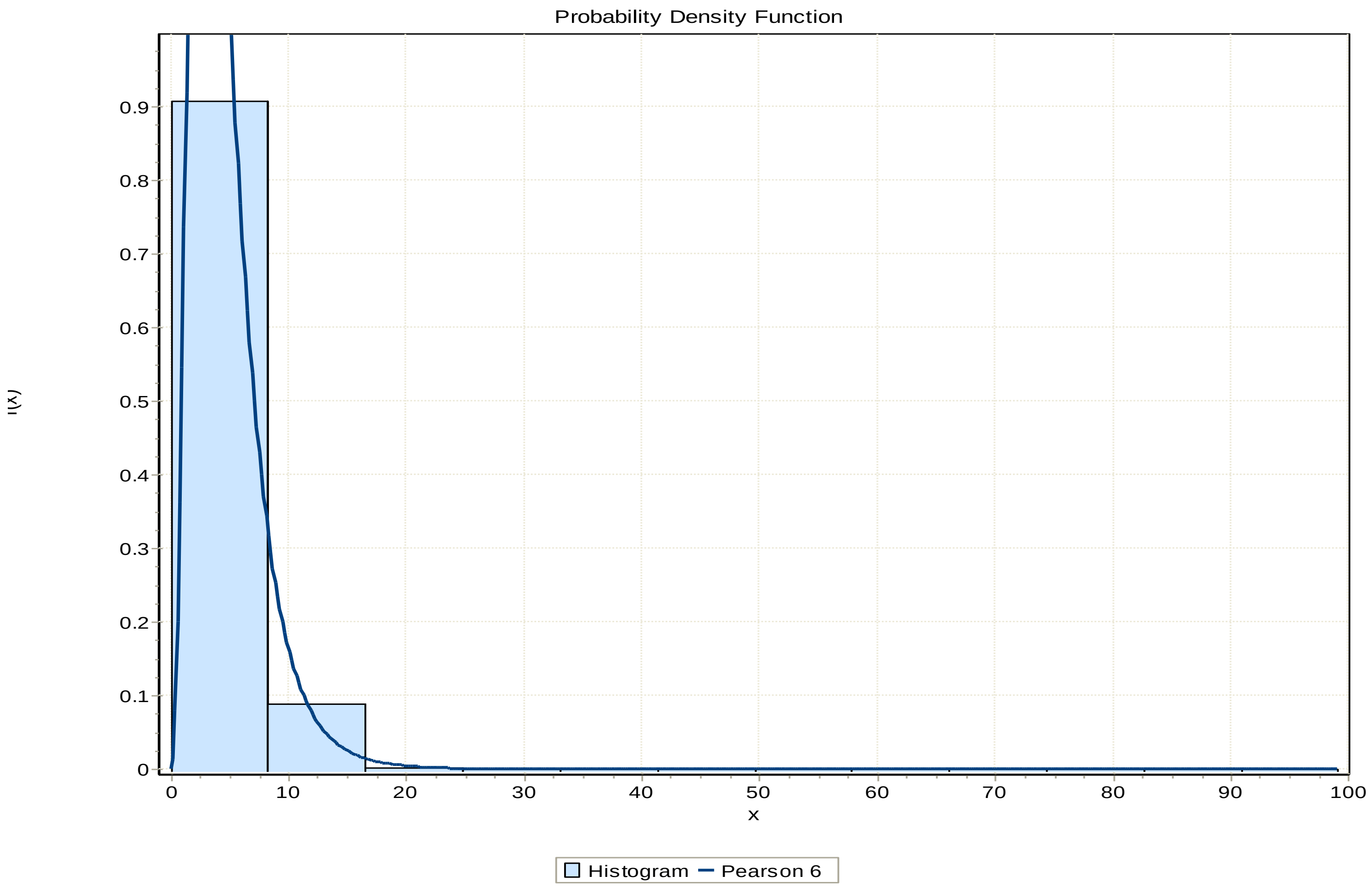
Distribution African American race- SCLC :




$$\widehat{k} = 3.71, \widehat{\alpha} = 1.717, \widehat{\beta} = 3.591$$

| | |
|---|---|
| Probability density function : | $f(x)=\dfrac{\beta^{-\alpha}x^{\alpha-1}\exp\left(-\dfrac{x}{\beta}\right)}{\Gamma(\alpha)}$ |
| Cumulative distribution function : | *No closed form* |
| Parameter restriction : | $\alpha>0,\ \beta>0$ |
| Domain : | $x\geq 0$ |
| Mean : | $\alpha\beta$ |
| Mode : | $\beta(\alpha-1)$    *if* $\alpha\geq 1$<br>$0$    *if* $\alpha<1$ |
| Variance : | $\alpha\beta^2$ |
| Skewness : | $\dfrac{2}{\sqrt{\alpha}}$ |
| Kurtosis : | $3+\dfrac{6}{\alpha}$ |

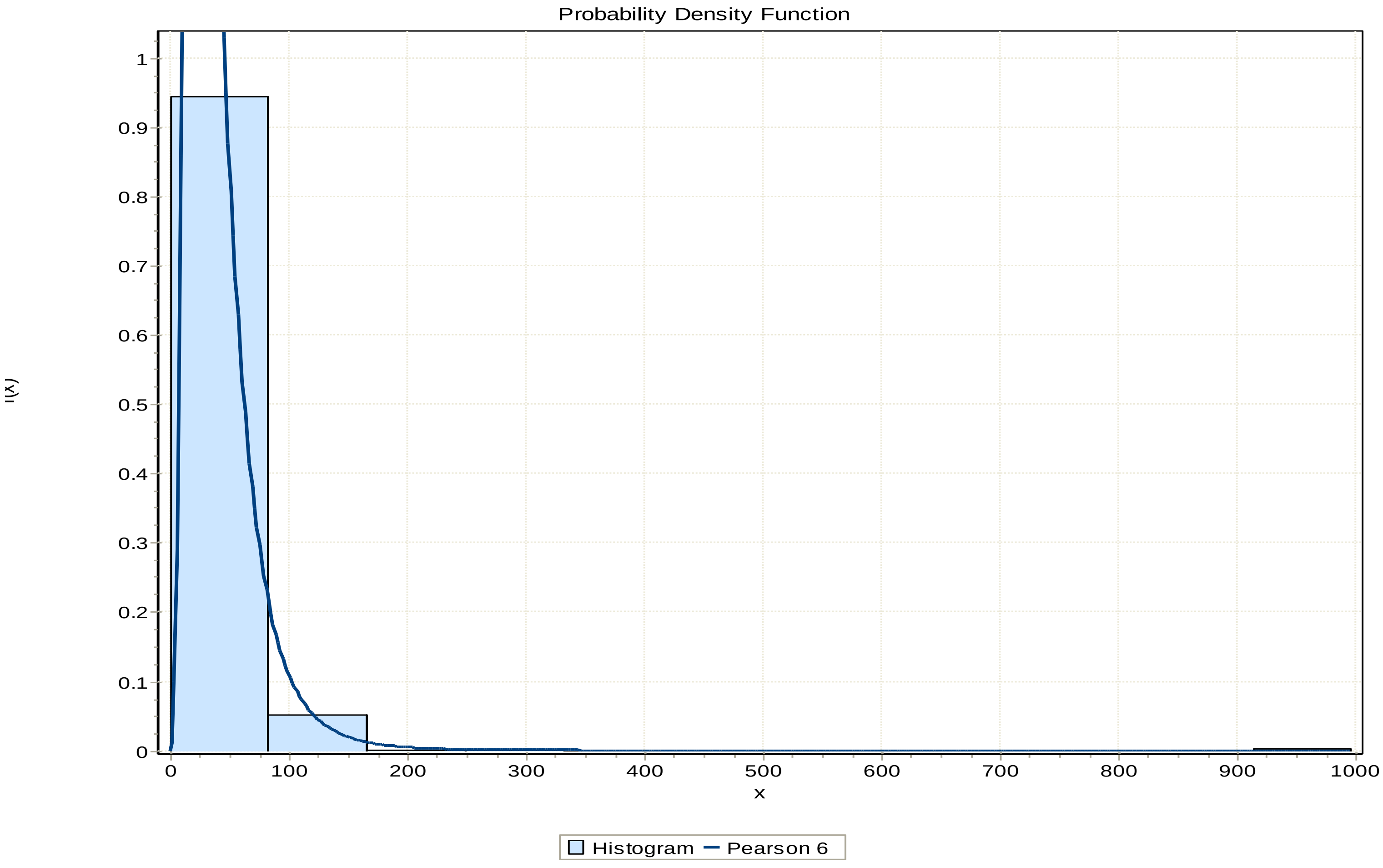
African American-NSCLC Distribution:




$$\widehat{\alpha_1} = 3.873, \widehat{\alpha_2} = 10.88, \widehat{\beta} = 11.88$$

| | |
|---|---|
| Probability density function : | $f(x)=\frac{1}{\beta B(\alpha_1,\alpha_2)}\frac{(x/\beta)^{\alpha_1-1}}{\left(1+\frac{x}{\beta}\right)^{\alpha_1+\alpha_2}}$ <br> *where* $B(\alpha_1,\alpha_2)$ *is a Beta function* |
| Cumulative distribution function : | *No closed form* |
| Parameter restriction : | $\alpha_1>0,\alpha_2>0,\beta>0$ |
| Domain : | $0\le x<+\infty$ |
| Mean : | $\frac{\beta\alpha_1}{\alpha_2-1}$ *for* $\alpha_2>1$ |
| Mode : | $\frac{\beta(\alpha_1-1)}{\alpha_2+1}$ *for* $\alpha_1>1$ <br> $0$ *otherwise* |
| Variance : | $\frac{\beta^2\alpha_1(\alpha_1+\alpha_2-1)}{(\alpha_2-1)^2(\alpha_2-2)}$ *for* $\alpha_2>2$ |
| Skewness : | $2\sqrt{\frac{\alpha_2-2}{\alpha_1(\alpha_1+\alpha_2-1)}}\left[\frac{2\alpha_1+\alpha_2-1}{\alpha_2-3}\right]$ *for* $\alpha_2>3$ |
| Kurtosis : | $\frac{3(\alpha_2-2)}{(\alpha_2-3)(\alpha_2-4)}\left[\frac{2(\alpha_2-1)^2}{\alpha_1(\alpha_1+\alpha_2-1)}+(\alpha_2+5)\right]$ <br> *for* $\alpha_2>4$ |

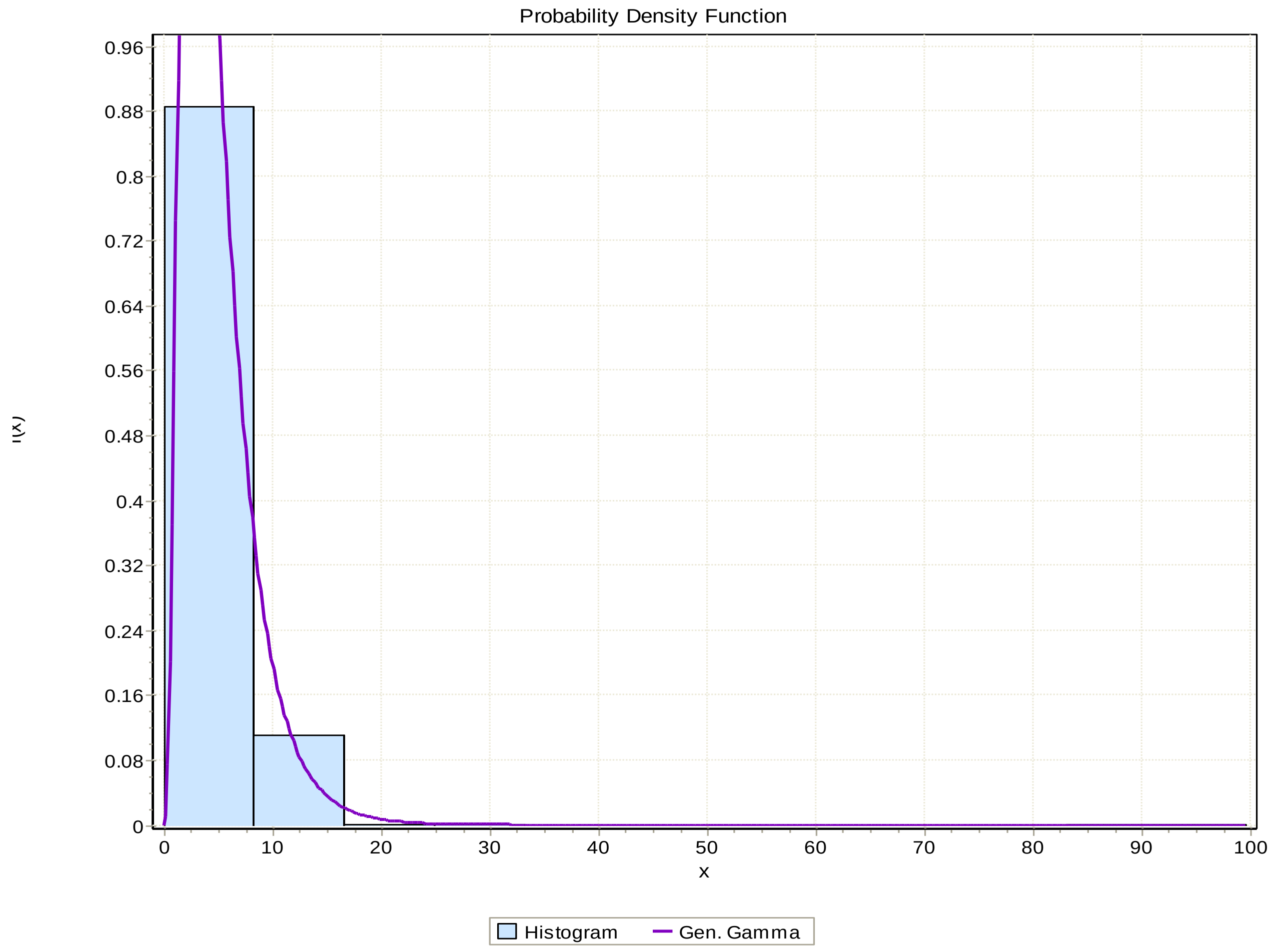
Lung Cancer (NSCLC and SCLC) Distribution White Race:




$$\widehat{\alpha_1} = 4.733, \widehat{\alpha_2} = 6.191, \widehat{\beta} = 44.63$$

| | |
|---|---|
| Probability density function : | $f(x)=\dfrac{1}{\beta B(\alpha_1,\alpha_2)}\dfrac{(x/\beta)^{\alpha_1-1}}{\left(1+\dfrac{x}{\beta}\right)^{\alpha_1+\alpha_2}}$ <br> *where* $B(\alpha_1,\alpha_2)$ *is a Beta function* |
| Cumulative distribution function : | *No closed form* |
| Parameter restriction : | $\alpha_1>0,\alpha_2>0,\beta>0$ |
| Domain : | $0\le x<+\infty$ |
| Mean : | $\dfrac{\beta\alpha_1}{\alpha_2-1}$ *for* $\alpha_2>1$ |
| Mode : | $\dfrac{\beta(\alpha_1-1)}{\alpha_2+1}$ *for* $\alpha_1>1$ <br> $0$ *otherwise* |
| Variance : | $\dfrac{\beta^2\alpha_1(\alpha_1+\alpha_2-1)}{(\alpha_2-1)^2(\alpha_2-2)}$ *for* $\alpha_2>2$ |
| Skewness : | $2\sqrt{\dfrac{\alpha_2-2}{\alpha_1(\alpha_1+\alpha_2-1)}}\left[\dfrac{2\alpha_1+\alpha_2-1}{\alpha_2-3}\right]$ *for* $\alpha_2>3$ |
| Kurtosis : | $\dfrac{3(\alpha_2-2)}{(\alpha_2-3)(\alpha_2-4)}\left[\dfrac{2(\alpha_2-1)^2}{\alpha_1(\alpha_1+\alpha_2-1)}+(\alpha_2+5)\right]$ <br> *for* $\alpha_2>4$ |

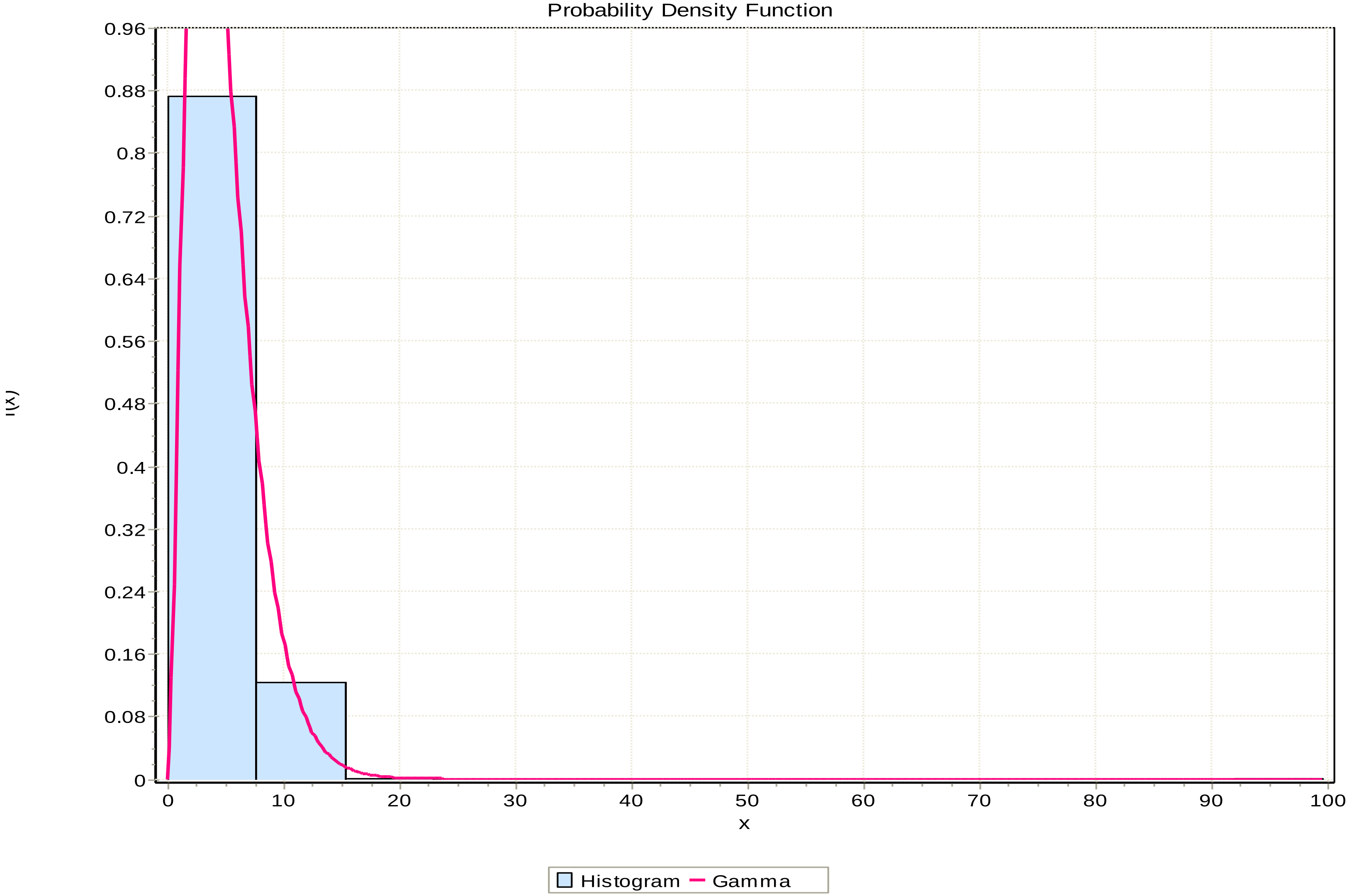
SCLC- White Race Distribution:




$$\hat{k} = 0.4471, \hat{\alpha} = 12.41, \hat{\beta} = 0.0158$$

| | |
|---|---|
| Probability density function : | $f(x) = \frac{\beta^{-\alpha} x^{\alpha-1} \exp\left(-\frac{x}{\beta}\right)}{\Gamma(\alpha)}$ |
| Cumulative distribution function : | *No closed form* |
| Parameter restriction : | $\alpha > 0,\ \beta > 0$ |
| Domain : | $x \geq 0$ |
| Mean : | $\alpha\beta$ |
| Mode : | $\beta(\alpha-1)$ *if* $\alpha \geq 1$<br>$0$ *if* $\alpha < 1$ |
| Variance : | $\alpha\beta^2$ |
| Skewness : | $\frac{2}{\sqrt{\alpha}}$ |
| Kurtosis : | $3+\frac{6}{\alpha}$ |

NSCLC White Race Distribution:




$$\widehat{\alpha} = 2.923, \widehat{\beta} = 1.6420$$

| | |
|---|---|
| Probability density function : | $f(x) = \frac{\beta^{-\alpha} x^{\alpha-1} \exp\left(-\frac{x}{\beta}\right)}{\Gamma(\alpha)}$ |
| Cumulative distribution function : | *No closed form* |
| Parameter restriction : | $\alpha > 0,\ \beta > 0$ |
| Domain : | $x \geq 0$ |
| Mean : | $\alpha\beta$ |
| Mode : | $\beta(\alpha-1) \quad if\ \alpha \geq 1$<br>$0 \quad if\ \alpha < 1$ |
| Variance : | $\alpha\beta^2$ |
| Skewness : | $\frac{2}{\sqrt{\alpha}}$ |
| Kurtosis : | $3+\frac{6}{\alpha}$ |