

openav__notebook__eda

October 16, 2022

This is analysis for the EDA

```
[10]: # Import libraries
import os, json, csv
from genericpath import exists
from turtle import title
import pandas as pd
import matplotlib.pyplot as plt
import numpy as np
from nltk.corpus import stopwords
import seaborn as sns
from collections import Counter
from sklearn.feature_extraction.text import CountVectorizer
import nltk
import gensim
from nltk.stem import WordNetLemmatizer, PorterStemmer
from nltk.tokenize import word_tokenize
from collections import defaultdict
import pyLDAvis.gensim_models as gensimvis
import pyLDAvis
from textstat import flesch_reading_ease
from wordcloud import WordCloud, STOPWORDS
```

```
[6]: reports = pd.read_csv('open_ave_data.csv')
reports = reports.dropna()
reports.head(3)
```

```
[6]:      Unnamed: 0      ReportText \
0      0  EXAM: CHEST RADIOGRAPHY EXAM DATE: 06/01/2019 ...
1      1  EXAM: CHEST RADIOGRAPHY EXAM DATE: 05/23/2020 ...
2      2  EXAM: CHEST RADIOGRAPHY EXAM DATE: 12/13/2019 ...

      findings \
0  FINDINGS: Lungs/Pleura: No focal opacities evi...
1  FINDINGS: Lungs/Pleura: No focal opacities evi...
2  FINDINGS: Lungs/Pleura: No focal opacities evi...

      clinicaldata \
```

```

0      CLINICAL HISTORY: Cough. \n\n
1  CLINICAL HISTORY: CHEST PAIN. \n\n
2  CLINICAL HISTORY: CHEST PAIN. \n\n

```

```

                                ExamName \
0  EXAM: CHEST RADIOGRAPHY EXAM DATE: 06/01/2019 ...
1  EXAM: CHEST RADIOGRAPHY EXAM DATE: 05/23/2020 ...
2  EXAM: CHEST RADIOGRAPHY EXAM DATE: 12/13/2019 ...

```

```

                                impression
0      IMPRESSION: Normal 2-view chest radiography.
1  IMPRESSION: No acute cardiopulmonary abnormali...
2      IMPRESSION: No acute cardiopulmonary process.

```

```

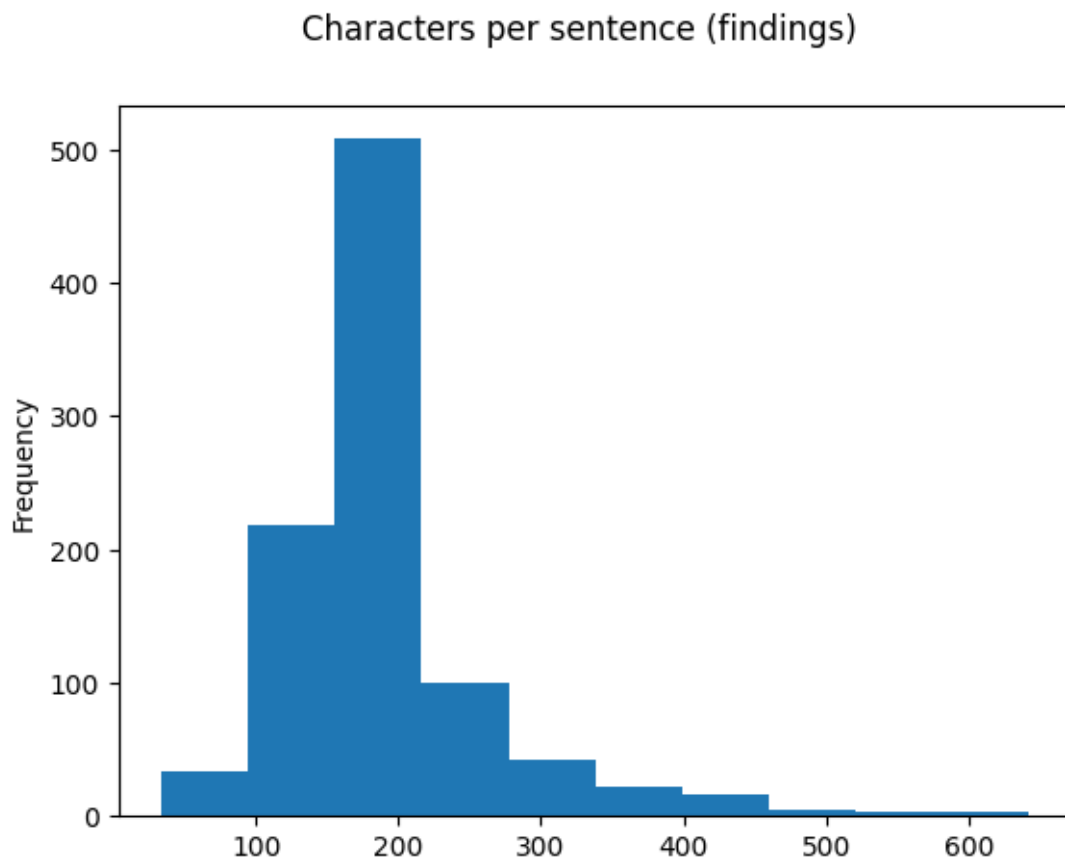
[3]: # Range of characters per sentence (findings)
reports['findings'].str.len().plot(kind='hist', subplots=True,
    ↪title="Characters per sentence (findings)")

```

```

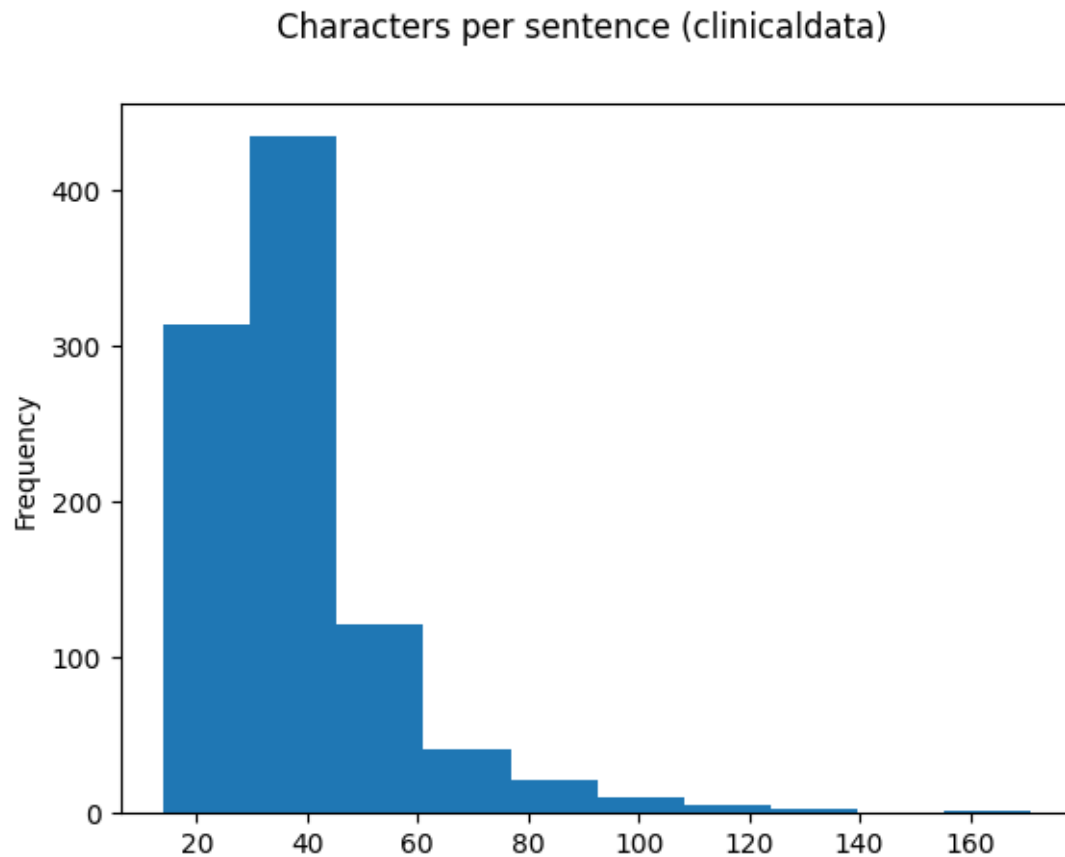
[3]: array([<AxesSubplot: ylabel='Frequency'>], dtype=object)

```



```
[4]: # Range of characters per sentence (clinicaldata)
reports['clinicaldata'].str.len().plot(kind='hist', subplots=True,
    ↪title="Characters per sentence (clinicaldata)")
```

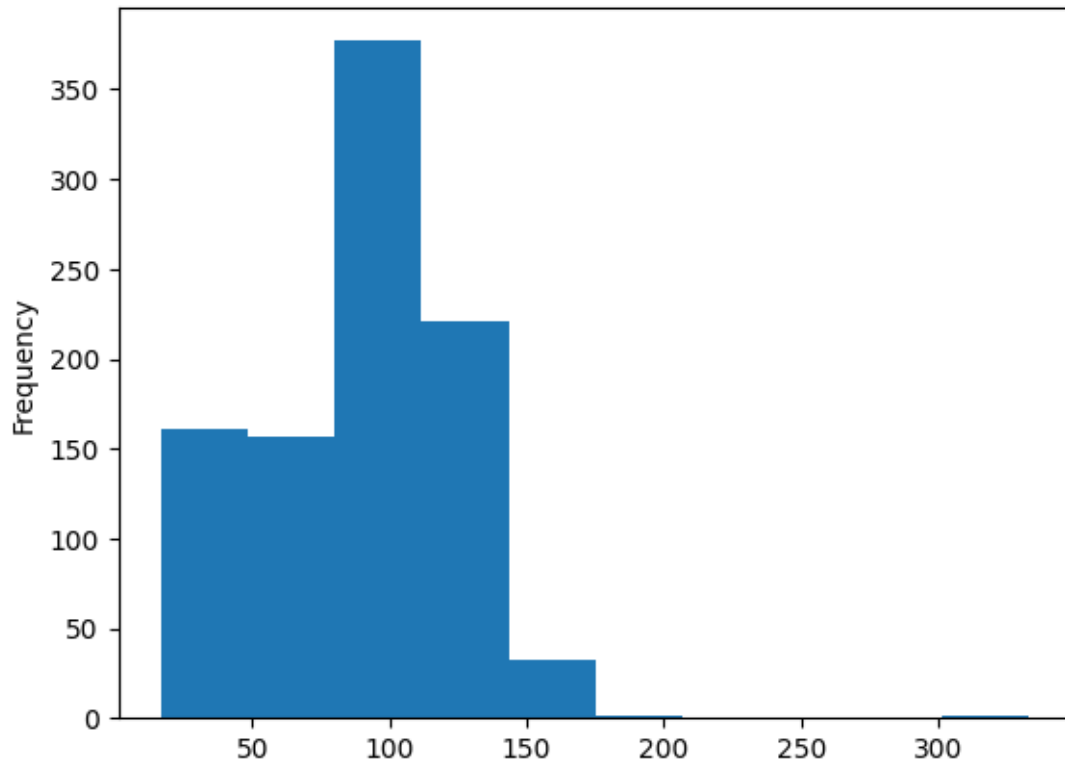
```
[4]: array([<AxesSubplot: ylabel='Frequency'>], dtype=object)
```



```
[5]: # Range of characters per sentence (ExamName)
reports['ExamName'].str.len().plot(kind='hist', subplots=True,
    ↪title="Characters per sentence (ExamName)")
```

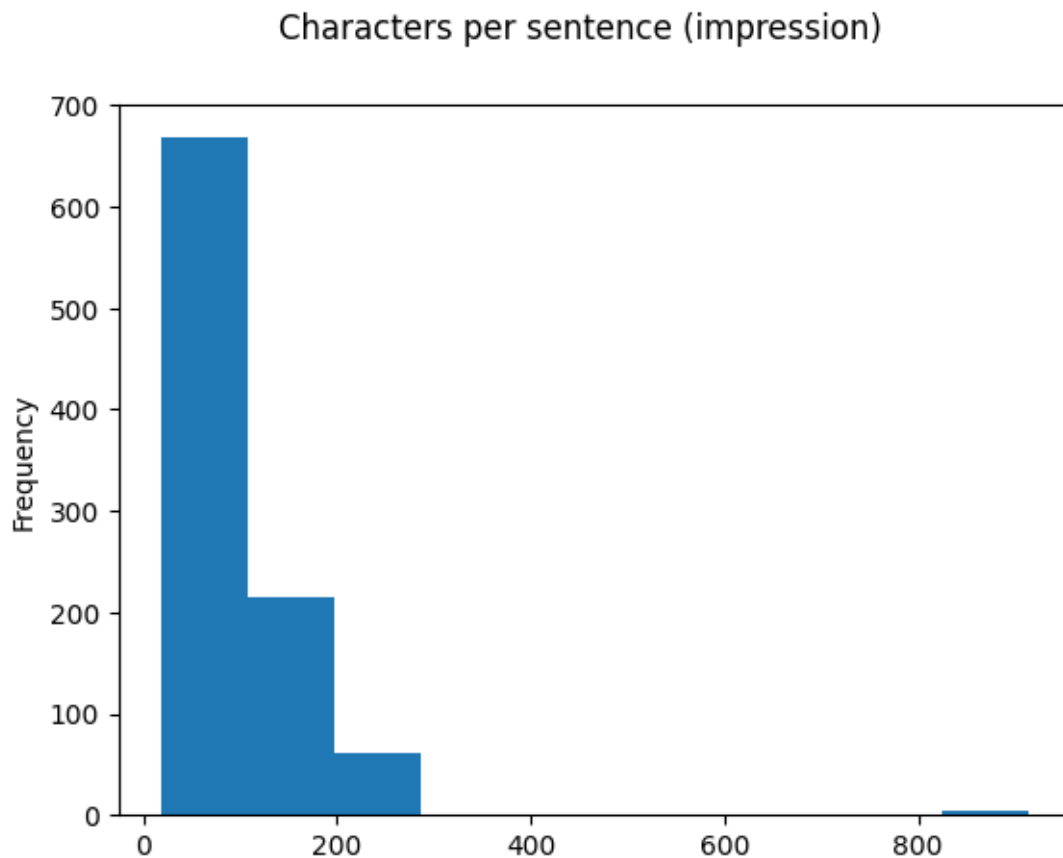
```
[5]: array([<AxesSubplot: ylabel='Frequency'>], dtype=object)
```

Characters per sentence (ExamName)



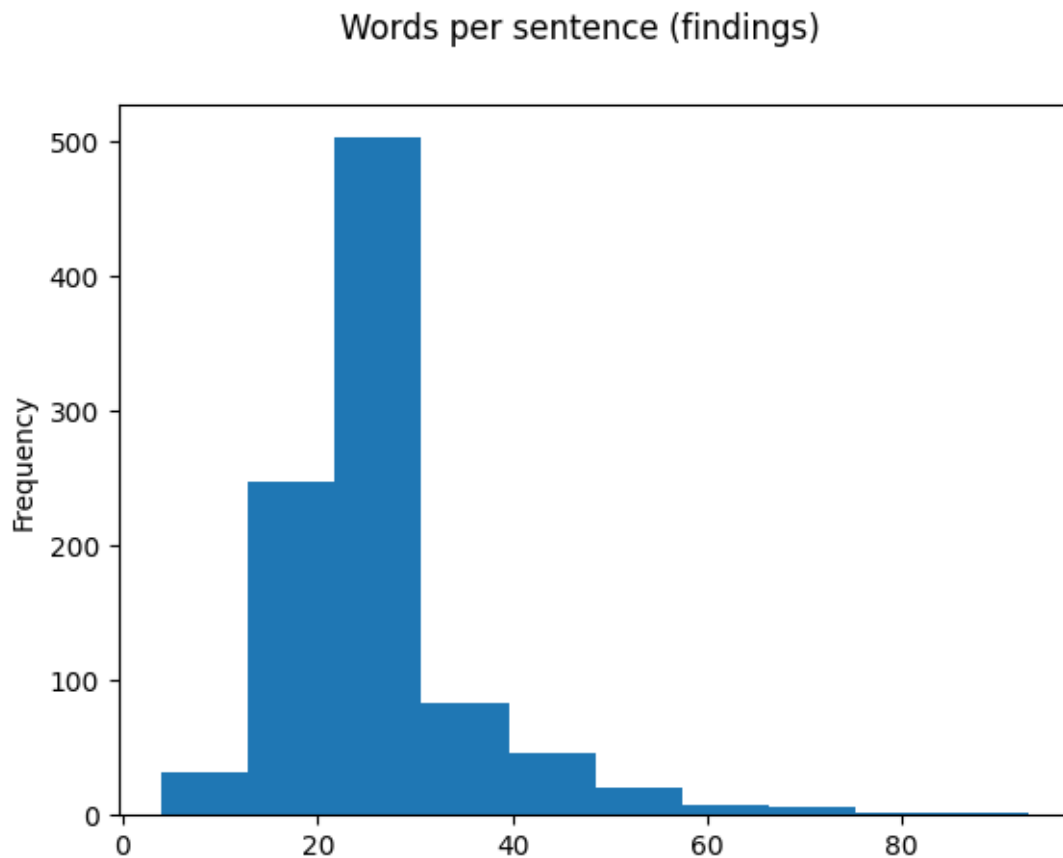
```
[6]: # Range of characters per sentence (impression)
reports['impression'].str.len().plot(kind='hist', subplots=True,
    title="Characters per sentence (impression)")
```

```
[6]: array([<AxesSubplot: ylabel='Frequency'>], dtype=object)
```



```
[7]: # Range of words per sentence (findings)
reports['findings'].str.split().map(lambda x: len(x)).plot(kind='hist',
↳subplots=True, title="Words per sentence (findings)")
```

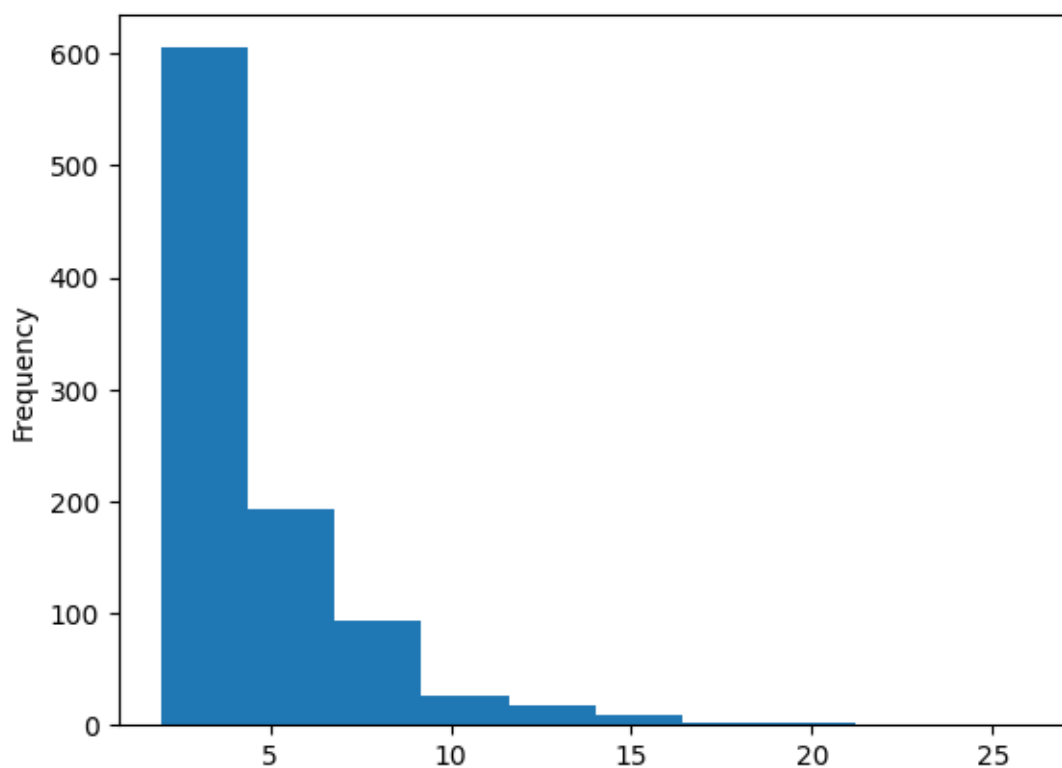
```
[7]: array([<AxesSubplot: ylabel='Frequency'>], dtype=object)
```



```
[8]: # Range of words per sentence (clinicaldata)
reports['clinicaldata'].str.split().map(lambda x: len(x)).plot(kind='hist',
↳subplots=True, title="Words per sentence (clinicaldata)")
```

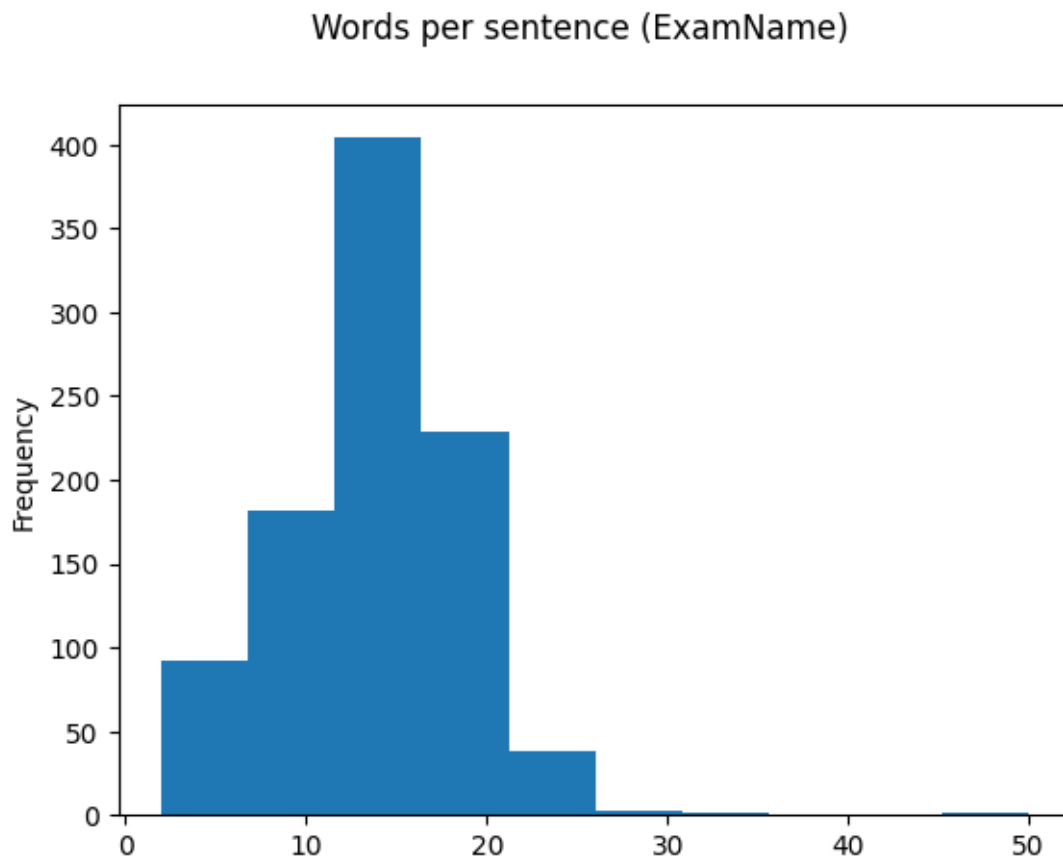
```
[8]: array([<AxesSubplot: ylabel='Frequency'>], dtype=object)
```

Words per sentence (clinicaldata)



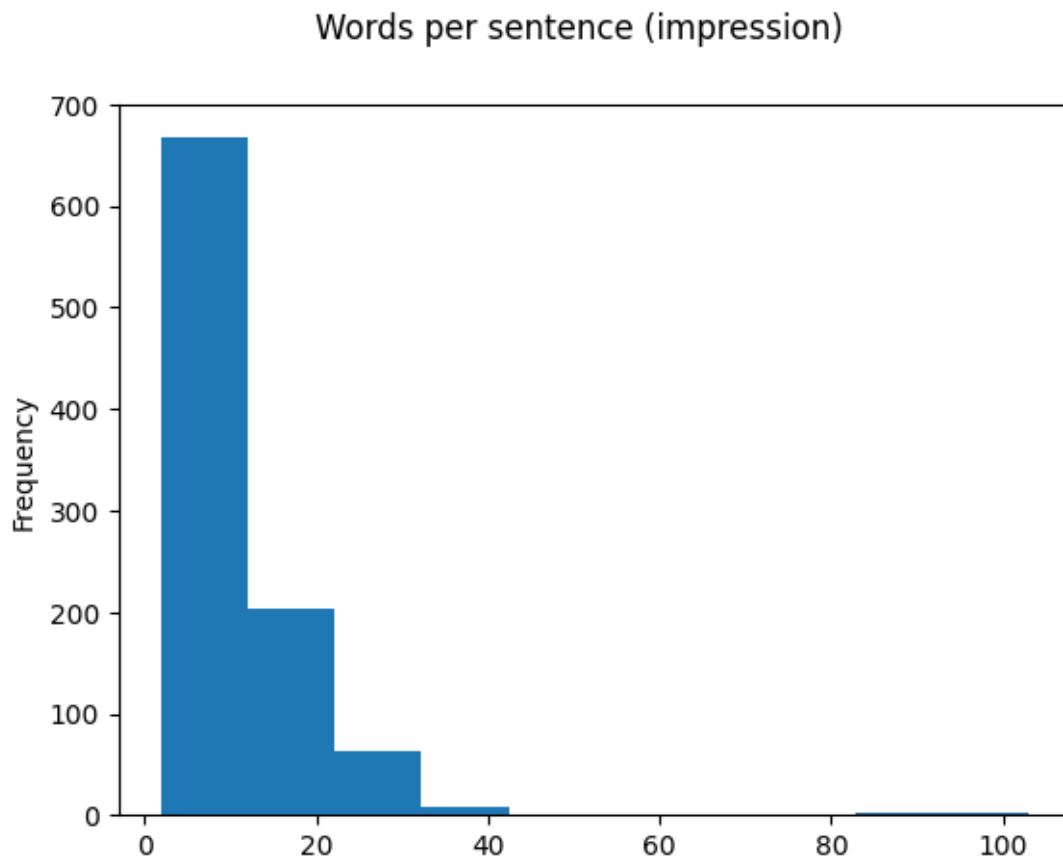
```
[9]: # Range of words per sentence (ExamName)
reports['ExamName'].str.split().map(lambda x: len(x)).plot(kind='hist',
↳subplots=True, title="Words per sentence (ExamName)")
```

```
[9]: array([<AxesSubplot: ylabel='Frequency'>], dtype=object)
```



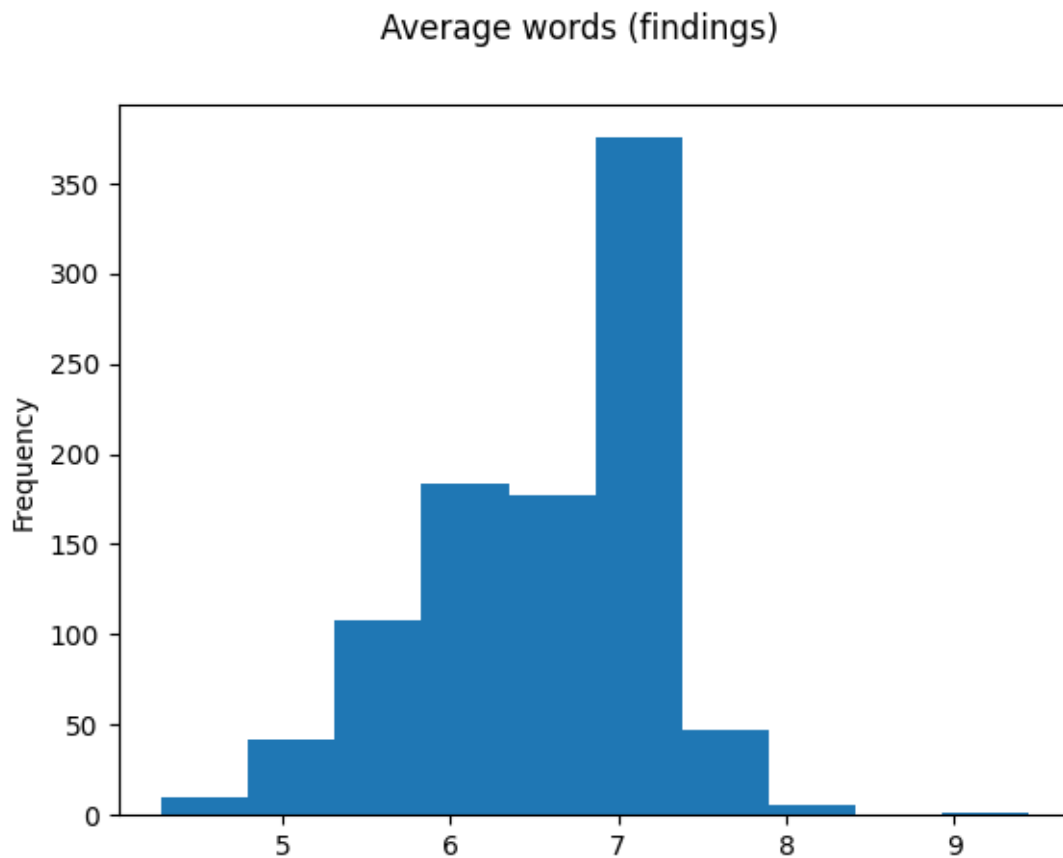
```
[10]: # Range of words per sentence (impression)
reports['impression'].str.split().map(lambda x: len(x)).plot(kind='hist',
↳subplots=True, title="Words per sentence (impression)")
```

```
[10]: array([<AxesSubplot: ylabel='Frequency'>], dtype=object)
```

```
[11]: # Range of average length of words per sentence (findings)
reports['findings'].str.split().\
    apply(lambda x : [len(i) for i in x]). \
    map(lambda x: np.mean(x)).plot(kind='hist', subplots=True, title="Average_
↪words (findings)")
```

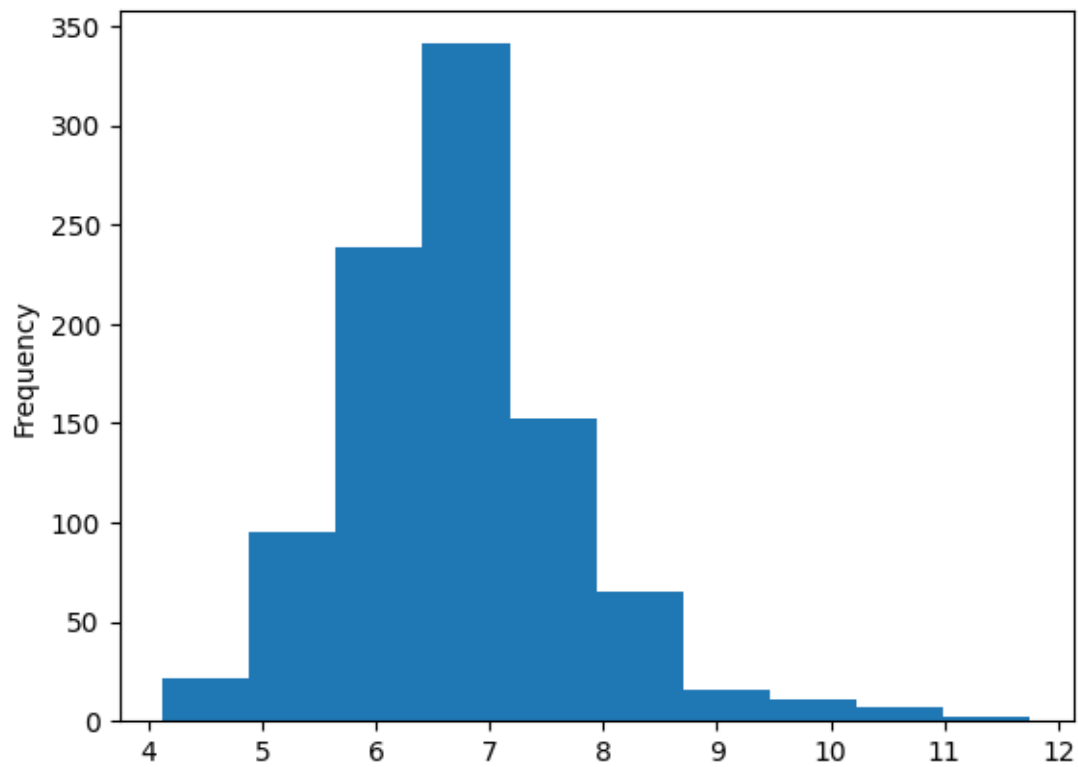
```
[11]: array([<AxesSubplot: ylabel='Frequency'>], dtype=object)
```



```
[12]: # Range of average length of words per sentence (clinicaldata)
reports['clinicaldata'].str.split().\
    apply(lambda x : [len(i) for i in x]). \
    map(lambda x: np.mean(x)).plot(kind='hist', subplots=True, title="Average_
↪words (clinicaldata)")
```

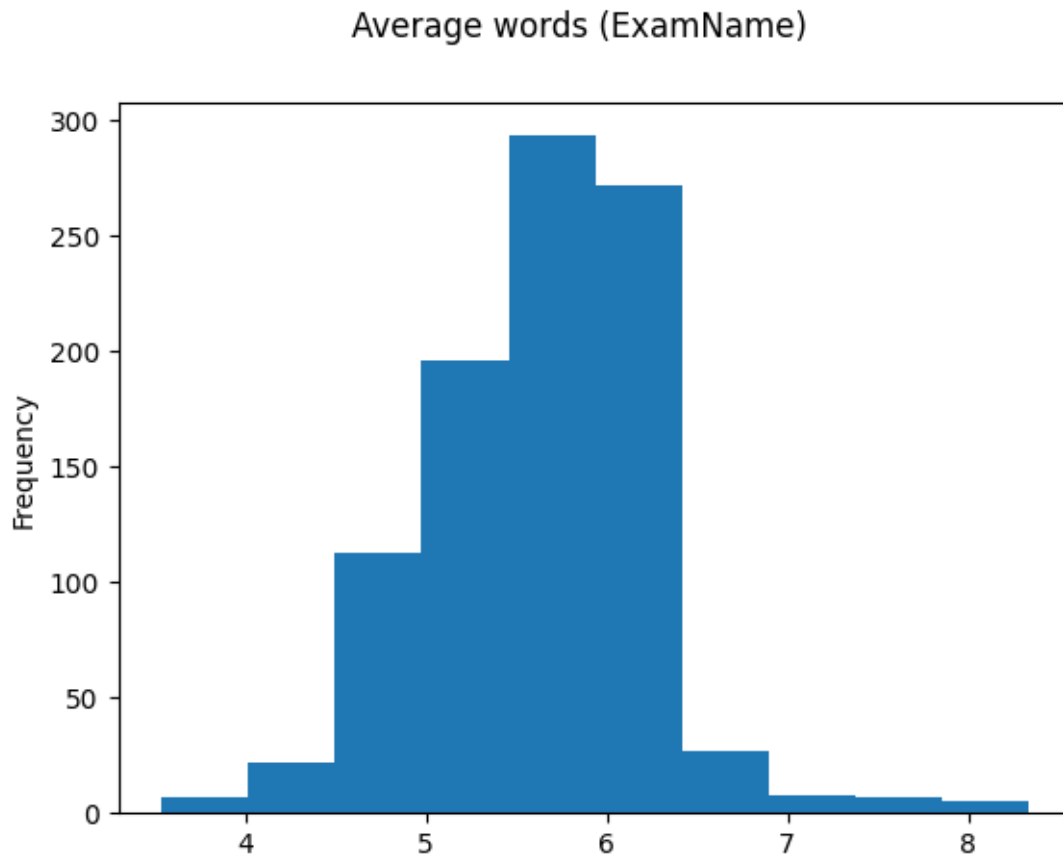
```
[12]: array([<AxesSubplot: ylabel='Frequency'>], dtype=object)
```

Average words (clinicaldata)



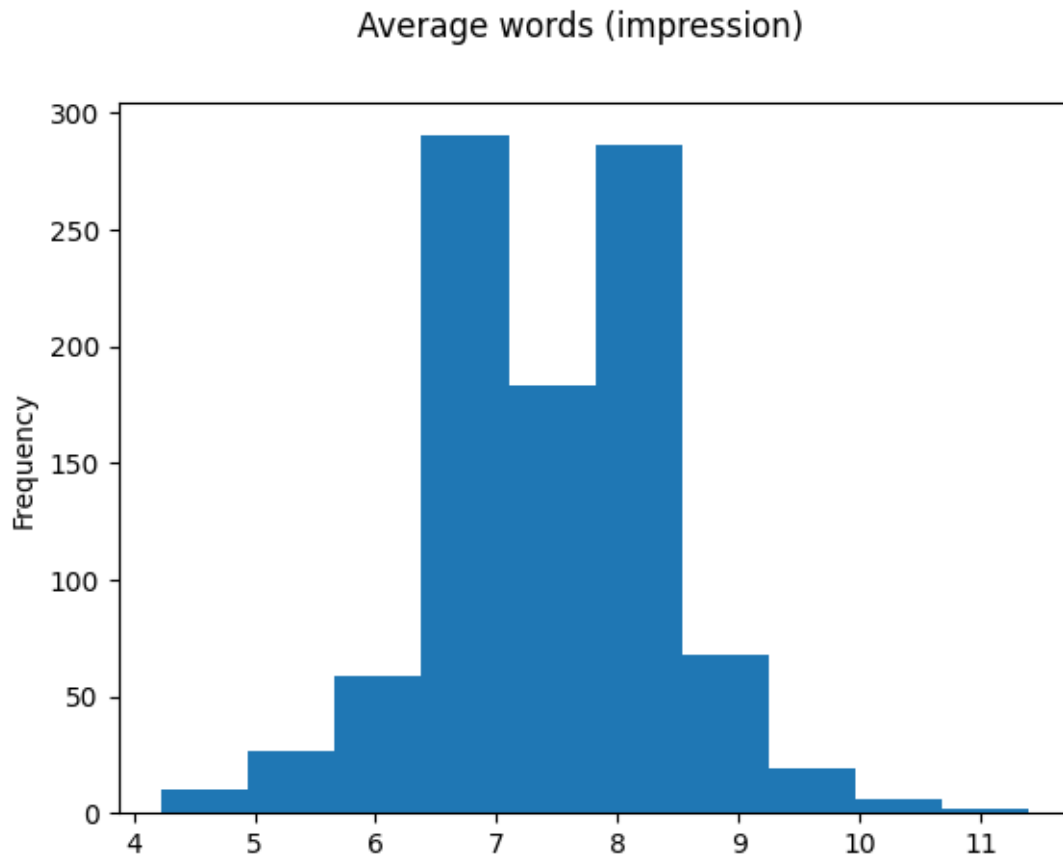
```
[13]: # Range of average length of words per sentence (ExamName)
reports['ExamName'].str.split().\
    apply(lambda x : [len(i) for i in x]). \
    map(lambda x: np.mean(x)).plot(kind='hist', subplots=True, title="Average_
↪words (ExamName)")
```

```
[13]: array([<AxesSubplot: ylabel='Frequency'>], dtype=object)
```



```
[14]: # Range of average length of words per sentence (impression)
reports['impression'].str.split().\
    apply(lambda x : [len(i) for i in x]). \
    map(lambda x: np.mean(x)).plot(kind='hist', subplots=True, title="Average_
↪words (impression)")
```

```
[14]: array([<AxesSubplot: ylabel='Frequency'>], dtype=object)
```



```
[8]: # Get all the english stopwords to see actual length
      nltk.download('stopwords')
      stop=set(stopwords.words('english'))
```

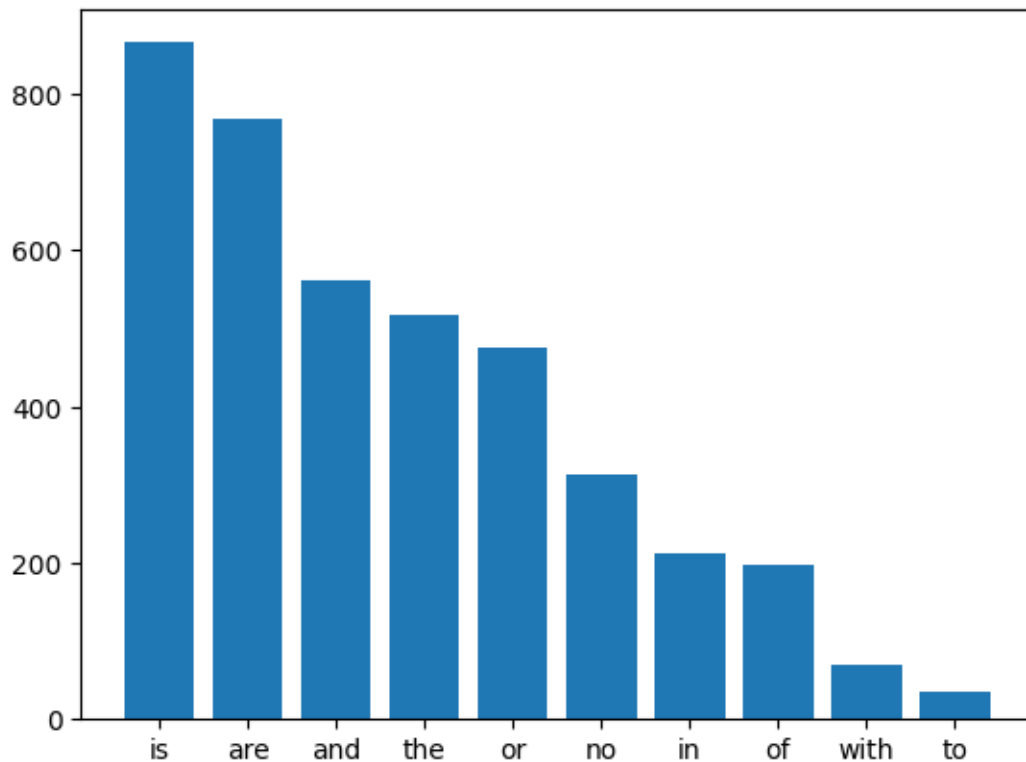
```
[nltk_data] Downloading package stopwords to
[nltk_data]   C:\Users\elefe\AppData\Roaming\nltk_data...
[nltk_data]   Package stopwords is already up-to-date!
```

```
[16]: # Stopwords
      corpus = []
      report = reports['findings'].str.split()
      report = report.tolist()
      corpus = [word for i in report if isinstance(i, list) for word in i]
      dic = defaultdict(int)
      for word in corpus:
          if word in stop:
              dic[word] += 1

      top = sorted(dic.items(), key=lambda x: x[1], reverse=True)[:10]
      x, y = zip(*top)
```

```
plt.bar(x, y)
```

[16]: <BarContainer object of 10 artists>

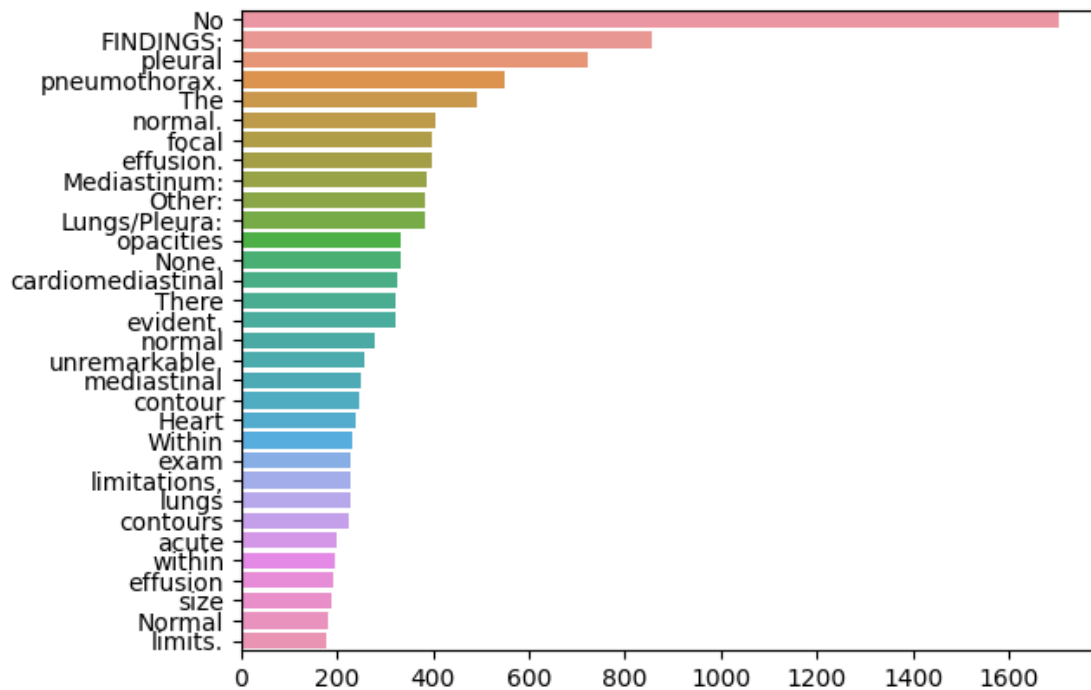


```
[17]: # Word-level analysis findings
counter=Counter(corpus)
most=counter.most_common()

x, y= [], []
for word,count in most[:40]:
    if (word not in stop):
        x.append(word)
        y.append(count)

sns.barplot(x=y,y=x)
```

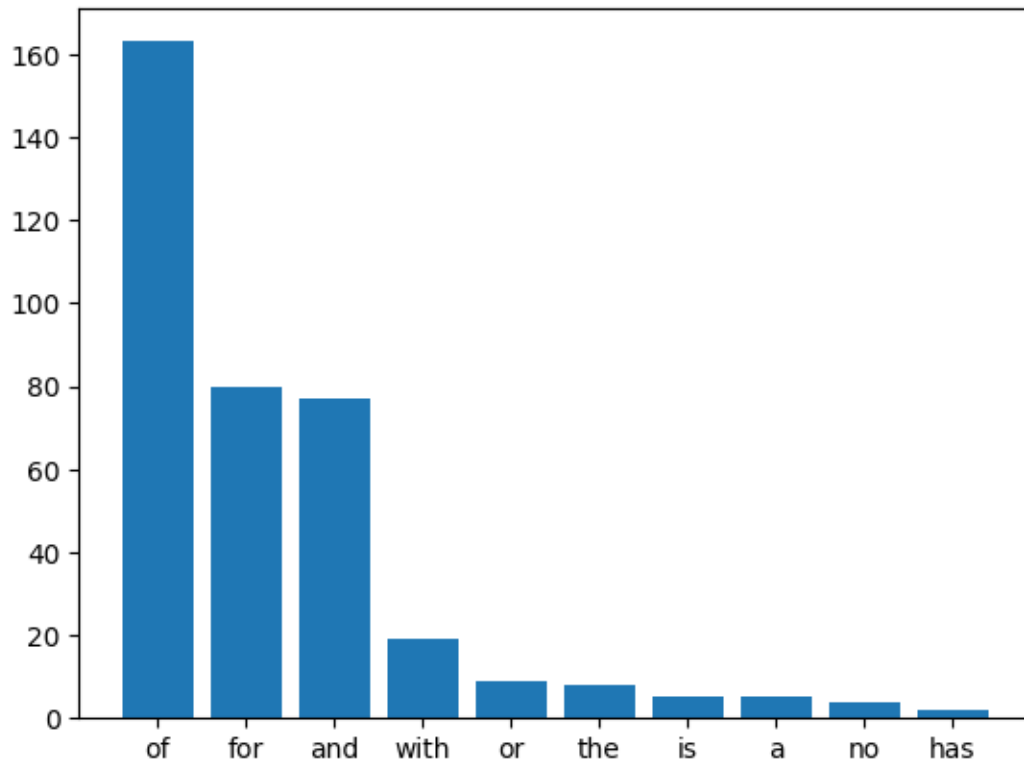
[17]: <AxesSubplot: >



```
[18]: # Stopwords
corpus=[]
report= reports['clinicaldata'].str.split()
report=report.tolist()
corpus=[word for i in report if isinstance(i, list) for word in i ]
dic=defaultdict(int)
for word in corpus:
    if word in stop:
        dic[word]+=1

top=sorted(dic.items(), key=lambda x:x[1],reverse=True)[:10]
x,y=zip(*top)
plt.bar(x,y)
```

[18]: <BarContainer object of 10 artists>

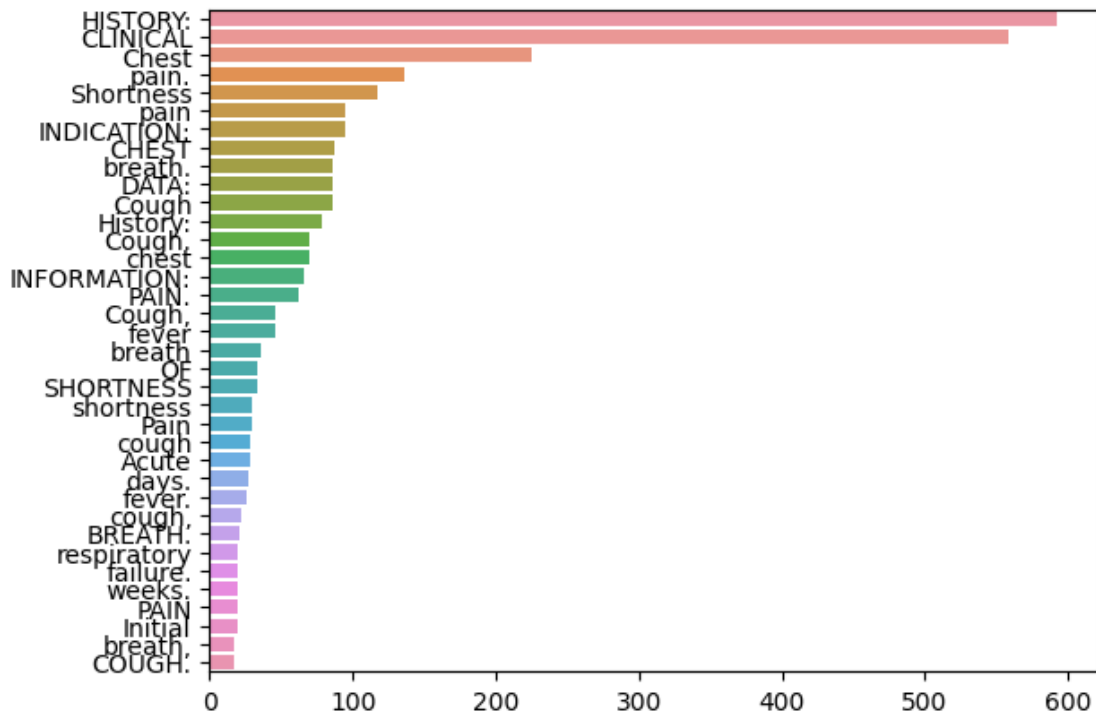


```
[19]: # Word-level analysis clinicaldata
counter=Counter(corpus)
most=counter.most_common()

x, y= [], []
for word,count in most[:40]:
    if (word not in stop):
        x.append(word)
        y.append(count)

sns.barplot(x=y,y=x)
```

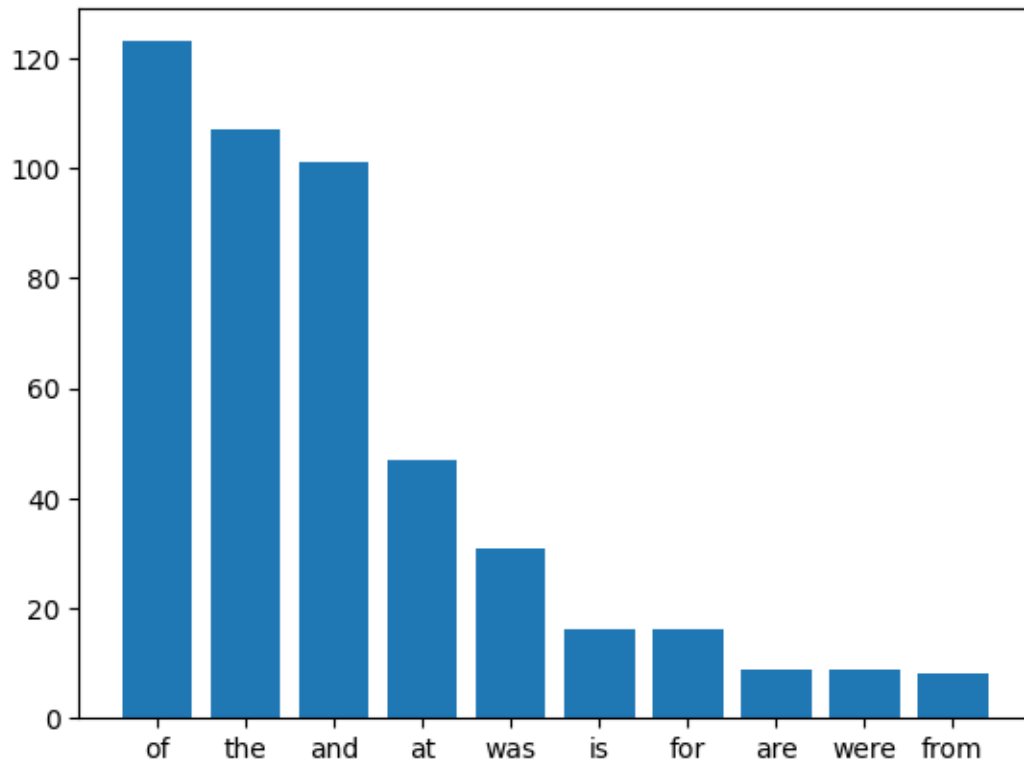
```
[19]: <AxesSubplot: >
```

```
[20]: # Stopwords
corpus=[]
report= reports['ExamName'].str.split()
report=report.tolist()
corpus=[word for i in report if isinstance(i, list) for word in i ]
dic=defaultdict(int)
for word in corpus:
    if word in stop:
        dic[word]+=1

top=sorted(dic.items(), key=lambda x:x[1],reverse=True)[:10]
x,y=zip(*top)
plt.bar(x,y)
```

[20]: <BarContainer object of 10 artists>

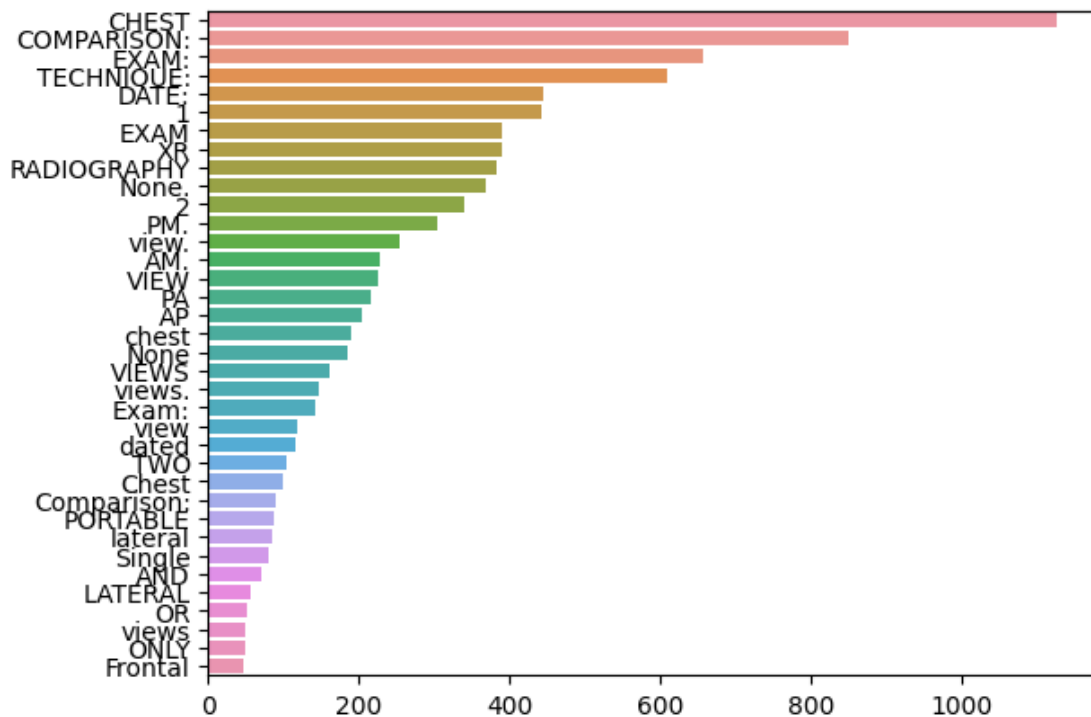


```
[21]: # Word-level analysis ExamName
counter=Counter(corpus)
most=counter.most_common()

x, y= [], []
for word,count in most[:40]:
    if (word not in stop):
        x.append(word)
        y.append(count)

sns.barplot(x=y,y=x)
```

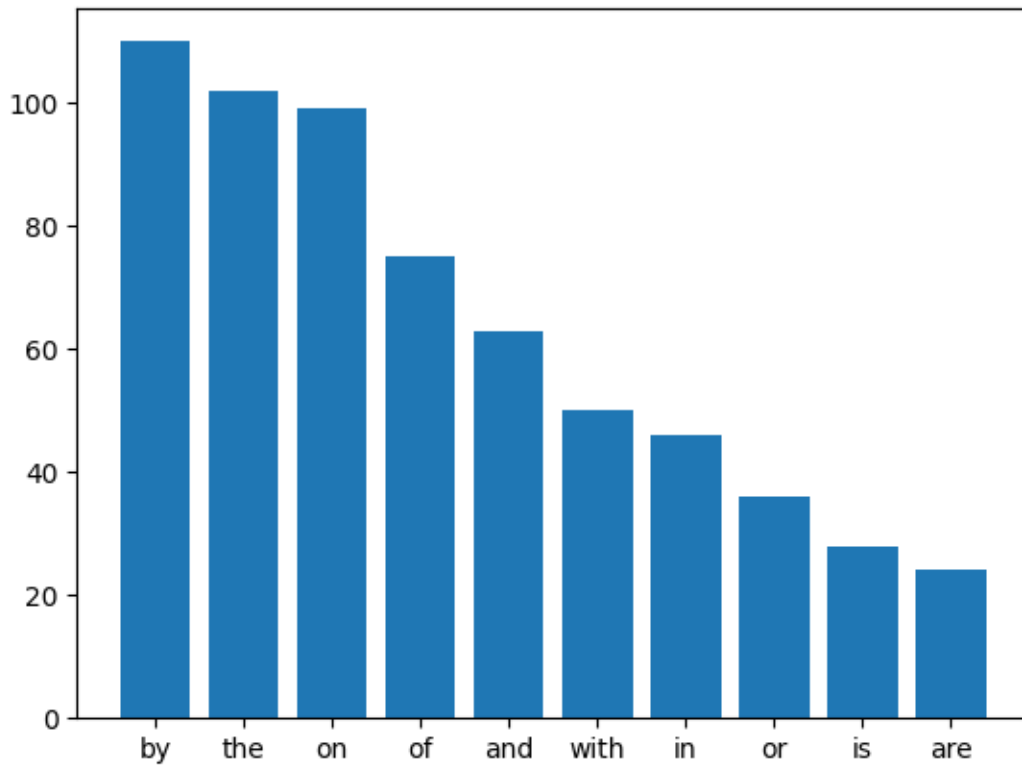
```
[21]: <AxesSubplot: >
```



```
[22]: # Stopwords
corpus=[]
report= reports['impression'].str.split()
report=report.tolist()
corpus=[word for i in report if isinstance(i, list) for word in i ]
dic=defaultdict(int)
for word in corpus:
    if word in stop:
        dic[word]+=1

top=sorted(dic.items(), key=lambda x:x[1],reverse=True)[:10]
x,y=zip(*top)
plt.bar(x,y)
```

[22]: <BarContainer object of 10 artists>

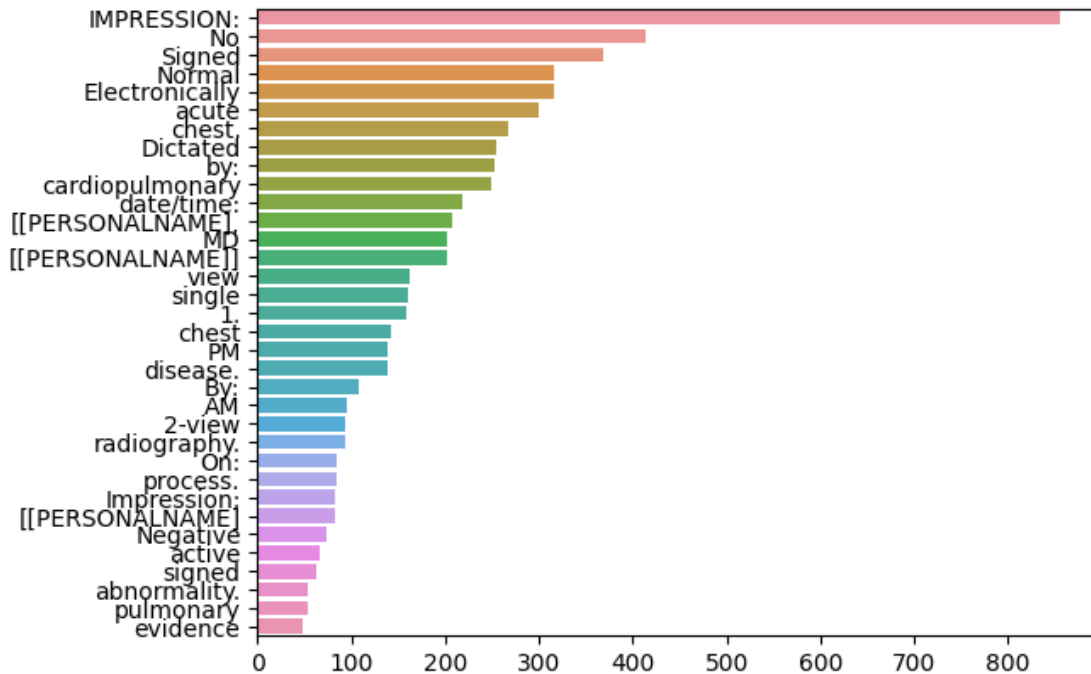


```
[23]: # Word-level analysis impression
counter=Counter(corpus)
most=counter.most_common()

x, y= [], []
for word,count in most[:40]:
    if (word not in stop):
        x.append(word)
        y.append(count)

sns.barplot(x=y,y=x)
```

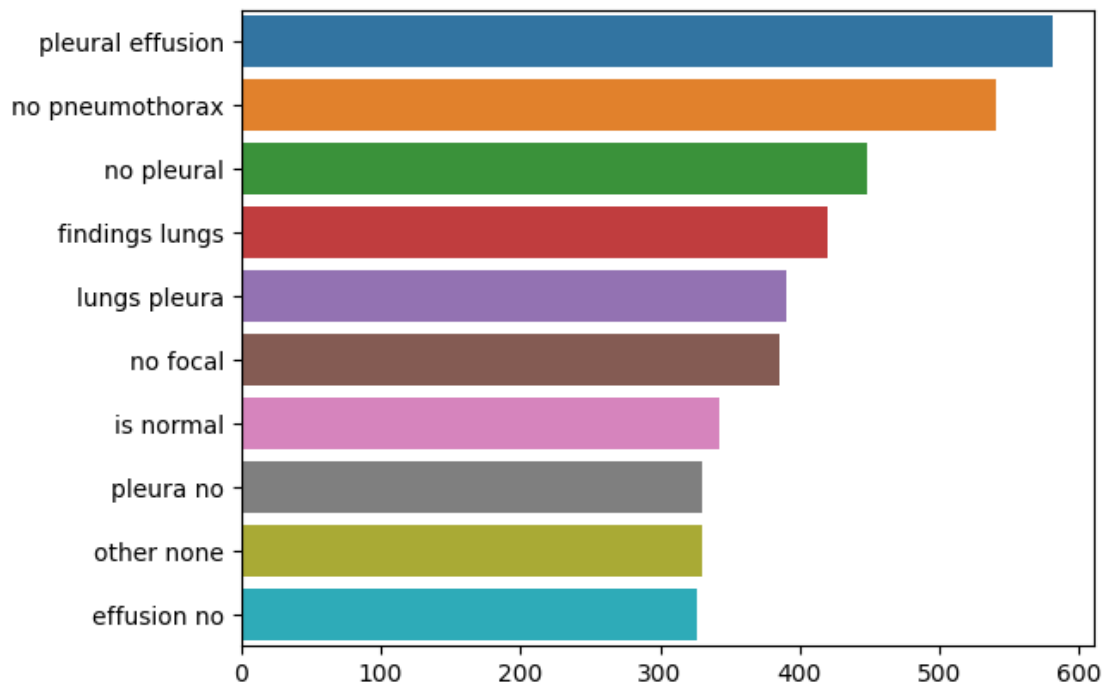
```
[23]: <AxesSubplot: >
```



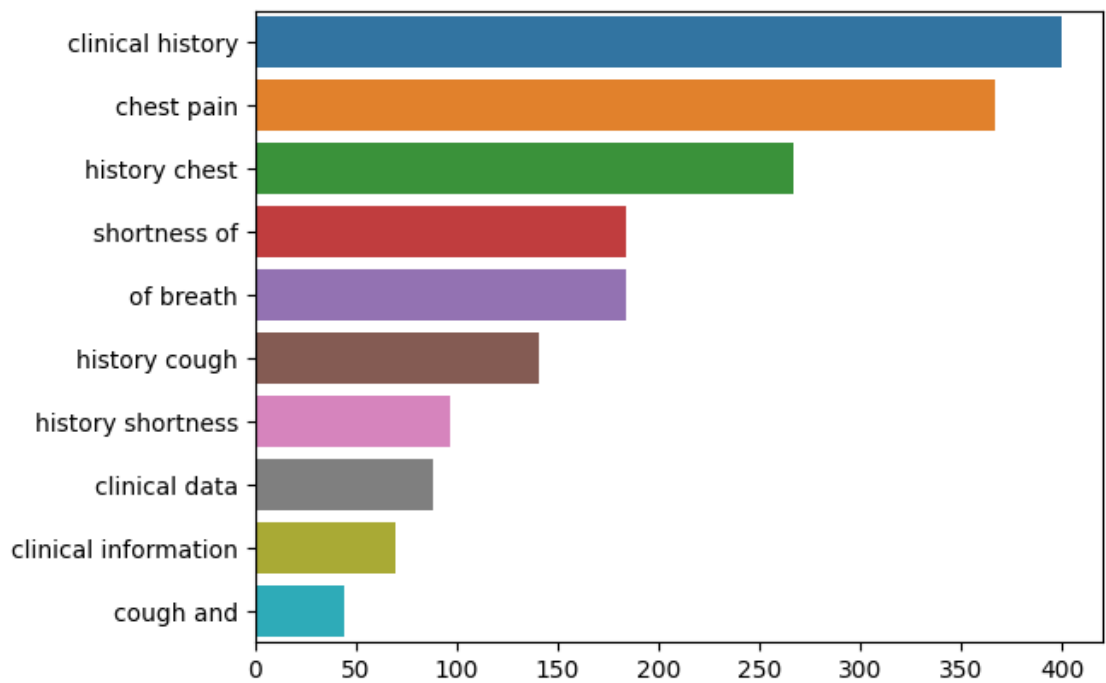
```
[24]: # Top ngrams - change the second parameter for more grams
def plot_top_ngrams_barchart(text, n=2):
    stop=set(stopwords.words('english'))
    new= text.str.split()
    new=new.tolist()
    corpus=[word for i in new if isinstance(i, list) for word in i]
    text = text.dropna()
    def _get_top_ngram(corpus, n=None):
        vec = CountVectorizer(ngram_range=(n, n)).fit(corpus)
        bag_of_words = vec.transform(corpus)
        sum_words = bag_of_words.sum(axis=0)
        words_freq = [(word, sum_words[0, idx])]
        for word, idx in vec.vocabulary_.items():
            words_freq.append((word, sum_words[0, idx]))
        words_freq =sorted(words_freq, key = lambda x: x[1], reverse=True)
        return words_freq[:10]

    top_n_bigrams=_get_top_ngram(text,n)[:10]
    x,y=map(list,zip(*top_n_bigrams))
    sns.barplot(x=y,y=x)
```

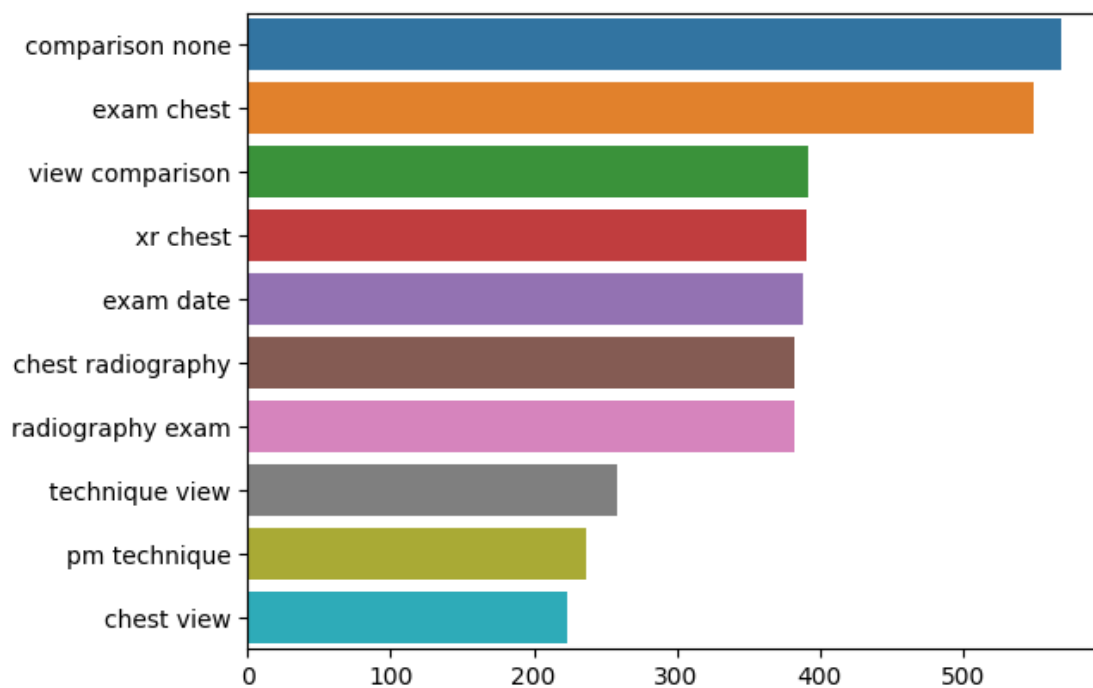
```
[25]: # Top ngrams findings
plot_top_ngrams_barchart(reports['findings'],2)
```



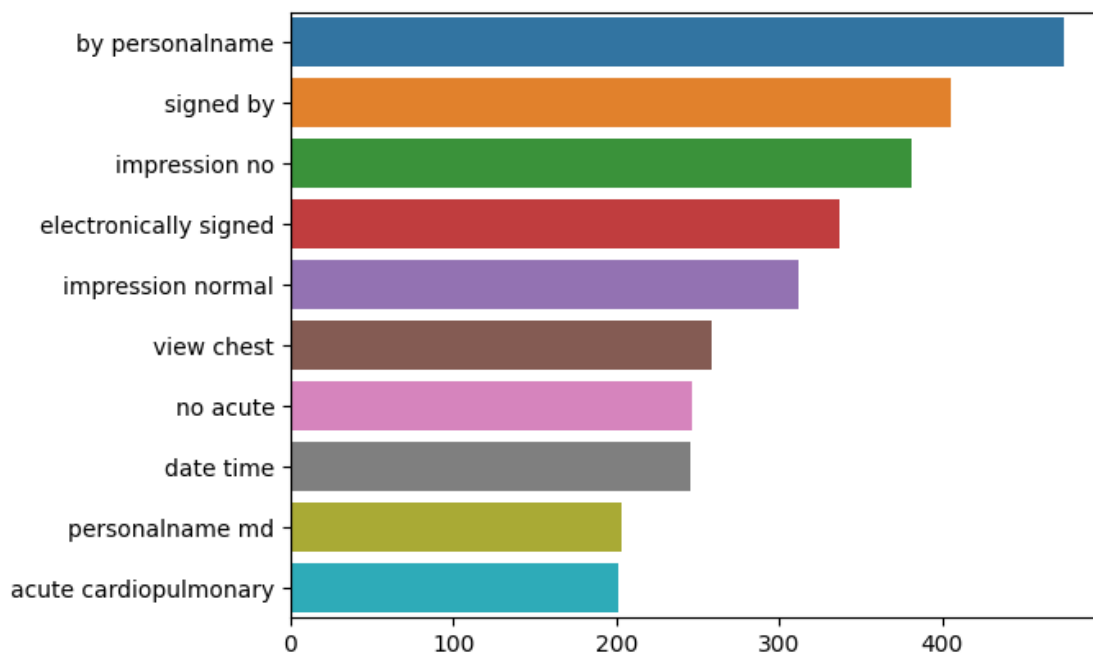
```
[26]: # Top ngrams clinicaldata
plot_top_ngrams_barchart(reports['clinicaldata'],2)
```



```
[27]: # Top ngrams ExamName
plot_top_ngrams_barchart(reports['ExamName'],2)
```



```
[28]: # Top ngrams impression
plot_top_ngrams_barchart(reports['impression'],2)
```



```
[29]: # Reupdate stopwords for the wordcloud
stopwords = set(STOPWORDS)
```

```
[30]: # Create wordcloud
def show_wordcloud(data):
    wordcloud = WordCloud(
        background_color='white',
        stopwords=stopwords,
        max_words=100,
        max_font_size=30,
        scale=3,
        random_state=1)

    wordcloud=wordcloud.generate(str(data))

    fig = plt.figure(1, figsize=(12, 12))
    plt.axis('off')

    plt.imshow(wordcloud)
    plt.show()
```

```
[4]: # LDA modeling function
nltk.download('punkt')
nltk.download('wordnet')

def preprocess_news(df, string):
    df = df.dropna()
    corpus=[]
    stem=PorterStemmer()
    lem=WordNetLemmatizer()
    for news in df[string]:
        words=[w for w in word_tokenize(news) if (w not in stop)]

        words=[lem.lemmatize(w) for w in words if len(w)>2]

        corpus.append(words)
    return corpus
```

```
[nltk_data] Downloading package punkt to
[nltk_data] C:\Users\elefe\AppData\Roaming\nltk_data...
[nltk_data] Package punkt is already up-to-date!
[nltk_data] Downloading package wordnet to
[nltk_data] C:\Users\elefe\AppData\Roaming\nltk_data...
[nltk_data] Package wordnet is already up-to-date!
```



```
[32]: # LDA findings
corpus=preprocess_news(reports, 'findings')
dic=gensim.corpora.Dictionary(corpus)
bow_corpus = [dic.doc2bow(doc) for doc in corpus]
lda_model = gensim.models.LdaMulticore(bow_corpus,
                                       num_topics = 4,
                                       id2word = dic,
                                       passes = 10,
                                       workers = 2)

lda_model.show_topics()
```

```
[32]: [(0,
        '0.038*"normal" + 0.036*"The" + 0.033*"FINDINGS" + 0.031*"size" +
        0.028*"within" + 0.028*"clear" + 0.027*"limit" + 0.020*"effusion" +
        0.020*"pneumothorax" + 0.019*"tube"'),
        (1,
        '0.074*"There" + 0.066*"The" + 0.038*"normal" + 0.037*"FINDINGS" +
        0.037*"pleural" + 0.036*"effusion" + 0.032*"acute" + 0.031*"lung" +
        0.028*"pneumothorax" + 0.028*"silhouette"'),
        (2,
        '0.061*"FINDINGS" + 0.058*"effusion" + 0.057*"pneumothorax" + 0.057*"pleural"
        + 0.055*"contour" + 0.048*"Mediastinum" + 0.047*"Lungs/Pleura" + 0.047*"Other" +
        0.044*"opacity" + 0.043*"focal"'),
        (3,
        '0.091*"Normal" + 0.040*"FINDINGS" + 0.036*"mass" + 0.030*"pulmonary" +
        0.027*"visible" + 0.027*"pleural" + 0.024*"bone" + 0.024*"adenopathy" +
        0.021*"abnormality" + 0.021*"Lungs"')]
```

```
[33]: show_wordcloud(corpus)
```

```
c:\Users\elefe\OneDrive\Documents\Programming\Internships\OpenAv
ML\venv\lib\site-packages\wordcloud\wordcloud.py:508: DeprecationWarning:
textsize is deprecated and will be removed in Pillow 10 (2023-07-01). Use
textbbox or textlength instead.
    box_size = draw.textsize(word, font=transposed_font)
c:\Users\elefe\OneDrive\Documents\Programming\Internships\OpenAv
ML\venv\lib\site-packages\wordcloud\wordcloud.py:508: DeprecationWarning:
textsize is deprecated and will be removed in Pillow 10 (2023-07-01). Use
textbbox or textlength instead.
    box_size = draw.textsize(word, font=transposed_font)
c:\Users\elefe\OneDrive\Documents\Programming\Internships\OpenAv
ML\venv\lib\site-packages\wordcloud\wordcloud.py:508: DeprecationWarning:
textsize is deprecated and will be removed in Pillow 10 (2023-07-01). Use
textbbox or textlength instead.
    box_size = draw.textsize(word, font=transposed_font)
c:\Users\elefe\OneDrive\Documents\Programming\Internships\OpenAv
ML\venv\lib\site-packages\wordcloud\wordcloud.py:508: DeprecationWarning:
```

```

textsize is deprecated and will be removed in Pillow 10 (2023-07-01). Use
textbbox or textlength instead.
    box_size = draw.textsize(word, font=transposed_font)
c:\Users\elefe\OneDrive\Documents\Programming\Internships\OpenAv
ML\venv\lib\site-packages\wordcloud\wordcloud.py:508: DeprecationWarning:
textsize is deprecated and will be removed in Pillow 10 (2023-07-01). Use
textbbox or textlength instead.
    box_size = draw.textsize(word, font=transposed_font)
c:\Users\elefe\OneDrive\Documents\Programming\Internships\OpenAv
ML\venv\lib\site-packages\wordcloud\wordcloud.py:508: DeprecationWarning:
textsize is deprecated and will be removed in Pillow 10 (2023-07-01). Use
textbbox or textlength instead.
    box_size = draw.textsize(word, font=transposed_font)
c:\Users\elefe\OneDrive\Documents\Programming\Internships\OpenAv
ML\venv\lib\site-packages\wordcloud\wordcloud.py:499: DeprecationWarning:
ROTATE_90 is deprecated and will be removed in Pillow 10 (2023-07-01). Use
Transpose.ROTATE_90 instead.
    orientation = Image.ROTATE_90
c:\Users\elefe\OneDrive\Documents\Programming\Internships\OpenAv
ML\venv\lib\site-packages\wordcloud\wordcloud.py:508: DeprecationWarning:
textsize is deprecated and will be removed in Pillow 10 (2023-07-01). Use
textbbox or textlength instead.
    box_size = draw.textsize(word, font=transposed_font)
c:\Users\elefe\OneDrive\Documents\Programming\Internships\OpenAv
ML\venv\lib\site-packages\wordcloud\wordcloud.py:508: DeprecationWarning:
textsize is deprecated and will be removed in Pillow 10 (2023-07-01). Use
textbbox or textlength instead.
    box_size = draw.textsize(word, font=transposed_font)
c:\Users\elefe\OneDrive\Documents\Programming\Internships\OpenAv
ML\venv\lib\site-packages\wordcloud\wordcloud.py:519: DeprecationWarning:
ROTATE_90 is deprecated and will be removed in Pillow 10 (2023-07-01). Use
Transpose.ROTATE_90 instead.
    orientation = (Image.ROTATE_90 if orientation is None else
c:\Users\elefe\OneDrive\Documents\Programming\Internships\OpenAv
ML\venv\lib\site-packages\wordcloud\wordcloud.py:508: DeprecationWarning:
textsize is deprecated and will be removed in Pillow 10 (2023-07-01). Use
textbbox or textlength instead.
    box_size = draw.textsize(word, font=transposed_font)
c:\Users\elefe\OneDrive\Documents\Programming\Internships\OpenAv
ML\venv\lib\site-packages\wordcloud\wordcloud.py:508: DeprecationWarning:
textsize is deprecated and will be removed in Pillow 10 (2023-07-01). Use
textbbox or textlength instead.
    box_size = draw.textsize(word, font=transposed_font)
c:\Users\elefe\OneDrive\Documents\Programming\Internships\OpenAv
ML\venv\lib\site-packages\wordcloud\wordcloud.py:508: DeprecationWarning:
textsize is deprecated and will be removed in Pillow 10 (2023-07-01). Use
textbbox or textlength instead.
    box_size = draw.textsize(word, font=transposed_font)

```

```

c:\Users\elefe\OneDrive\Documents\Programming\Internships\OpenAv
ML\venv\lib\site-packages\wordcloud\wordcloud.py:508: DeprecationWarning:
textsize is deprecated and will be removed in Pillow 10 (2023-07-01). Use
textbbox or textlength instead.
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```
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```

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```



```

dic=gensim.corpora.Dictionary(corpus)
bow_corpus = [dic.doc2bow(doc) for doc in corpus]
lda_model = gensim.models.LdaMulticore(bow_corpus,
                                       num_topics = 4,
                                       id2word = dic,
                                       passes = 10,
                                       workers = 2)

lda_model.show_topics()

```

```

[36]: [(0,
        '0.124*"EXAM" + 0.106*"CHEST" + 0.093*"COMPARISON" + 0.076*"TECHNIQUE" +
        0.068*"None" + 0.065*"view" + 0.045*"DATE" + 0.039*"VIEW" + 0.034*"chest" +
        0.033*"RADIOGRAPHY"'),
        (1,
        '0.048*"x-ray" + 0.046*"chest" + 0.045*"COMPARISON" + 0.039*"Chest" +
        0.032*"lateral" + 0.030*"performed" + 0.027*"portable" + 0.023*"view" +
        0.021*"CHEST" + 0.019*"EXAMINATION"'),
        (2,
        '0.121*"CHEST" + 0.066*"VIEWS" + 0.061*"COMPARISON" + 0.054*"Exam" +
        0.049*"None" + 0.044*"dated" + 0.043*"TWO" + 0.036*"Comparison" + 0.034*"Chest"
        + 0.020*"chest"'),
        (3,
        '0.140*"EXAM" + 0.102*"CHEST" + 0.077*"DATE" + 0.075*"COMPARISON" +
        0.075*"view" + 0.070*"TECHNIQUE" + 0.067*"RADIOGRAPHY" + 0.040*"None" +
        0.013*"PORTABLE" + 0.012*"VIEW"')]

```

```

[37]: show_wordcloud(corpus)

```

```

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```



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workers = 2)
lda_model.show_topics()
```

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[38]: [(0,
        '0.056*"IMPRESSION" + 0.053*"PERSONALNAME" + 0.051*"Electronically" +
        0.046*"Signed" + 0.022*"Impression" + 0.017*"opacity" + 0.015*"lung" +
        0.015*"consolidation" + 0.014*"exam" + 0.013*"prior"'),
        (1,
        '0.133*"IMPRESSION" + 0.118*"chest" + 0.085*"Normal" + 0.073*"PERSONALNAME" +
        0.068*"view" + 0.066*"single" + 0.053*"Signed" + 0.031*"Negative" +
        0.025*"Electronically" + 0.010*"active"'),
        (2,
        '0.112*"IMPRESSION" + 0.083*"chest" + 0.078*"Normal" + 0.063*"radiography" +
        0.063*"2-view" + 0.015*"effusion" + 0.014*"pleural" + 0.014*"left" +
        0.011*"disease" + 0.011*"airspace"'),
        (3,
        '0.092*"acute" + 0.087*"IMPRESSION" + 0.082*"Dictated" + 0.079*"PERSONALNAME"
        + 0.077*"cardiopulmonary" + 0.069*"date/time" + 0.053*"Electronically" +
        0.053*"Signed" + 0.044*"disease" + 0.030*"process"')]
```

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[39]: show_wordcloud(corpus)
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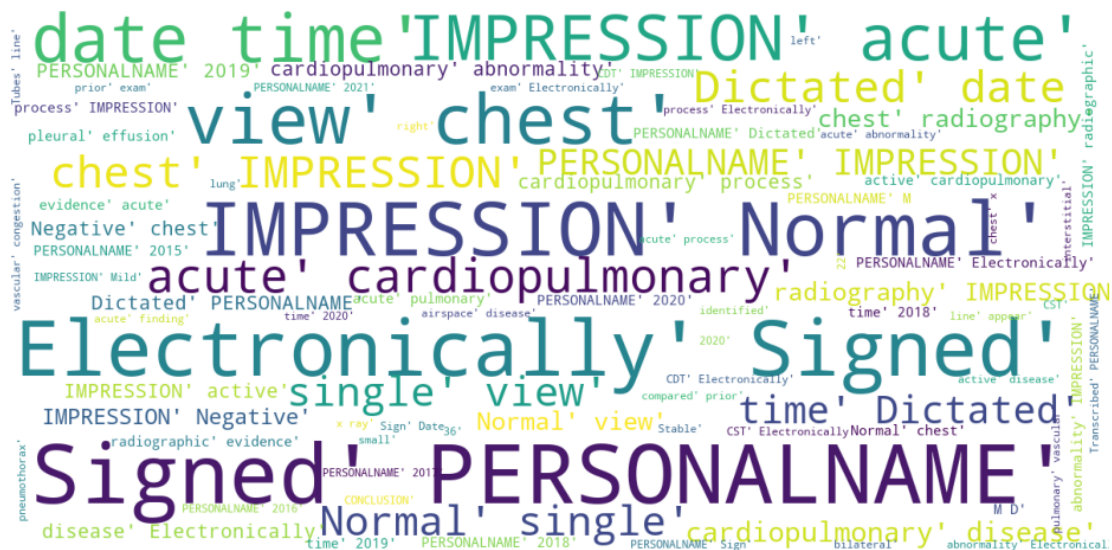
```



```

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```



```

[13]: # LDA Full ReportText - saves html file as well
corpus=preprocess_news(reports, 'ReportText')
dic=gensim.corpora.Dictionary(corpus)
bow_corpus = [dic.doc2bow(doc) for doc in corpus]
lda_model = gensim.models.LdaMulticore(bow_corpus,
                                         num_topics = 4,
                                         id2word = dic,
                                         passes = 10,

```

```

workers = 2)

lda_model.show_topics()
pyLDavis.enable_notebook()
vis = gensimvis.prepare(lda_model, bow_corpus, dic)
pyLDavis.save_html(vis, 'lda.html')
vis

```

c:\Users\elefe\OneDrive\Documents\Programming\Internships\OpenAv
ML\venv\lib\site-packages\pyLDavis_prepare.py:247: FutureWarning: In a future
version of pandas all arguments of DataFrame.drop except for the argument
'labels' will be keyword-only.

```
by='saliency', ascending=False).head(R).drop('saliency', 1)
```

[13]: PreparedData(topic_coordinates= x y topics cluster

```

Freq
topic
1      0.205261 -0.017824      1      1  40.699688
3     -0.067474  0.078828      2      1  30.413633
0     -0.045219  0.070334      3      1  16.052001
2     -0.092569 -0.131338      4      1  12.834678, topic_info=
Term      Freq      Total Category  logprob  loglift
169    Dictated  235.000000  235.000000  Default  30.0000  30.0000
194    date/time  196.000000  196.000000  Default  29.0000  29.0000
115  PERSONALNAME  502.000000  502.000000  Default  28.0000  28.0000
13    Lungs/Pleura  362.000000  362.000000  Default  27.0000  27.0000
18    RADIOGRAPHY  363.000000  363.000000  Default  26.0000  26.0000
..      ...      ...      ...      ...      ...
12    IMPRESSION  107.678484  802.505515  Topic4  -3.8517  0.0444
11      Heart     64.237067  285.087654  Topic4  -4.3683  0.5628
59    process     44.404215  139.502261  Topic4  -4.7375  0.9083
4     CLINICAL     55.118638  521.119078  Topic4  -4.5213 -0.1935
15      None     58.967431  846.975735  Topic4  -4.4538 -0.6117

```

```

[295 rows x 6 columns], token_table=      Topic      Freq      Term
term
649      4  0.829543  02/20/2018
902      3  0.830882  02/20/2020
911      4  0.735235  07/05/2013
166      3  0.886045  08/03/2020
963      3  0.830138  09/17/2020
...      ...      ...
220      2  0.469990      within
220      3  0.508245      within
220      4  0.021860      within
111      2  0.903069      without
111      3  0.090307      without

```

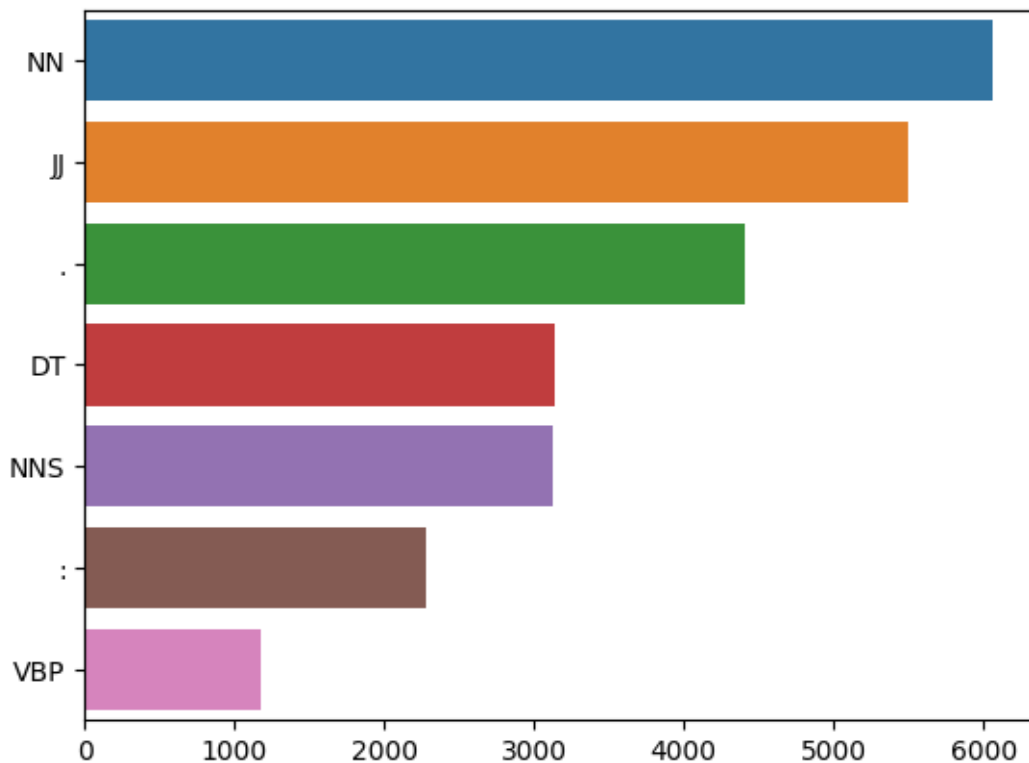
```
[492 rows x 3 columns], R=30, lambda_step=0.01, plot_opts={'xlab': 'PC1',  
'ylab': 'PC2'}, topic_order=[2, 4, 1, 3])
```

```
[40]: # POS tagging  
nltk.download('averaged_perceptron_tagger')  
def pos(text):  
    pos=nltk.pos_tag(word_tokenize(text))  
    pos=list(map(list,zip(*pos)))[1]  
    return pos
```

```
[nltk_data] Downloading package averaged_perceptron_tagger to  
[nltk_data] C:\Users\elefe\AppData\Roaming\nltk_data...  
[nltk_data] Package averaged_perceptron_tagger is already up-to-  
[nltk_data] date!
```

```
[41]: # Text tagging findings  
tags=reports['findings'].apply(lambda x : pos(x))  
tags=[x for l in tags for x in l]  
counter=Counter(tags)  
  
x,y=list(map(list,zip(*counter.most_common(7))))  
sns.barplot(x=y,y=x)
```

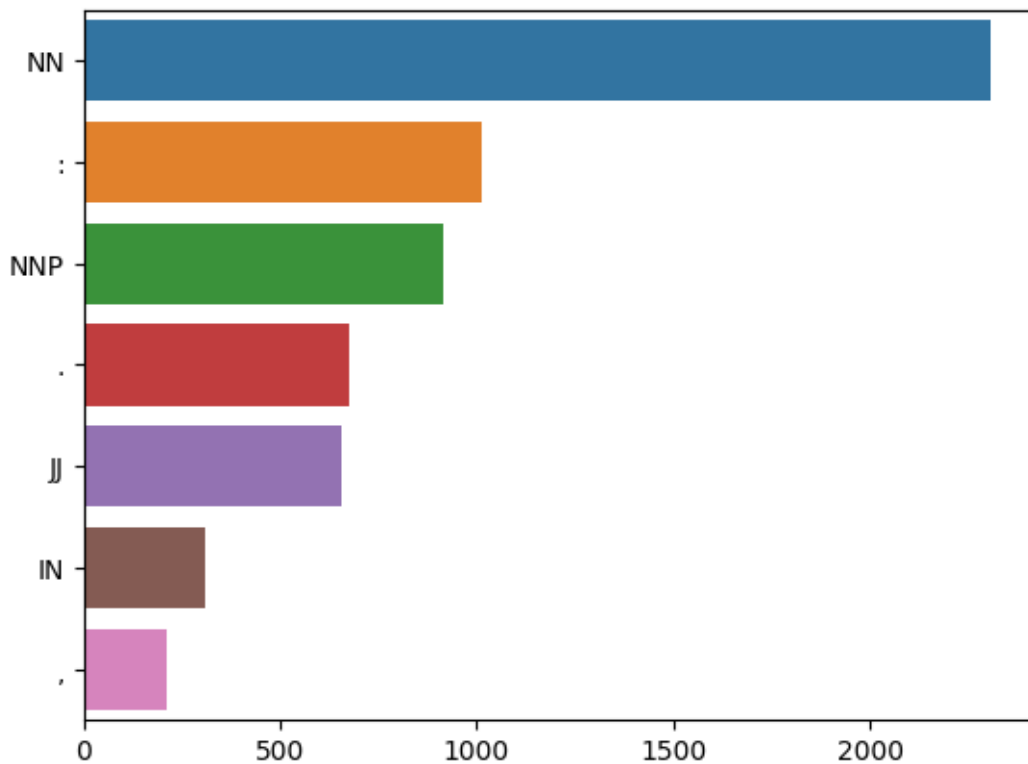
```
[41]: <AxesSubplot: >
```



```
[42]: # Text tagging clinicaldata
tags=reports['clinicaldata'].apply(lambda x : pos(x))
tags=[x for l in tags for x in l]
counter=Counter(tags)

x,y=list(map(list,zip(*counter.most_common(7))))
sns.barplot(x=y,y=x)
```

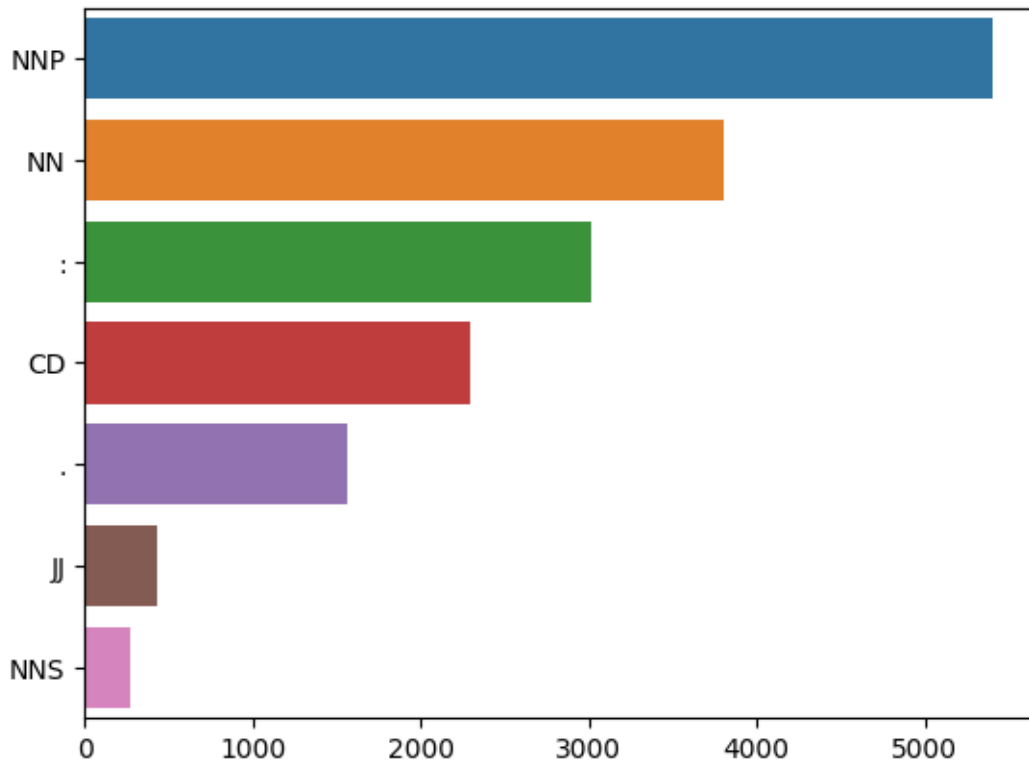
[42]: <AxesSubplot: >



```
[43]: # Text tagging ExamName
tags=reports['ExamName'].apply(lambda x : pos(x))
tags=[x for l in tags for x in l]
counter=Counter(tags)

x,y=list(map(list,zip(*counter.most_common(7))))
sns.barplot(x=y,y=x)
```

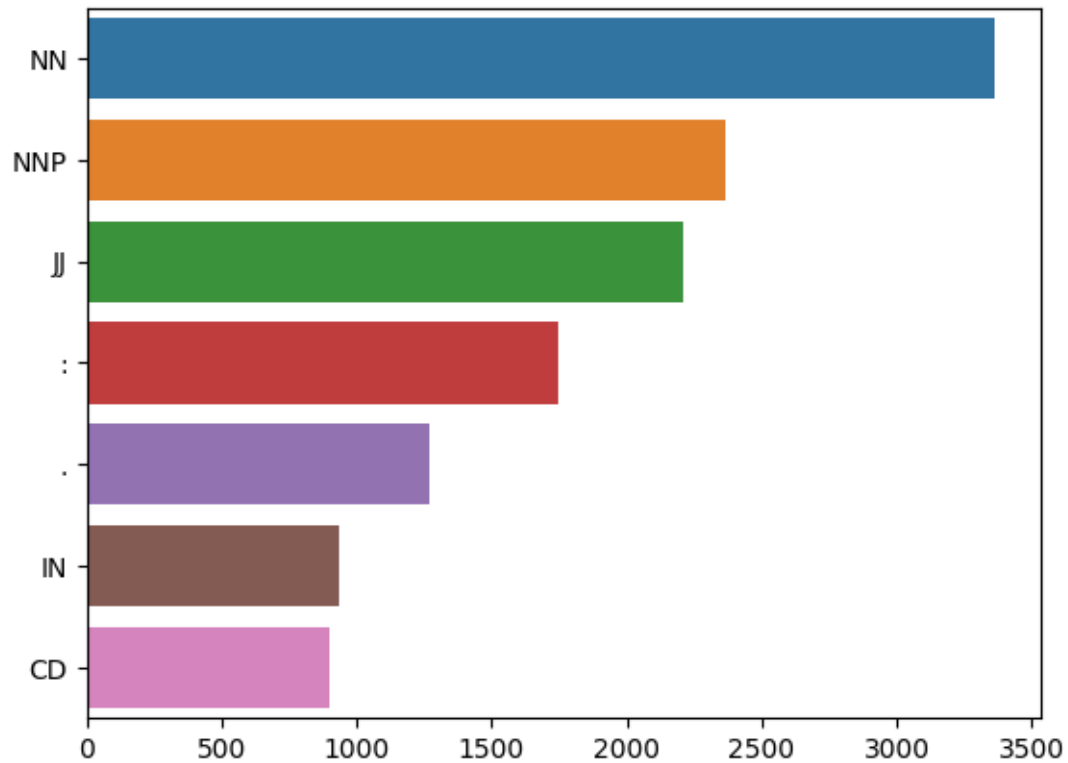
[43]: <AxesSubplot: >



```
[44]: # Text tagging impression
tags=reports['impression'].apply(lambda x : pos(x))
tags=[x for l in tags for x in l]
counter=Counter(tags)

x,y=list(map(list,zip(*counter.most_common(7))))
sns.barplot(x=y,y=x)
```

[44]: <AxesSubplot: >

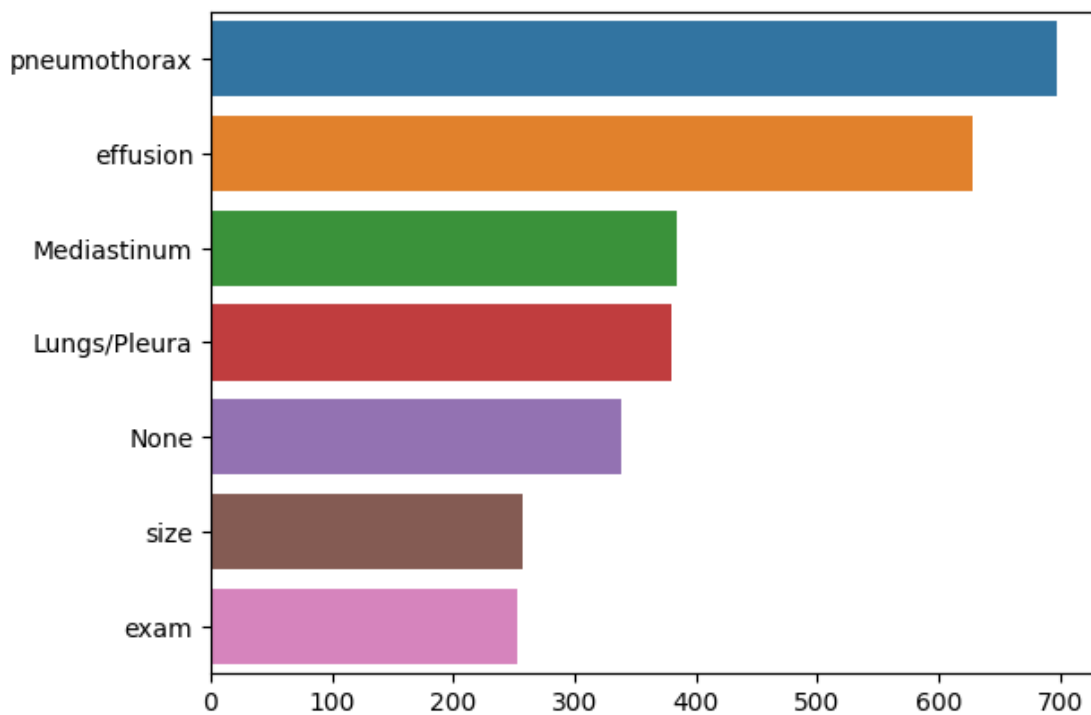


```
[45]: def get_adjs(text):
      adj=[]
      pos=nltk.pos_tag(word_tokenize(text))
      for word,tag in pos:
          if tag=='NN':
              adj.append(word)
      return adj
```

```
[46]: # Adj tagging findings
      words=reports['findings'].apply(lambda x : get_adjs(x))
      words=[x for l in words for x in l]
      counter=Counter(words)

      x,y=list(map(list,zip(*counter.most_common(7))))
      sns.barplot(x=y,y=x)
```

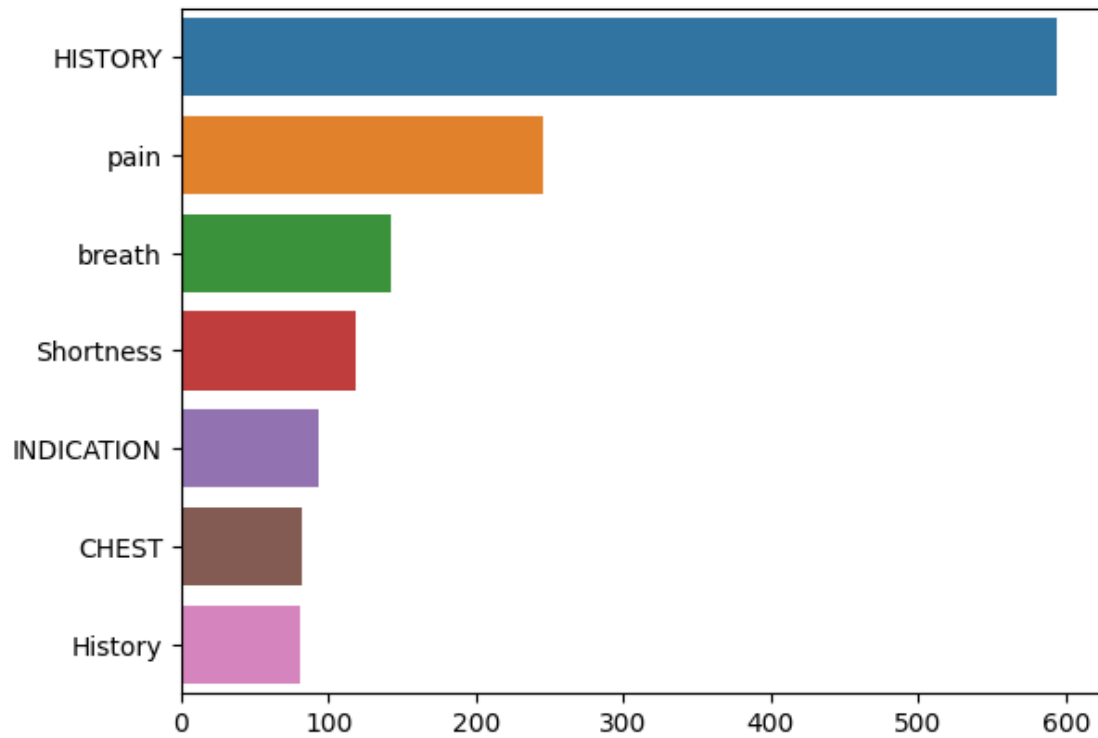
```
[46]: <AxesSubplot: >
```



```
[47]: # Adj tagging clinicaldata
words=reports['clinicaldata'].apply(lambda x : get_adjs(x))
words=[x for l in words for x in l]
counter=Counter(words)

x,y=list(map(list,zip(*counter.most_common(7))))
sns.barplot(x=y,y=x)
```

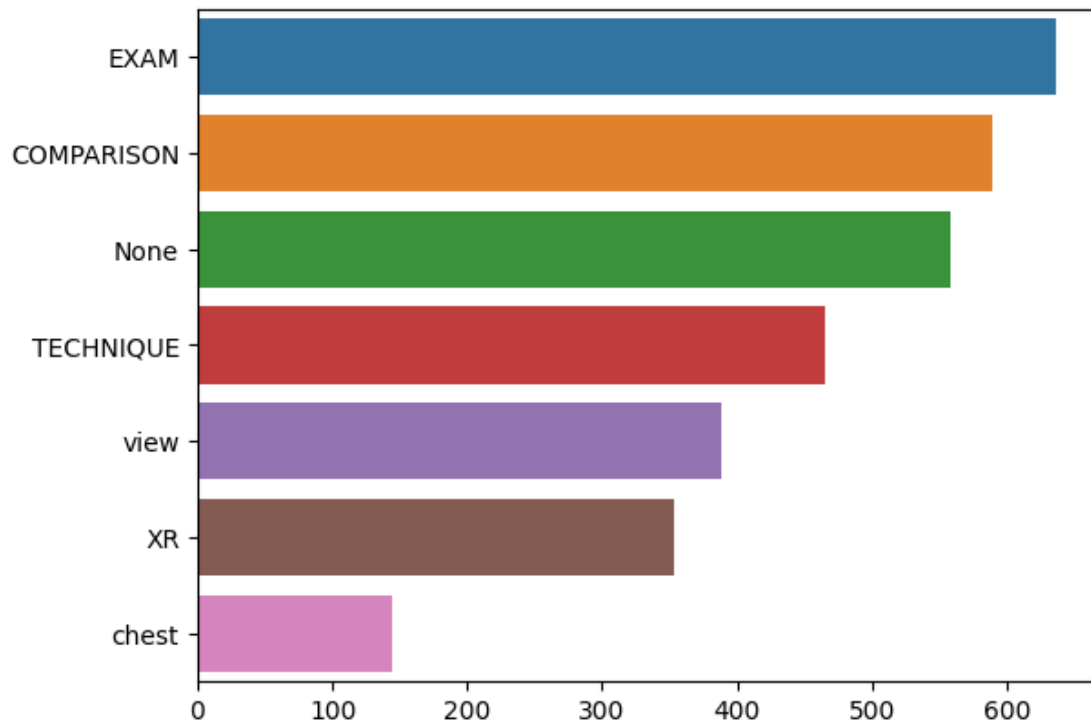
[47]: <AxesSubplot: >



```
[48]: # Adj tagging ExamName
words=reports['ExamName'].apply(lambda x : get_adjs(x))
words=[x for l in words for x in l]
counter=Counter(words)

x,y=list(map(list,zip(*counter.most_common(7))))
sns.barplot(x=y,y=x)
```

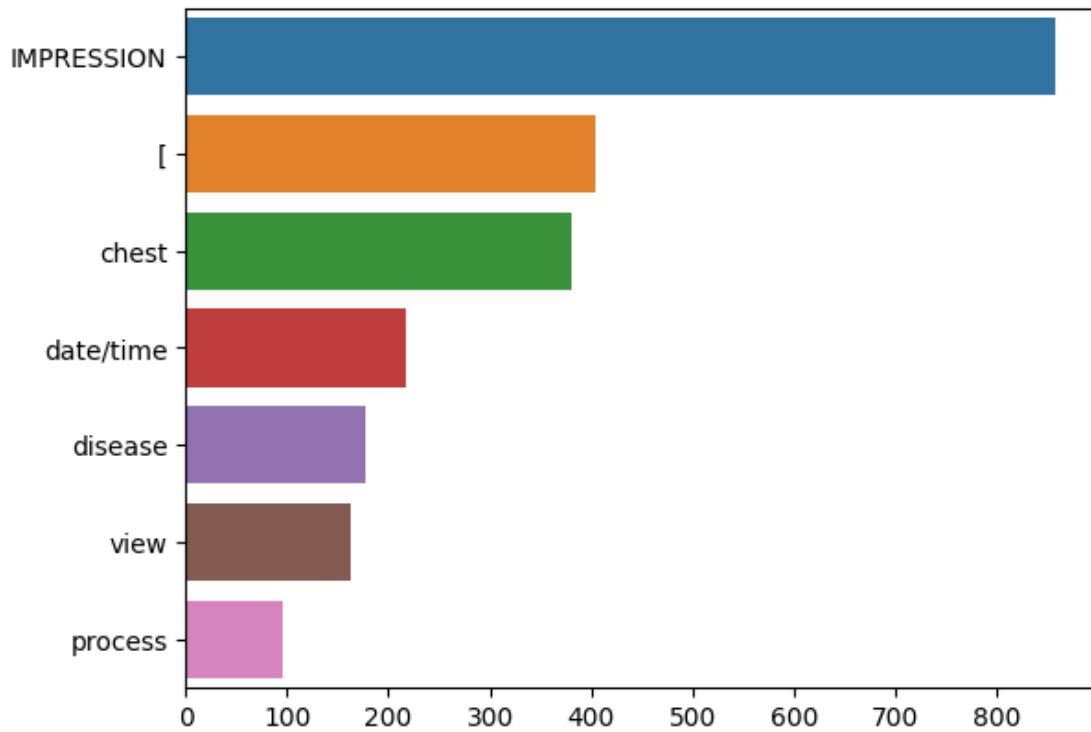
[48]: <AxesSubplot: >



```
[49]: # Adj tagging impression
words=reports['impression'].apply(lambda x : get_adjs(x))
words=[x for l in words for x in l]
counter=Counter(words)

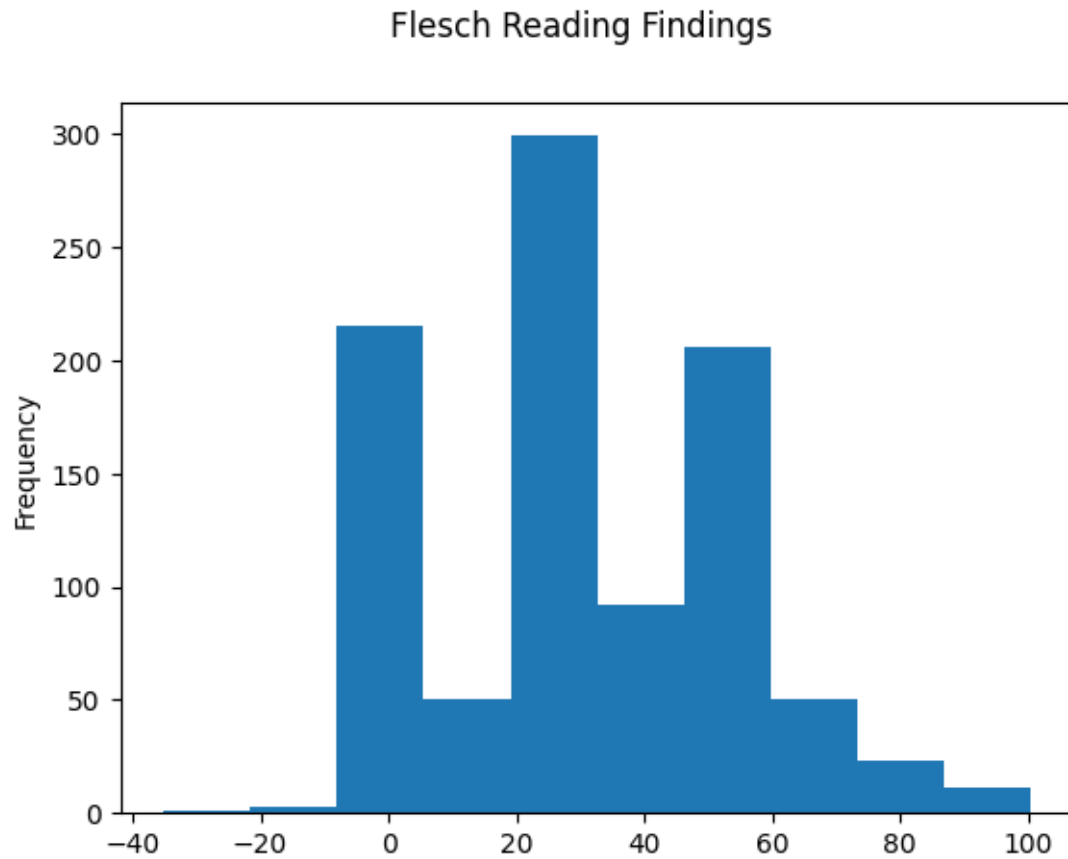
x,y=list(map(list,zip(*counter.most_common(7))))
sns.barplot(x=y,y=x)
```

```
[49]: <AxesSubplot: >
```



```
[50]: # Ease score findings
reports['findings'].apply(lambda x : flesch_reading_ease(x)).plot(kind='hist',
↳subplots=True, title="Flesch Reading Findings")
```

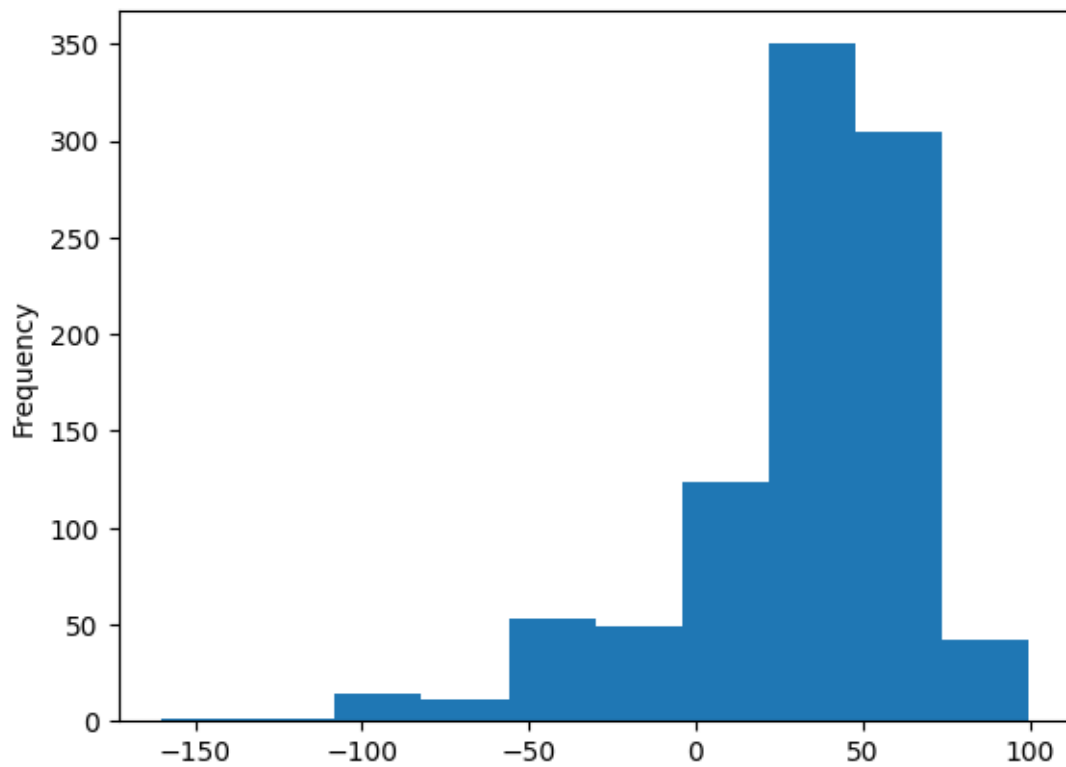
```
[50]: array([<AxesSubplot: ylabel='Frequency'>], dtype=object)
```



```
[51]: # Ease score clinicaldata
reports['clinicaldata'].apply(lambda x : flesch_reading_ease(x)).
    plot(kind='hist', subplots=True, title="Flesch Reading Clinical Data")
```

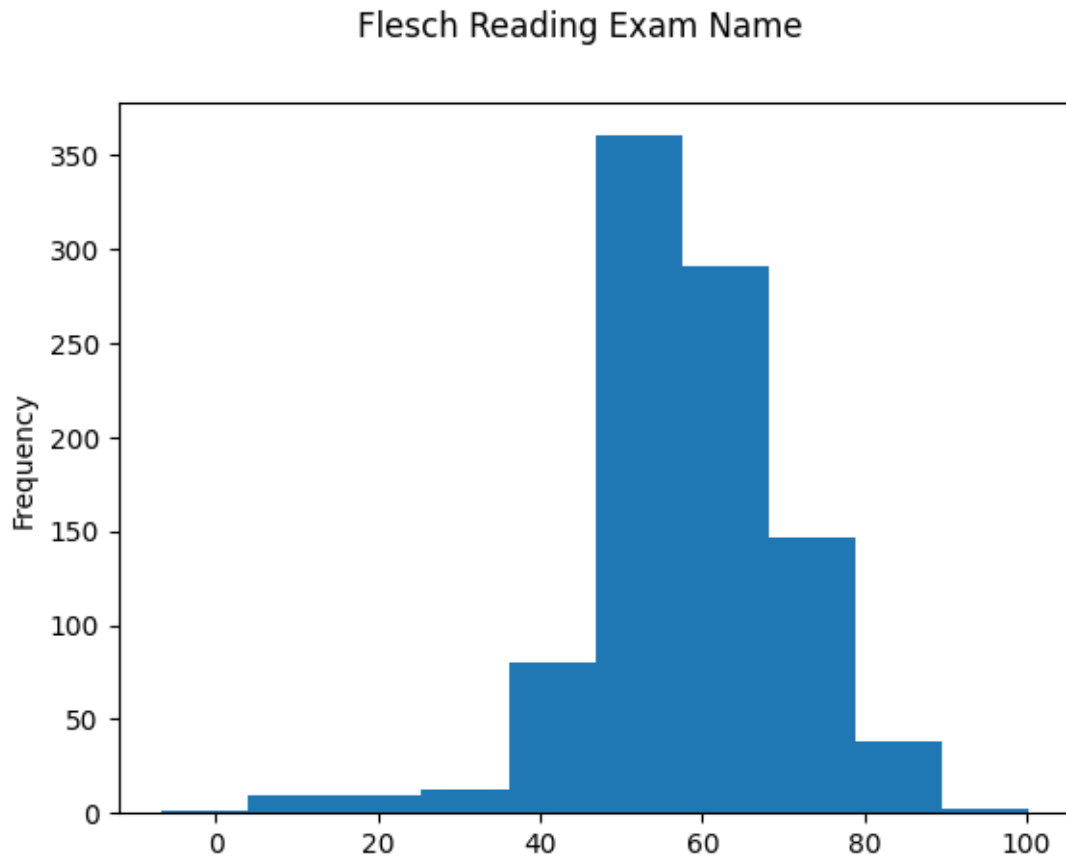
```
[51]: array([<AxesSubplot: ylabel='Frequency'>], dtype=object)
```

Flesch Reading Clinical Data



```
[52]: # Ease score ExamName
reports['ExamName'].apply(lambda x : flesch_reading_ease(x)).plot(kind='hist',
↳subplots=True, title="Flesch Reading Exam Name")
```

```
[52]: array([<AxesSubplot: ylabel='Frequency'>], dtype=object)
```



```
[53]: # Ease score impression
reports['impression'].apply(lambda x : flesch_reading_ease(x)).
    plot(kind='hist', subplots=True, title="Flesch Reading Impression")
```

```
[53]: array([<AxesSubplot: ylabel='Frequency'>], dtype=object)
```

Flesch Reading Impression

