NOTE:

This dataset contains data of Females only

This dataset contains parameters revolving around the condition of diabetes

In this case study, i have tried to see the impact of parameters on a patient being diabetic

In [1]:

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
%matplotlib inline
import warnings
warnings.filterwarnings('ignore')
```

In [59]:

```
df = pd.read_csv('diabetes.csv')
```

In [3]:

```
df.head()
```

Out[3]:

	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI	DiabetesPedigreeFunction	Age	Outcome
0	6	148	72	35	0	33.6	0.627	50	1
1	1	85	66	29	0	26.6	0.351	31	0
2	8	183	64	0	0	23.3	0.672	32	1
3	1	89	66	23	94	28.1	0.167	21	0
4	0	137	40	35	168	43.1	2.288	33	1

Checking Null Values

In [14]:

```
df.isnull().sum()
```

Out[14]:

```
Pregnancies                 0
Glucose                     0
BloodPressure               0
SkinThickness               0
Insulin                     0
BMI                         0
DiabetesPedigreeFunction    0
Age                         0
Outcome                     0
dtype: int64
```

Checking zero values

In [30]:

```
#Glucose
zeros_gl = (df['Glucose']==0).sum()
zeros_gl
```

Out[30]:

```
5
```

In [31]:

```
#BloodPressure
zeros_bp = (df['BloodPressure']==0).sum()
zeros_bp
```

Out[31]:

```
35
```

In [32]:

```
#SkinThickness
zeros_st = (df['SkinThickness']==0).sum()
zeros_st
```

Out[32]:

```
227
```

In [33]:

```
#Insulin
zeros_in = (df['Insulin']==0).sum()
zeros_in
```

Out[33]:

```
374
```

In [34]:

```
#BMI
zeros_bm = (df['BMI']==0).sum()
zeros_bm
```

Out[34]:

```
11
```

In [35]:

```
#DiabetesPedigreeFunction
zeros_dpf = (df['DiabetesPedigreeFunction']==0).sum()
zeros_dpf
```

Out[35]:

```
0
```

In [36]:

```
#Age
zeros_ag = (df['Age']==0).sum()
zeros_ag
```

Out[36]:

```
0
```

5 Point Summary and Checking Outliers

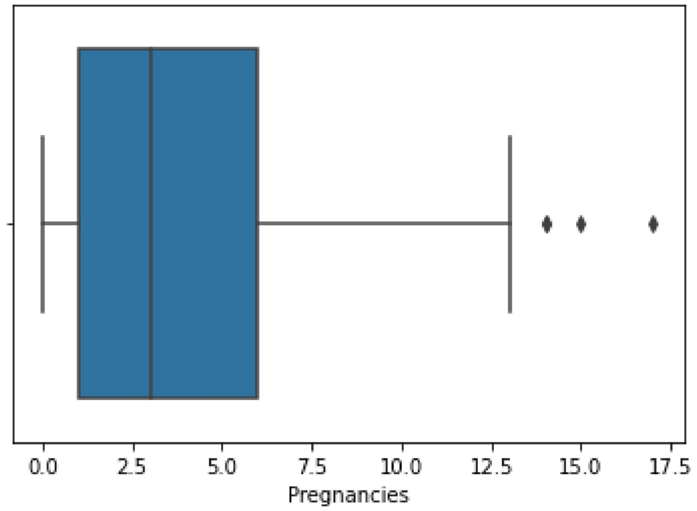
In [39]:

```
#Pregnancies
df['Pregnancies'].describe()
```

Out[39]:

```
count    768.000000
mean       3.845052
std        3.369578
min        0.000000
25%        1.000000
50%        3.000000
75%        6.000000
max       17.000000
Name: Pregnancies, dtype: float64
```

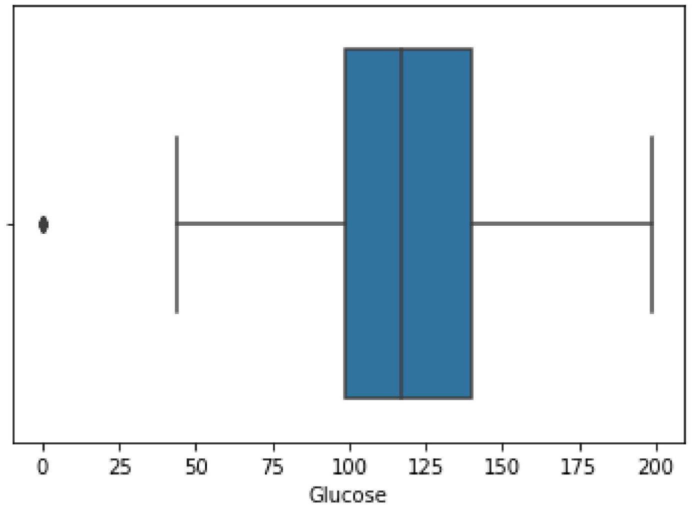
In [40]:
```
sns.boxplot(df['Pregnancies'])
plt.show()
```



In [41]:
```
#Glucose
df['Glucose'].describe()
```

Out[41]:
```
count    768.000000
mean     120.894531
std       31.972618
min        0.000000
25%       99.000000
50%      117.000000
75%      140.250000
max      199.000000
Name: Glucose, dtype: float64
```

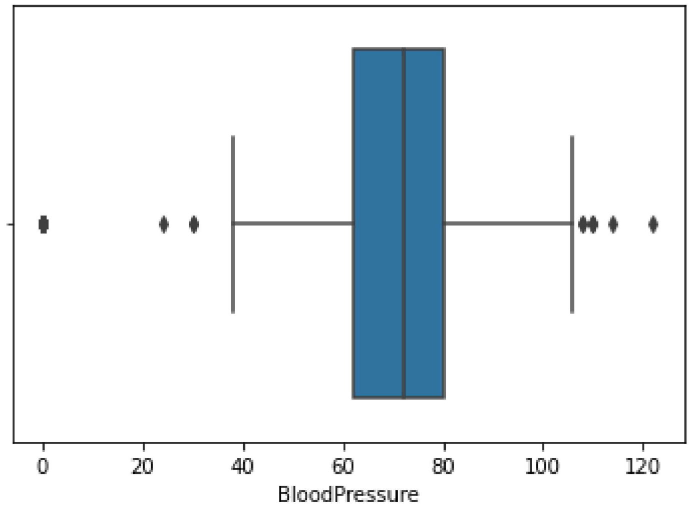
In [42]:
```
sns.boxplot(df['Glucose'])
plt.show()
```



In [43]:
```
#BloodPressure
df['BloodPressure'].describe()
```

Out[43]:
```
count    768.000000
mean      69.105469
std       19.355807
min        0.000000
25%       62.000000
50%       72.000000
75%       80.000000
max      122.000000
Name: BloodPressure, dtype: float64
```

In [44]:
```
sns.boxplot(df['BloodPressure'])
plt.show()
```

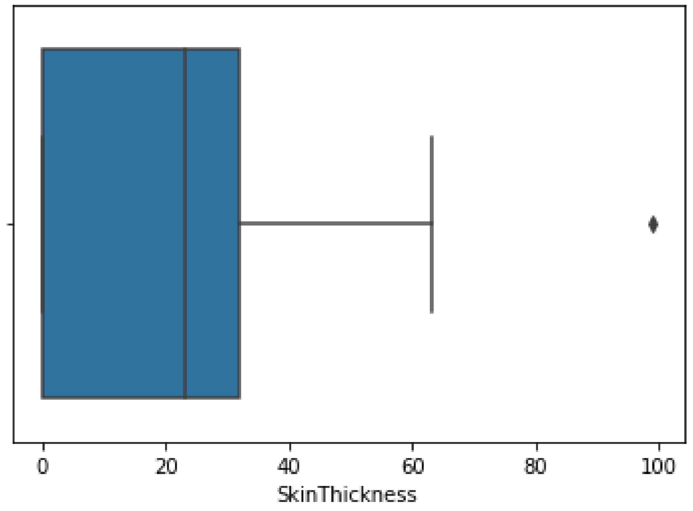


In [45]:
```
#SkinThickness
df['SkinThickness'].describe()
```

Out[45]:
```
count    768.000000
mean      20.536458
std       15.952218
min        0.000000
25%        0.000000
50%       23.000000
75%       32.000000
max       99.000000
Name: SkinThickness, dtype: float64
```

In [46]:

```
sns.boxplot(df['SkinThickness'])
plt.show()
```



In [47]:

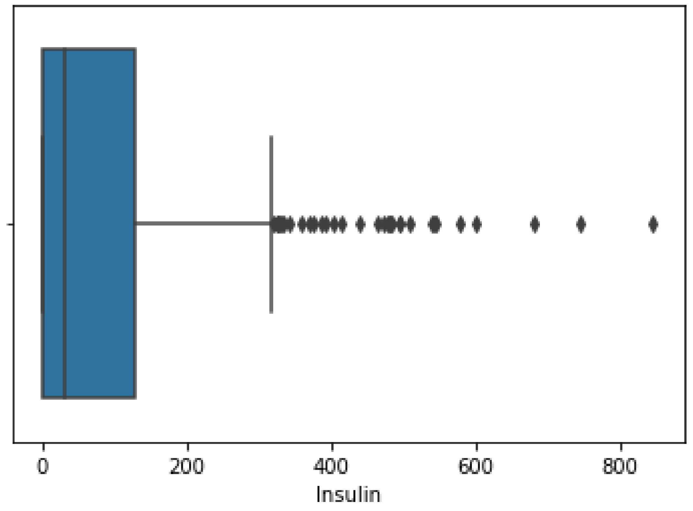
```
#Insulin
df['Insulin'].describe()
```

Out[47]:

```
count    768.000000
mean      79.799479
std      115.244002
min        0.000000
25%        0.000000
50%       30.500000
75%      127.250000
max      846.000000
Name: Insulin, dtype: float64
```

In [48]:

```
sns.boxplot(df['Insulin'])
plt.show()
```



In [49]:

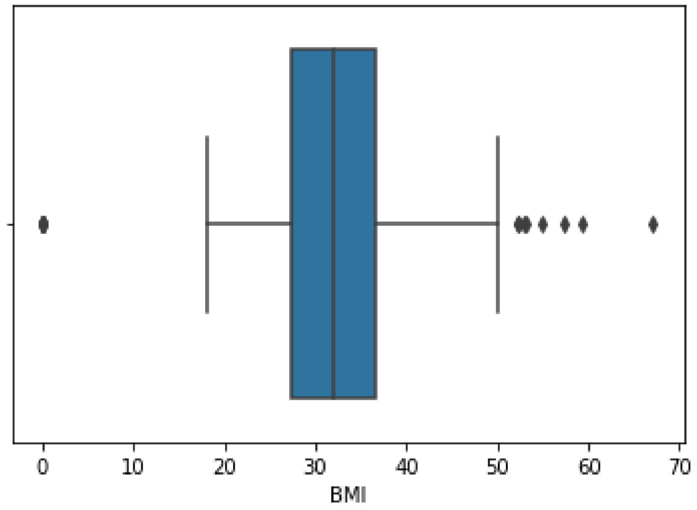
```
#BMI
df['BMI'].describe()
```

Out[49]:

```
count    768.000000
mean      31.992578
std        7.884160
min        0.000000
25%       27.300000
50%       32.000000
75%       36.600000
max       67.100000
Name: BMI, dtype: float64
```

In [50]:

```
sns.boxplot(df['BMI'])
plt.show()
```



In [51]:

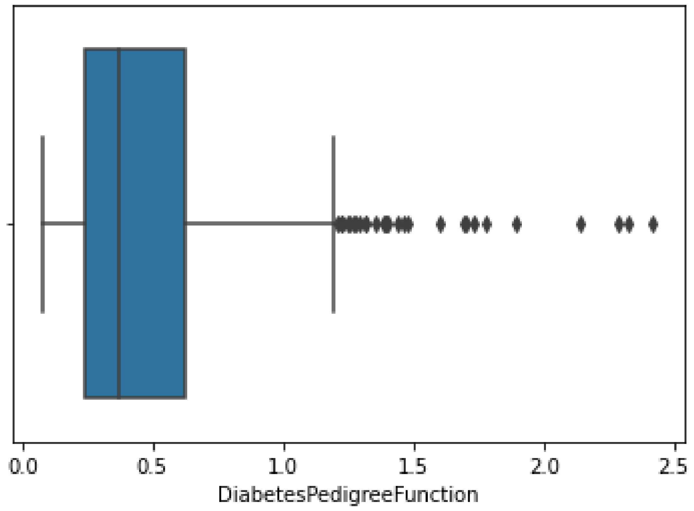
```
#DiabetesPedigreeFunction
df['DiabetesPedigreeFunction'].describe()
```

Out[51]:

```
count    768.000000
mean       0.471876
std        0.331329
min        0.078000
25%        0.243750
50%        0.372500
75%        0.626250
max        2.420000
Name: DiabetesPedigreeFunction, dtype: float64
```

In [52]:

```
sns.boxplot(df['DiabetesPedigreeFunction'])
plt.show()
```



In [53]:

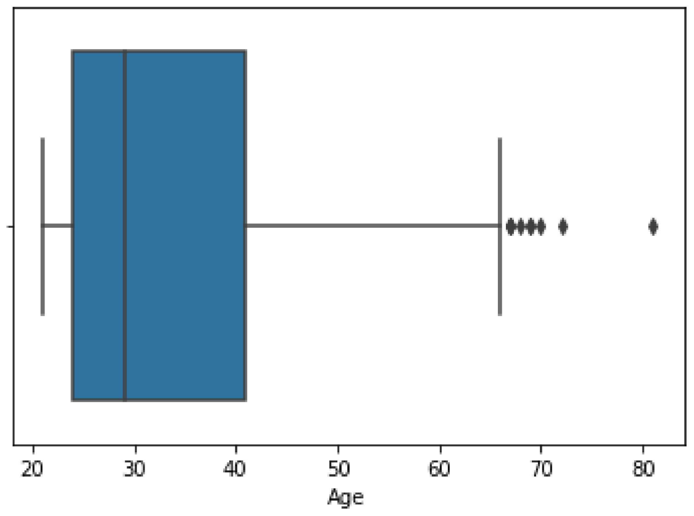
```
#Age
df['Age'].describe()
```

Out[53]:

```
count    768.000000
mean      33.240885
std       11.760232
min       21.000000
25%       24.000000
50%       29.000000
75%       41.000000
max       81.000000
Name: Age, dtype: float64
```

In [54]:

```
sns.boxplot(df['Age'])
plt.show()
```



Replacing zero values with NaN

In [66]:

```
x = df.columns
x
```

Out[66]:

```
Index(['Pregnancies', 'Glucose', 'BloodPressure', 'SkinThickness', 'Insulin',
       'BMI', 'DiabetesPedigreeFunction', 'Age', 'Outcome'],
      dtype='object')
```

In [67]:

```
x = x.drop(['Pregnancies','DiabetesPedigreeFunction','Age','Outcome'])
x
```

Out[67]:

```
Index(['Glucose', 'BloodPressure', 'SkinThickness', 'Insulin', 'BMI'], dtype='object')
```

In [68]:

```
for y in x:
    df[y].replace(0, np.NaN, inplace=True)
```

In [69]:

```
df.isnull().sum()
```

Out[69]:

```
Pregnancies                   0
Glucose                       5
BloodPressure                35
SkinThickness               227
Insulin                     374
BMI                          11
DiabetesPedigreeFunction      0
Age                           0
Outcome                       0
dtype: int64
```

Filling of NaN values

In [70]:

```
mean_gl = df['Glucose'].mean()
mean_gl
```

Out[70]:

```
121.6867627785059
```

In [71]:

```
df['Glucose'].fillna(mean_gl, inplace=True)
```

In [72]:

```
median_bp = df['BloodPressure'].median()
median_bp
```

Out[72]:

```
72.0
```

In [73]:

```
df['BloodPressure'].fillna(median_bp, inplace=True)
```

In [74]:

```
median_st = df['SkinThickness'].median()
median_st
```

Out[74]:

```
29.0
```

In [75]:

```
df['SkinThickness'].fillna(median_st, inplace=True)
```

In [79]:

```
median_in = 30.5
```

In [80]:

```
df['Insulin'].fillna(median_in, inplace=True)
```

In [81]:

```
df['BMI'].fillna(32, inplace=True)
```

In [82]:

```
df.isnull().sum()
```

Out[82]:

```
Pregnancies                 0
Glucose                     0
BloodPressure               0
SkinThickness               0
Insulin                     0
BMI                         0
DiabetesPedigreeFunction    0
Age                         0
Outcome                     0
dtype: int64
```

Feature Engineering

In [83]:
```
b = df['BMI']
b
```

Out[83]:
```
0      33.6
1      26.6
2      23.3
3      28.1
4      43.1
       ...
763    32.9
764    36.8
765    26.2
766    30.1
767    30.4
Name: BMI, Length: 768, dtype: float64
```

In [84]:
```
c = []
for x in b:
    if x<18.5:
        c.append('Under-Weight')
    elif x>=18.5 and x<=24.9:
        c.append('Normal-Weight')
    elif x>=25 and x<=29.9:
        c.append('Over-Weight')
    elif x>=30 and x<=39.9:
        c.append('Obesity')
    else:
        c.append('Extreme Obesity')
```

In [85]:
```
c
```

Out[85]:
```
['Obesity',
 'Over-Weight',
 'Normal-Weight',
 'Over-Weight',
 'Extreme Obesity',
 'Over-Weight',
 'Obesity',
 'Obesity',
 'Obesity',
 'Obesity',
 'Obesity',
 'Obesity',
 'Over-Weight',
 'Obesity',
 'Over-Weight',
 'Obesity',
 'Extreme Obesity',
 'Over-Weight',
 'Extreme Obesity',
```

In [86]:
```
df['PatientBodyType'] = c
```

In [87]:
```
df
```

Out[87]:

	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI	DiabetesPedigreeFunction	Age	Outcome	PatientBodyType
0	6	148.0	72.0	35.0	30.5	33.6	0.627	50	1	Obesity
1	1	85.0	66.0	29.0	30.5	26.6	0.351	31	0	Over-Weight
2	8	183.0	64.0	29.0	30.5	23.3	0.672	32	1	Normal-Weight
3	1	89.0	66.0	23.0	94.0	28.1	0.167	21	0	Over-Weight
4	0	137.0	40.0	35.0	168.0	43.1	2.288	33	1	Extreme Obesity
...	...	...	...	...	...	...	...	...	...	...
763	10	101.0	76.0	48.0	180.0	32.9	0.171	63	0	Obesity
764	2	122.0	70.0	27.0	30.5	36.8	0.340	27	0	Obesity
765	5	121.0	72.0	23.0	112.0	26.2	0.245	30	0	Over-Weight
766	1	126.0	60.0	29.0	30.5	30.1	0.349	47	1	Obesity
767	1	93.0	70.0	31.0	30.5	30.4	0.315	23	0	Obesity

768 rows × 10 columns

In [88]:
```
d = df['Glucose']
d
```

Out[88]:
```
0      148.0
1       85.0
2      183.0
3       89.0
4      137.0
       ...  
763    101.0
764    122.0
765    121.0
766    126.0
767     93.0
Name: Glucose, Length: 768, dtype: float64
```

In [100]:
```
e = []
for x in d:
    if x<120:
        e.append('Normal')
    elif x>=120 and x<160:
        e.append('Early Diabetes')
    else:
        e.append('Diabetic')
```

```
In [101]: e
```

```
Out[101]: ['Early Diabetes',
           'Normal',
           'Diabetic',
           'Normal',
           'Early Diabetes',
           'Normal',
           'Normal',
           'Normal',
           'Diabetic',
           'Early Diabetes',
           'Normal',
           'Diabetic',
           'Early Diabetes',
           'Diabetic',
           'Diabetic',
           'Normal',
           'Normal',
           'Normal',
           'Normal',
```

```
In [102]: df['GlucoseResult'] = e
```

```
In [103]: df
```

Out[103]:

	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI	DiabetesPedigreeFunction	Age	Outcome	PatientBodyType	GlucoseResult
0	6	148.0	72.0	35.0	30.5	33.6	0.627	50	1	Obesity	Early Diabetes
1	1	85.0	66.0	29.0	30.5	26.6	0.351	31	0	Over-Weight	Normal
2	8	183.0	64.0	29.0	30.5	23.3	0.672	32	1	Normal-Weight	Diabetic
3	1	89.0	66.0	23.0	94.0	28.1	0.167	21	0	Over-Weight	Normal
4	0	137.0	40.0	35.0	168.0	43.1	2.288	33	1	Extreme Obesity	Early Diabetes
...	...	...	...	...	...	...	...	...	...	...	...
763	10	101.0	76.0	48.0	180.0	32.9	0.171	63	0	Obesity	Normal
764	2	122.0	70.0	27.0	30.5	36.8	0.340	27	0	Obesity	Early Diabetes
765	5	121.0	72.0	23.0	112.0	26.2	0.245	30	0	Over-Weight	Early Diabetes
766	1	126.0	60.0	29.0	30.5	30.1	0.349	47	1	Obesity	Early Diabetes
767	1	93.0	70.0	31.0	30.5	30.4	0.315	23	0	Obesity	Normal

768 rows × 11 columns

In [97]:
```
f = df['BloodPressure']
f
```

Out[97]:
```
0      72.0
1      66.0
2      64.0
3      66.0
4      40.0
       ...
763    76.0
764    70.0
765    72.0
766    60.0
767    70.0
Name: BloodPressure, Length: 768, dtype: float64
```

In [98]:
```
g = []
for x in f:
    if x<80:
        g.append('Normal')
    elif x>=80 and x<90:
        g.append('HighBloodPressure-Stage-1')
    elif x>=90 and x<=120:
        g.append('HighBloodPressure-Stage-2')
    else:
        g.append('Hypertensive Crisis')
```

In [99]:
```
g
```

Out[99]:
```
['Normal',
 'Normal',
 'Normal',
 'Normal',
 'Normal',
 'Normal',
 'Normal',
 'Normal',
 'Normal',
 'HighBloodPressure-Stage-2',
 'HighBloodPressure-Stage-2',
 'Normal',
 'HighBloodPressure-Stage-1',
 'Normal',
 'Normal',
 'Normal',
 'HighBloodPressure-Stage-1',
 'Normal',
 'Normal',
 'Normal'
```

In [123]:
```
df['BPResult'] = g
```

In [124]:

```
df
```

Out[124]:

	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI	DiabetesPedigreeFunction	Age	Outcome	PatientBodyType	GlucoseResult	Insulin SI	Insulin_Status	BPResult
0	6	148.0	72.0	35.0	30.5	33.6	0.627	50	1	Obesity	Early Diabetes	211.8225	Normal Insulin Level	Normal
1	1	85.0	66.0	29.0	30.5	26.6	0.351	31	0	Over-Weight	Normal	211.8225	Normal Insulin Level	Normal
2	8	183.0	64.0	29.0	30.5	23.3	0.672	32	1	Normal-Weight	Diabetic	211.8225	Normal Insulin Level	Normal
3	1	89.0	66.0	23.0	94.0	28.1	0.167	21	0	Over-Weight	Normal	652.8300	Abnormal Insulin Level	Normal
4	0	137.0	40.0	35.0	168.0	43.1	2.288	33	1	Extreme Obesity	Early Diabetes	1166.7600	Abnormal Insulin Level	Normal
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
763	10	101.0	76.0	48.0	180.0	32.9	0.171	63	0	Obesity	Normal	1250.1000	Abnormal Insulin Level	Normal
764	2	122.0	70.0	27.0	30.5	36.8	0.340	27	0	Obesity	Early Diabetes	211.8225	Normal Insulin Level	Normal
765	5	121.0	72.0	23.0	112.0	26.2	0.245	30	0	Over-Weight	Early Diabetes	777.8400	Abnormal Insulin Level	Normal
766	1	126.0	60.0	29.0	30.5	30.1	0.349	47	1	Obesity	Early Diabetes	211.8225	Normal Insulin Level	Normal
767	1	93.0	70.0	31.0	30.5	30.4	0.315	23	0	Obesity	Normal	211.8225	Normal Insulin Level	Normal

768 rows × 14 columns

In [104]:

```
h = df['Insulin']
h
```

Out[104]:

```
0       30.5
1       30.5
2       30.5
3       94.0
4      168.0
       ...  
763    180.0
764     30.5
765    112.0
766     30.5
767     30.5
Name: Insulin, Length: 768, dtype: float64
```

In [108]:

```
i = []
for x in h:
    z = x*6.945
    i.append(z)
```

In [110]:
```
i
```

Out[110]:
```
[211.82250000000002,
 211.82250000000002,
 211.82250000000002,
 652.83,
 1166.76,
 211.82250000000002,
 611.1600000000001,
 211.82250000000002,
 3771.135,
 211.82250000000002,
 211.82250000000002,
 211.82250000000002,
 211.82250000000002,
 5875.47,
 1215.375,
 211.82250000000002,
 1597.3500000000001,
 211.82250000000002,
 576.4350000000001,
```

In [111]:
```
df['Insulin SI'] = i
```

In [112]:
```
df
```

Out[112]:

	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI	DiabetesPedigreeFunction	Age	Outcome	PatientBodyType	GlucoseResult	Insulin SI
0	6	148.0	72.0	35.0	30.5	33.6	0.627	50	1	Obesity	Early Diabetes	211.8225
1	1	85.0	66.0	29.0	30.5	26.6	0.351	31	0	Over-Weight	Normal	211.8225
2	8	183.0	64.0	29.0	30.5	23.3	0.672	32	1	Normal-Weight	Diabetic	211.8225
3	1	89.0	66.0	23.0	94.0	28.1	0.167	21	0	Over-Weight	Normal	652.8300
4	0	137.0	40.0	35.0	168.0	43.1	2.288	33	1	Extreme Obesity	Early Diabetes	1166.7600
...	...	...	...	...	...	...	...	...	...	...	...	...
763	10	101.0	76.0	48.0	180.0	32.9	0.171	63	0	Obesity	Normal	1250.1000
764	2	122.0	70.0	27.0	30.5	36.8	0.340	27	0	Obesity	Early Diabetes	211.8225
765	5	121.0	72.0	23.0	112.0	26.2	0.245	30	0	Over-Weight	Early Diabetes	777.8400
766	1	126.0	60.0	29.0	30.5	30.1	0.349	47	1	Obesity	Early Diabetes	211.8225
767	1	93.0	70.0	31.0	30.5	30.4	0.315	23	0	Obesity	Normal	211.8225

768 rows × 12 columns

In [118]:
```
j = []
for x in i:
    if x<549:
        j.append('Normal Insulin Level')
    else:
        j.append('Abnormal Insulin Level')
```

In [119]:
```
j
```

Out[119]:
```
['Normal Insulin Level',
 'Normal Insulin Level',
 'Normal Insulin Level',
 'Abnormal Insulin Level',
 'Abnormal Insulin Level',
 'Normal Insulin Level',
 'Abnormal Insulin Level',
 'Normal Insulin Level',
 'Abnormal Insulin Level',
 'Normal Insulin Level',
 'Normal Insulin Level',
 'Normal Insulin Level',
 'Normal Insulin Level',
 'Abnormal Insulin Level',
 'Abnormal Insulin Level',
 'Normal Insulin Level',
 'Abnormal Insulin Level',
 'Normal Insulin Level',
 'Abnormal Insulin Level',
 'Abnormal Insulin Level',
```

In [120]:
```
df['Insulin_Status'] = j
```

In [194]:
```
df
```

Out[194]:

	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI	DiabetesPedigreeFunction	Age	Outcome	PatientBodyType	GlucoseResult	Insulin SI	Insulin_Status	BPResult
0	6	148.0	72.0	35.0	30.5	33.6	0.627	50	1	Obesity	Early Diabetes	211.8225	Normal Insulin Level	Normal
1	1	85.0	66.0	29.0	30.5	26.6	0.351	31	0	Over-Weight	Normal	211.8225	Normal Insulin Level	Normal
2	8	183.0	64.0	29.0	30.5	23.3	0.672	32	1	Normal-Weight	Diabetic	211.8225	Normal Insulin Level	Normal
3	1	89.0	66.0	23.0	94.0	28.1	0.167	21	0	Over-Weight	Normal	652.8300	Abnormal Insulin Level	Normal
4	0	137.0	40.0	35.0	168.0	43.1	2.288	33	1	Extreme Obesity	Early Diabetes	1166.7600	Abnormal Insulin Level	Normal
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
763	10	101.0	76.0	48.0	180.0	32.9	0.171	63	0	Obesity	Normal	1250.1000	Abnormal Insulin Level	Normal
764	2	122.0	70.0	27.0	30.5	36.8	0.340	27	0	Obesity	Early Diabetes	211.8225	Normal Insulin Level	Normal
765	5	121.0	72.0	23.0	112.0	26.2	0.245	30	0	Over-Weight	Early Diabetes	777.8400	Abnormal Insulin Level	Normal
766	1	126.0	60.0	29.0	30.5	30.1	0.349	47	1	Obesity	Early Diabetes	211.8225	Normal Insulin Level	Normal
767	1	93.0	70.0	31.0	30.5	30.4	0.315	23	0	Obesity	Normal	211.8225	Normal Insulin Level	Normal

768 rows × 14 columns

In [122]:
```
df['Insulin_Status'].value_counts()
```

Out[122]:
```
Normal Insulin Level      479
Abnormal Insulin Level    289
Name: Insulin_Status, dtype: int64
```

In [125]:

```
df['BPResult'].value_counts()
```

Out[125]:

```
Normal                       563
HighBloodPressure-Stage-1    145
HighBloodPressure-Stage-2     59
Hypertensive Crisis            1
Name: BPResult, dtype: int64
```

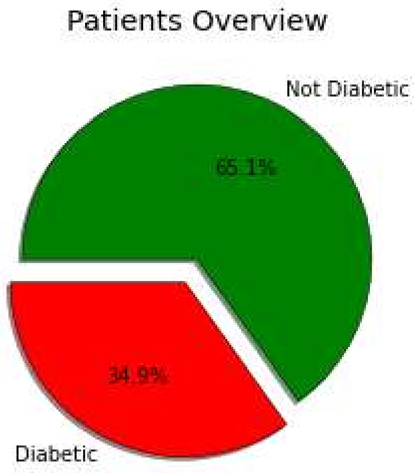
Visualisations and Conclusions

In [129]:

```
k = (df['Outcome']==1).sum()
l = (df['Outcome']==0).sum()
```

In [135]:

```
plt.style.use('ggplot')

plt.pie([k,l], labels=['Diabetic', 'Not Diabetic'],
       colors=['Red', 'Green'], explode=[0.15, 0],
       shadow=True, startangle=180, autopct='%1.1f%%',
       wedgeprops={'edgecolor':'black'})

plt.title('Patients Overview')

plt.show()
```

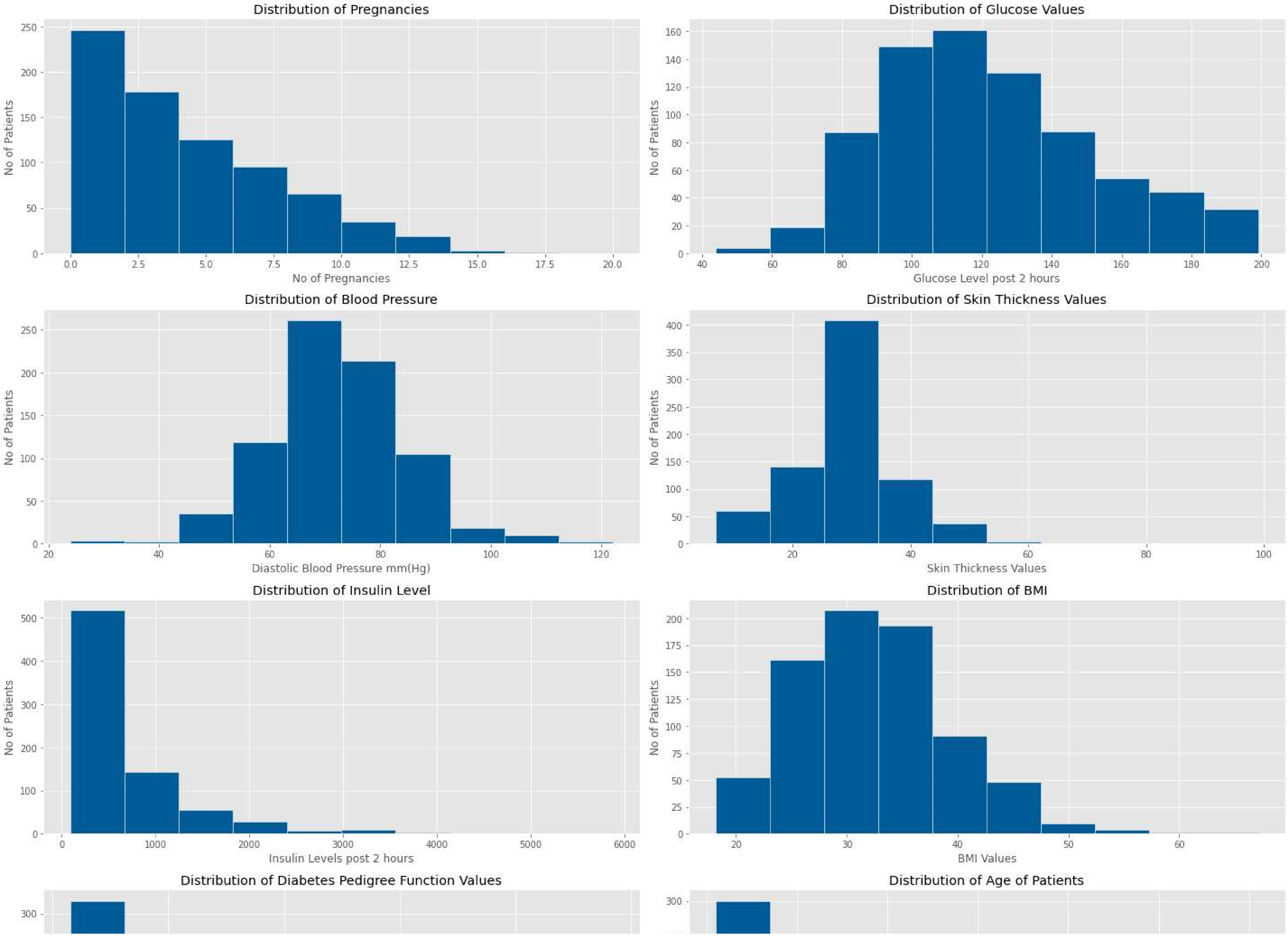


Insight 1

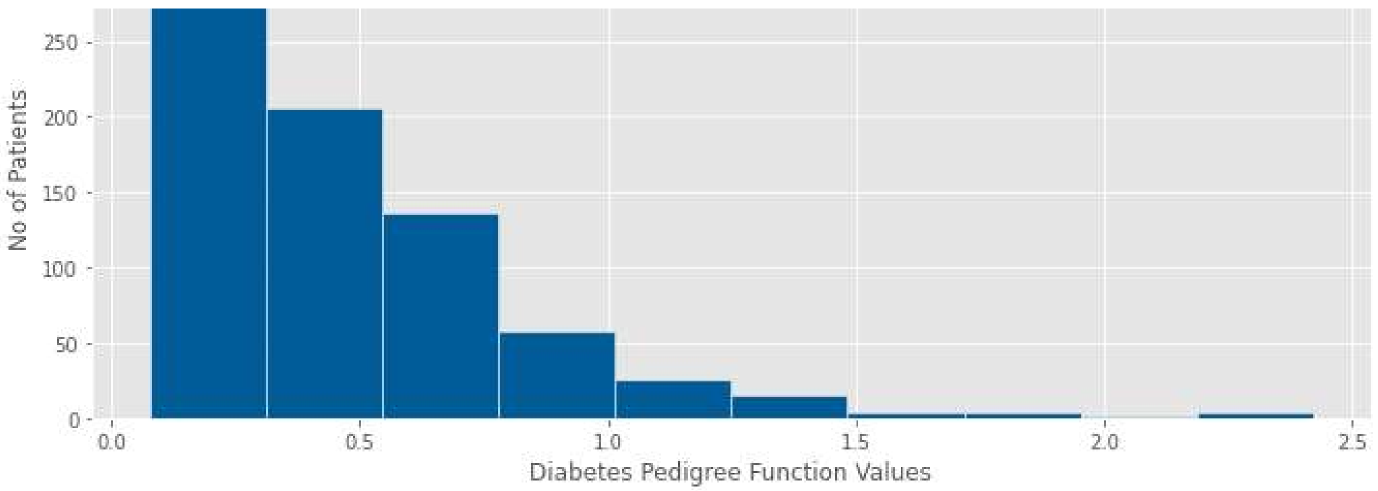
From the above pie chart, we can see that, of all the data that we have, there are 34.9 % of patients who are Diabetic and 65.1 % of patients who are Not Diabetic.

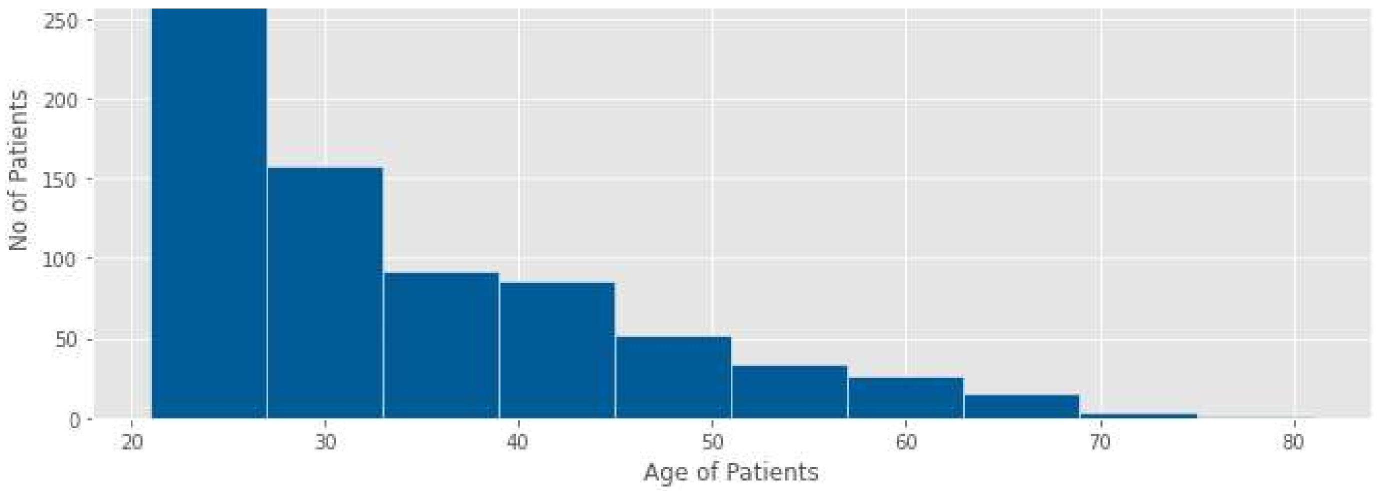
In [163]:

```
plt.style.use('ggplot')

fig = plt.figure(figsize=(20,18))

aa = plt.subplot(4,2,1)
ab = plt.subplot(4,2,2)
ac = plt.subplot(4,2,3)
ad = plt.subplot(4,2,4)
ae = plt.subplot(4,2,5)
af = plt.subplot(4,2,6)
ag = plt.subplot(4,2,7)
ah = plt.subplot(4,2,8)

aa.hist(df['Pregnancies'], color='#005b96', bins=[0,2,4,6,8,10,12,14,16,18,20], edgecolor='white')
aa.set(xlabel='No of Pregnancies')
aa.set(ylabel='No of Patients')
aa.set_title('Distribution of Pregnancies')


ab.hist(df['Glucose'], color='#005b96', edgecolor='white')
ab.set(xlabel='Glucose Level post 2 hours')
ab.set(ylabel='No of Patients')
ab.set_title('Distribution of Glucose Values')


ac.hist(df['BloodPressure'], color='#005b96', edgecolor='white')
ac.set(xlabel='Diastolic Blood Pressure mm(Hg)')
ac.set(ylabel='No of Patients')
ac.set_title('Distribution of Blood Pressure')


ad.hist(df['SkinThickness'], color='#005b96', edgecolor='white')
ad.set(xlabel='Skin Thickness Values')
ad.set(ylabel='No of Patients')
ad.set_title('Distribution of Skin Thickness Values')


ae.hist(df['Insulin SI'], color='#005b96', edgecolor='white')
ae.set(xlabel='Insulin Levels post 2 hours')
ae.set(ylabel='No of Patients')
ae.set_title('Distribution of Insulin Level')


af.hist(df['BMI'], color='#005b96', edgecolor='white')
af.set(xlabel='BMI Values')
af.set(ylabel='No of Patients')
af.set_title('Distribution of BMI')


ag.hist(df['DiabetesPedigreeFunction'], color='#005b96', edgecolor='white')
ag.set(xlabel='Diabetes Pedigree Function Values')
ag.set(ylabel='No of Patients')
ag.set_title('Distribution of Diabetes Pedigree Function Values')

ah.hist(df['Age'], color='#005b96', edgecolor='white')
ah.set(xlabel='Age of Patients')
ah.set(ylabel='No of Patients')
ah.set_title('Distribution of Age of Patients')

plt.tight_layout()
plt.show()
```



Distribution of Pregnancies
No of Patients
250
200
150
100
50
0
0.0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
No of Pregnancies
Distribution of Glucose Values
No of Patients
160
140
120
100
80
60
40
20
0
40
60
80
100
120
140
160
180
200
Glucose Level post 2 hours
Distribution of Blood Pressure
No of Patients
250
200
150
100
50
0
20
40
60
80
100
120
Diastolic Blood Pressure mm(Hg)
Distribution of Skin Thickness Values
No of Patients
400
350
300
250
200
150
100
50
0
20
40
60
80
100
Skin Thickness Values
Distribution of Insulin Level
No of Patients
500
400
300
200
100
0
0
1000
2000
3000
4000
5000
6000
Insulin Levels post 2 hours
Distribution of BMI
No of Patients
200
175
150
125
100
75
50
25
0
20
30
40
50
60
BMI Values
Distribution of Diabetes Pedigree Function Values
300
Distribution of Age of Patients
300

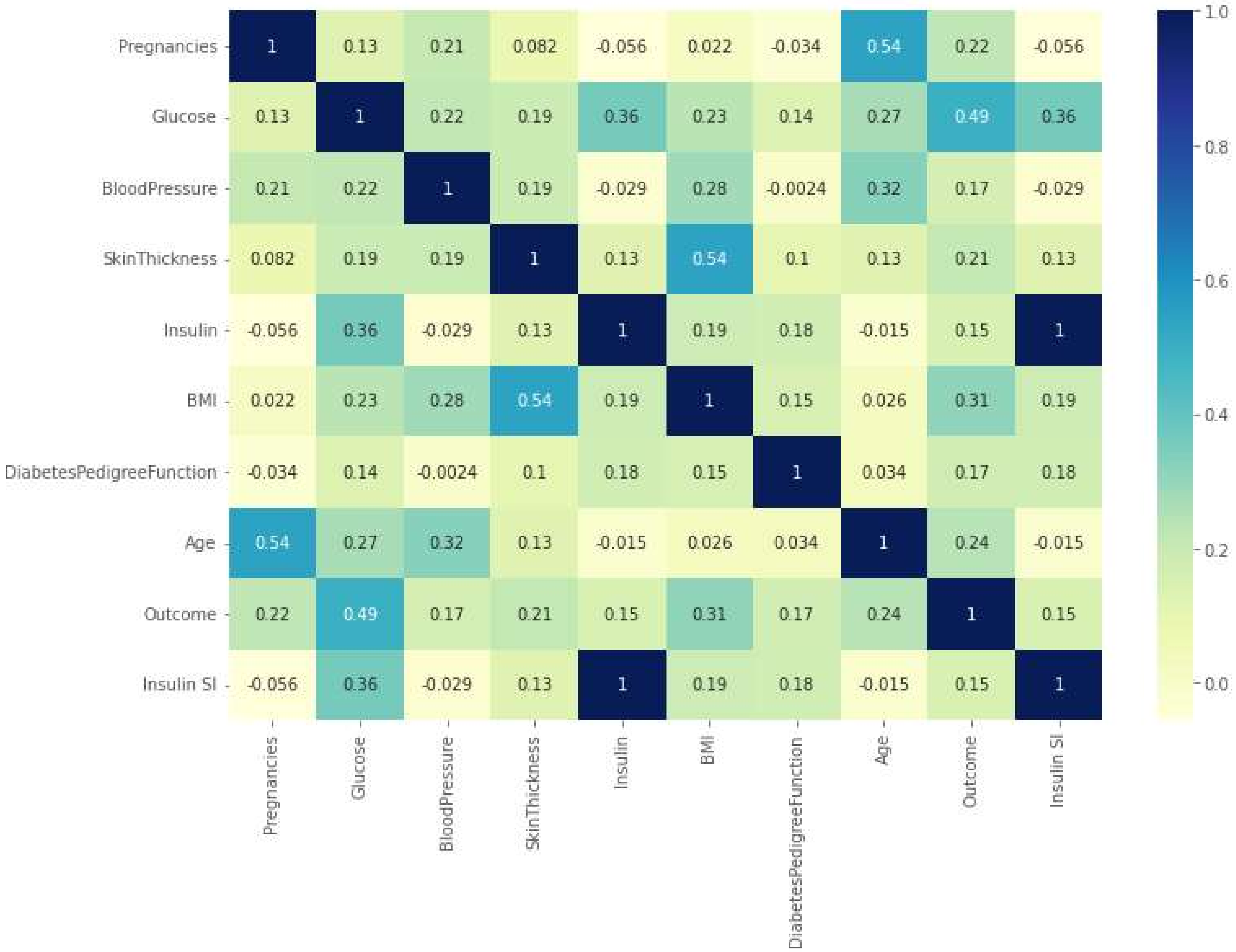




Insight 2

Above Histogram Plots have been drawn to understand the variation of multiple parameters responsible for Diabetes and their distribution amongs the patients involved in our data set

```
In [169]: cor=df.corr()

          fig = plt.figure(figsize=(12,8))

          sns.heatmap(cor,cmap='YlGnBu',annot=True)
          plt.show()
```



Insight 3

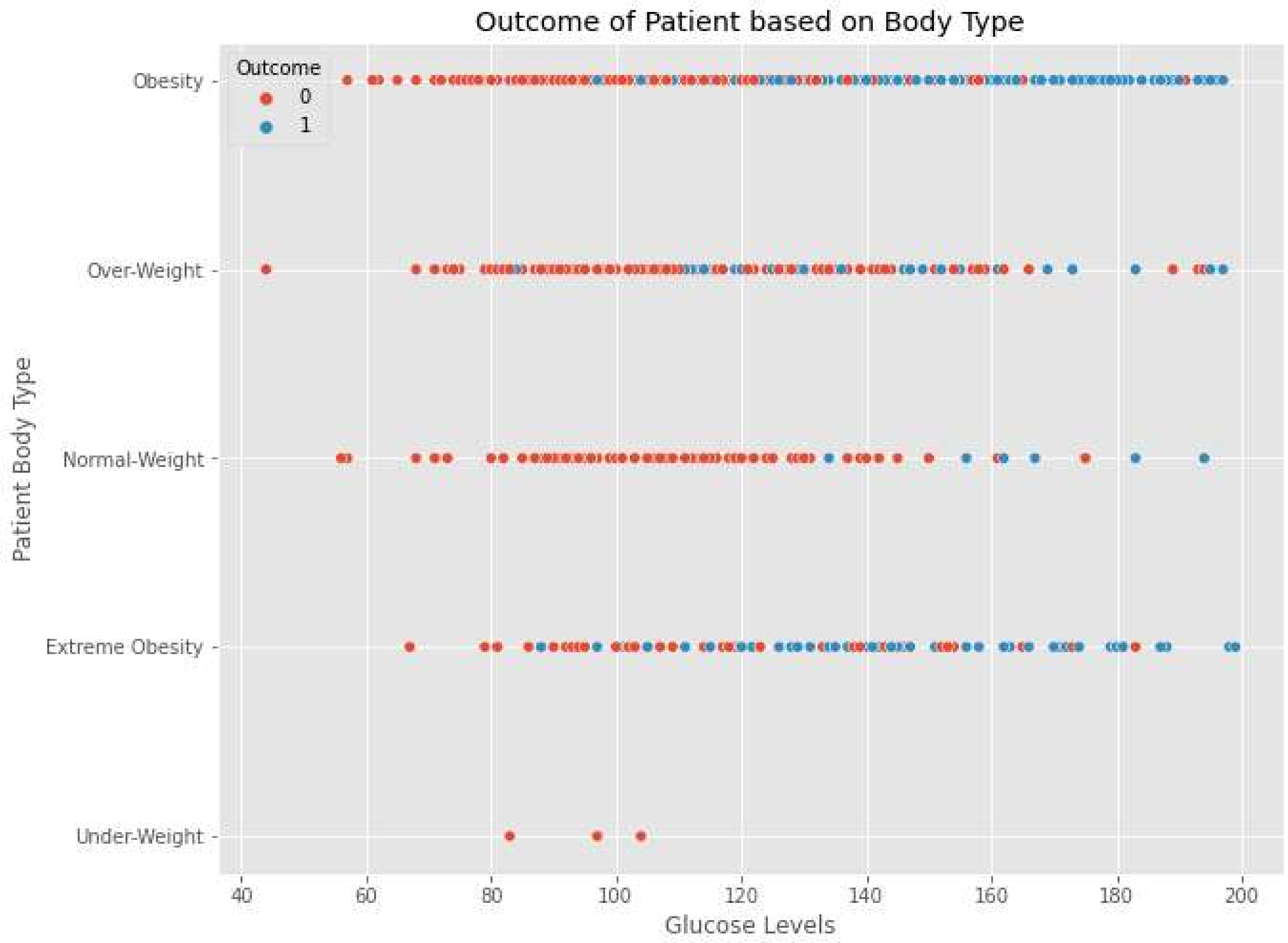
From the above heatmap, we can conclude the following points:

1) Outcome(whether the patient is Diabetic or Not) is significantly positively correlated to Glucose Level and BMI of the patient.

2) Outcome(whether the patient is Diabetic or Not) is lightly positively correlated to Age, Pregnancies and Skin Thickness of the patient.

3) Outcome(whether the patient is Diabetic or Not) is very lightly positively correlated to Blood Pressure, Insulin level and Diabetes Pedigree Function.

```
In [176]: plt.style.use('ggplot')

          fig = plt.figure(figsize=(10,8))

          sns.scatterplot(df.Glucose, df.PatientBodyType, hue=df.Outcome)

          plt.xlabel('Glucose Levels')
          plt.ylabel('Patient Body Type')
          plt.title('Outcome of Patient based on Body Type')


          plt.show()
```



Insight 4

1) For Under-Weight people, there is no case seen of being Diabetic in this data set.

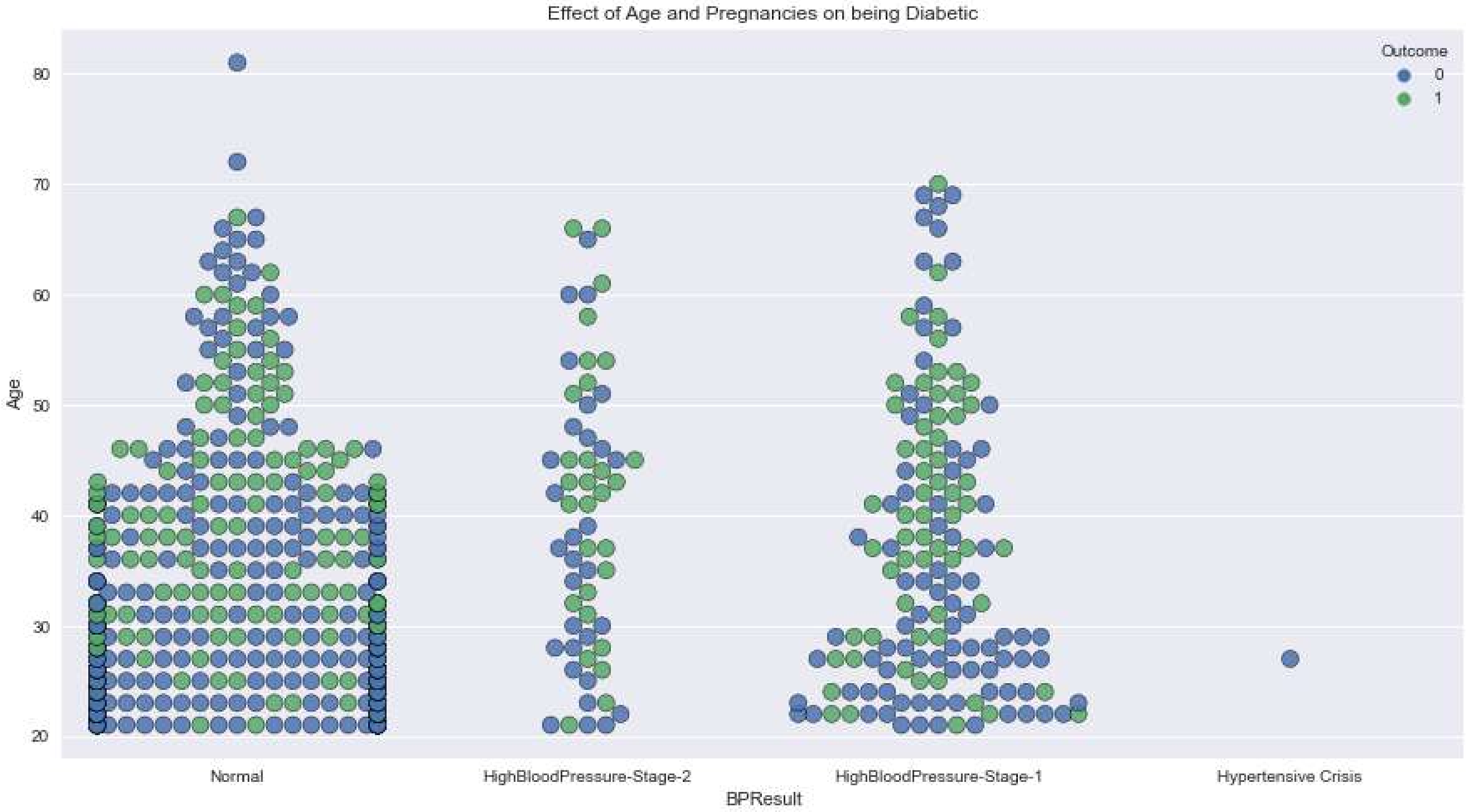
2) For Normal-Weight people, there are few cases seen of being Diabetic post the threshold value of 140 Glucose Level.

3) For Over-Weight people, cases of being Diabetic can be seen below the threshold value of Glucose Level. In this particular dataset, it starts from around 110 Glucose Level.

4) For Obese People, there is huge concentration of being Diabetic post the Glucose Value of 120.

5) For Extreme Obese People, there is case of being Diabetic post the Glucose Value of 100.

```
In [198]: plt.style.use('seaborn')

          fig = plt.figure(figsize=(15,8))

          sns.swarmplot(df.BPResult, df.Age, hue=df.Outcome, size=10, alpha=0.85, edgecolor='black', linewidth=0.5)

          plt.title('Effect of Age and Pregnancies on being Diabetic')

          plt.show()
```

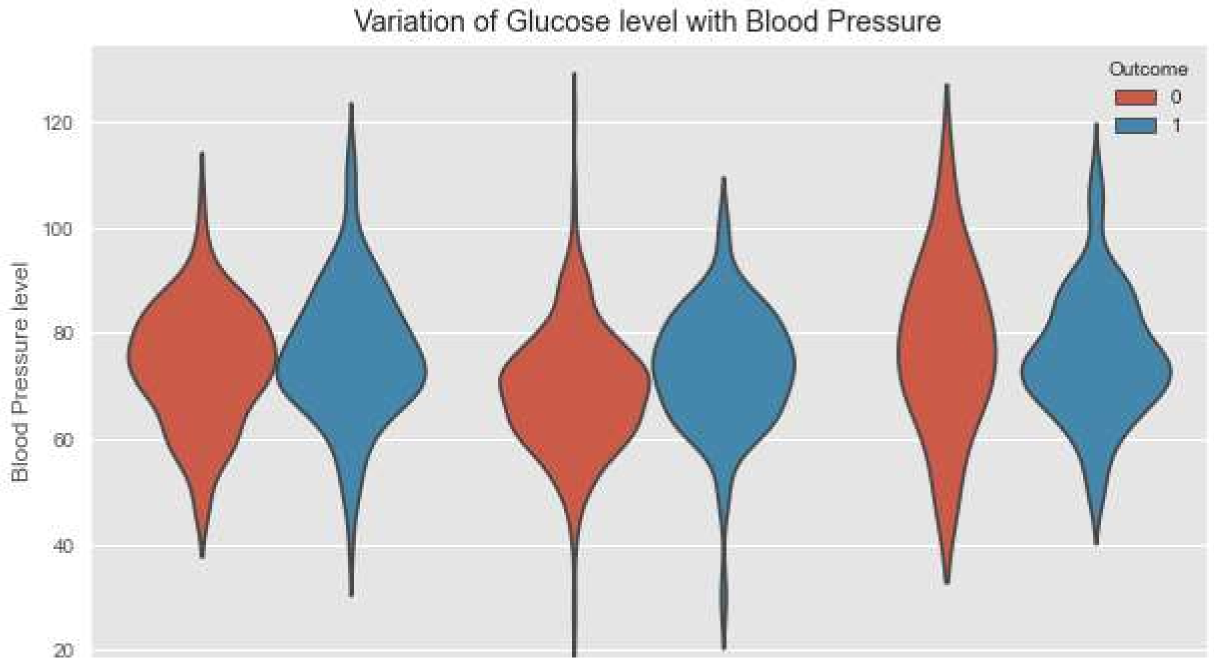


Insight 5

Irrespective of the Blood Pressure Levels, More No of People are Diabetic above the age of 30 as compared to people below the age of 30

In [209]:

```
plt.style.use('ggplot')

fig = plt.figure(figsize=(10,6))

sns.violinplot(df.GlucoseResult, df.BloodPressure, hue=df.Outcome, inner=None)

plt.xlabel('Glucose level')
plt.ylabel('Blood Pressure level')
plt.title('Variation of Glucose level with Blood Pressure')


plt.show()
```



Insight 6

It is a strange behavior. There is not much relation between Blood Pressure Level and Glucose Level of a Patient.