# 2 - Distribution of age ranges

November 29, 2023

In this notebook I shall use the cleaned up census data to look at the distribution of the proportion of people in different age ranges across the Local Authorities. I have decided to split the ages into three ranges: children and young people (aged 0-19), working age adults (aged 20-64), and older people (aged 65+).I will produce histograms to show how the proportion of the population in each categories varies in the Local Authorities.

[2]:
```
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
```

[3]:
```
census_demographic_df = pd.read_csv(r"cleaned_census_df.csv", index_col=0)

census_demographic_df.head()
```

[3]:

| | Area code | Area name | All persons | Females:Aged 4 years and under | Females:Aged 5 to 9 years | Females:Aged 10 to 14 years | Females:Aged 15 to 19 years | Females:Aged 20 to 24 years | Females:Aged 25 to 29 years | Females:Aged 30 to 34 years | … |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | E06000047 | County Durham | 522100 | 12000 | 13800 | 14400 | 15300 | 16400 | 15000 | 16000 | … |
| 1 | E06000005 | Darlington | 107800 | 2700 | 3000 | 3300 | 2800 | 2800 | 3300 | 3600 | … |
| 2 | E06000001 | Hartlepool | 92300 | 2400 | 2700 | 2900 | 2500 | 2600 | | | |
| 3 | E06000002 | Middlesbrough | 143900 | 4400 | 4700 | 4600 | 4200 | 4900 | | | |
| 4 | E06000057 | Northumberland | 320600 | 7000 | 8100 | 8400 | 7400 | 6700 | | | |

```
2                         2900                         3100  …
3                         5200                         5200  …
4                         8000                         8700  …

   Males:Aged 50 to 54 years  Males:Aged 55 to 59 years  \
0                      18600                      19500
1                       3800                       3900
2                       3100                       3400
3                       4200                       4600
4                      11200                      12400

   Males:Aged 60 to 64 years  Males:Aged 65 to 69 years  \
0                      17200                      15400
1                       3400                       3000
2                       3200                       2600
3                       4300                       3500
4                      11900                      11100

   Males:Aged 70 to 74 years  Males:Aged 75 to 79 years  \
0                      14800                      10300
1                       2800                       2000
2                       2400                       1500
3                       3100                       2000
4                      11100                       7600

   Males:Aged 80 to 84 years  Males:Aged 85 to 89 years  \
0                       6700                       3400
1                       1400                        800
2                       1000                        600
3                       1400                        700
4                       4700                       2500

   Males:Aged 90 years and over      Region
0                          1400  North East
1                           300  North East
2                           200  North East
3                           300  North East
4                          1100  North East

[5 rows x 42 columns]
```

[4]:
```
#Create list of columns with data on females only
females_la_cols = [col for col in census_demographic_df.columns if 'Females' in␣
 ↪col]

#Create list of columns with data on males only
males_la_cols = [col for col in census_demographic_df.columns if 'Males' in col]
```

```
la_cols = females_la_cols + males_la_cols
la_cols
```

[4]:
```
['Females:Aged 4 years and under',
 'Females:Aged 5 to 9 years',
 'Females:Aged 10 to 14 years',
 'Females:Aged 15 to 19 years',
 'Females:Aged 20 to 24 years',
 'Females:Aged 25 to 29 years',
 'Females:Aged 30 to 34 years',
 'Females:Aged 35 to 39 years',
 'Females:Aged 40 to 44 years',
 'Females:Aged 45 to 49 years',
 'Females:Aged 50 to 54 years',
 'Females:Aged 55 to 59 years',
 'Females:Aged 60 to 64 years',
 'Females:Aged 65 to 69 years',
 'Females:Aged 70 to 74 years',
 'Females:Aged 75 to 79 years',
 'Females:Aged 80 to 84 years',
 'Females:Aged 85 to 89 years',
 'Females:Aged 90 years and over',
 'Males:Aged 4 years and under',
 'Males:Aged 5 to 9 years',
 'Males:Aged 10 to 14 years',
 'Males:Aged 15 to 19 years',
 'Males:Aged 20 to 24 years',
 'Males:Aged 25 to 29 years',
 'Males:Aged 30 to 34 years',
 'Males:Aged 35 to 39 years',
 'Males:Aged 40 to 44 years',
 'Males:Aged 45 to 49 years',
 'Males:Aged 50 to 54 years',
 'Males:Aged 55 to 59 years',
 'Males:Aged 60 to 64 years',
 'Males:Aged 65 to 69 years',
 'Males:Aged 70 to 74 years',
 'Males:Aged 75 to 79 years',
 'Males:Aged 80 to 84 years',
 'Males:Aged 85 to 89 years',
 'Males:Aged 90 years and over']
```

[5]:
```
#Create new dataframe to store percentages of females and males in each age␣
 ↪group by LA
la_proportions_df = census_demographic_df[['Area name','Area code',␣
 ↪'Region','All persons']].copy()
```

```
for i in la_cols:
    la_proportions_df['%' + i] = census_demographic_df[i]/
 ↪census_demographic_df['All persons']*100

la_proportions_df
```

[5]:

| | Area name | Area code | Region | All persons | \ |
|---|---|---|---|---|---|
| 0 | County Durham | E06000047 | North East | 522100 | |
| 1 | Darlington | E06000005 | North East | 107800 | |
| 2 | Hartlepool | E06000001 | North East | 92300 | |
| 3 | Middlesbrough | E06000002 | North East | 143900 | |
| 4 | Northumberland | E06000057 | North East | 320600 | |
| .. | … | … | … | … | |
| 326 | Caerphilly | W06000018 | Wales | 175900 | |
| 327 | Blaenau Gwent | W06000019 | Wales | 66900 | |
| 328 | Torfaen | W06000020 | Wales | 92300 | |
| 329 | Monmouthshire | W06000021 | Wales | 93000 | |
| 330 | Newport | W06000022 | Wales | 159600 | |

| | %Females:Aged 4 years and under | %Females:Aged 5 to 9 years | \ |
|---|---|---|---|
| 0 | 2.298410 | 2.643172 | |
| 1 | 2.504638 | 2.782931 | |
| 2 | 2.600217 | 2.925244 | |
| 3 | 3.057679 | 3.266157 | |
| 4 | 2.183406 | 2.526513 | |
| .. | … | … | |
| 326 | 2.615122 | 2.899375 | |
| 327 | 2.541106 | 2.690583 | |
| 328 | 2.600217 | 2.816901 | |
| 329 | 2.043011 | 2.365591 | |
| 330 | 3.007519 | 3.132832 | |

| | %Females:Aged 10 to 14 years | %Females:Aged 15 to 19 years | \ |
|---|---|---|---|
| 0 | 2.758092 | 2.930473 | |
| 1 | 3.061224 | 2.597403 | |
| 2 | 3.141928 | 2.708559 | |
| 3 | 3.196664 | 2.918694 | |
| 4 | 2.620087 | 2.308172 | |
| .. | … | … | |
| 326 | 3.013076 | 2.558272 | |
| 327 | 2.840060 | 2.391629 | |
| 328 | 2.925244 | 2.491874 | |
| 329 | 2.688172 | 2.365591 | |
| 330 | 3.132832 | 2.631579 | |

| | %Females:Aged 20 to 24 years | %Females:Aged 25 to 29 years | … | \ |
|---|---|---|---|---|
| 0 | 3.141161 | 2.873013 | … | |

```
1                        2.597403                        3.061224  …
2                        2.816901                        3.141928  …
3                        3.405142                        3.613621  …
4                        2.089832                        2.495321  …
..                            …                             …  …
326                      2.501421                        3.183627  …
327                      2.690583                        3.437967  …
328                      2.491874                        3.250271  …
329                      1.935484                        2.365591  …
330                      2.694236                        3.571429  …

     %Males:Aged 45 to 49 years  %Males:Aged 50 to 54 years  \
0                       2.949627                    3.562536
1                       3.061224                    3.525046
2                       2.925244                    3.358613
3                       2.710215                    2.918694
4                       2.963194                    3.493450
..                           …                           …
326                     3.069926                    3.524730
327                     3.139013                    3.587444
328                     2.816901                    3.358613
329                     3.010753                    3.763441
330                     3.007519                    3.320802

     %Males:Aged 55 to 59 years  %Males:Aged 60 to 64 years  \
0                       3.734917                    3.294388
1                       3.617811                    3.153989
2                       3.683640                    3.466956
3                       3.196664                    2.988186
4                       3.867748                    3.711790
..                           …                           …
326                     3.581580                    3.069926
327                     3.886398                    3.139013
328                     3.575298                    3.141928
329                     4.086022                    3.548387
330                     3.258145                    2.819549

     %Males:Aged 65 to 69 years  %Males:Aged 70 to 74 years  \
0                       2.949627                    2.834706
1                       2.782931                    2.597403
2                       2.816901                    2.600217
3                       2.432245                    2.154274
4                       3.462258                    3.462258
..                           …                           …
326                     2.671973                    2.728823
327                     2.840060                    2.840060
328                     2.708559                    2.708559
```

```
329                     3.225806                     3.333333
330                     2.255639                     2.192982

     %Males:Aged 75 to 79 years  %Males:Aged 80 to 84 years  \
0                       1.972802                    1.283279
1                       1.855288                    1.298701
2                       1.625135                    1.083424
3                       1.389854                    0.972898
4                       2.370555                    1.466001
..                           …                           …
326                     1.876066                    1.193860
327                     1.943199                    1.195815
328                     1.950163                    1.191766
329                     2.473118                    1.612903
330                     1.566416                    1.065163

     %Males:Aged 85 to 89 years  %Males:Aged 90 years and over
0                       0.651216                        0.268148
1                       0.742115                        0.278293
2                       0.650054                        0.216685
3                       0.486449                        0.208478
4                       0.779788                        0.343107
..                           …                               …
326                     0.568505                        0.227402
327                     0.597907                        0.149477
328                     0.650054                        0.325027
329                     0.967742                        0.430108
330                     0.563910                        0.250627

[331 rows x 42 columns]
```

[6]:
```
#Produce list of columns to be included in the age range 0-19
zero_to_nineteen_group_list = ['Females:Aged 4 years and under', 'Females:Aged␣
 ↪5 to 9 years','Females:Aged 10 to 14 years', 'Females:Aged 15 to 19 years',␣
 ↪'Males:Aged 4 years and under','Males:Aged 5 to 9 years', 'Males:Aged 10 to␣
 ↪14 years', 'Males:Aged 15 to 19 years']
mystring = '%'
zero_to_nineteen_group_list = [mystring + s for s in␣
 ↪zero_to_nineteen_group_list]

#Produce list of columns to be included in the age range 20-64
twenty_to_sixty_four_group_list = ['Females:Aged 20 to 24 years',
                                   'Females:Aged 25 to 29 years',
                                   'Females:Aged 30 to 34 years',
                                   'Females:Aged 35 to 39 years',
                                   'Females:Aged 40 to 44 years',
                                   'Females:Aged 45 to 49 years',
```

```
                                    'Females:Aged 50 to 54 years',
                                    'Females:Aged 55 to 59 years',
                                    'Females:Aged 60 to 64 years',
                                    'Males:Aged 20 to 24 years',
                                    'Males:Aged 25 to 29 years',
                                    'Males:Aged 30 to 34 years',
                                    'Males:Aged 35 to 39 years',
                                    'Males:Aged 40 to 44 years',
                                    'Males:Aged 45 to 49 years',
                                    'Males:Aged 50 to 54 years',
                                    'Males:Aged 55 to 59 years',
                                    'Males:Aged 60 to 64 years']
twenty_to_sixty_four_group_list = [mystring + s for s in␣
 ↪twenty_to_sixty_four_group_list]

#Produce list of columns to be included in the age range 65+
sixty_five_and_over_group_list = ['Females:Aged 65 to 69 years',
                                  'Females:Aged 70 to 74 years',
                                  'Females:Aged 75 to 79 years',
                                  'Females:Aged 80 to 84 years',
                                  'Females:Aged 85 to 89 years',
                                  'Females:Aged 90 years and over',
                                  'Males:Aged 65 to 69 years',
                                  'Males:Aged 70 to 74 years',
                                  'Males:Aged 75 to 79 years',
                                  'Males:Aged 80 to 84 years',
                                  'Males:Aged 85 to 89 years',
                                  'Males:Aged 90 years and over']

sixty_five_and_over_group_list = [mystring + s for s in␣
 ↪sixty_five_and_over_group_list]

#Produce list of columns to be included in the age range 0-34
zero_to_thirty_four_group_list = ['Females:Aged 4 years and under',
                                  'Females:Aged 5 to 9 years',
                                  'Females:Aged 10 to 14 years',
                                  'Females:Aged 15 to 19 years',
                                  'Males:Aged 4 years and under',
                                  'Males:Aged 5 to 9 years',
                                  'Males:Aged 10 to 14 years',
                                  'Males:Aged 15 to 19 years',
                                  'Females:Aged 20 to 24 years',
                                 'Females:Aged 25 to 29 years',
                                  'Females:Aged 30 to 34 years',
                                  'Males:Aged 20 to 24 years',
                                  'Males:Aged 25 to 29 years',
                                  'Males:Aged 30 to 34 years']
```

```
zero_to_thirty_four_group_list = [mystring + s for s in␣
 ↪zero_to_thirty_four_group_list]
```

[7]:
```
#Modify la_proportions df to only show age ranges in list above
la_proportions_df['Proportion pop aged 0-19'] = ␣
 ↪la_proportions_df[zero_to_nineteen_group_list ].sum(axis=1)
la_proportions_df['Proportion pop aged 20-64'] = ␣
 ↪la_proportions_df[twenty_to_sixty_four_group_list].sum(axis=1)
la_proportions_df['Proportion pop aged 65+'] = ␣
 ↪la_proportions_df[sixty_five_and_over_group_list ].sum(axis=1)

la_proportions_df['Proportion pop aged 0-34'] = ␣
 ↪la_proportions_df[zero_to_thirty_four_group_list].sum(axis=1)

la_proportions_df = la_proportions_df[['Area name','Area code',␣
 ↪'Region','Proportion pop aged 0-19','Proportion pop aged 20-64', 'Proportion␣
 ↪pop aged 65+', 'Proportion pop aged 0-34', 'All persons']]
la_proportions_df
```

[7]:

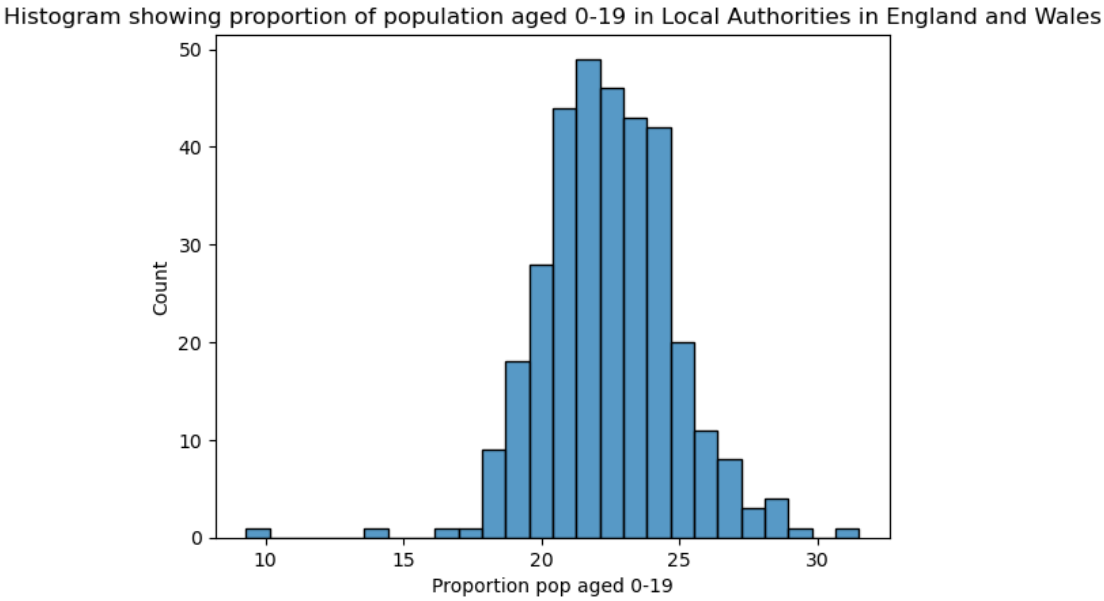
| | Area name | Area code | Region | Proportion pop aged 0-19 | Proportion pop aged 20-64 | Proportion pop aged 65+ | Proportion pop aged 0-34 | All persons |
|---|---|---|---|---|---|---|---|---|
| 0 | County Durham | E06000047 | North East | 21.796591 | 56.904808 | 21.356062 | 56.904808 | 513242 |
| 1 | Darlington | E06000005 | North East | 22.541744 | 56.957328 | 20.686456 | 56.957328 | 107789 |
| 2 | Hartlepool | E06000001 | North East | 23.401950 | 56.663055 | 19.718310 | 56.663055 | 92028 |
| 3 | Middlesbrough | E06000002 | North East | 25.573315 | 57.748436 | 16.817234 | 57.748436 | 140545 |
| 4 | Northumberland | E06000057 | North East | 19.962570 | 54.585153 | 25.452277 | 54.585153 | 320977 |
| .. | … | … | … | … | … | … | … | … |
| 326 | Caerphilly | W06000018 | Wales | 22.797044 | 57.248437 | 20.011370 | 57.248437 | 180067 |
| 327 | Blaenau Gwent | W06000019 | Wales | 21.375187 | 58.295964 | 20.328849 | 58.295964 | 69992 |
| 328 | Torfaen | W06000020 | Wales | 22.535211 | 56.446371 | 20.801733 | 56.446371 | 91075 |
| 329 | Monmouthshire | W06000021 | Wales | 19.677419 | 54.623656 | 25.913978 | 54.623656 | 93000 |
| 330 | Newport | W06000022 | Wales | 24.436090 | 58.583960 | 17.042607 | 58.583960 | 159587 |

```
0                    39.590117       522100
1                    39.888683       107800
2                    41.170098        92300
3                    46.977067       143900
4                    34.591391       320600
..                         …            …
326                  40.648096       175900
327                  40.209268        66900
328                  40.628386        92300
329                  33.763441        93000
330                  44.674185       159600

[331 rows x 8 columns]
```

[8]:
```
la_proportions_df.describe()
```

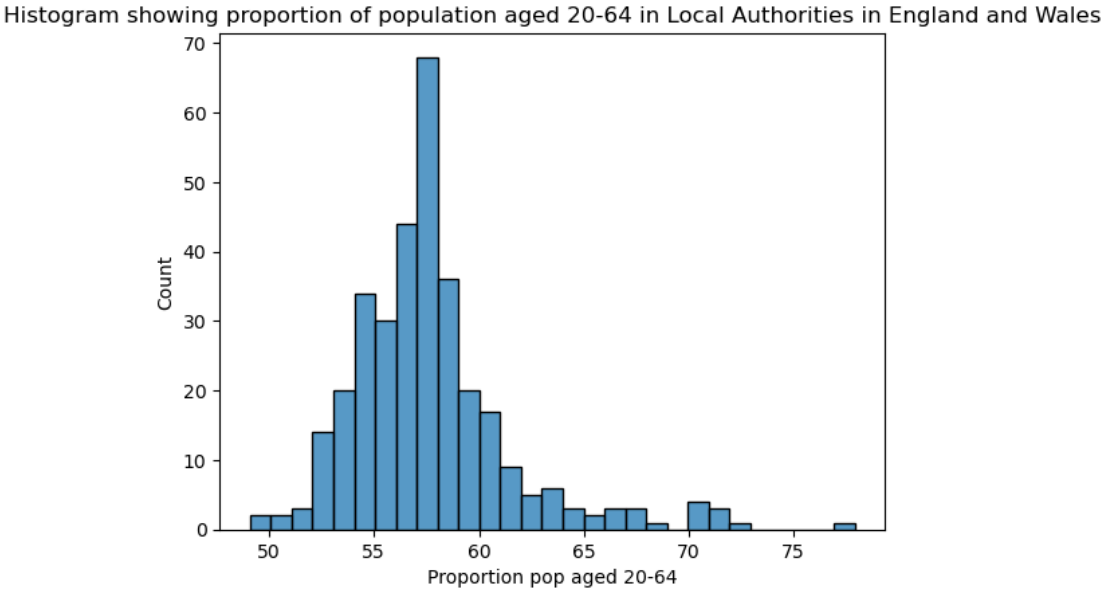
[8]:
```
       Proportion pop aged 0-19  Proportion pop aged 20-64  \
count                331.000000                 331.000000
mean                  22.487586                  57.671129
std                    2.418400                   3.895428
min                    9.302326                  49.087003
25%                   20.927640                  55.250087
50%                   22.535211                  57.248437
75%                   23.967155                  58.791758
max                   31.521243                  77.906977

       Proportion pop aged 65+  Proportion pop aged 0-34   All persons
count                331.000000                331.000000  3.310000e+02
mean                  19.935056                 40.997544  1.800529e+05
std                    4.998504                  5.460765  1.214260e+05
min                    5.671930                 29.126214  2.100000e+03
25%                   17.038823                 37.137977  1.033000e+05
50%                   20.057307                 40.191898  1.419000e+05
75%                   23.515459                 44.254085  2.178000e+05
max                   33.398058                 61.102159  1.144900e+06
```

[9]:
```
#Produce histogram showing distribution of LAs for age range 0-19
sns.histplot(data=la_proportions_df, x="Proportion pop aged 0-19")
plt.title('Histogram showing proportion of population aged 0-19 in Local␣
 ↪Authorities in England and Wales');
```



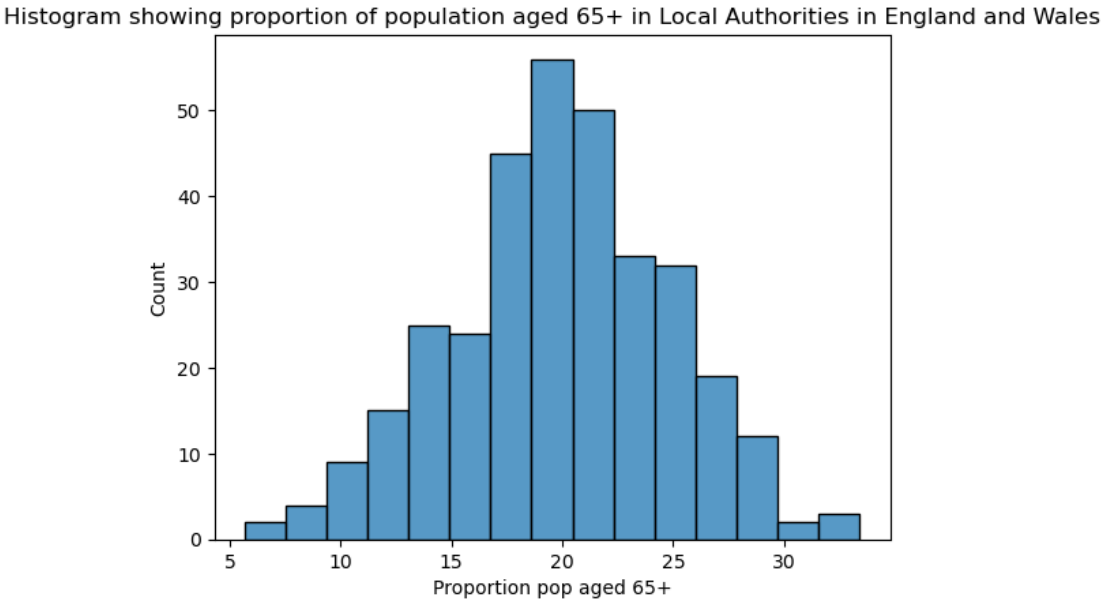

The histogram is slightly right-skew. It shows the vast majority of Local Authorities have between 20-25% of their population aged 0-19. However, there are a number of outliers, two LAs have less than 15% of their population between 0-19 and one LA has above 30% of its population aged 0-19.

[11]:
```
#Produce histogram showing distribution of LAs for age range 20-64
sns.histplot(data=la_proportions_df, x="Proportion pop aged 20-64")
plt.title('Histogram showing proportion of population aged 20-64 in Local␣
 ↪Authorities in England and Wales');
```



This histogram is also right-skewed. Most Local Authorities have between 54-59% of their population aged between 20-64. However, there is some variation with a few LAs approaching 70% and one outlier above 75%.

[13]:
```
#Produce histogram showing distribution of LAs for age range 65+
sns.histplot(data=la_proportions_df, x="Proportion pop aged 65+")
plt.title('Histogram showing proportion of population aged 65+ in Local␣
 ↪Authorities in England and Wales');
```




This histogram is more symmetrical although with a slight left-skew. The majority of Local Authorities have around 17-26% of their population aged 65 or over.

[14]:
```
la_proportions_df.to_csv('age_group_proportions_census_df.csv')
```

[ ]:
```

```