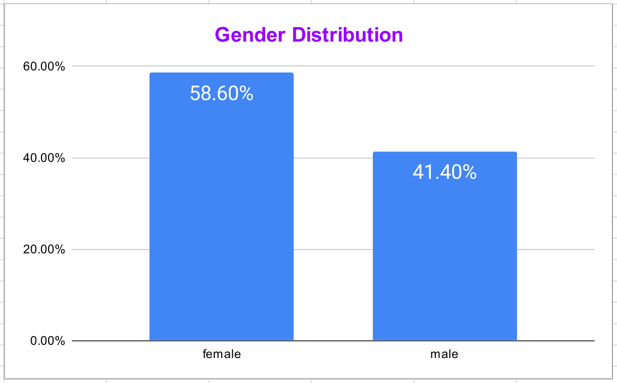
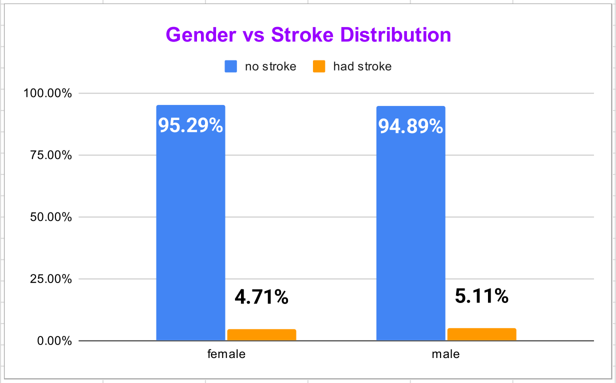
Gender Distribution Analysis

	stroke category	*Values*							
	no stroke			had stroke			Grand Total		
gender	Count	Row %	Column %	Count	Row %	Column %	Count	Row %	Column %
female	2853	95.29%	58.70%	141	4.71%	56.63%	2994	100.00%	58.60%
male	2007	94.89%	41.30%	108	5.11%	43.37%	2115	100.00%	41.40%
Grand Total	**4860**	**95.13%**	**100.00%**	**249**	**4.87%**	**100.00%**	**5109**	**100.00%**	**100.00%**


Gender Distribution


Gender vs Stroke Distribution

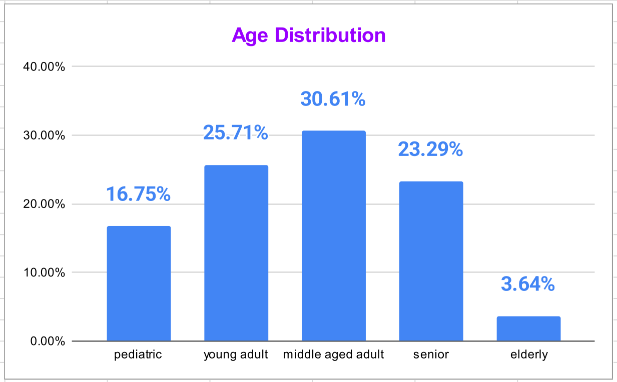
Insights

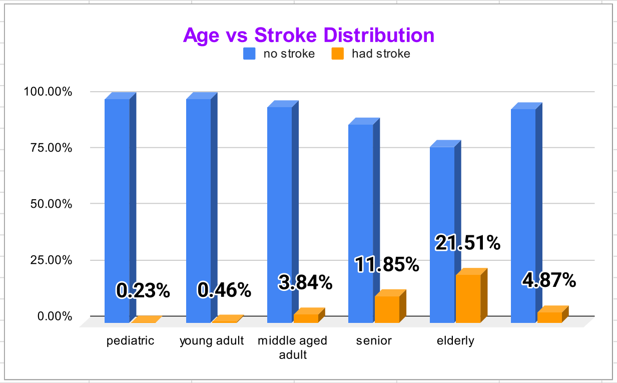
1. The female patients (58.60%) outnumber the male patients (41.40%) in this dataset.

2. The bar chart visualization shows that male patients' risk of having a stroke is 5.11% while the female patients have a 4.71% risk of having a stroke. The values are very similar when comparing the probability of having a stroke.

Age Distribution Analysis

		stroke category	*Values*							
		no stroke			had stroke			Grand Total		
age helper	*age*	Count	Row %	Column %	Count	Row %	Column %	Count	Row %	Column %
1	pediatric	854	99.77%	17.57%	2	0.23%	0.80%	856	100.00%	16.75%
2	young adult	1308	99.54%	26.91%	6	0.46%	2.41%	1314	100.00%	25.71%
3	middle aged adul	1504	96.16%	30.94%	60	3.84%	24.10%	1564	100.00%	30.61%
4	senior	1049	88.15%	21.58%	141	11.85%	56.63%	1190	100.00%	23.29%
5	elderly	146	78.49%	3.00%	40	21.51%	16.06%	186	100.00%	3.64%
Grand Total		**4861**	**95.13%**	**100.00%**	**249**	**4.87%**	**100.00%**	**5110**	**100.00%**	**100.00%**


Age Distribution

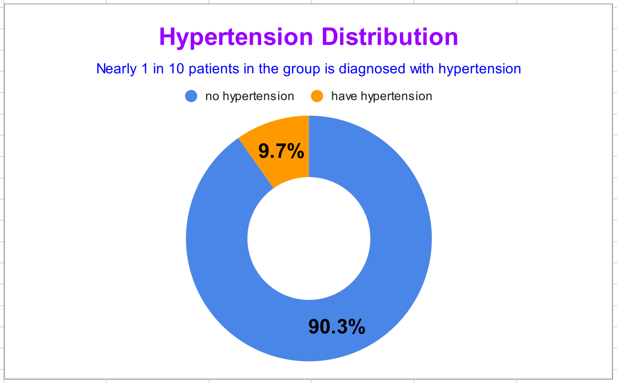

Age vs Stroke Distribution

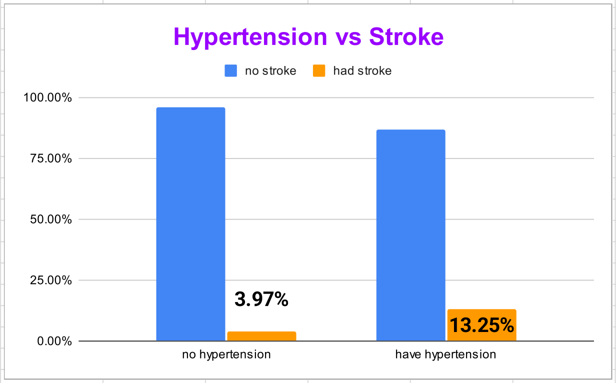
Insights

* The patient distribution according to age category follows a fairly normal distribution with the exception of elderly patients that make up 3.64% of the data.
* The highest number of patients belong to the middle aged adult bracket, which makes up 30.61% of the data.
* The bar chart visualization of the age vs stroke distribution shows that the risk of having a heart attack increases as the patient ages.
* Pediatric risk of stroke is 0.23% while elderly stroke risk is highest at 21.51%, which is almost twice as much as seniors.
* Note that the number of elderly patients are only 3.64% of the data, therefore the smallest movements in occurence of stroke can make significant changes.

Hypertension Distribution Analysis

	stroke category	*Values*							
	no stroke			had stroke			Grand Total		
hypertension	Count	Row %	Column %	Count	Row %	Column %	Count	Row %	Column %
no hypertension	4429	96.03%	91.11%	183	3.97%	73.49%	4612	100.00%	90.25%
have hypertension	432	86.75%	8.89%	66	13.25%	26.51%	498	100.00%	9.75%
Grand Total	**4861**	**95.13%**	**100.00%**	**249**	**4.87%**	**100.00%**	**5110**	**100.00%**	**100.00%**



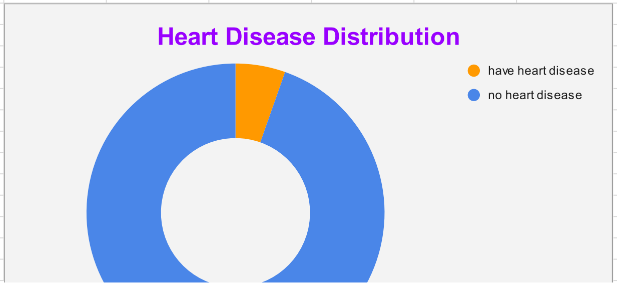


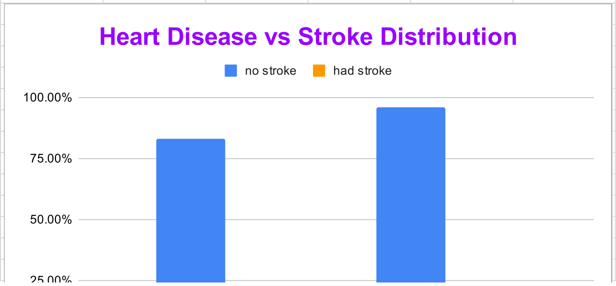
Insights

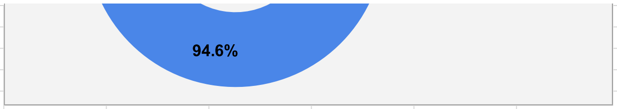
* Nearly 1 in 10 patients have been diagnosed with hypertension, this represents a heavily imbalanced data distribution.
* The risk of having a stroke for patients with hypertension is 13.25%, which is nearly four times as much as patients without hypertension (3.97%).

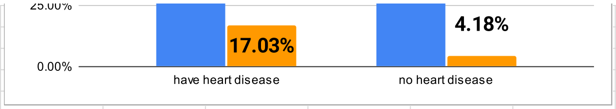
Heart Disease Distribution Analysis

	stroke category	*Values*							
	no stroke			had stroke			Grand Total		
heart disease	Count	Row %	Column %	Count	Row %	Column %	Count	Row %	Column %
have heart disease	229	82.97%	4.71%	47	17.03%	18.88%	276	100.00%	5.40%
no heart disease	4632	95.82%	95.29%	202	4.18%	81.12%	4834	100.00%	94.60%
Grand Total	**4861**	**95.13%**	**100.00%**	**249**	**4.87%**	**100.00%**	**5110**	**100.00%**	**100.00%**









Insights

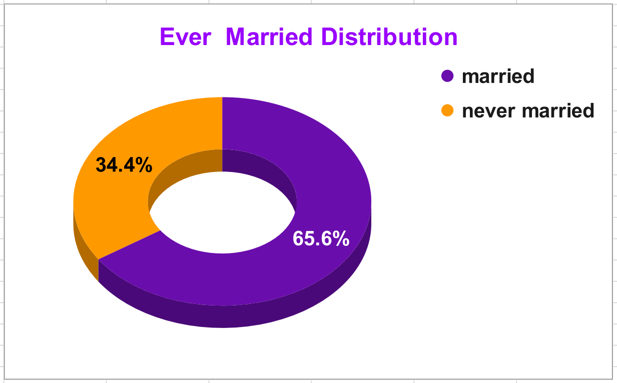
* Only 5.4% of the data represents patients with heart disease.

* Patients with heart disease posts a risk of 17.03% of having a stroke - this is the highest risk percentage that we have observed so far.

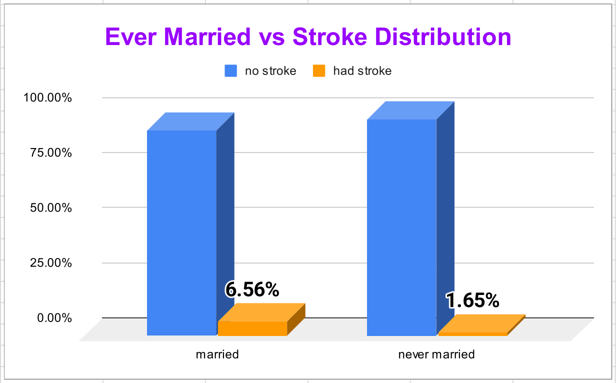
* Patients with heart disease is a little more than four times as likely to have a stroke than patients with no heart disease (4.18%)

Ever Married Distribution Analysis

	stroke category	*Values*							
	no stroke			had stroke			Grand Total		
ever married	Count	Row %	Column %	Count	Row %	Column %	Count	Row %	Column %
married	3133	93.44%	64.45%	220	6.56%	88.35%	3353	100.00%	65.62%
never married	1728	98.35%	35.55%	29	1.65%	11.65%	1757	100.00%	34.38%
Grand Total	**4861**	**95.13%**	**100.00%**	**249**	**4.87%**	**100.00%**	**5110**	**100.00%**	**100.00%**



Ever Married Distribution



Ever Married vs Stroke Distribution

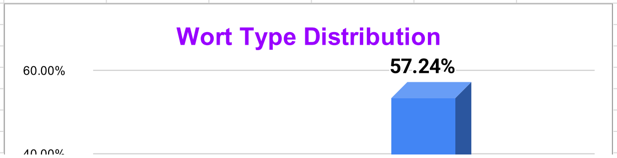
Insights

* Married and once married patients make up **65.6%** of the data, which is **almost under twice** as much as the never married patients (**34.4%**)

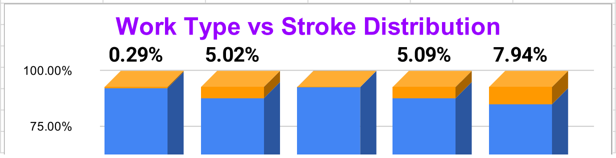
* Married and once married patients have a **6.56%** likelihood of having a stroke while only patients that were never married only have a **1.65%** risk of having a stroke - around four times less likely to have a stroke.

Work Type Distribution Analysis

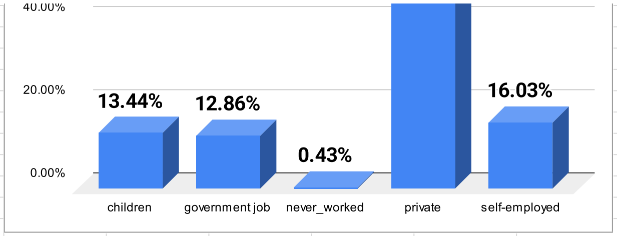
	stroke category	*Values*							
	no stroke			had stroke			Grand Total		
work type	Count	Row %	Column %	Count	Row %	Column %	Count	Row %	Column %
children	685	99.71%	14.09%	2	0.29%	0.80%	687	100.00%	13.44%
government job	624	94.98%	12.84%	33	5.02%	13.25%	657	100.00%	12.86%
never_worked	22	100.00%	0.45%				22	100.00%	0.43%
private	2776	94.91%	57.11%	149	5.09%	59.84%	2925	100.00%	57.24%
self-employed	754	92.06%	15.51%	65	7.94%	26.10%	819	100.00%	16.03%
Grand Total	**4861**	**95.13%**	**100.00%**	**249**	**4.87%**	**100.00%**	**5110**	**100.00%**	**100.00%**

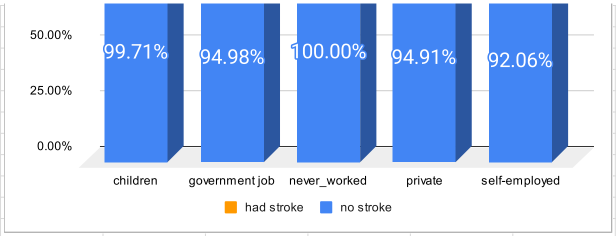


Wort Type Distribution



Work Type vs Stroke Distribution





Insights

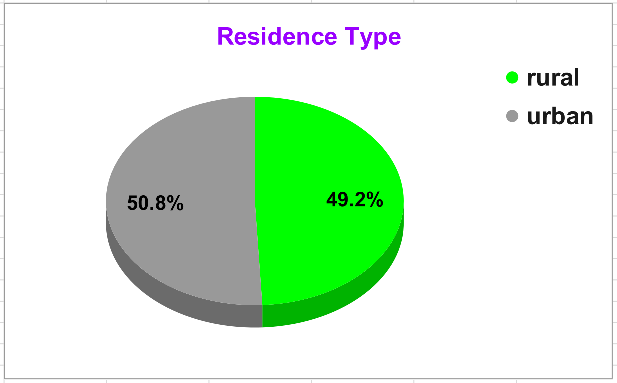
* 57.24% of the data is composed of patients that worked in the private sector.

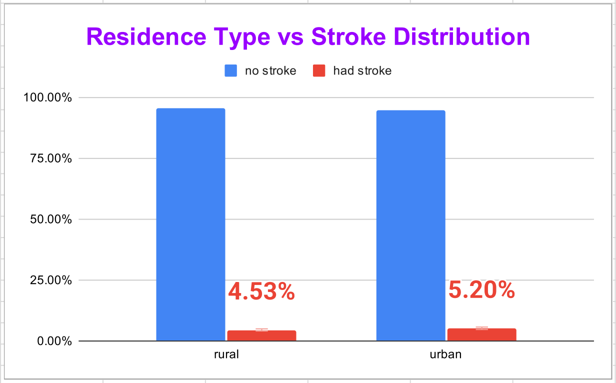
* The patients that never worked makeup 0.43% of the dataset, this is not significant enough to make affirmative conclusions about the risk factors of this category in the group.

* Patients that are self-employed carries the highest risk factor of 7.94%, but this is close to the risk factor of patients that work government jobs (5.02%) and private company jobs (5.09%) -- which suggests that work type may not be a strong determining factor of stroke risk. Further analysis required to confirm its statistical significance.

Residence Type Distribution Analysis

	stroke category	*Values*							
	no stroke			had stroke			Grand Total		
residence type	Count	Row %	Column %	Count	Row %	Column %	Count	Row %	Column %
rural	2400	95.47%	49.37%	114	4.53%	45.78%	2514	100.00%	49.20%
urban	2461	94.80%	50.63%	135	5.20%	54.22%	2596	100.00%	50.80%
Grand Total	**4861**	**95.13%**	**100.00%**	**249**	**4.87%**	**100.00%**	**5110**	**100.00%**	**100.00%**


Residence Type


Residence Type vs Stroke Distribution

Insights

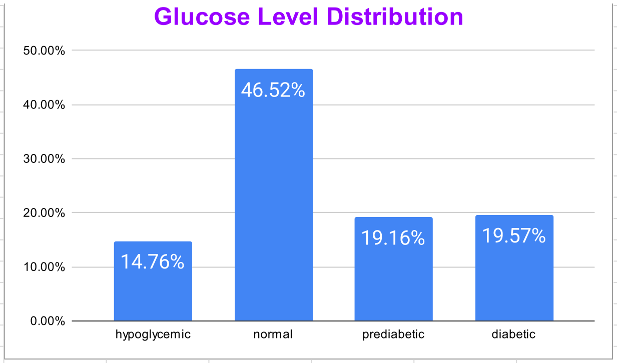
* The dataset is about evenly distributed (50.8% urban vs 49.2% rural) in terms of residence type.

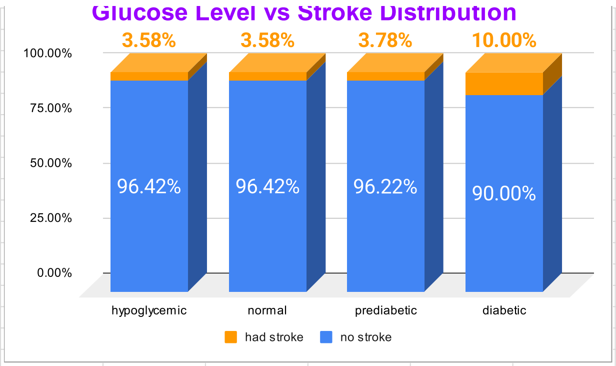
* Patients that lives in urban areas have a slightly higher risk of having a stroke at 5.20% while patients that live in rural areas have a 4.53% chance of having a stroke.

Glucose Level Distribution Analysis

		stroke category	*Values*							
		no stroke			had stroke			Grand Total		
glucose helper	*glucose category*	Count	Row %	Column %	Count	Row %	Column %	Count	Row %	Column %
1	hypoglycemic	727	96.42%	14.96%	27	3.58%	10.84%	754	100.00%	14.76%
2	normal	2292	96.42%	47.15%	85	3.58%	34.14%	2377	100.00%	46.52%
3	prediabetic	942	96.22%	19.38%	37	3.78%	14.86%	979	100.00%	19.16%
4	diabetic	900	90.00%	18.51%	100	10.00%	40.16%	1000	100.00%	19.57%
Grand Total		**4861**	**95.13%**	**100.00%**	**249**	**4.87%**	**100.00%**	**5110**	**100.00%**	**100.00%**

Glucose Level vs Stroke Distribution





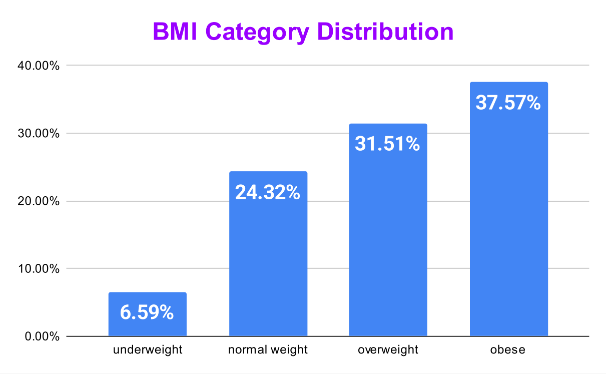
Insights

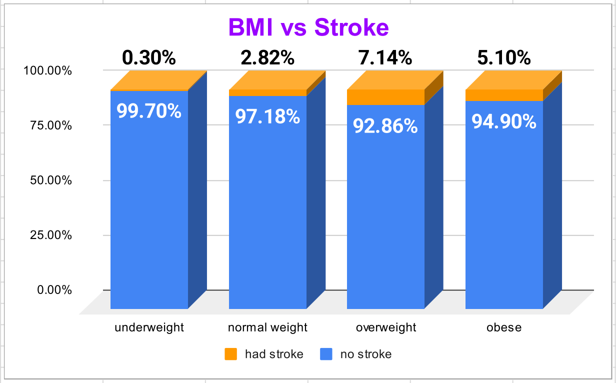
* Patients with normal glucose level has the highest composition at 46.52% of the data, while the other three categories are nearly at the same level.

* The most at risk patients of having a stroke are patients with diabetes (10%) which is just under three times the risk of hypoglycemic (3.58%), normal (3.58%), and prediabetic (3.78) patients.

BMI Category Distribution Analysis

		stroke category	*Values*							
		no stroke			had stroke			Grand Total		
bmi helper	*bmi category*	Count	Row %	Column %	Count	Row %	Column %	Count	Row %	Column %
1	underweight	336	99.70%	6.91%	1	0.30%	0.40%	337	100.00%	6.59%
2	normal weight	1208	97.18%	24.85%	35	2.82%	14.06%	1243	100.00%	24.32%
3	overweight	1495	92.86%	30.75%	115	7.14%	46.18%	1610	100.00%	31.51%
4	obese	1822	94.90%	37.48%	98	5.10%	39.36%	1920	100.00%	37.57%
Grand Total		**4861**	**95.13%**	**100.00%**	**249**	**4.87%**	**100.00%**	**5110**	**100.00%**	**100.00%**





Insights

* The highest distribution for bmi category is patients that are in the obese level with 37.57% risk of having a stroke. The distribution is left skewed with underweight patients representing 6.59%

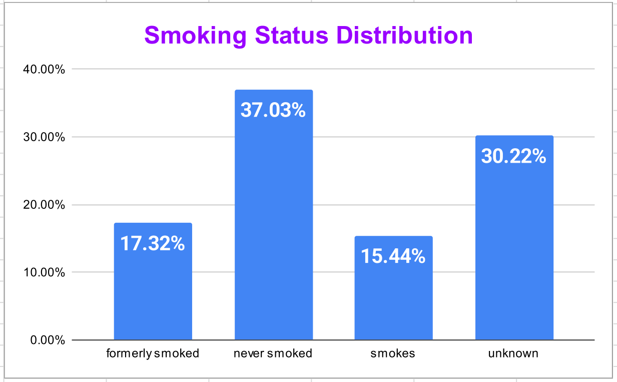
* The stacked bar graph shows that patients in the overweight category (7.14%) have the highest risk of having a stroke, while patients in the obese level have a 5.10% chance of having a stroke - this is interesting as one would expect it to be the

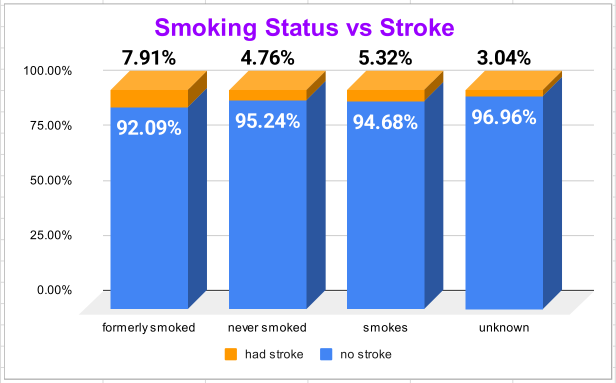
* Further data gathering and study is necessary to uncover the reasons why overweight people have a higher risk of stroke compared to people in the overweight category.

Smoking Status Distribution Analysis

	stroke category	*Values*						
	no stroke			had stroke			Grand Total	

smoking status	Count	Row %	Column %	Count	Row %	Column %	Count	Row %	Column %
formerly smoked	815	92.09%	16.77%	70	7.91%	28.11%	885	100.00%	17.32%
never smoked	1802	95.24%	37.07%	90	4.76%	36.14%	1892	100.00%	37.03%
smokes	747	94.68%	15.37%	42	5.32%	16.87%	789	100.00%	15.44%
unknown	1497	96.96%	30.80%	47	3.04%	18.88%	1544	100.00%	30.22%
Grand Total	**4861**	**95.13%**	**100.00%**	**249**	**4.87%**	**100.00%**	**5110**	**100.00%**	**100.00%**


Smoking Status Distribution

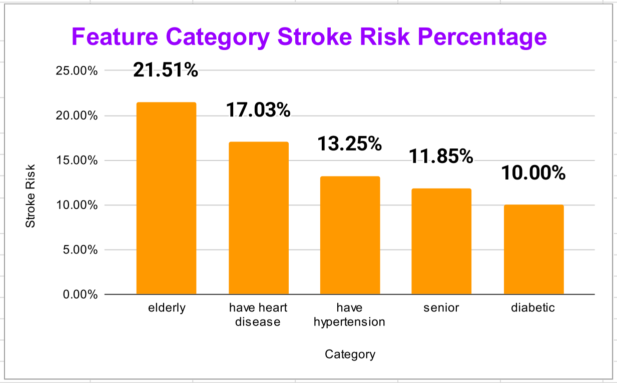

Smoking Status vs Stroke

Insights

* Patients that never smoked (37.03%) have the highest distribution in the dataset.
* Patients with the unknown smoking status comprise of 30.22% of the dataset. This is a significant portion of the data and should not simply be removed from the dataset.
* People that formerly smoked have the highest risk of having a stroke at 7.91% while people that smokes have a 5.32% chance of having a stroke.
* The risk of having a stroke for people that never smoked (4.76%) and people that smokes (5.32%) is very similar.

Top Stroke Risk Predictors by Feature Category

Feature	Category	Stroke Risk
age	elderly	21.51%
heart disease	have heart disea	17.03%
hypertension	have hypertensio	13.25%
age	senior	11.85%
glucose level	diabetic	10.00%
work type	self-employed	7.94%
smoking status	formerly smoked	7.91%
bmi	overweight	7.14%
ever married	married	6.56%
smoking status	smokes	5.32%
residence type	urban	5.20%
gender	male	5.11%
bmi	obese	5.10%
work type	private	5.09%
work type	government job	5.02%
smoking status	never smoked	4.76%
gender	female	4.71%
residence type	rural	4.53%
heart disease	no heart disease	4.18%
hypertension	no hypertension	3.97%
age	middle aged adu	3.84%
glucose level	prediabetic	3.78%


Feature Category Stroke Risk Percentage

Feature	Highest-Risk Group	Stroke Rate	Risk vs baseline	Interpretation
Age	Elderly	21.50%	~4.4x more likely	Strongest predictor
Heart Disease	Have Heart Disease	17.00%	~4.0x more likely	Strong predictor
Hypertension	Have Hypertension	13.30%	~2.7x more likely	Strong predictor
Glucose Level	Diabetic	10.00%	~2.1x more likely	Strong predictor

Baseline Stroke Risk = $\frac{249}{5110}$ = 4.87%

These are the top four features associated with the highest stroke risk percentages among patients.

This list is validated by the Chi-Square Test results, which confirm that each feature has a statistically significant association with stroke occurrence.

The stroke risks in these groups are substantially higher than the baseline stroke risk of 4.87% observed across the full dataset.

glucose level	hypoglycemic	3.58%
glucose level	normal	3.58%
smoking status	unknown	3.04%
bmi	normal weight	2.82%
ever married	never married	1.65%
age	young adult	0.46%
bmi	underweight	0.30%
work type	children	0.29%
age	pediatric	0.23%
work type	never_worked	0.00%