Cardio vascular Disease project.

To start with…

4 levels of analytics for better decision making

Data is all about helping you make smarter, more well-informed decisions.

it's important to understand the four levels of analytics: descriptive, diagnostic, predictive and prescriptive.

1. Descriptive analytics- what has happened

Descriptive (also known as observation and reporting) is the most basic level of analytics.

Build reports on what happened in the past.

It's important to get beyond the initial observations and dive into insights, which is the second level of analytics.

2. Diagnostic analytics-- why

Diagnostic analytics is where we get to the why.

We move beyond an observation (like whether the chart is trending up or down) and get to the "what" that is making it happen.

Imagine going to a doctor where the only thing they do is look at you, make the observation that "oh, yeah, you look sick," and then leave the room. That's not going to do much for your health. We need to be able to understand what is causing the sickness. The doctor should make the observation, diagnose you and then give you a treatment plan to help you feel better. It's the same thing with analytics: you make an observation, identify the descriptive analysis and move forward to the diagnosis.

3. Predictive analytics--- what will happen

Predictive analytics allows organizations to predict different decisions, make more predictions—and so forth. This flow allows organizations to see how the first three levels can work together. Predictive analytics involves technologies like machine learning,

algorithms, and artificial intelligence, which gives it power because this is where the data science comes in.

4. Prescriptive analytics-- what action to take

Prescriptive analytics exist at advanced level and is the most powerful and final phase, and truly encompasses the "why" of analytics. It's when the data itself prescribes what should be done. Data-driven decision making is tied most closely to predictive and prescriptive analytics.

"Prescriptive analytics builds on predictive by informing decision makers about different decision choices with their anticipated impact on a specific key performance indicators.

Think of traffic navigation app, google-map or waze . Pick an origin and destination and a multitude of factors get mashed together, and it advises you on different route choices, each with a predicted ETA. This is everyday prescriptive analytics at work."

What is Cardiovascular Disease?

Heart disease

Heart and blood vessel disease (also called heart disease) called atherosclerosis.

Atherosclerosis is a condition that develops when a substance called plaque builds up in the walls of the arteries. This buildup narrows the arteries, making it harder for blood to flow through. If a blood clot forms, it can block the blood flow. This can cause a heart attack or stroke.

Heart attack

A heart attack occurs when the blood flow to a part of the heart is blocked by a blood clot. If this clot cuts off the blood flow completely, the part of the heart muscle supplied by that artery begins to die.

Most people survive their first heart attack and return to their normal lives, enjoying many more years of productive activity. But experiencing a heart attack does mean that you need to make some changes.

The medications and lifestyle changes that your doctor recommends may vary according to how badly your heart was damaged, and to what degree of heart disease caused the heart attack.

Stroke

An ischemic stroke (the most common type of stroke) occurs when a blood vessel that feeds the brain gets blocked, usually from a blood clot.

When the blood supply to a part of the brain is cut off, some brain cells will begin to die. This can result in the loss of functions controlled by that part of the brain, such as walking or talking.

A hemorrhagic stroke occurs when a blood vessel within the brain bursts. This is most often caused by uncontrolled hypertension (high blood pressure).

Some effects of stroke are permanent if too many brain cells die after being starved of oxygen. These cells are never replaced.

The good news is that sometimes brain cells don't die during stroke — instead, the damage is temporary. Over time, as injured cells repair themselves, previously impaired function improves. (In other cases, undamaged brain cells nearby may take over for the areas of the brain that were injured.)

Either way, strength may return, speech may get better and memory may improve. This recovery process is what stroke rehabilitation is all about.

Heart failure

Heart failure, sometimes called congestive heart failure, means the heart isn't pumping blood as well as it should. Heart failure does not mean that the heart stops beating — that's a common misperception. Instead, the heart keeps working, but the body's need for blood and oxygen isn't being met.

Heart failure can get worse if left untreated. If your loved one has heart failure, it's very important to follow the doctor's orders.

Arrhythmia

Arrhythmia refers to an abnormal heart rhythm. There are various types of arrhythmias. The heart can beat too slow, too fast or irregularly.

Bradycardia, or a heart rate that's too slow, is when the heart rate is less than 60 beats per minute. Tachycardia, or a heart rate that's too fast, refers to a heart rate of more than 100 beats per minute.

An arrhythmia can affect how well your heart works. With an irregular heartbeat, your heart may not be able to pump enough blood to meet your body's needs.

Heart valve problems

When heart valves don't open enough to allow the blood to flow through as it should, a condition called stenosis results. When the heart valves don't close properly and thus allow blood to leak through, it's called regurgitation. If the valve leaflets bulge or prolapse back into the upper chamber, it's a condition called prolapse.

Common treatments

Here are some common treatments for different types of cardiovascular disease:

Heart Valve Problems

- **Medications**
- **Heart valve surgery**

Arrhythmia

- **Medications**
- **Pacemaker**

Heart Attack

- **Medications — clotbusters (should be administered as soon as possible for certain types of heart attacks)**
- **Coronary angioplasty**
- **Coronary artery bypass graft surgery**

Stroke

- **Medications – clotbusters (must be administered within three hours from onset of stroke symptoms for certain types of strokes)**
- **Carotid endarterectomy :- vascular surgical procedures –carotid endarterectomy. This type of surgery is performed to prevent stroke caused by atherosclerotic plaque at the common carotid artery bifurcation and, most important, internal carotid artery**

About THE DATA SET

The dataset used in this article is the Cleveland Heart Disease dataset. There are 14 columns in the dataset, which are described below.

The dataset used in this article is provided by 4 hospitals 2 from USA and 2 from Europe. It was combined to make single dataset.

There are 14 columns in the dataset,

which are described below.

1. Age, in years

2. Sex, 1 = male; 0 = female

3. cp: chest pain type

– Value 0: typical angina

– Value 1: atypical angina

– Value 2: non-anginal pain

– Value 3: asymptomatic

4. trestbps: resting blood pressure (in mm Hg on admission to the hospital)

5. chol: serum cholestoral in mg/dAttribute Information:

6. fbs: (fasting blood sugar > 120 mg/dl) 1 = true; 0 =false

7. restecg: resting electrocardiographic results

– Value 0: normal

– Value 1: having ST-T wave abnormality (T wave inversions and/or ST elevation or depression of >0.05 mV)

– Value 2: showing probable or definite left ventricu lar hypertrophy by Estes' criteria

8. thalach: maximum heart rate achieved during stress TEST

9. exang: exercise induced angina, 1 = yes; 0 = no

10. oldpeak = ST depression induced by exercise relative to rest

11. slope: the slope of the peak exercise ST segment

– Value 0: upsloping

– Value 1: flat

– Value 2: downsloping

12. ca: number of major vessels (0-4) colored by flourosopy

13. thal: thalassmia, 0 = normal; 1=mild defect; 2 = fixed defect; 3 = reversible defect

14. condition (target) : 0 = no disease, 1 = disease

(3)CP:- chest pain type (4 values) Chest pain at rest, 1=typical angina, 2= atypical angina, 3= non- anginal chest pain pain, 4=asymtomatic	Angina is the discomfort when the heart does not get enough blood or oxygen symptom feel like a tightness or heaviness in the central part / left /right side of chest. It may also feel like the discomfort moves or radiates to the shoulder, arms, jaw, neck, and back.

The signs of a woman having a heart attack are much less noticeable than the signs of a male. The exact reason for the lower heart disease rate among women is thought to be linked to **estrogen**. **Estrogen**, the female growth hormone, affects almost every part of the body to some degree. For the cardiovascular system, the effects are a mix of benefits and drawbacks.	Men commonly have the usual kind of angina as described above.
Typical angina	Typical angina means that the history of the patient is classical and chance of having coronary artery blockages is high.
Atypical angina	Atypical angina means that the symptoms have some features suggesting blockages and other symptoms which are not specific and chance of blockages is lower.
– non-anginal pain	Non-cardiac chest pain is not related to heart. In most people, non-cardiac chest pain is actually related to a problem with their esophagus, most often gastroesophageal reflux disease (GERD).
– Value 3: asymptomatic	**"silent" (asymptomatic) myocardial ischemia is the most common manifestation of coronary heart disease (CHD), accounting for more than 75 percent of ischemic episodes**

	during daily life as assessed by electrocardiographic (ECG) monitoring. **Silent myocardial ischemia is defined as the presence of objective evidence of myocardial ischemia in the absence of chest discomfort or another anginal equivalent symptom (eg, dyspnea, nausea, diaphoresis, etc).**
resting blood pressure (in mm Hg on admission to the hospital)	Resting blood pressure (in mm Hg on admission to the hospital)
serum cholestoral in mg/dl What is serum cholesterol?	**Cholesterol is a type of body fat, or lipid. A person's serum cholesterol level represents the amount of total cholesterol in their blood. A person's serum cholesterol level comprises the amount of high-density lipoprotein (HDL), low-density lipoprotein (LDL), and triglycerides in the blood.**
(5)Fasting blood sugar. 1= >120 mg/dl, 0 = <120 mg/dl	fbs: (fasting blood sugar > 120 mg/dl) 1 = true; 0 = false

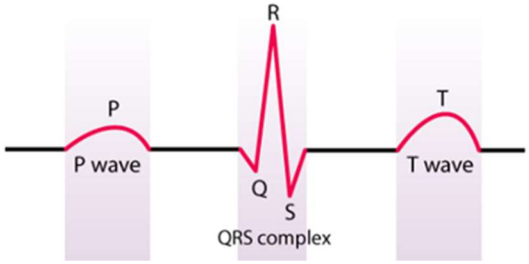
(6)resting ECG electrocardiographic results (values 0,1,2)

ECG

An electrocardiogram provides details about one's heart rate and rhythm and depicts if the heart has enlarged due to hypertension (high blood pressure) or evidence of a myocardial infarction previously (heart attack if any).

Second, a cardiologist may be able to find out if areas of the heart are too large or overworked by measuring the amount of electrical activity that flows through the heart muscle.

Resting electrocardiographic results. 0=normal, 1=ST-T wave abnormality, 2=left ventricular hypertrophy



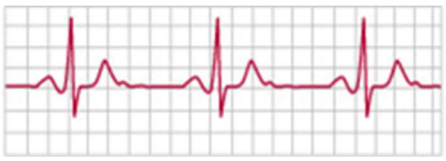
Two main forms of data are given by an ECG. First, a surgeon will determine how long it takes for the electromagnetic pulse to travel through the heart by calculating time intervals on the ECG. Whether the electrical activity is natural or sluggish, fast or erratic, figuring out how long a pulse takes to travel from one part of the heart to the next.

There are three primary ECG types:

Resting ECG If your doctor is interested in how your heart works while you're in rest, you'll be asked to lie down and relax while recording your heartbeat.

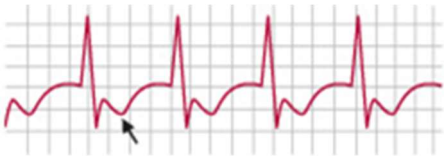
The overall objective of an ECG is to obtain information about the heart's electrical function. Some signs for an ECG are as follows: An ECG is used to measure: any heart damage and weaknesses in various parts of the heart musclehow quickly your heart beats and whether it normally beats the effects of drugs or devices used to control your heart (such as a pacemaker)the size and position of your heart chambers To diagnose abnormal heart rhythms Also Check: Systole and Diastole	Exercise ECG The doctor may be interested in how the heart responds to movement and you may be asked to walk or run on a treadmill or cycle on an exercise bike when monitoring your pulse. 24-hour ECG:- Often checking your rhythm throughout the day may be useful The Electrocardiogram Wave An ECG has three main components: the P wave, which denotes depolarising atria; the QRS complex, denotes the depolarization of the ventricles; and the T wave represents repolarising ventricles. If the heart is beating normally, it takes about a second (approximately 60 heartbeats per minute) for the entire cycle.

Normal



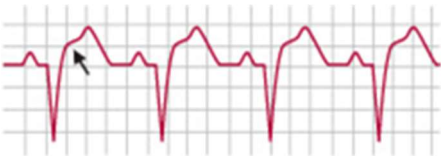
In the normal ECG pattern, there is a regular pattern of The P wave, QRS complex, and T wave. They occur in a sequence.

Angina



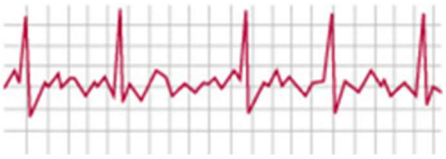
When the heart muscle doesn't get enough blood with oxygen, it causes discomfort, that feels like putting pressure on the chest. This condition is termed as Angina pain. It can sometimes be misunderstood as indigestion. As you can see in the figure above (see arrow), the ST-segment dips, which normally is flat.

Serious heart attack

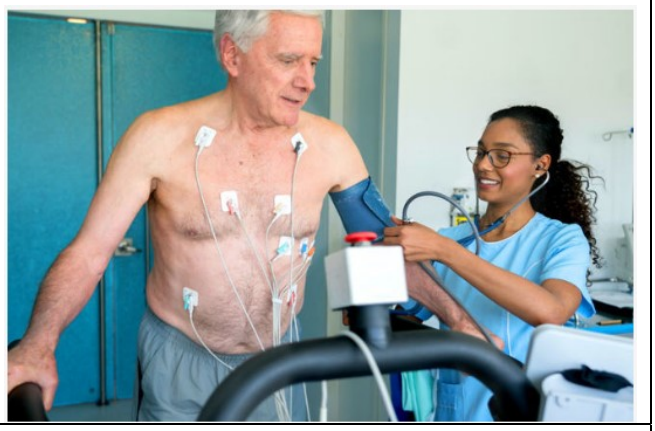


The elevated ST segment of the ECG is an indication of a serious heart attack. In the medical terminology, it is referred to as "STEMI", which needs immediate attention. Generally, the ST segment remains flat.

Atrial fibrillation



Atrial fibrillation is the state when the atria and the ventricles show a lack of coordination of movement. It results in rapid heartbeat, weakness and shortness of breath. On ECG, it is represented by jumpy baseline and the P wave disappears.

(7)maximum heart rate achieved **Maximum heart rate achieved. based on values, likely taken during exercise stress test**	**STRESS TEST** **TRADEMILL TEST** 
(8)exercise induced angina **Exercise induced angina (chest pain). 1=yes, 0=no**	exang: exercise induced angina, 1 = yes; 0 = no
(9)oldpeak = ST depression induced by exercise relative to rest ST depression induced by exercise relative to rest	oldpeak = ST depression induced by exercise relative to rest
(10) Slope **Slope of the peak exercise ST segment. 1=upsloping/normal, 2=flat, 3=downsloping**	slope: the slope of the peak exercise ST segment – Value 1: Upsloping – Value 1: flat – Value 2: downsloping

(11)number of major vessels (0-4) colored by flourosopy **Number of major vessels colored by flourosopy**	ca: number of major vessels (0-4) colored by fluoroscopy **Fluoroscopy is an imaging modality that uses x-rays to allow real-time visualization of body structures. During fluoroscopy, x-ray beams are continually emitted and captured on a screen, producing a real-time, dynamic image. This allows for dynamic assessment of anatomy and function.**
(12) thal: 0 = null; 1 = normal;2=fixed defect; 3 = reversable defect	thal: A blood disorder called thalassemia any of a group of hereditary haemolytic diseases caused by faulty haemoglobin synthesis, widespread in Mediterranean, African, and Asian countries. Value 1: normal Value 2: fixed defect (no blood flow in some part of the heart) Value 3: reversible defect **: reversible defect (a blood flow is observed but it is not normal)**

	Heart failure and arrhythmias are the major cause of death in patients with b-thalassemia. Iron cardiomyopathy is reversible
exang: Exercise induced angina (1 = yes; 0 = no)	
condition (target) : 0 = no disease, 1 = disease Angiographic status of heart disease. 0= <50% diameter narrowing (no heart disease), >1= >50% diameter narrowing (heart disease present)	