

STATISTICAL ANALYSIS ON MENTAL HEALTH DISORDERS



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CHAPTER 1

INTRODUCTION

Mental health is a state of well-being in which an individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively, and is able to make a contribution to his or her community. Mental health includes emotional, psychological, and social well-being. It affects how one's think, feel, and act. It also helps determine how human handle stress, and make choices. Mental health is important at every stage of life, from childhood and adolescence through adulthood. Over the course of life, if he/she experience mental health problems, his/her thinking, mood, and behavior could be affected. Many factors contribute to mental health problems, including: Biological factors such as genes or brain chemistry, life experiences, such as trauma or abuse and family history of mental health problems. Mental health problems are common but help is available and many recovered completely. Mental health is an integral and essential component of health. The WHO states that, "health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity".

Poor mental health is also associated with rapid social change, stressful work conditions, gender discrimination, social exclusion, unhealthy lifestyle, physical ill-health and human rights violations. There are specific psychological and personality factors that make people vulnerable to mental health problems. In recent years, there has been increasing acknowledgement of the important role mental health plays in achieving global development goals, as illustrated by the inclusion of mental health in the Sustainable Development Goals (able to be maintained at a certain rate or level). Depression is one of the leading causes of disability. Suicide is the fourth leading cause of death among 15-29-year-olds. People with severe mental health conditions die prematurely – as much as two decades early – due to preventable physical conditions. Despite progress in some countries, people with mental health conditions often experience severe human rights violations, discrimination, and stigma (a mark of disgrace associated with a particular circumstance, quality, or person). Many mental health conditions can be effectively treated at relatively low cost, yet the gap between people needing care and those with access to care remains substantial. Effective treatment coverage remains extremely low.



1.1 Types of mental health disorders.

There are various types of mental health disorders. They are Bipolar, Eating disorders, Schizophrenia, Anxiety disorder(AD), Drug use disorder(DUD), Depression disorder(DD), Alcohol use disorder(AUD)

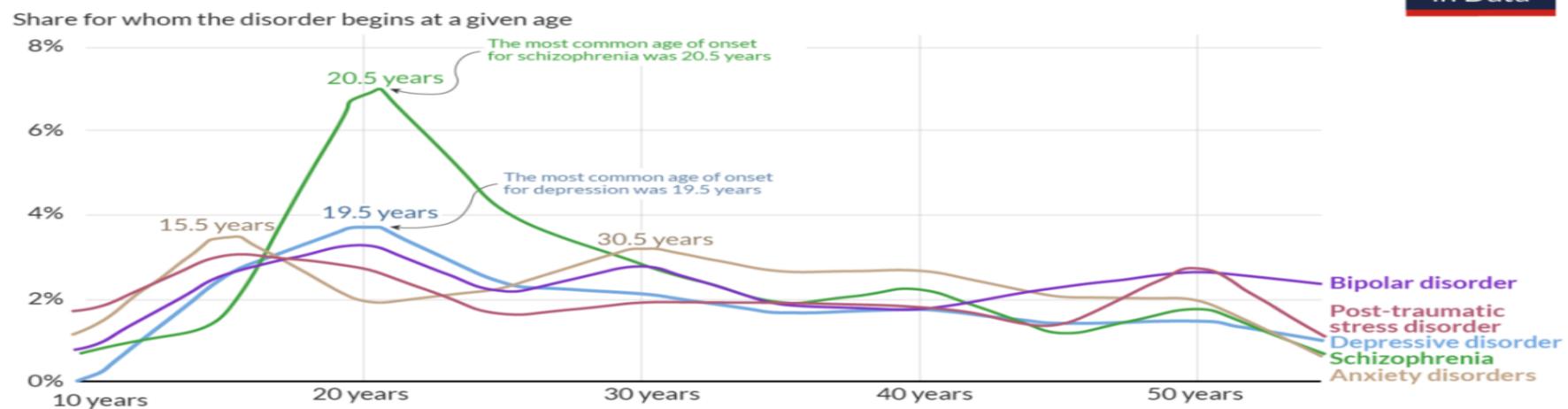
Disorder	Share of global population with disorder [difference across countries]	Number of people With disorders	Share of male female With disorder
Any mental health disorder	10.7%	792 million	9.3% males 11.9% females
Depression	3.4% [2-6%]	264 million	2.7% males 4.1% females
Anxiety disorders	3.8% [2.5-7%]	284 million	2.8% males 4.7% females
Bipolar disorder	0.6% [0.3-1.2%]	46 million	0.55% males

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			0.65% females
Eating disorders	0.2% [0.1-1%]	16 million	0.13% males 0.29% females
Schizophrenia	0.3% [0.2-0.4%]	20 million	0.26% males 0.25% females
Any mental or substance use disorder	13% [11-18%]	970 million	12.6% males 13.3% females
Alcohol use disorder	1.4% [0.5-5%]	107 million	2% males 0.8% females
Drug use disorder (excluding alcohol)	0.9% [0.4-3.5%]	71 million	1.3% males 0.6% females

Age of onset of mental health disorders

Our World in Data



Source: Marco Solmi et al. (2021). Age at onset of mental disorders worldwide: large-scale meta-analysis of 192 epidemiological studies. *Nature Molecular Psychiatry*. OurWorldInData.org – Research and data to make progress against the world's largest problems. Licensed under CC-BY by the author Saloni Dattani.

From the above-mentioned disorders we have taken some common disorders which are AD, DD, AUD and DUD.

1)AD: Anxiety is a normal phenomenon, which is characterized by a state of apprehension or uneasiness arising out of anticipation of danger. Normal anxiety becomes pathological when it causes significant subject distress and impairment of functioning of the individual. Anxiety disorders are abnormal states in which the most striking features are mental and physical symptoms of anxiety, which are not caused by organic brain disease or any other psychiatric disorder. A phobia is an unreasonable fear of a specific object, activity or situation. This irrational fear is characterized by various features. In phobic anxiety disorders by individual experiences intermittent anxiety which arises in particular circumstances, that is in response to the phobic object or situation.

The symptoms, causes ,medication ,treatment and prevention are listed below:

Causes:

Chemical imbalance: Severe or long-lasting stress can change the chemical balance that controls mood. Experiencing a lot of stress over a long period can lead to an anxiety disorder.

Environmental factors: Experiencing a trauma might trigger an anxiety disorder, especially in someone who has inherited a higher risk to start.

Heredity: Anxiety disorders tend to run in families. He/she may inherit them from one or both parents, like eye color.

Symptoms: Symptoms vary depending on the type of anxiety disorder an individual have.

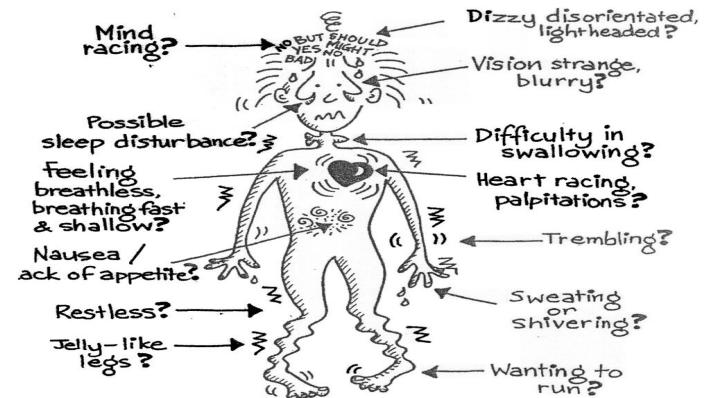
General symptoms of an anxiety disorder include:

1)Physical symptoms: Cold or sweaty hands, Dry mouth, Heart palpitations, Nausea, Numbness or tingling in hands or feet, Muscle tension, Shortness of Breath.

2) Mental symptoms: Feeling panic, fear and uneasiness, Nightmares, Repeated thoughts or flashbacks of traumatic experiences, Uncontrollable, obsessive thoughts.

3) Behavioral symptoms: Inability to be still and calm, Ritualistic behaviors, such as washing hands repeatedly, Trouble sleeping.

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Medication: Medications can't cure an anxiety disorder. But they can improve symptoms and help individual function better. Medications for anxiety disorders often include:

- 1) Anti-anxiety medications, such as benzodiazepines, may decrease anxiety, panic and worry. They work quickly, but an individual can build up a tolerance to them. That makes them less effective over time. Healthcare provider may prescribe an anti-anxiety medication for the short-term.
- 2) Antidepressants can also help with anxiety disorders. They tweak how human brain uses certain chemicals to improve mood and reduce stress. Antidepressants may take some time to work, so individual should be patient. If an individual feel like he/she is ready to stop taking antidepressants, talk to healthcare provider first.
- 3) Beta-blockers, usually used for high blood pressure, can help reduce some of the physical symptoms of anxiety disorders. They can relieve rapid heartbeat, shaking and trembling.

Treatment:

Psychotherapy, or counseling, helps to deal with emotional response to the illness. A mental health provider talks through strategies to help, understand and manage the disorder. Approaches include:

Cognitive behavioral therapy (CBT) is the most common type of psychotherapy used with anxiety disorders. CBT for anxiety teaches to recognize thought patterns and behaviors that lead to troublesome feelings then work on changing them.

Exposure therapy focuses on dealing with the fears behind the anxiety disorder. It helps to engage with activities or situations that may have been avoiding. Provider may also use relaxation exercises and imagery with exposure therapy.

Prevention: An Individual can't prevent anxiety disorders. But they can take steps to control or reduce their symptoms:

Medications: Talk to a healthcare provider or pharmacist before taking over-the-counter medications or herbal remedies. Some of these contain chemicals that may make anxiety symptoms worse.
Limit caffeine: Stop or limit caffeine consumption, including coffee, tea, cola and chocolate.
Live a healthy lifestyle: Exercise regularly and eat a healthy, balanced diet.

2)DUD: Drug addiction, also called substance use disorder, is a disease that affects a person's brain and behavior and leads to an inability to control the use of a legal or illegal drug or medication. Substances such as alcohol, marijuana and nicotine also are considered drugs. When they are addicted, they may continue using the drug despite the harm it causes. Drug addiction can start with experimental use of a recreational drug in social situations, and, for some people, the drug use becomes more frequent. For others, particularly with opioids, drug addiction begins with exposure to prescribed medications, or receiving medications from a friend or relative who has been prescribed the medication. The risk of addiction and how fast someone become addicted varies by drug. Some drugs, such as opioid painkillers, have a higher risk and cause addiction more quickly than others.

The symptoms, causes ,medication ,treatment and prevention are listed below:

Symptoms/behaviours:

Drug addiction symptoms or behaviors include, among others:

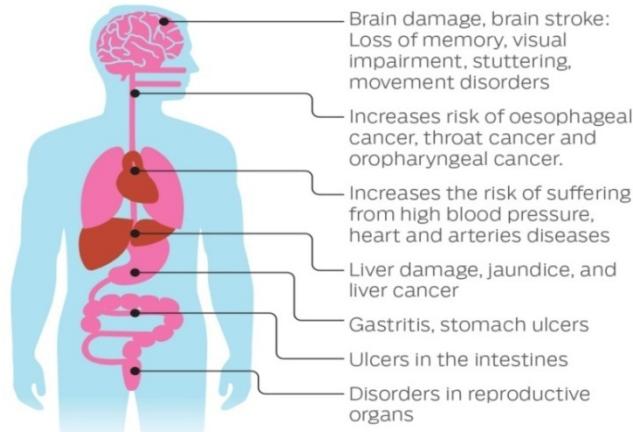
An individual feeling to have the drug regularly(daily) or even several times a day. Having intense urges for the drug that block out any other thoughts

Over time, needing more of the drug to get the same effect. Taking larger amounts of the drug over a longer period of time than intended. Making certain that he/she maintain a supply of the drug. Spending money on the drug, even though an individual can't afford it. Not meeting obligations and work responsibilities, or cutting back on social or recreational activities because of drug use. Continuing to use the drug, even though the person know it's causing problems in his/her life or causing physical or psychological harm. Doing things to get the drug that normally wouldn't do, such as stealingEtc...

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Health complications due to drug use

- Pancreas infection
- Vitamin deficiency (Thiamine)
- Anaemia, body is slow in healing wounds
- Impedes ability of immunity system to fight infections and diseases
- Harms babies during pregnancy



Source: National Rehabilitation Centre

©Gulf News

Causes:

Like many mental health disorders, several factors may contribute to development of drug addiction. The main factors are:

Environment: Environmental factors, including family's beliefs and attitudes and exposure to a peer group that encourages drug use, seem to play a role in initial drug use.

Genetics: Once a person started using a drug, the development into addiction may be influenced by inherited (genetic) traits, which may delay or speed up the disease progression.

Treating substance use disorder:

Medical treatment is available for substance use disorders. Programs should follow these principles of addiction treatment:

Addiction is a complex but treatable health condition.

There's no single treatment that works for everyone.

Treatment is readily available.

Treatment programs should also check and assess for infectious diseases while providing risk-education counseling. This empowers to take control of ones health so they don't contract or transmit infectious diseases.

Detoxification/Medication:

Depending on the type of substance use disorder, the first stage of treatment may be medically assisted detoxification. During this process, supportive care is provided as the substance is cleared from bloodstream. Detoxification is followed by other treatments to encourage long-term abstinence.

Many treatments involve both individual and group counseling. These are provided in outpatient facilities or inpatient residential recovery programs. Medications can also reduce withdrawal symptoms and encourage recovery. In heroin addiction, for example, doctor may prescribe a medication called methadone or buprenorphine/naloxone (Suboxone). These medications can ease recovery and help to cope with the intense withdrawal stage.

Preventing substance use disorder:

The best way to avoid a substance use disorder is to prevent use in the first place. However, while abstaining from substances is the safest approach, it may not be the most realistic. Because of this, education and safety practices are the best tools to reduce harm and avoid addiction. Mental healthcare, community outreach, and reducing stigma can all help prevent the development of substance use disorders. Harm reduction programs can also reduce complications of substance use and connect people to treatment.



3)DD: Depression (major depressive disorder) is a common and serious medical illness that negatively affects how you feel, the way you think and how you act. Depression causes feelings of sadness and/or a loss of interest in activities you once enjoyed. It can lead to a variety of emotional and physical problems and can decrease your ability to function at work and at home.

Variations in elevation of mood, expansive mood may also be present, which is an unceasing and unselective enthusiasm for interacting with people and surrounding environment. At times, elevated mood may not be apparent and instead an irritable mood may be predominant, especially when the person is stopped from doing what he wants. There may be rapid, short lasting shifts from euphoria to depression or irritability. Physical well-being also has an impact on your mental health. People with physical health conditions may also develop mental health conditions. Psoriasis is a dermatological condition characterized by painful red sores on the skin. It is associated with acute stress and depression. Individuals with psoriasis experience emotional and psychological distress that negatively impacts their overall health and quality of life. Stress and depression mainly come from anxiety, stigma, and rejection. Being diagnosed with cancer or having a heart attack can also lead to feelings of depression or anxiety. Around one-third of people with serious medical conditions will have symptoms of depression, such as low mood, sleep problems, and a loss of interest in activities.

The symptoms, causes ,medication ,treatment and prevention are listed below:

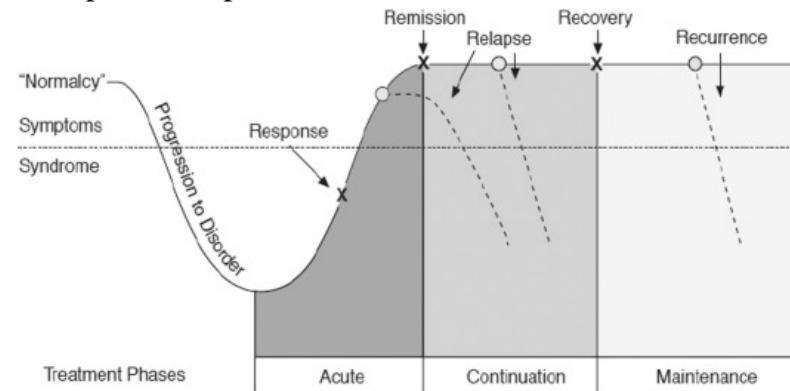
Symptoms:

Reduced concentration and attention, reduced self-esteem and self-confidence, ideas of guilt and unworthiness (even in a mild type of episode), bleak and pessimistic views of the future, ideas or acts of self-harm or suicide, disturbed sleep, diminished appetite.

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Mild persistent depression (dysthymia) tends to have the following diagnostic guidelines: Depressed mood, loss of interest and enjoyment, and increased fatigability are usually regarded as the most typical symptoms of depression. None of the symptoms should be present to an intense degree. Minimum duration of the whole episode is about 2 weeks. An individual with a mild depressive episode is usually distressed by the symptoms and has some difficulty in continuing with ordinary work and social activities, but will probably not cease to function completely.

Severe depressive disorder tends to have the following diagnostic guidelines: In a severe depressive episode, the sufferer usually shows considerable distress or agitation, unless retardation is a marked feature. Loss of self-esteem or feelings of uselessness or guilt are likely to be prominent, and suicide is a distinct danger in particularly severe cases. It is presumed here that the somatic syndrome will almost always be present in a severe depressive episode.



Causes:

It's not known exactly what causes depression. As with many mental disorders, a variety of factors may be involved, such as:

Biological differences: People with depression appear to have physical changes in their brains. The significance of these changes is still uncertain, but may eventually help pinpoint causes.

Brain chemistry: Neurotransmitters are naturally occurring brain chemicals that likely play a role in depression. Recent research indicates that changes in the function and effect of these neurotransmitters and how they interact with neuro circuits involved in maintaining mood stability may play a significant role in depression and its treatment.

Hormones: Changes in the body's balance of hormones may be involved in causing or triggering depression. Hormone changes can result with pregnancy and during the weeks or months after delivery (postpartum) and from thyroid problems, menopause or a number of other conditions.

Inherited traits: Depression is more common in people whose blood relatives also have this condition. Researchers are trying to find genes that may be involved in causing depression.

Treatment.

Medications and psychotherapy are effective for most people with depression. Individual's primary care doctor or psychiatrist can prescribe medications to relieve symptoms. However, many people with depression also benefit from seeing a psychiatrist, psychologist or other mental health professional.

If an individual has severe depression, they may need a hospital stay or may need to participate in an outpatient treatment program until their symptoms improve.

Medications:

Many types of antidepressants are available, including those below.

Selective serotonin reuptake inhibitors (SSRIs): Doctors often start by prescribing an SSRI. These drugs are considered safer and generally cause fewer bothersome side effects than other types of antidepressants. SSRIs include citalopram (Celexa), escitalopram (Lexapro), fluoxetine (Prozac), paroxetine (Paxil, Pexeva), sertraline (Zoloft) and vilazodone (Viibryd).

Serotonin-norepinephrine reuptake inhibitors (SNRIs): Examples of SNRIs include duloxetine (Cymbalta), venlafaxine (Effexor XR), desvenlafaxine (Pristiq, Khedezla) and levomilnacipran (Fetzima). Atypical antidepressants: These medications don't fit neatly into any of the other antidepressant categories. It includes bupropion (Wellbutrin XL, Wellbutrin SR, Aplenzin, Forfivo XL), mirtazapine (Remeron), nefazodone, trazodone and vortioxetine (Trintellix).

Tricyclic antidepressants: These drugs such as imipramine (Tofranil), nortriptyline (Pamelor), amitriptyline, doxepin, trimipramine (Surmontil), desipramine (Norpramin) and protriptyline (Vivactil) can be very effective, but tend to cause more-severe side effects than newer antidepressants. So, tricyclics generally aren't prescribed unless tried an SSRI first without improvement.

Prevention:

There's no sure way to prevent depression. However, these strategies may help. Take steps to control stress, to increase resilience and boost self-esteem, reach out to family and friends, especially in times of crisis, to help weather rough spells, get treatment at the

earliest sign of a problem to help prevent depression from worsening and consider getting long-term maintenance treatment to help prevent a relapse of symptoms.



4)AUD:Alcohal addiction refers to the use of alcholic beverages to the point of causing damage to the individual,society or both.

Alcholic dependence was previously called as alcoholism. This term much like ‘addiction’ has been dropped due to its derogatory meaning .

Alcohol use disorder (AUD) is a long-term brain condition in which they can't stop or controlling their drinking even though it's hurting their social life, their job, or their health. It's a range that includes alcohol abuse, which is when drinking has serious consequences again and again. It also includes alcohol dependence or alcoholism, which is when they've lost control of their drinking.

The symptoms, causes ,medication ,treatment and prevention are listed below:

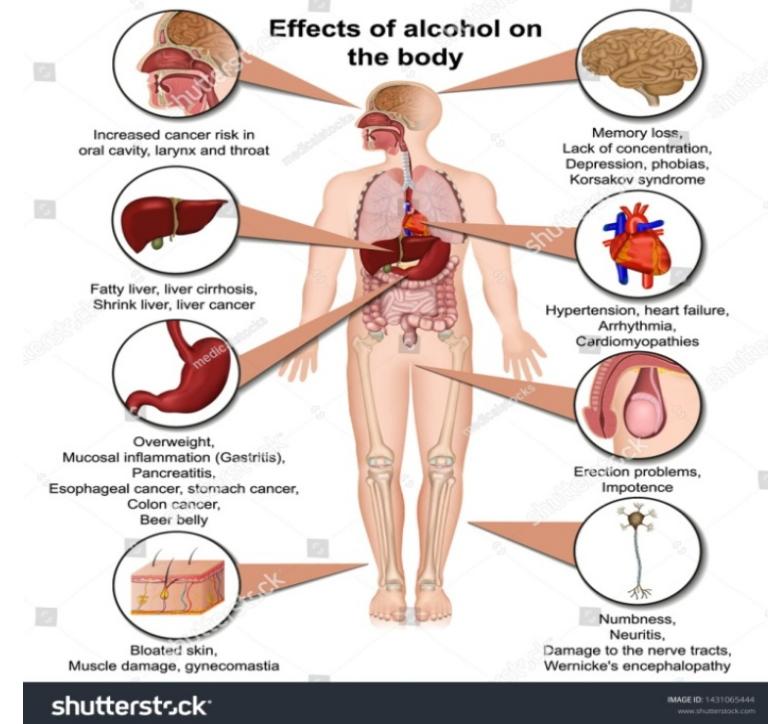
Symptoms:

Alcohol use disorder can be mild, moderate or severe, based on the number of symptoms they experience. Signs and symptoms may include:

Being unable to limit the amount of alcohol they drink,wanting to cut down on how much they drink or making unsuccessful attempts to do so,spending a lot of time drinking, getting alcohol or recovering from alcohol use,feeling a strong craving or urge to drink alcohol,failing to fulfill major obligations at work, school or home due to repeated alcohol use, continuing to drink alcohol even though they know it's causing physical, social, work or relationship problems,giving up or reducing social and work activities and hobbies to use alcohol,using alcohol in situations where it's not safe, such as when driving or swimming,developing a tolerance to

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alcohol so they need more to feel its effect or they have a reduced effect from the same amount and experiencing withdrawal symptoms such as nausea, sweating and shaking when they don't drink, or drinking to avoid these symptoms.



Causes:

Genetic, psychological, social and environmental factors can impact how drinking alcohol affects their body and behavior. Theories suggest that for certain people drinking has a different and stronger impact that can lead to alcohol use disorder.

Over time, drinking too much alcohol may change the normal function of the areas of their brain associated with the experience of pleasure, judgment and the ability to exercise control over their behavior. This may result in craving alcohol to try to restore good feelings or reduce negative ones.

Treatment:

Treatment for alcohol use disorder can vary, depending on their needs. Treatment may involve a brief intervention, individual or group counseling, an outpatient program, or a residential inpatient stay. Working to stop alcohol use to improve quality of life is the main treatment goal.

Treatment for alcohol use disorder may include:

Detox and withdrawal: Treatment may begin with a program of detoxification withdrawal that's medically managed. Sometimes called detox, this generally takes 2 to 7 days. They may need to take sedating medications to prevent withdrawal symptoms. Detox is usually done at an inpatient treatment center or a hospital.

Learning new skills and making a treatment plan: This process usually involves alcohol treatment specialists. It may include goal setting, behavior change techniques, use of self-help manuals, counseling and follow-up care at a treatment center.

Oral medications: A drug called disulfiram may help prevent you from drinking, although it won't cure alcohol use disorder or remove the urge to drink. If they drink alcohol while taking disulfiram, the drug produces a physical reaction that may include flushing, nausea, vomiting and headaches. Naltrexone, a drug that blocks the good feelings alcohol causes, may prevent heavy drinking and reduce the urge to drink. Acamprosate may help them to combat alcohol cravings once they stop drinking. Unlike disulfiram, naltrexone and acamprosate don't make them feel sick after taking a drink.

Injected medication: Vivitrol, a version of the drug naltrexone, is injected once a month by a health care professional. Although similar medication can be taken in pill form, the injectable version of the drug may be easier for people recovering from alcohol use disorder to use consistently.

Prevention: Early intervention can prevent alcohol-related problems in teens. If he/she have a teenager, be alert to signs and symptoms that may indicate a problem with alcohol: Loss of interest in activities and hobbies and in personal appearance, red eyes, slurred speech, problems with coordination and memory lapses, difficulties or changes in relationships with friends, such as joining a new crowd, declining grades and problems in school, frequent mood changes and defensive behavior.



1.2 Some myths and facts about the mental health.

Here we have listed some myths and it's respective facts about mental health.

Myths

- 1) Children don't experience mental health problems.
- 2) People with mental health problems are violent and unpredictable
- 3) People with mental health needs, even those who are managing their mental illness, cannot tolerate the stress of holding down a job.
- 4) There is no hope for people with mental health problems. Once a friend or family member develops mental health problems, he or she will never recover.
- 5) People can't do anything for a person with a mental health problem.

Facts for the above myths

- 1) Even very young children may show early warning signs of mental health concerns. These mental health problems are often clinically diagnosable, and can be a product of the interaction of biological, psychological, and social factors. Half of all mental health disorders show first signs before a person turns 14 years old, and three-quarters of mental health disorders begin before age 24. Unfortunately, only half of children and adolescents with diagnosable mental health problems receive the treatment they need. Early mental health support can help a child before problems interfere with other developmental needs.

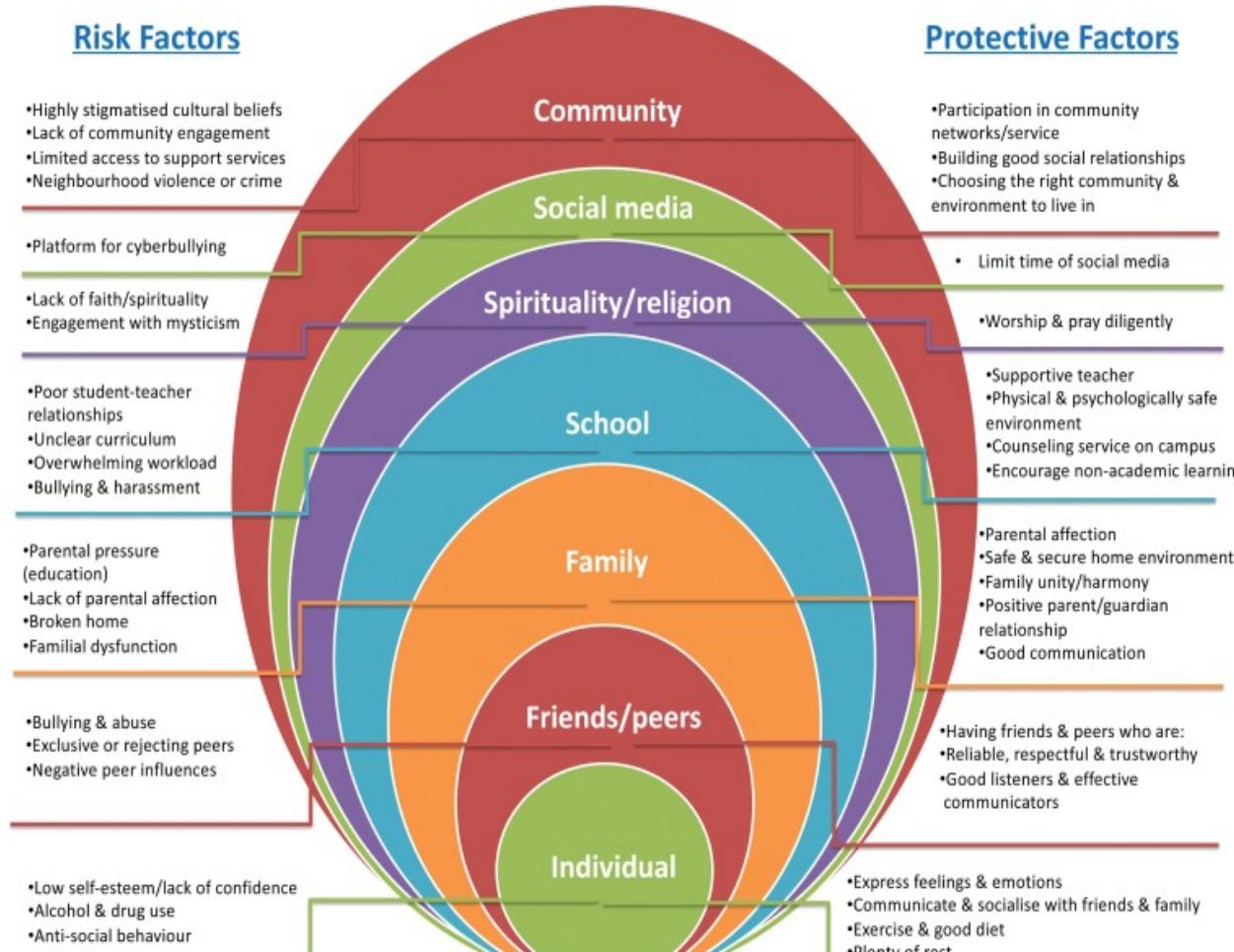
- 2) The vast majority of people with mental health problems are no more likely to be violent than anyone else. Most people with mental illness are not violent and only 3%–5% of violent acts can be attributed to individuals living with a serious mental illness. In fact, people with severe mental illnesses are over 10 times more likely to be victims of violent crime than the general population. An individual probably knows someone with a mental health problem and don't even realize it, because many people with mental health problems are highly active and productive members of our communities.
- 3) People with mental health problems are just as productive as other employees. Employers who hire people with mental health problems report good attendance and punctuality as well as motivation, good work, and job tenure on par with or greater than other employees. When employees with mental health problems receive effective treatment, it can result in: Lower total medical costs, increased productivity, lower absenteeism and decreased disability costs.
- 4) Studies show that people with mental health problems get better and many recover completely. Recovery refers to the process in which people are able to live, work, learn, and participate fully in their communities. There are more treatments, services, and community support systems than ever before, and they work.
- 5) Friends and loved ones can make a big difference. In 2020, only 20% of adults received any mental health treatment in the past year, which included 10% who received counseling or therapy from a professional. Friends and family can be important influences to help someone get the treatment and services they need by: Reaching out and letting them know they are available to help, helping them access mental health services, learning and sharing the facts about mental health, treating them with respect, refusing to define them by their diagnosis or using labels such as "crazy", instead use person-first language.



1.3 Risk factors for mental health:

The determinants, onset and severity of mental health disorders are complex – they can rarely be attributed to a single factor. Identifying potential risk factors form an important element of health research, potential prevention and in some cases, appropriate treatment; nonetheless, many risk factors remain only correlates of observed patterns in mental health. They therefore need to be interpreted carefully. The World Health Organization synthesizes the potential contributors to mental health and wellbeing into three categories: Individual attributes and behavior; these can be particular genetic factors or personality traits; social and economic circumstances; environmental factors. In the table we see the WHO breakdown of potential adverse and protective factors for mental health within these three categories. These factors often interact, compound or negate one another and should therefore not be considered as individual traits or exposures. For example, particular individual traits may make a given person more vulnerable to mental health disorders with the onset of a particular economic or social scenario — the instance of one does not necessarily result in a mental health disorder, but combined there is a significantly higher vulnerability.

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1.4 Aim and objectives of the study

The aim of this project work is to carry out a study on analysis of some mental health disorders in Asian countries. The objectives of our study are to

- 1) Present the data of Asia on various mental disorders, viz. AD, DUD, DD and AUD using various Statistical figures and graphs
- .2) Compare the four types of mental health disorders of India under consideration
- 3) Forecast the future trend of various mental health disorders in India.
- 4) To check the mean of mental health disorders between India and China.
- 5) To check the median of mental health disorder in India, China and Pakistan.

CHAPTER 2

DATA AND ITS PRESENTATION

In this chapter we focus on collection of data required for analysis also we furnish the information regarding the sources where we can get the data. We have collected the data of mental health disorders in Asian countries.

In section 3.1 we have explain about the sources of data and in 2.2 we explain about the figures and graphs which we used to present the data. In section 2.3 we represent the data. In table 2.1, 2.2, 2.3, 2.4, 2.5 show the data of various mental health disorders in Eastern Asian countries, Southern Asian countries, South Eastern Asian countries, western Asian countries and Central Asian countries respectively. In table 2.6 we show the data of various mental health disorders in India. In 2.7 we show the data of various mental health disorders in Asia and in 2.8 we show the data of various types of mental health disorders of India and its neighbor countries.

2.1 Sources of data

The data of mental health disorders were collected from the secondary source viz. (<https://ourworldindata.org/mental-health>). The mental health disorders of world were taken a period from 1990 to 2019. For our study we have taken the mental health disorders of Asian countries from 2007 to 2019.

2.2 Figures and graphs

There are many types of graphs/charts/plots in that we have choose few graphs namely Pie chart, stacked bar diagram, multiple bar diagram and line graph

Pie chart to make a pie chart, we need a list of categorical variables and numerical variables. In case of pie-diagram a circle is subdivided into sectors to represent its components. Where, the area of the sector will be proportional to the magnitude of the components. This will be done by computing the angles of each sector by using the formula:

$$\text{Angle of an individual component} = \frac{\text{individual value}}{\text{total value}} * 360^\circ$$

Uses are

- When we want to create and represent the composition of something.
- It is very useful for displaying nominal or ordinal categories of data.
- To show percentage or proportional data.
- When comparing areas of growth within a business such as profit.
- Pie charts work best for displaying data for 3 to 7 categories.

100%Stacked bar graph there two types of stacked bar diagram they are

Simple stacked and 100%stacked bar graph. In that we have chosen 100% Stack bar Graph. 100% Stack bar graph display the comparison of the percentage each part of the category brings to the whole category, taking the whole category as 100%. So, each of the stack components shows its relative contribution (in percents) to the entire bar and the entity as a whole.

Uses are:-

- These are the good way to represent totals.
- These show how the percentage that each value contributes changes over time
- Compares a percentage that each value contributes to a total

Multiple bar charts are used to represent various sets of interlinked data. Here, a set of adjacent bars (one for each component) is drawn for comparison. Bars are differentiated with shades or colors and an index is provided for easy reference of bars.

Uses are:

- When we want to display data that are grouped into nominal or ordinal categories.
- To compare data among different categories.
- Multiple Bar charts can also show large data changes over time.
- Multiple Bar charts are ideal for visualizing the distribution of data when we have more than three categories.

Line graph graphically displays data that changes continuously over time. Each line graph consists of points that connect data to show a trend (continuous change). Line graphs have an x-axis and a y-axis. In the most cases, time is distributed on the horizontal axis.

Uses are:

- When we want to show trends. For example, how house prices have increased over time.
- When we want to make predictions based on a data history over time.
- When comparing two or more different variables, situations, and information over a given period of time.

Scatter plot is an X-Y diagram that shows a relationship between two variables. It is used to plot data points on a vertical and a horizontal axis. The purpose is to show how much one variable affects another.

Usually, when there is a relationship between 2 variables, the first one is called independent. The second variable is called dependent because its values depend on the first variable.

Scatter plots also help you predict the behavior of one variable (dependent) based on the measure of the other variable (independent).

Uses are:

- When trying to find out whether there is a relationship between 2 variables.
- To predict the behavior of dependent variable based on the measure of the independent variable.
- When having paired numerical data.
- When working with root cause analysis tools to identify the potential for problems.
- When you just want to visualize the correlation between 2 large datasets without regard to time.

2.3Data presentation

We have shown the total no of subjects suffering from various mental health disorders during 2007- 2019 in the pie-chart. Year wise mental health disorder are shown in percentage bar diagrams. These diagrams are drawn separately for the data on different zones of Asia viz. Eastern, Southern, Northern, Western, South eastern and Central Asia. A multiple bar diagram is given to present four types of disorders during 2007-2019 in Asia. The line graphs are used to present the data of mental health disorders in India and its neighbor countries.

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Table 2.1 Mental health disorder in Eastern Asia from 2007-2019.

YEAR	AD	DUD	DD	AUD	TOTAL
2007	34943081	5664928	53022471	20115046	113745526
2008	36419845	5750855	51150939	19436212	112757851
2009	37790132	5954371	49555979	18724884	112025366
2010	38802586	6035920	49117863	18346872	112303241
2011	39562263	6114746	49762355	18177128	113616492
2012	40314635	6193428	50267937	18092804	114868804
2013	41060934	6267428	50880770	17989685	116198817
2014	41675980	6340094	51615529	18014968	117646571
2015	42286741	6412876	52212757	18064507	118976881
2016	42897016	6883631	52665678	18286415	120732740
2017	43365663	7361050	53243739	18517777	122488229
2018	43557471	7440019	53540271	18485510	123023271
2019	43196841	7519049	53686162	18050071	122452123
TOTAL	525873188	83938395	670722450	240301879	1520835912

Statistical Analysis on Mental Health in Asia

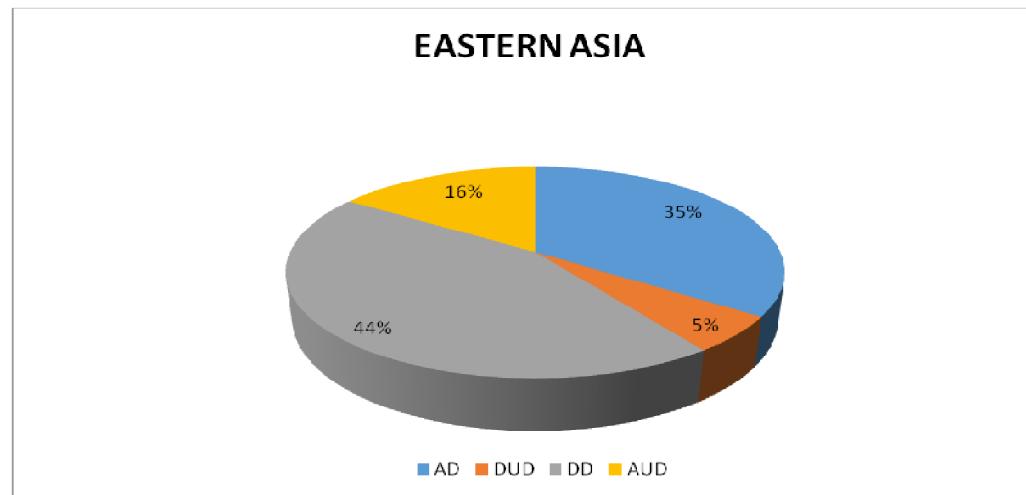


Fig 2.1.1

Fig 2.1.1 percentage of mental health disorders in Eastern Asia.

In the above Pie-chart, we can see that DD is highest in the Eastern Asian country that is 44% and the lowest is DUD that is 5%.

Statistical Analysis on Mental Health in Asia

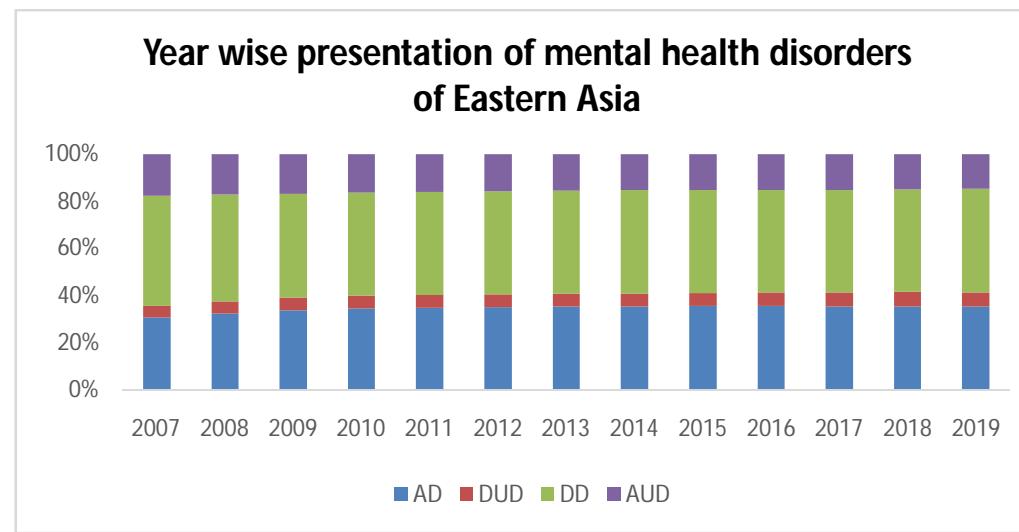


Fig 2.1.2

Fig 2.1.2 percentage of mental health disorders in Eastern Asia from 2007-2019.

In the above 100% stacked diagram, we can see that AD, DUD, DD are significantly increasing whereas AUD has a variation, that is it has gradually decreased in 2009 and there on it has significantly increased until 2019.

Statistical Analysis on Mental Health in Asia

Table 2.2 Mental health disorders in Southern Asia from 2007-2019.

YEAR	AD	DUD	DD	AUD	TOTAL
2007	52543374	7676257	71324519	23168433	154712583
2008	54319855	7808958	69753430	22559071	154441314
2009	56026177	8077399	68478311	21940758	154522645
2010	57347234	8209075	68338374	21650019	155544702
2011	58441884	8309297	69317253	21545230	157613664
2012	59551713	8400613	70142714	21543684	159638724
2013	60659060	8467772	71109395	21538432	161774659
2014	61677260	8519726	72178713	21622736	163998435
2015	62647106	8636634	73114820	21743607	166142167
2016	63508331	9155140	73903902	22071173	168638546
2017	64210284	9702597	74816725	22380539	171110145
2018	64785267	9770360	75550099	22450369	172556095
2019	64842002	9788619	76184204	22082413	172897238
TOTAL	780559547	112522447	934212459	286296464	2113590917

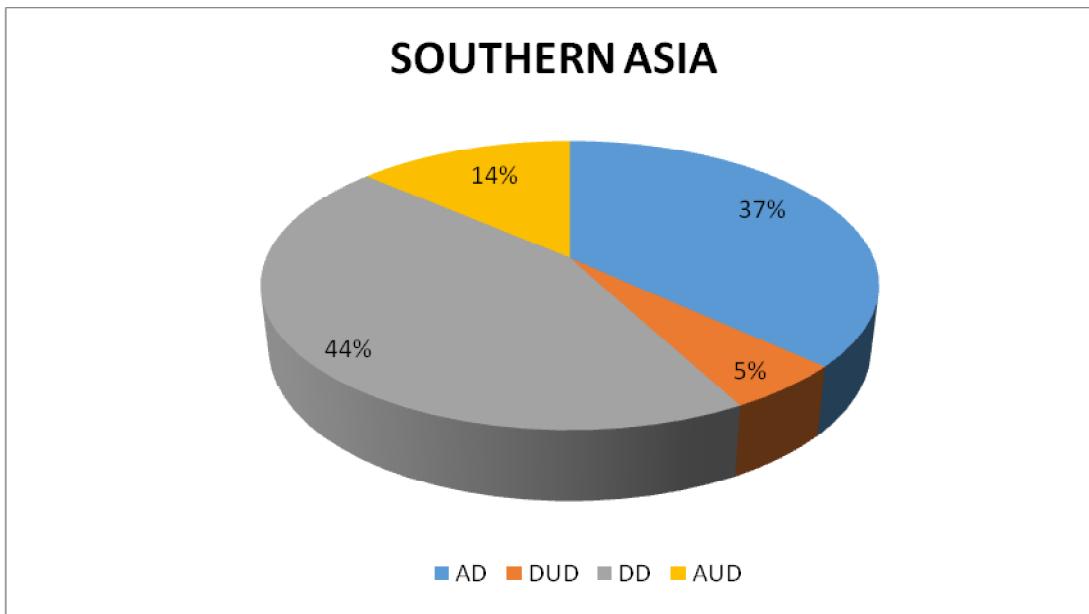


Fig 2.2.1

Fig 2.2.1 percentage of mental health disorders in Southern Asia.

In the above Pie-chart, we can see that DD is highest in the Southern Asian country that is 44% and the lowest is DUD that is 5%.

Statistical Analysis on Mental Health in Asia

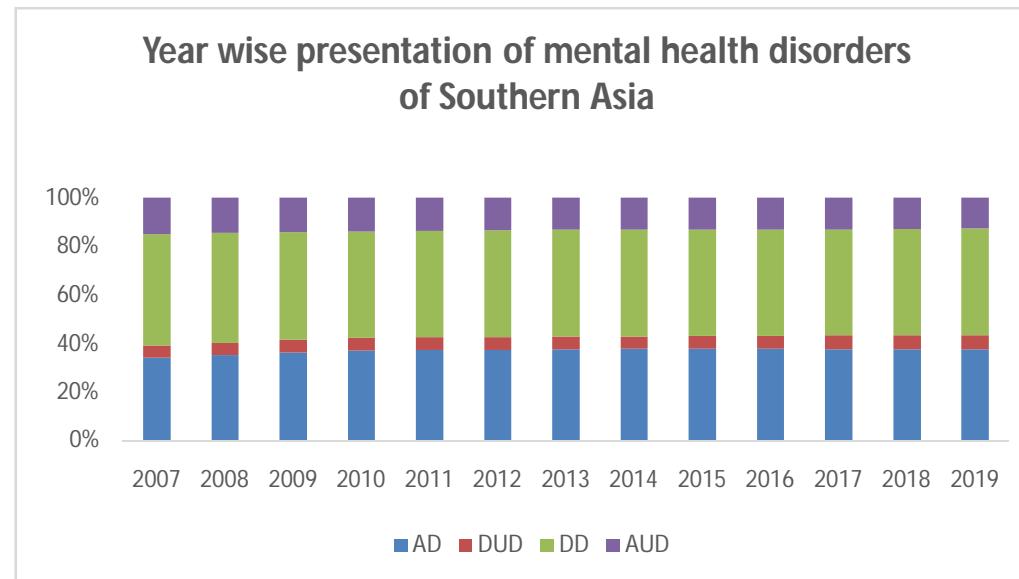


Fig 2.2.2

Fig 2.2.2percentage of mental health disorders in Southern Asia from 2007-2019.

In the above 100%stacked diagram, we can see that AD, DUD, DD are significantly increasing whereas AUD has a variation, that is it has gradually decreased in 2009 and there on it has significantly increased until 2019.

Table 2.3 Mental health disorders in South eastern Asia from 2007-2019.

YEAR	AD	DUD	DD	AUD	TOTAL
2007	18858525	2918025	14225218	3920884	39922652
2008	19158758	2934725	14353086	4027612	40474181
2009	19460124	2957651	14490521	4102373	41010669
2010	19776511	2994214	14631880	4186174	41588779
2011	20098324	3033167	14851456	4245800	42228747
2012	20477541	3072535	15060280	4304932	42915288

Statistical Analysis on Mental Health in Asia

2013	20904352	3100344	15290708	4323818	43619222
2014	21296863	3136845	15535999	4384643	44354350
2015	21637330	3182582	15767895	4437077	45024884
2016	21930243	3277952	15936550	4503935	45648680
2017	22231710	3377162	16111901	4560618	46281391
2018	22529991	3411695	16328618	4645882	46916186
2019	22852317	3446000	16635834	4763450	47697601
TOTAL	271212589	40842897	199219946	56407198	567682630

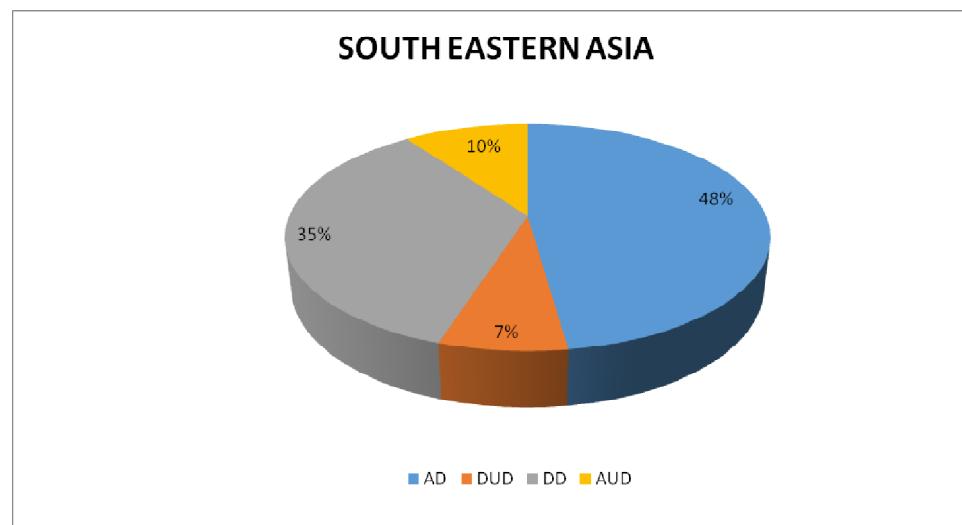


Fig 2.3.1

Fig 2.3.1 percentage of mental health disorders in South eastern Asia.

In the above Pie-chart, we can see that AD is highest in the South Eastern Asia country that is 48% and the lowest is DUD that is 7%.

Statistical Analysis on Mental Health in Asia

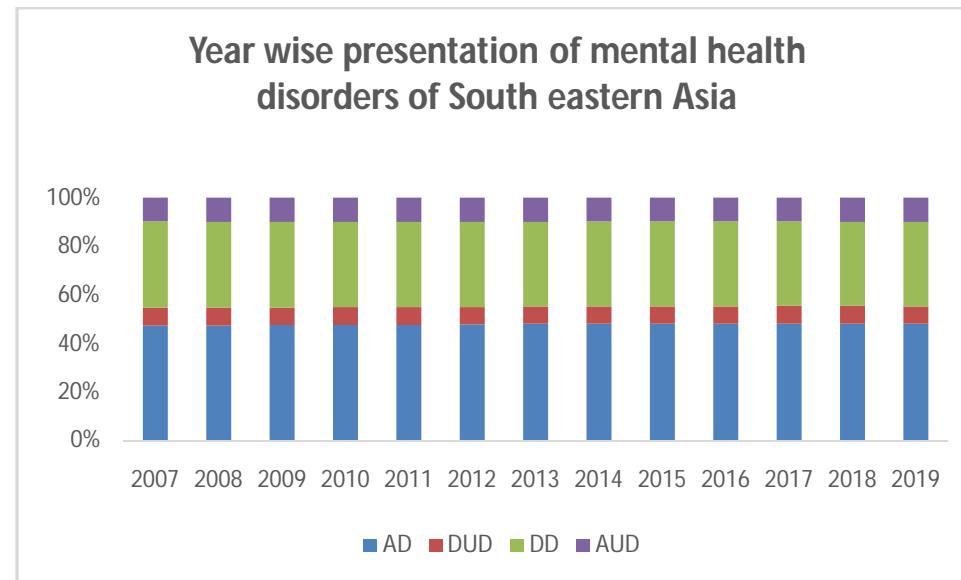


Fig 2.3.2

Fig 2.3.2 percentage of mental health disorders in South eastern Asia from 2007-2019.

In the above 100%stacked diagram, we can see that AD, DUD, DD, AUD are significantly increasing.

Table 2.4 Mental health disorders in Western Asia from 2007-2019.

YEARS	AD	DUD	DD	AUD	TOTAL
2007	10266506	828872	9288252	1372849	21756479
2008	10568491	868270	9496282	1404784	22337827
2009	10861735	911539	9695241	1430128	22898643
2010	11152372	935594	9904903	1461348	23454217
2011	11445326	977502	10143737	1486312	24052877
2012	11756481	1004361	10395186	1499175	24655203

Statistical Analysis on Mental Health in Asia

2013	12075409	1032861	10658490	1506848	25273608
2014	12091796	1009091	10596985	1456080	25153952
2015	12651537	1087790	11138577	1540461	26418365
2016	12849344	1135630	11271509	1566513	26822996
2017	13036208	1169992	11408950	1596093	27211243
2018	13259495	1187744	11605301	1642846	27695386
2019	13508556	1195327	11835187	1690025	28229095
TOTAL	155523256	13344573	137438600	19653462	325959891

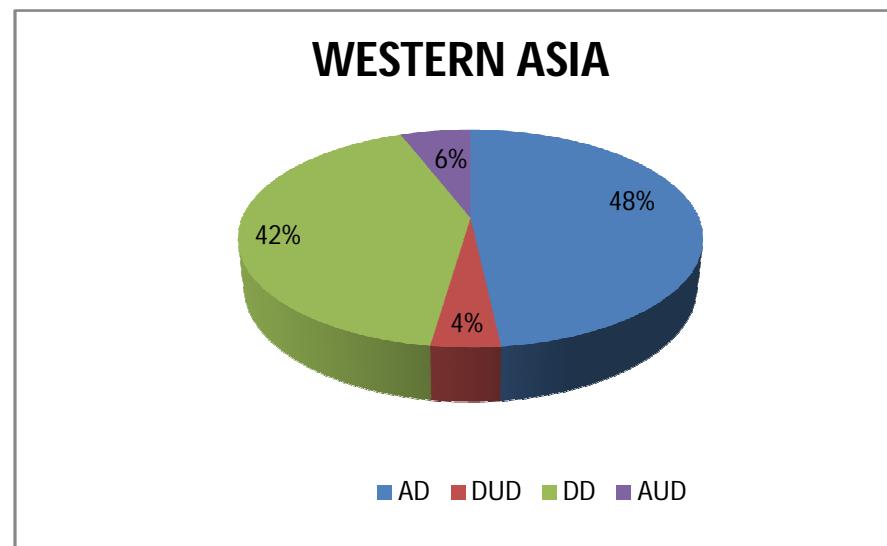


Fig 2.4.1

Fig 2.4.1 percentage of mental health disorders in Western Asia.

In the above Pie-chart, we can see that AD is highest in the Western Asia country that is 48% and the lowest is DUD that is 4%.

Statistical Analysis on Mental Health in Asia

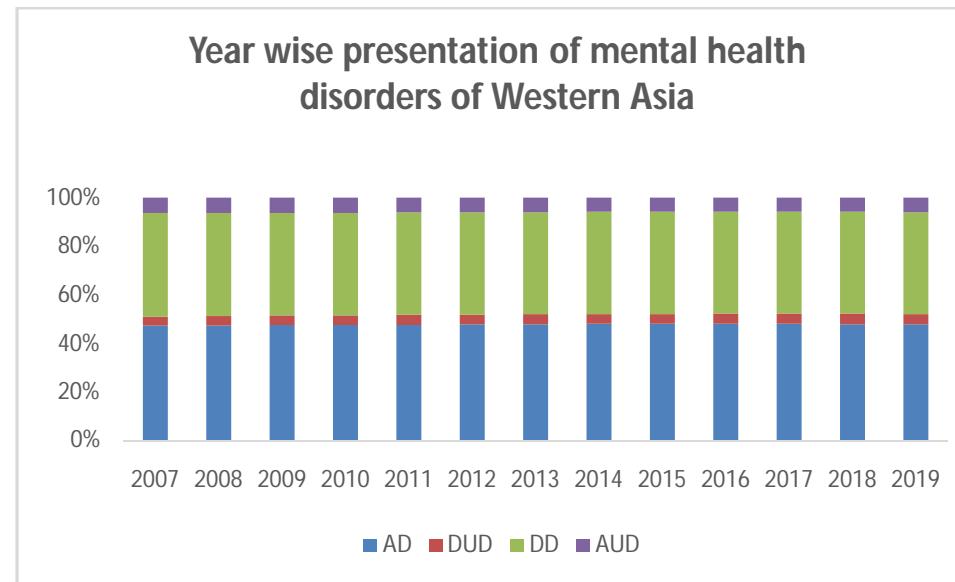


Fig 2.4.2

Fig 2.4.2 percentage of mental health disorders in Western Asia from 2007- 2019.

In the above 100%stacked diagram, we can see that AD, DUD, AUD are significantly increasing whereas DD has a variation, that is it has decreased in 2014 and there on it has significantly increased until 2019.

Table 2.5 Mental health disorders in Central Asia from 2007- 2019.

YEAR	AD	DUD	DD	AUD	TOTAL
2007	1222562	313153	1865428	1620915	5022058
2008	1240842	320167	1881653	1629409	5072071
2009	1258926	324780	1901398	1639237	5124341
2010	1280756	329764	1926417	1646239	5183176
2011	1302751	333987	1958228	1636925	5231891

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2012	1326645	340907	1997081	1606729	5271362
2013	1351437	345099	2034362	1571122	5302020
2014	1377338	349344	2075484	1542807	5344973
2015	1402983	354107	2114523	1540679	5412292
2016	1431085	360903	2149995	1578764	5520747
2017	1455581	366823	2186897	1627708	5637009
2018	1479873	372666	2220239	1685940	5758718
2019	1509783	378976	2252378	1758774	5899911
TOTAL	17640562	4490676	26564083	21085248	69780569

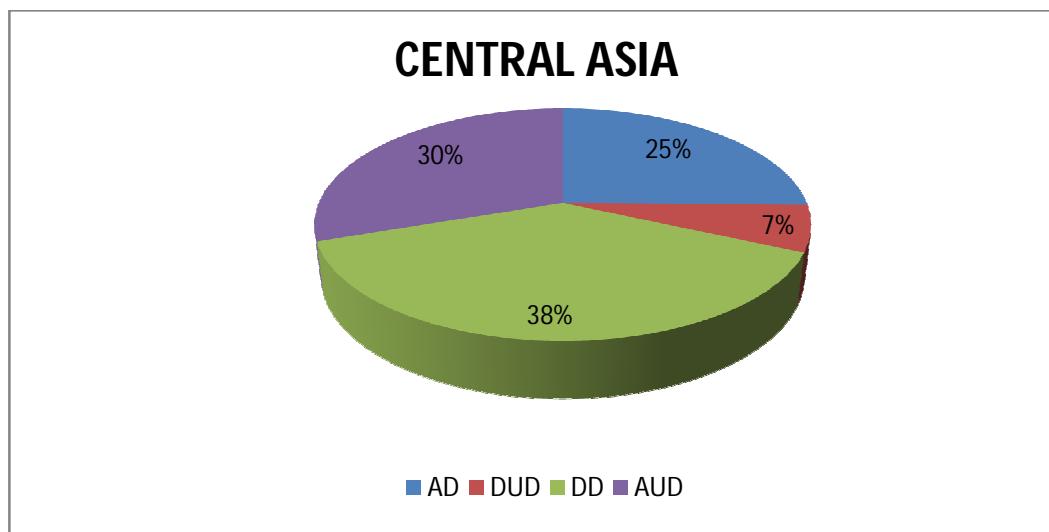


Fig 2.5.1

Fig 2.5.1 percentage of mental health disorders in Central Asia.

In the above Pie-chart, we can see that DD is highest in the Central Asia that is 38% and the lowest is DUD that is 7%.

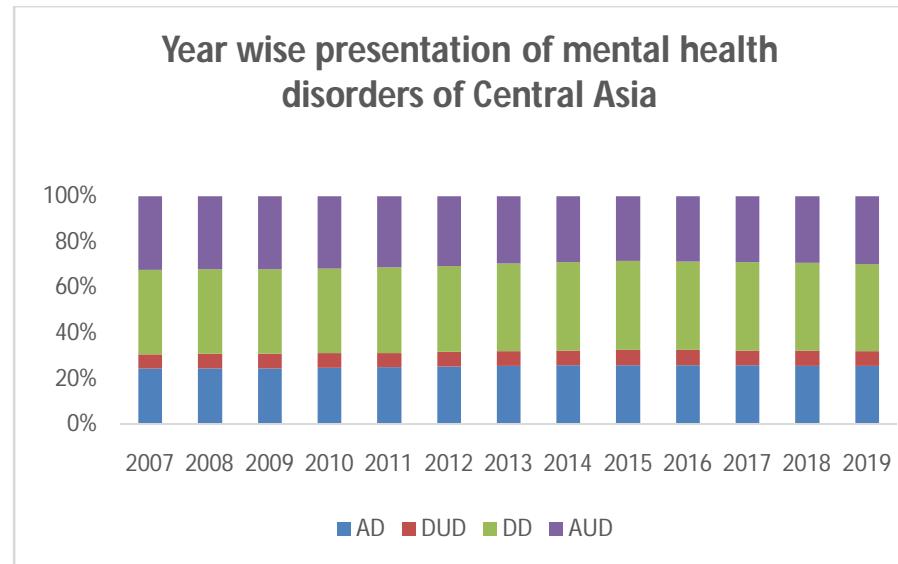


Fig 2.5.2

Fig 2.5.2percentage of mental health disordersin Central Asia from 2007- 2019.

In the above 100% stacked diagram, we can see that AD, DUD, DD, AUD are significantly increasing

Table 2.6 Mental health disorders in India from 2007- 2019.

YEAR	AD	DUD	DD	AUD	TOTAL
2007	33603149	5324443	50996328	18339747	108263667
2008	35059557	5403014	49107393	17649846	107219810
2009	36410014	5601541	47491322	16926394	106429271
2010	37398719	5677693	47026112	16539368	106641892

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2011	38133782	5751325	47635970	16378772	107899849
2012	38859453	5822589	48099649	16328565	109110256
2013	39578021	5891874	48672001	16266695	110408591
2014	40163624	5959764	49362389	16324570	111810347
2015	40745739	6026701	49916806	16376905	113066151
2016	41324938	6490135	50331656	16556466	114703195
2017	41766716	6961119	50869718	16733460	116331013
2018	41931911	7033740	51129878	16637500	116733029
2019	41539100	7105372	51240666	16123730	116008868
TOTAL	506514723	79049310	641879888	217182018	1444625939

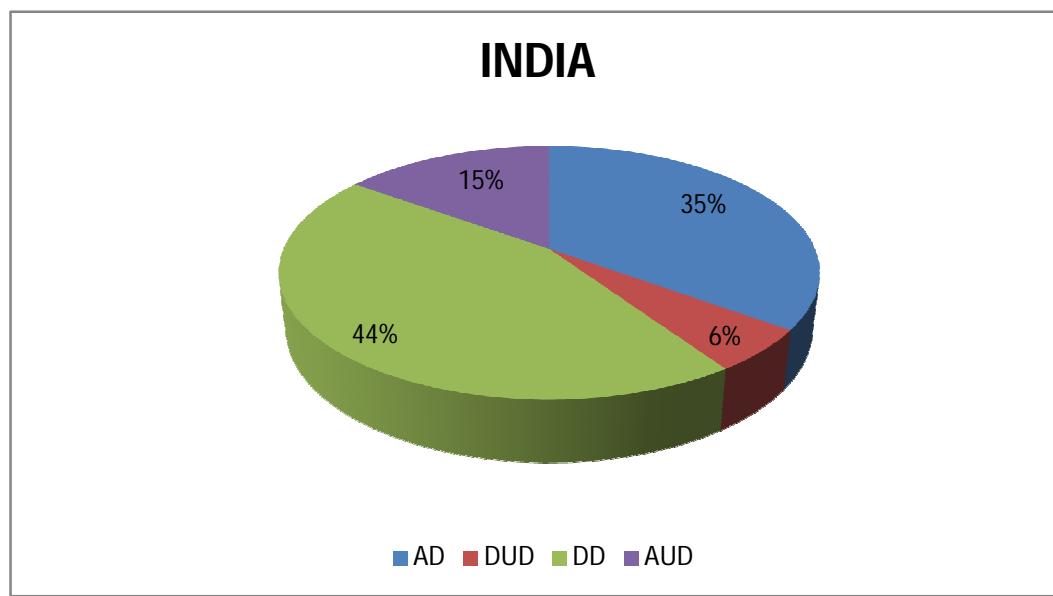


Fig 2.6.1

Statistical Analysis on Mental Health in Asia

Fig 2.6.1 percentage of mental health disorders in India.

In the above Pie-chart, we can see that DD is highest in India that is 44% and the lowest is DUD that is 6%.

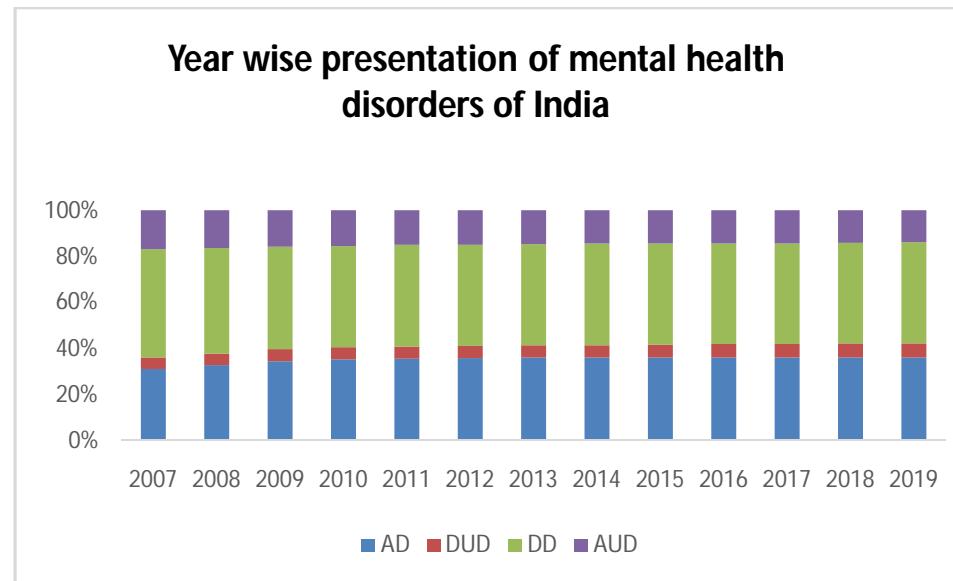


Fig 2.6.2

Fig 2.6.2 percentage of mental health disorders in India from 2007- 2019.

In the above 100%stacked diagram, we can see that AD, DUD, DD are significantly increasing whereas AUD has a variation, that is it has gradually decreased in 2009 and there on it has significantly increased until 2019.

Table 2.7 Mental health disorders in Asia.

	AD	DUD	DD	AUD	TOTAL
EA	525873188	83938395	670722450	240301879	1520835912
SA	780559547	112522447	934212459	286296464	2113590917
SEA	271212589	40842897	199219946	56407198	567682630

Statistical Analysis on Mental Health in Asia

WA	155523256	13344573	137438600	19653462	325959891
CA	17640562	4490676	26564083	21085248	69780569
TOTAL	1750809142	255138988	1968157538	623744251	4597849919

EA=Eastern Asian countries

SA=Southern Asian countries

SEA=South Eastern Asian countries

WA=Western Asian countries

CA=Central Asian countries.

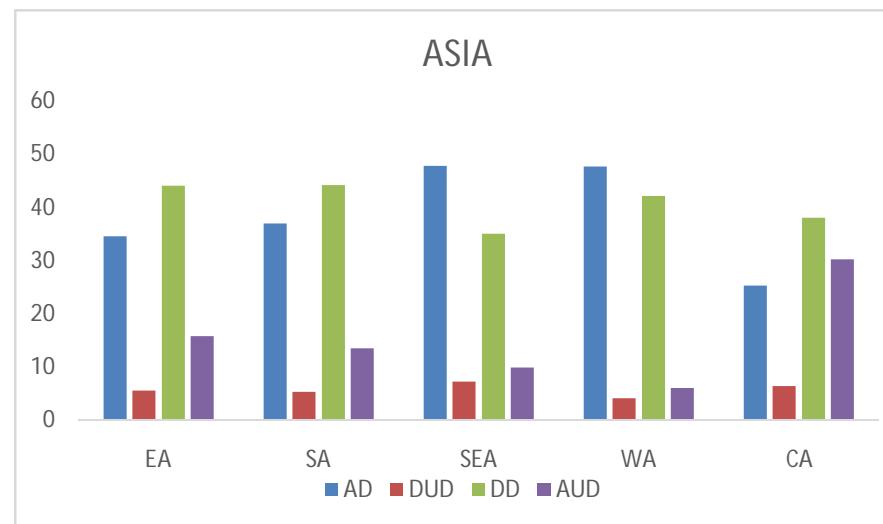


Fig 2.7.1

Fig 2.7.1 percentage of mental health disorders in Asia.

From the above graph we can conclude DD is highest in EA and least in SEA, AD is highest in SEA and least in CA, DUD is highest in SEA and least in WA and AUD is highest in CA and least in WA.

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Table 2.8 Mental health disorder in India and its neighbor countries.

	COUNTRIES	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
	INDIA	2.84	2.92	2.99	3.03	3.05	3.07	3.09	3.1	3.11	3.12	3.12	3.1	3.04
	AFG	4.81	4.82	4.84	4.85	4.86	4.89	4.92	4.95	4.97	4.99	4.99	5.01	5.03
	BANG	3.33	3.28	3.24	3.22	3.22	3.23	3.23	3.24	3.24	3.25	3.25	3.26	3.27
	BHUTAN	3.28	3.28	3.29	3.29	3.3	3.31	3.33	3.34	3.35	3.35	3.35	3.36	3.38
AD	CHINA	3.5	3.5	3.5	3.49	3.46	3.42	3.37	3.33	3.32	3.38	3.44	3.43	3.39
	MYNMR	3.93	3.95	3.96	3.97	3.98	4	4.01	4.02	4.03	4.04	4.06	4.08	4.09
	NEPAL	3.1	3.12	3.15	3.17	3.2	3.23	3.27	3.31	3.33	3.35	3.36	3.37	3.39
	PAK	3.49	3.5	3.52	3.53	3.54	3.55	3.56	3.58	3.59	3.59	3.59	3.6	3.61
	SRILNK	4.06	4.07	4.09	4.1	4.11	4.13	4.15	4.17	4.18	4.2	4.22	4.23	4.25
	MLDVS	3.79	3.79	3.79	3.78	3.78	3.78	3.78	3.78	3.77	3.76	3.76	3.75	3.74
		2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
	INDIA	0.45	0.45	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.49	0.52	0.52	0.52
	AFG	0.51	0.52	0.54	0.54	0.55	0.55	0.56	0.56	0.56	0.58	0.59	0.57	0.52
	BANG	0.33	0.34	0.34	0.35	0.35	0.36	0.36	0.36	0.37	0.37	0.37	0.37	0.37
	BHUTAN	0.35	0.36	0.36	0.36	0.37	0.37	0.37	0.37	0.37	0.38	0.38	0.38	0.38
	CHINA	0.68	0.65	0.62	0.6	0.6	0.6	0.6	0.6	0.61	0.64	0.68	0.68	0.69
DUD	MYNMR	0.53	0.53	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52
	NEPAL	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.39	0.39	0.39	0.39
	PAK	0.58	0.58	0.59	0.59	0.58	0.56	0.54	0.51	0.51	0.51	0.52	0.5	0.46
	SRILNK	0.62	0.61	0.61	0.61	0.61	0.61	0.6	0.6	0.6	0.61	0.61	0.61	0.61
	MLDVS	0.53	0.53	0.54	0.54	0.54	0.55	0.55	0.55	0.55	0.56	0.56	0.56	0.56
		2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
	INDIA	4.31	4.09	3.9	3.81	3.81	3.8	3.8	3.81	3.81	3.8	3.8	3.78	3.75
	AFG	5.1	5.1	5.1	5.1	5.1	5.1	5.11	5.11	5.11	5.11	5.11	5.12	5.13
	BANG	4.68	4.67	4.68	4.68	4.69	4.7	4.71	4.72	4.72	4.73	4.73	4.74	4.75

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	BHUTAN	4.09	4.07	4.06	4.05	4.05	4.07	4.08	4.09	4.1	4.09	4.09	4.11	4.16
DD	CHINA	3	2.96	2.93	2.91	2.91	2.92	2.93	2.94	2.94	2.94	2.93	2.93	2.92
	MYNMR	2.17	2.16	2.16	2.16	2.16	2.18	2.2	2.22	2.23	2.23	2.22	2.24	2.26
	NEPAL	5.26	5.3	5.34	5.36	5.33	5.24	5.13	5.04	5	5	5.01	5.03	5.06
	PAK	4.04	4.01	3.98	3.96	3.96	3.96	3.97	3.97	3.98	3.97	3.97	4.02	4.1
	SRILNK	3.01	2.98	2.96	2.96	2.96	2.97	2.98	2.99	3	3	3.01	3.01	3.02
	MLDVS	3.28	3.24	3.21	3.18	3.16	3.14	3.12	3.1	3.08	3.07	3.06	3.05	3.05
		2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
	INDIA	1.55	1.47	1.39	1.34	1.31	1.29	1.27	1.26	1.25	1.25	1.25	1.23	1.18
	AFG	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.43	0.43	0.43	0.44	0.44	0.44
	BANG	1.14	1.14	1.15	1.15	1.14	1.12	1.11	1.09	1.08	1.09	1.1	1.13	1.16
	BHUTAN	2.6	2.61	2.61	2.62	2.62	2.61	2.61	2.6	2.59	2.62	2.65	2.57	2.39
AUD	CHINA	1.14	1.15	1.17	1.17	1.18	1.18	1.18	1.19	1.2	1.21	1.23	1.26	1.28
	MYNMR	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.78	0.79	0.79	0.79	0.8
	NEPAL	1.21	1.21	1.22	1.22	1.21	1.21	1.21	1.2	1.2	1.21	1.21	1.22	1.23
	PAK	1.36	1.37	1.38	1.39	1.39	1.39	1.39	1.38	1.38	1.4	1.41	1.42	1.42
	SRILNK	1	0.98	0.96	0.94	0.93	0.91	0.89	0.88	0.87	0.87	0.87	0.87	0.87
	MLDVS	0.61	0.62	0.63	0.64	0.64	0.64	0.65	0.65	0.65	0.65	0.66	0.68	0.71

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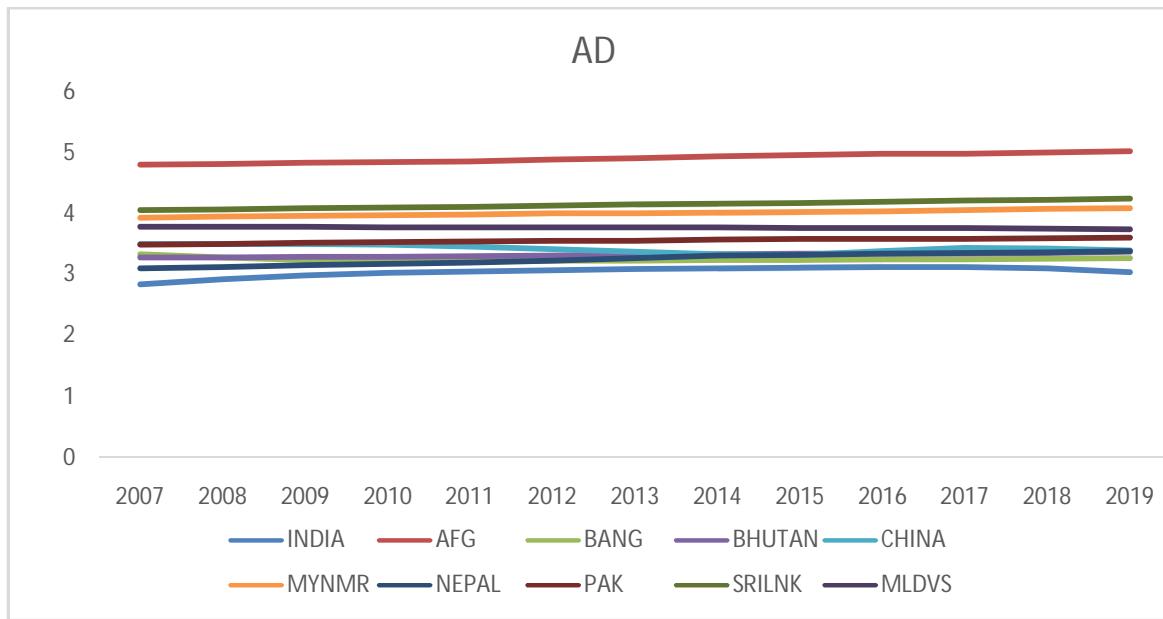


Fig 2.8.1

Fig 2.8.1 AD in India and its neighbor countries from 2007-2019.

From the above Fig 2.8.1 we have observe that Afghanistan has highest AD and India has least AD as compaired to other countries and we can observe slight variation in all countries from 2008-2019.

Statistical Analysis on Mental Health in Asia

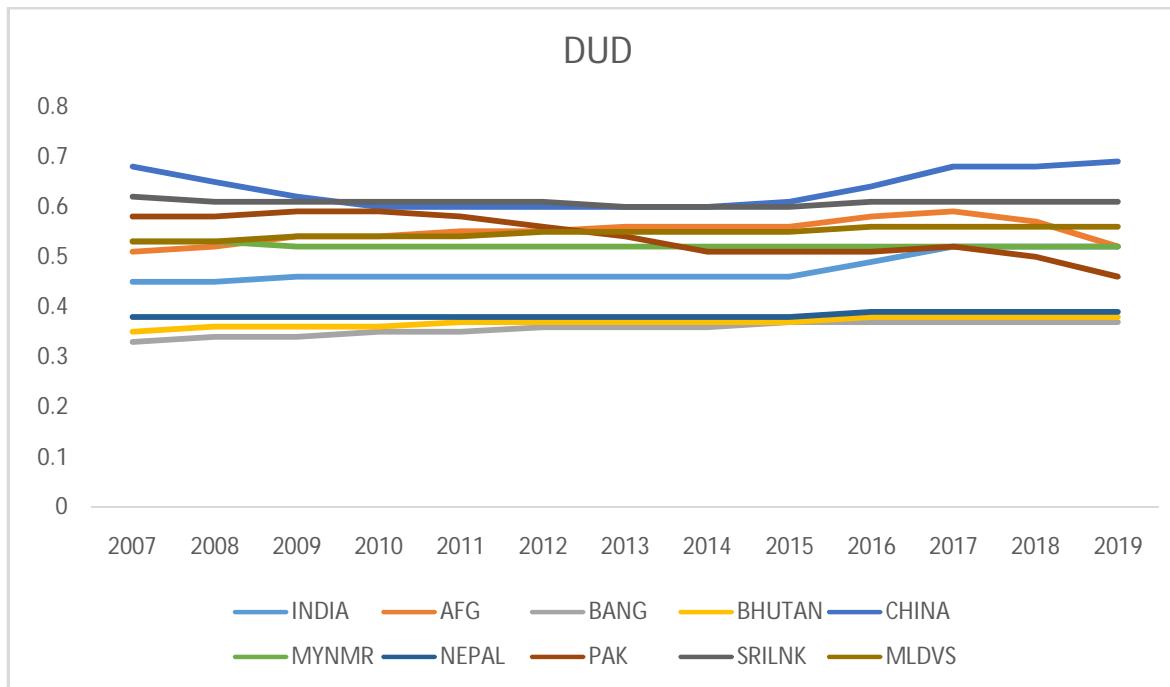


Fig 2.8.2

Fig 2.8.2 DUD in India and its neighbour countries from 2007-2019.

From the above Fig 2.8.2 we have observe that china has highest DUD and Bangladesh has least DUD as comparied to other countries and we can observe variations in all countries from 2008-2019.

Statistical Analysis on Mental Health in Asia

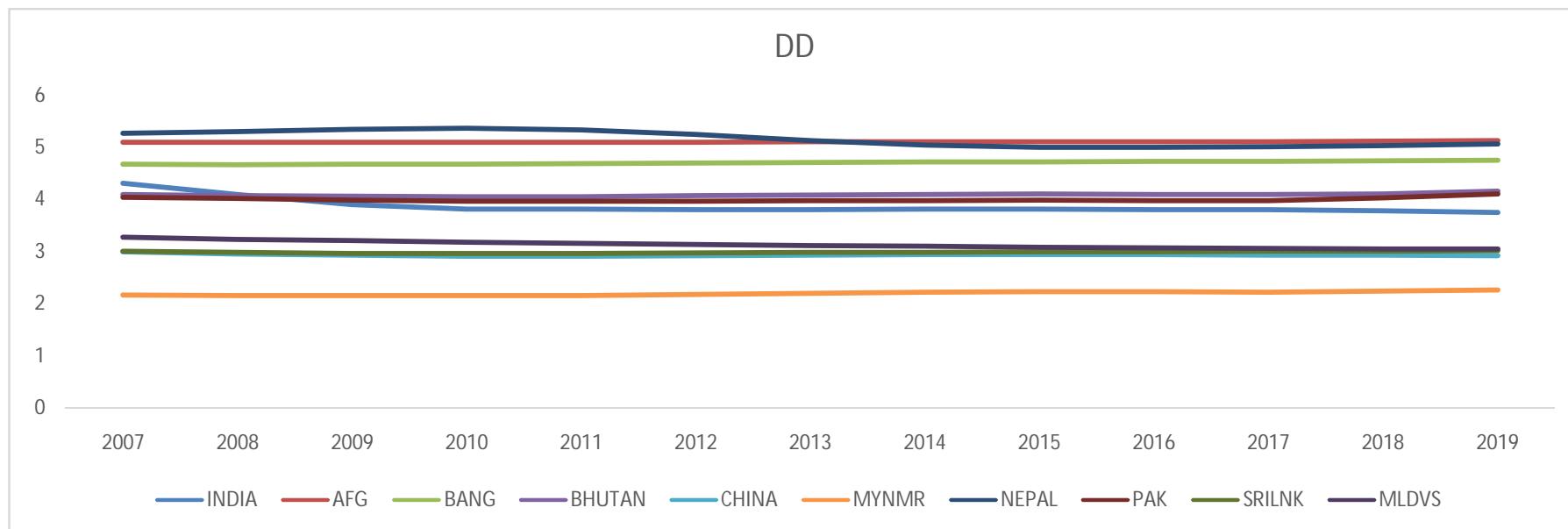


Fig 2.8.3

Fig 2.8.3 DD in India and its neighbour countries from 2007-2019.

From the above Fig 2.8.3 we have observe that Afghanistan has highest DD and Myanmar has least DD compare to other countries.

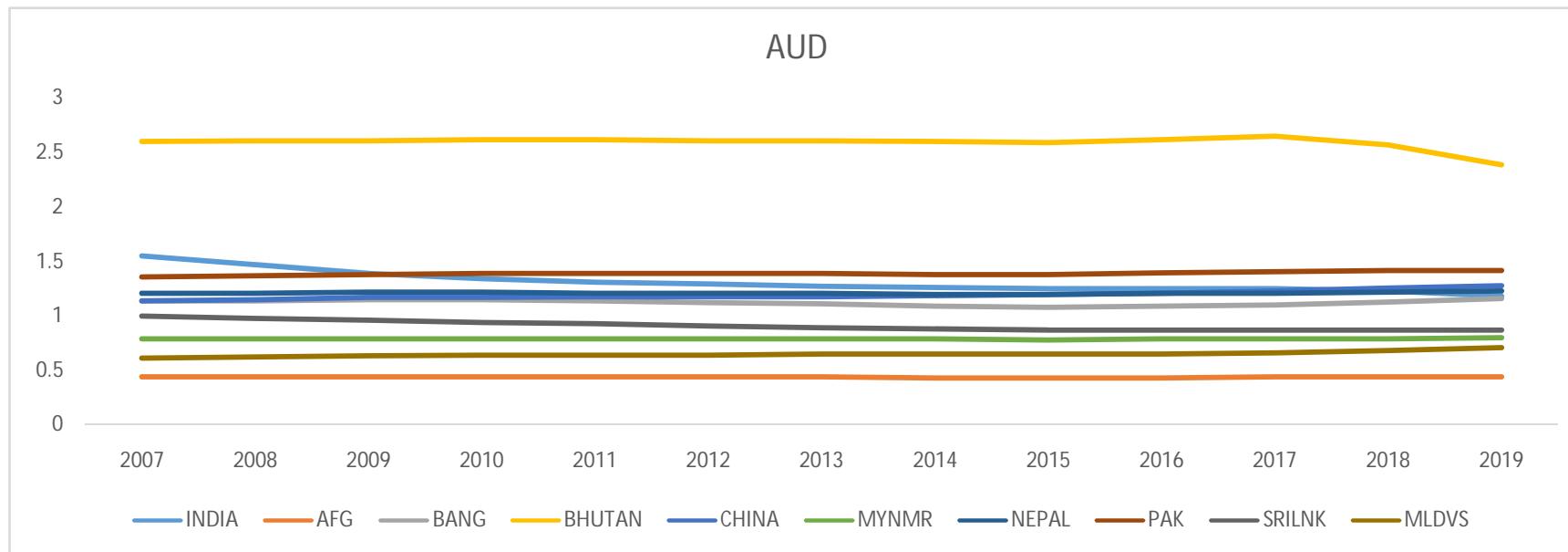


Fig 2.8.4

Fig 2.8.4 AUD in India and its neighbour countries from 2007-2019.

From the above Fig 2.8.4 we have observe that Bhutan has significantly highest and Afghanistan has least AUD than other countries.

2.4 Observations

From the pie charts we observe that DD is highest in Eastern, Southern, Central Asia and India, AD is highest in South eastern and Western Asia. DUD is least in all zones of Asia.

From the line graph we observe that AD and DD is highest in Afghanistan, DUD is highest in China, and AUD is highest in Bhutan. AD, DUD, DD, AUD are least in India, Bangladesh, Mayanmar and Afghanistan respectively.

CHAPTER 3

CORRELATION AND TIME SERIES ANALYSES

In this chapter, we discuss about the theoretical aspects of the statistical methods used in this project.

In section 3.1, we explain correlation which is used to test the relation between the mental health disorders. Section 3.2 we explain the statistical analysis using correlation. Section 3.3 we explain about the time series (ARIMA). Section 3.4 we explain the statistical analysis using ARIMA.

3.1 CORRELATION

'Correlation is a statistical device which helps in analyzing the covariation of two or more variables.' It is a study of interdependence between the variables.

Correlation analysis determines the degree of relationship between variables. It refers to the techniques used in measuring the closeness of relationship between the variables.

Correlation may be:

- i) Simple Correlation ii) Multiple Correlation iii) Partial Correlation.

Simple correlation concerns with related variation between two related variables. Multiple Correlation and Partial Correlation concern with the related variations among three or more variables. In Multiple Correlation three or more variables are studied simultaneously. In Partial Correlation, we recognize more than two variables but consider only two variables to be influencing each other and the effect of other influencing variables being kept constant. Two variables are said to be correlated when they tend to vary either in the same direction or in the opposite directions. If the variation in one variable is accompanied by a definite variation in the other variable then, the two variables are said to be correlated.

Types of correlations

- 1) Positive Correlation: If the variables vary in the same direction (if both the variables increase or decrease together) then, correlation is said to be Positive or Direct.
- 2] Negative Correlation: If the variables vary in the opposite directions (if one variable increases the other variable decreases} then, correlation is said to be Negative or Inverse.
- 3) Non correlation: If the two variables do not show the associated variation, they are said to be non -correlated.

4) Perfect Correlation: If the variables vary in the same proportion (the variables show exact linear relationship) then, the correlation is said to be perfect. Perfect correlation may be positive or negative. Correlation is perfect positive when the variations are in the same proportion and in the same direction.

Measurement of Correlation: The important methods of ascertaining whether two variables are correlated or not are,

- 1) Scatter diagram method
- 2) Karl Pearson's coefficient of correlation
- 3) Spearman's coefficient of rank correlation
- 4) Kendall's correlation coefficient

In our project we apply Spearman's coefficient of rank correlation

Spearman's rank correlation

The Spearman correlation coefficient is defined as the Pearson correlation coefficient between the rank variables. For a sample of size n , the n raw scores are converted to ranks, and is computed as

$$\rho = 1 - \frac{6\sum d_i^2}{n(n^2 - 1)}$$

Where,

$d_i = R(X_i) - R(Y_i)$ is the difference between the two ranks of each observation,

n is the number of observations.

The sign of the Spearman correlation indicates the direction of association between X (the independent variable) and Y (the dependent variable). If Y tends to increase when X increases, the Spearman correlation coefficient is positive. If Y tends to decrease when X increases, the Spearman correlation coefficient is negative. A Spearman correlation of zero indicates that there is no tendency for Y to either increase or decrease when X increases. The Spearman correlation increases in magnitude as X and Y become closer to being perfectly monotone functions of each other. When X and Y are perfectly monotonically related, the Spearman correlation coefficient becomes 1. A perfectly monotone increasing relationship implies that for any two pairs of data values X_i, Y_i and X_j, Y_j ,

that $X_i - X_j$ and $Y_i - Y_j$ always have the same sign. A perfectly monotone decreasing relationship implies that these differences always have opposite signs.

3.2 Statistical analysis of mental health disorders using correlation

Analyses of Correlation

We compute Spearman's rank correlation coefficient among various disorders and scatterplots are presented to show the relation between various mental health disorders.

Under consideration

$H_0: \rho = 0$

$H_1: \rho \neq 0$

a) AD~AUD

Spearman's rank correlation rho

data: AD and AUD

S = 46, p-value < 2.2e-16

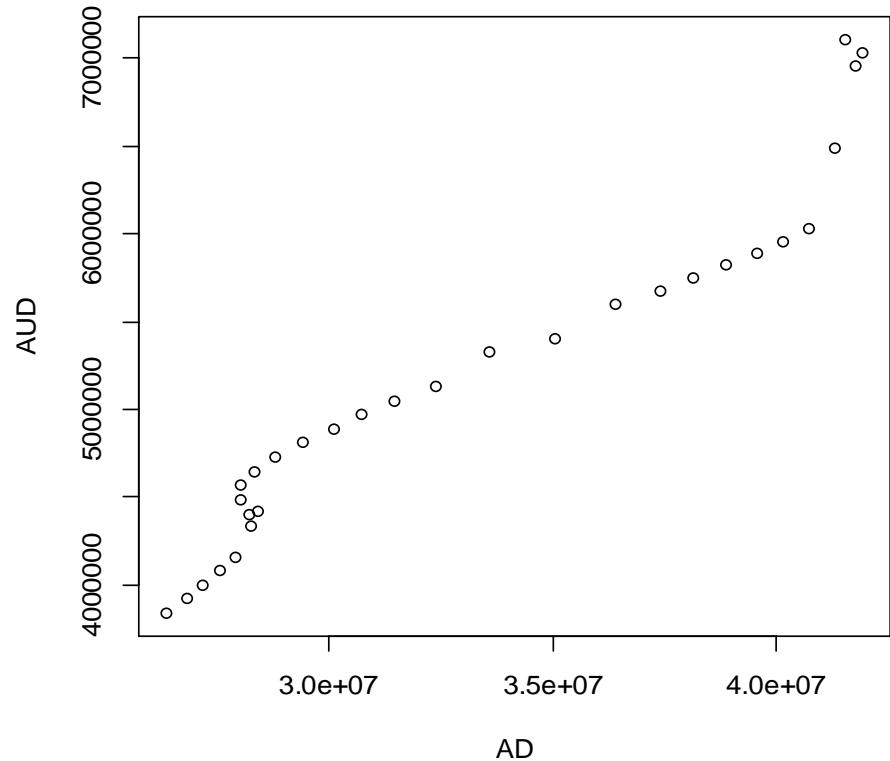
alternative hypothesis: true rho is not equal to 0

sample estimates:

rho

0.9897664

Statistical Analysis on Mental Health in Asia



Interpretation

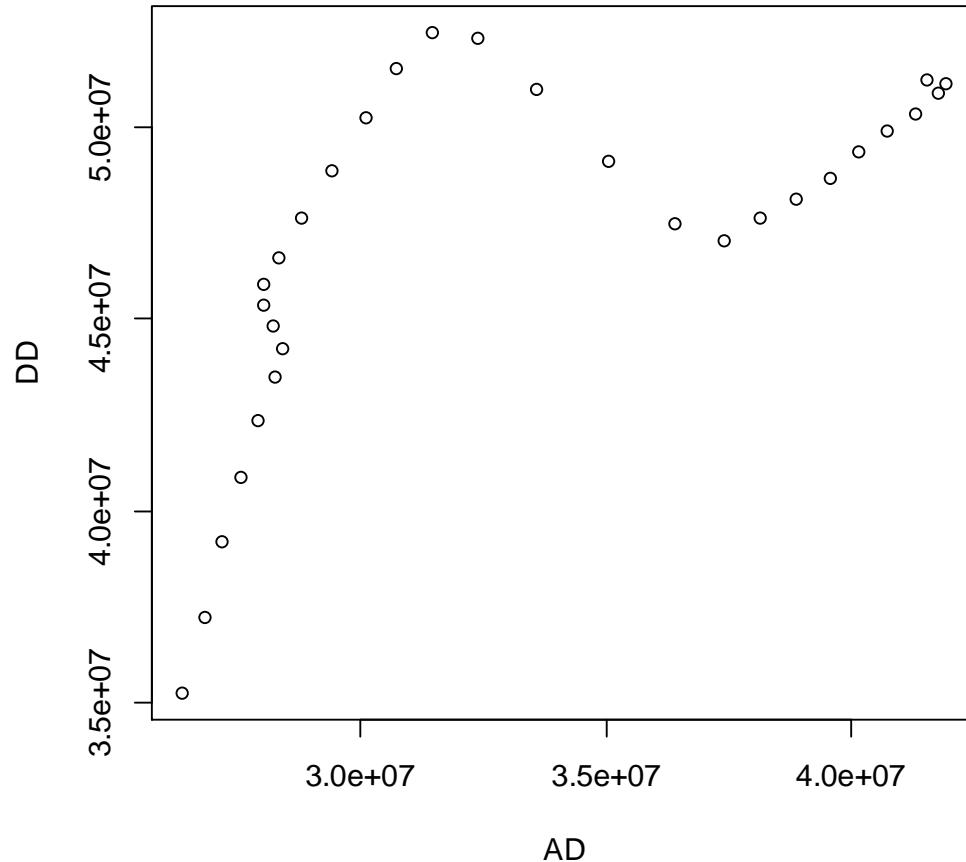
The correlation coefficient between AD and AUD is 0.9897664 and is significant at 5% level of significance. Hence, we conclude that AD and AUD are highly correlated that is as AD increases AUD also increases and vice versa.

b)AD~DD

Spearman's rank correlation rho

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```
data: AD and DD  
S = 1082, p-value = 3.129e-06  
alternative hypothesis: true rho is not equal to 0  
sample estimates:  
rho  
0.7592881
```



Interpretation

The correlation coefficient between AD and DD is 0.7592881 and is significant at 5% level of significance. Hence, we conclude that AD and DD are highly correlated that is as AD increases DD also increases and vice versa.

c)AD~DUD

Spearman's rank correlation rho

data: AD and DUD

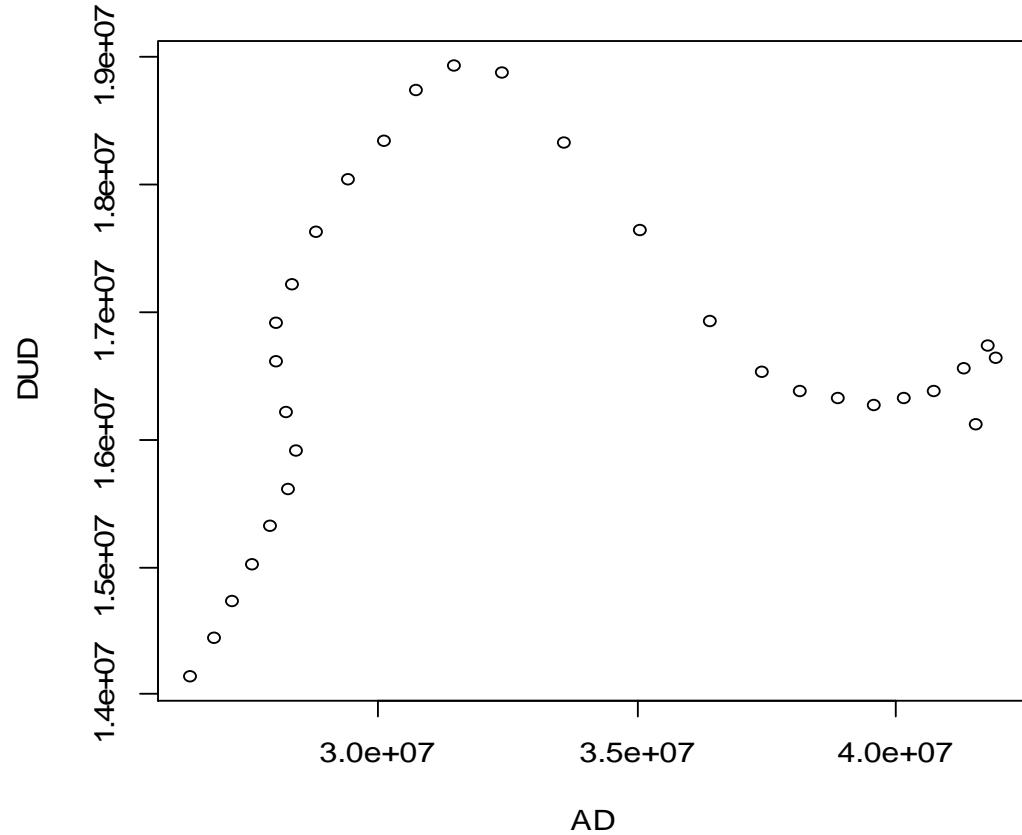
S = 3046, p-value = 0.08273

alternative hypothesis: true rho is not equal to 0

sample estimates:

rho

0.3223582



Interpretation

The correlation coefficient between AD and DUD is 0.3223582 and is significant at 10% level of significance. Hence, we conclude that AD-DUD is moderately correlated.

d) DD~DUD

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Spearman's rank correlation rho

data: DD and DUD

S = 1250, p-value = 1.224e-05

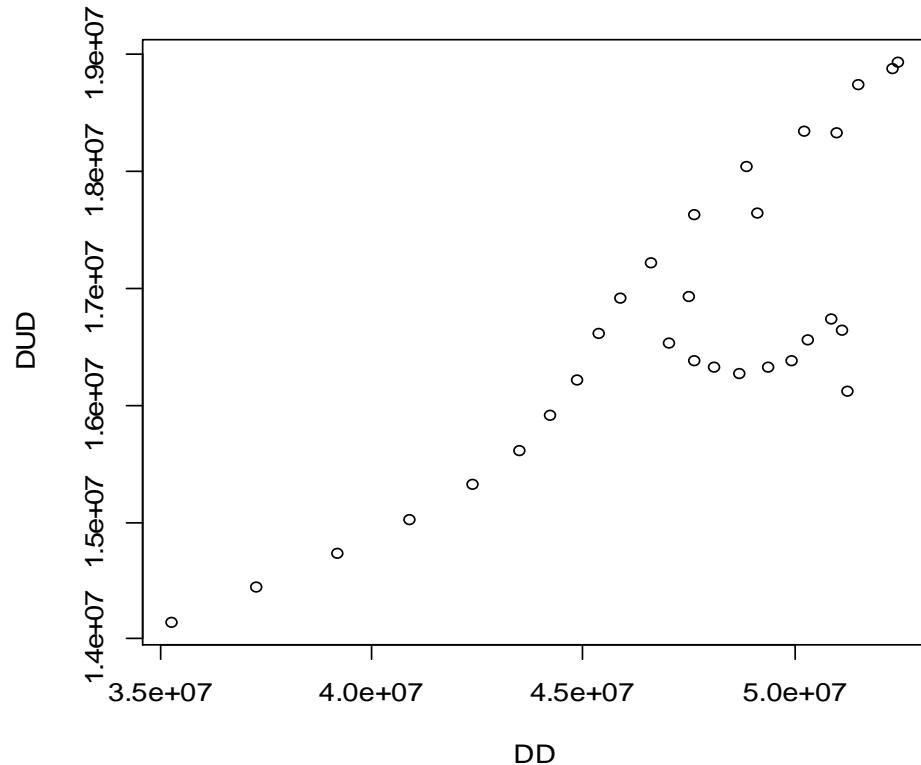
alternative hypothesis: true rho is not equal to 0

sample estimates:

rho

0.7219132

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$3.5e+07 = 35000000$ and all other are same to its respective value

Interpretation

The correlation coefficient between DUD and DD is 0.7219132 and is significant at 5% level of significance. Hence, we conclude that DUD-DD is moderately correlated.

e) DD~AUD

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Spearman's rank correlation rho

data: DD and AUD

S = 1030, p-value = 2.213e-06

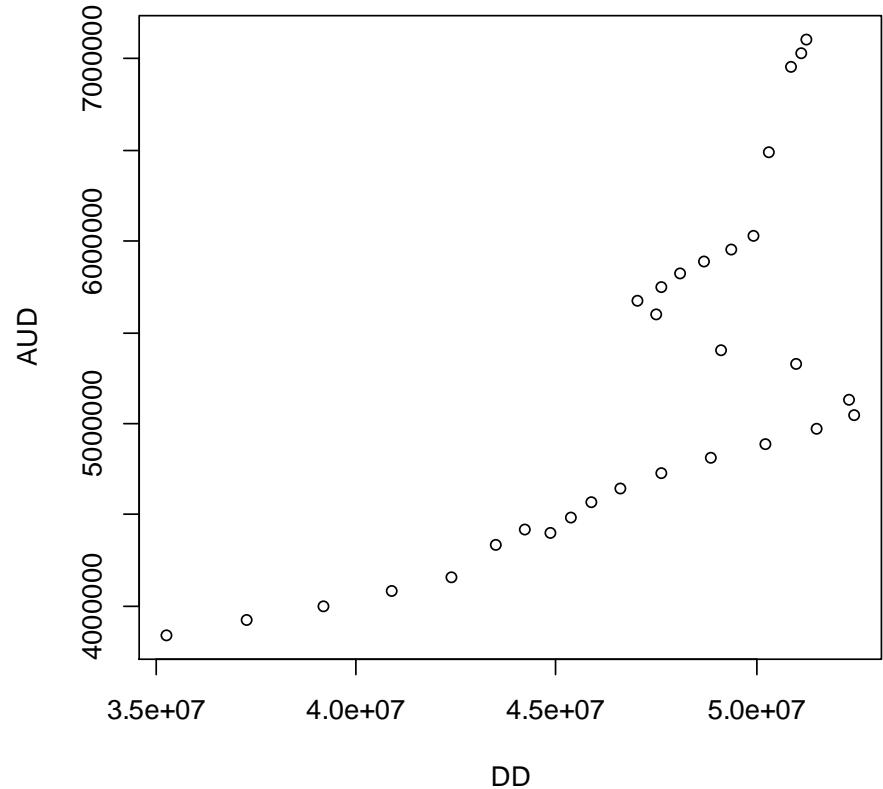
alternative hypothesis: true rho is not equal to 0

sample estimates:

rho

0.7708565

Statistical Analysis on Mental Health in Asia



Interpretation

The correlation coefficient between AUD and DD is 0.7708565 and is significant at 5% level of significance. Hence, we conclude that AUD-DD are moderately correlated.

Statistical Analysis on Mental Health in Asia

f) AUD~DUD

Spearman's rank correlation rho

data: AUD and DUD

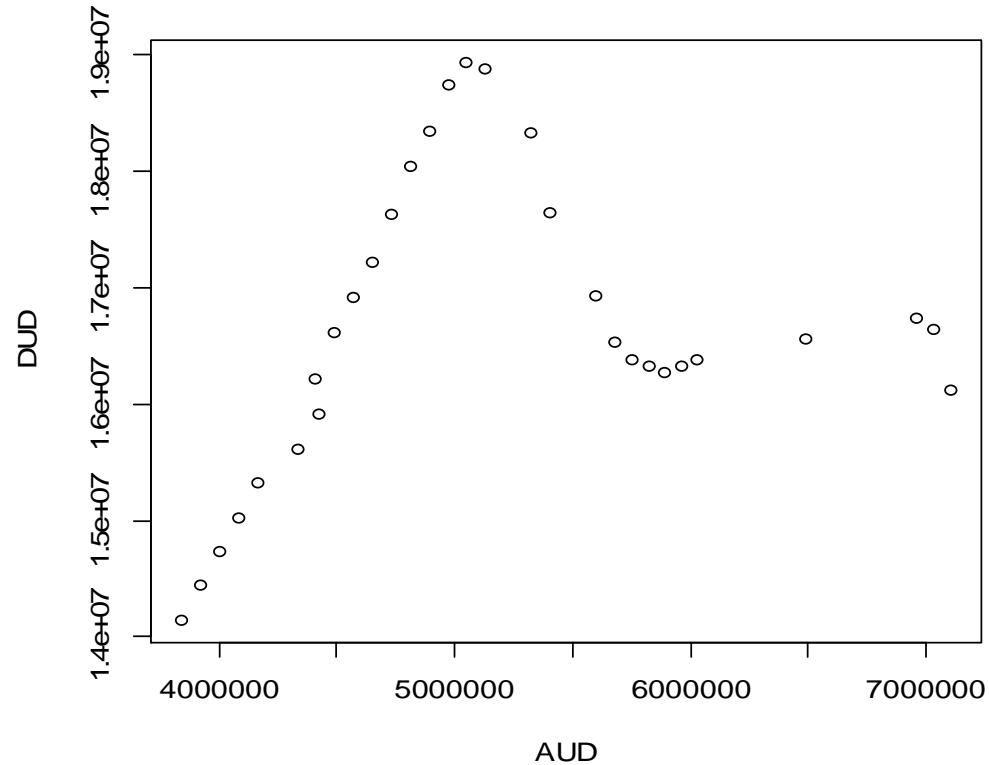
S = 2912, p-value = 0.05698

alternative hypothesis: true rho is not equal to 0

sample estimates:

rho

0.3521691



Interpretation

The correlation coefficient between AUD and DUD is 0.3521691 and is significant at 10% level of significance. Hence we conclude that AUD-DUD are moderately correlated.

3.3 TIME SERIES (ARIMA)

ARIMA, short for Auto Regressive Integrated Moving Average is a Statistical tool which is actually a class of models that explains a given time series based on its own past values, that is its own lags so that equation can be used to forecast future values.

An ARIMA models contains 3 parameters: p, d, q where,

p is the order of the AR term (Auto Regressive).

q is the order of the MA term (Moving Average)

d is the number of differencing required to make a time series stationary.

Term Auto Regressive means it is a linear regression model that uses its own lags as predictors. It assumes that future will resemble the past.

A pure Auto Regressive (AR only) model is one where y_t , depends only on its own lags. That is, y_t is the function of the lags of y_t

$$y_t = \alpha + \beta_1 y_{t-1} + \beta_2 y_{t-2} + \dots + \beta_p y_{t-p} + \varepsilon_t$$

Where y_{t-1} is the log 1 of the series, β is the coefficient of lagl that the model estimates and α is the intercept term, also estimated by the model.

Term 'Moving Average' incorporates the dependency between the observations and a residual error from a moving average model applied to lagged observations. A pure moving average model is one where y_t , depends only on the lagged forecast errors.

$$y_t = \alpha + \varphi_1 \varepsilon_{t-1} + \varphi_2 \varepsilon_{t-2} + \dots + \varphi_q \varepsilon_{t-q}$$

An ARIMA model is one where the time series was differenced once to make it stationary and you combine the AR and MA terms. So the equation becomes:

$$y_t = \alpha + \beta_1 y_{t-1} + \beta_2 y_{t-2} + \dots + \beta_p y_{t-p} + \varepsilon_t + \varphi_1 \varepsilon_{t-1} + \varphi_2 \varepsilon_{t-2} + \dots + \varphi_q \varepsilon_{t-q}$$

The ARIMA model assume that the time series is stationary. A series is said to be stationary if it satisfies the following conditions.

1 Mean is constant.

2 Standard deviation is constant.

3 Seasonality does not exist.

The most common approach is to difference it. That is, subtract the previous value

from the current value. Sometimes depending on the complexity of the series more than one differencing is needed. The value of 'd' is minimum number of differencing needed to make the series stationary. And if the time series is already stationary, then d=0

ACF is an auto correlation function which gives us values of an auto correlation of any series with its lagged values. It describes how well the present value of the series is related with its past values. PACF is a partial auto correlation plot used to see the correlation between the series and its lags. So, PACF sort of conveys the pure correlation between a lag and the series. That way, we will know if that lag is needed in the AR term or not. 'p' is the order of the Auto Regressive term. It refers the number of lags of Y to be used as predictors. 'q' is the order of the Moving Average term. It refers to the lagged forecast errors that should go into the ARIMA model.

3.4 Statistical analysis of mental health disorders using time series (ARIMA)

ARIMA forecasting

In this section we use the ARIMA model to forecast future trend of **AD, DD, DUD and AUD** using various functions available in R programming language. As the data is available for us from 1990-2019 so forecast is done from 2020-2035.

a) AD

We use Augmented Dickey-Fuller Test to check the stationarity of the data.

Null hypothesis: not stationary

Level of significance (α) =0.05

Augmented Dickey-Fuller Test

Dickey-Fuller = -3.8264, Lag order = 2, p-value = 0.03345

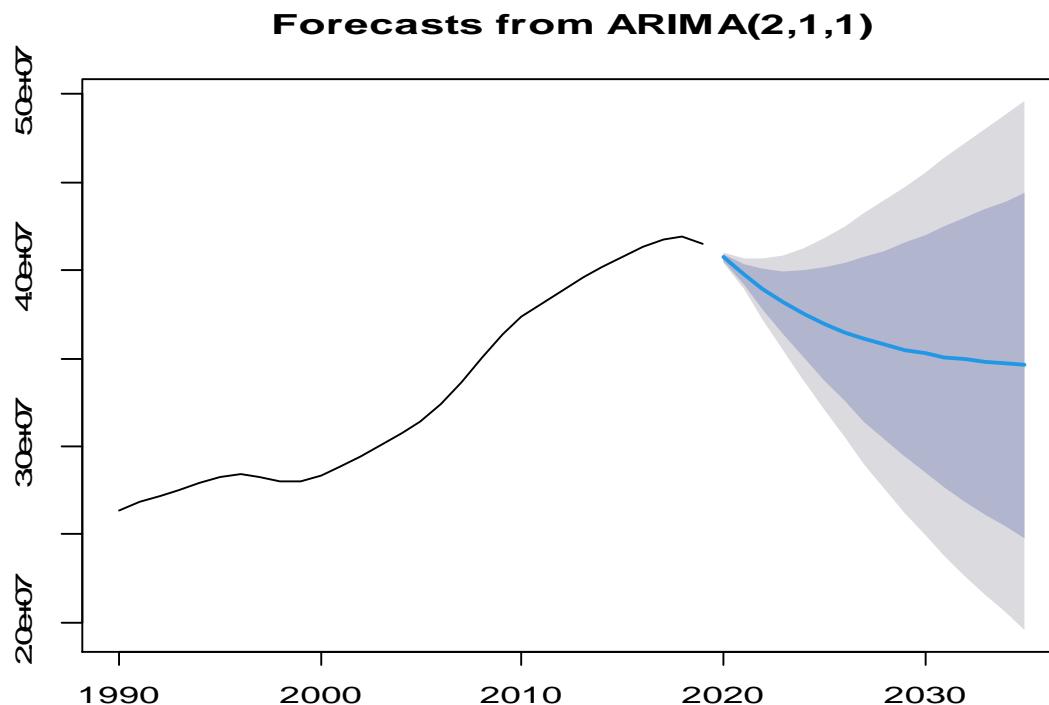
Alternative hypothesis: stationary

The forecasted values from 2020-2035

Point	Forecast	Lo 95	Hi 95
2020	40713196	40447372	40979020
2021	39797848	38915118	40680578
2022	38932285	37206329	40658241
2023	38165029	35453943	40876115
2024	37505573	33728631	41282515
2025	36947657	32065770	41829544

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2026	36479588	30481238	42477937
2027	36088673	28980260	43197086
2028	35763002	27562333	43963671
2029	35492055	26223970	44760140
2030	35266805	24960239	45573371
2031	35079621	23765632	46393610
2032	34924107	22634554	47213660
2033	34794921	21561584	48028257
2034	34687612	20541619	48833605
2035	34598480	19569940	49627019



Interpretation

In the above graph we can see a decreasing trend in the AD. This means that according to our forecast in future AD may gradually decrease.

b) DUD

We use Augmented Dickey-Fuller Test to check the stationarity of the data.

Null hypothesis: not stationary

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Level of significance (α) = 0.05

Augmented Dickey-Fuller Test

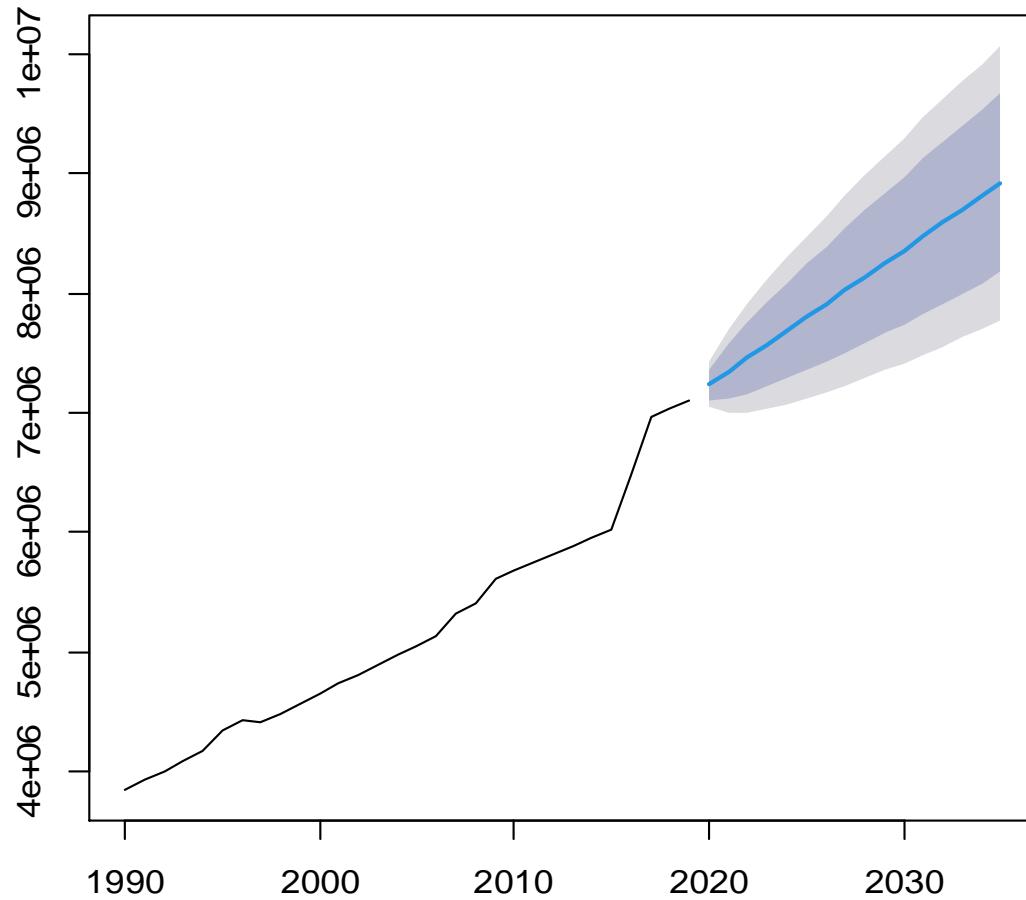
Dickey-Fuller = -3.9456, Lag order = 3, p-value = 0.02473

Alternative hypothesis: stationary

The forecasted values from 2020-2035

Point	Forecast	Lo 95	Hi 95
2020	7233094	7043353	7422835
2021	7345827	6997255	7694400
2022	7458561	7003584	7913537
2023	7571294	7030457	8112131
2024	7684027	7069206	8298849
2025	7796760	7115947	8477574
2026	7909494	7168543	8650444
2027	8022227	7225667	8818788
2028	8134960	7286427	8983494
2029	8247694	7350191	9145196
2030	8360427	7416493	9304361
2031	8473160	7484974	9461347
2032	8585894	7555353	9616434
2033	8698627	7627406	9769848
2034	8811360	7700948	9921773
2035	8924094	7775827	10072360

Forecasts from ARIMA(0,1,1) with drift



Interpretation

In the above graph we can see a increasing trend in the DUD. This means that according to our forecast in future DUD may gradually increase.

c) DD

We use Augmented Dickey-Fuller Test to check the stationarity of the data.

Null hypothesis: not stationary

Level of significance (α) = 0.05

Augmented Dickey-Fuller Test

Dickey-Fuller = -4.333, Lag order = 2, p-value = 0.01164

Alternative hypothesis: stationary

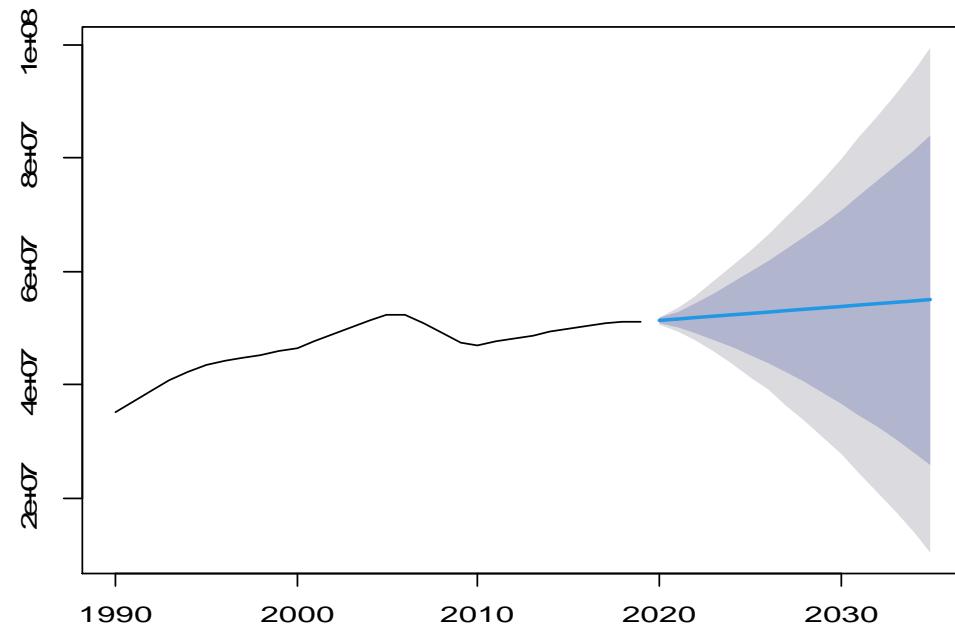
The forecasted values from 2020-2035

Point	Forecast	Lo 95	Hi 95
2020	51349479	50712854	51986104
2021	51530955	49553106	53508803
2022	51781824	47887074	55676574
2023	52061771	45902978	58220564
2024	52334470	43735689	60933251
2025	52585839	41441816	63729862
2026	52820744	39022700	66618787
2027	53050790	36458010	69643569

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2028	53284476	33730103	72838848
2029	53524013	30834147	76213879
2030	53767242	27776769	79757715
2031	54011029	24569577	83452480
2032	54253497	21223388	87283606
2033	54494447	17745733	91243161
2034	54734625	14141158	95328092
2035	54974834	10412674	99536993

Forecasts from ARIMA(2,2,0)



Interpretation

In the above graph we can see continuous in the DD. This means that according to our forecast in future DD may be continues.

d) AUD

We use Augmented Dickey-Fuller Test to check the stationary of the data.

Null hypothesis: not stationary

Level of significance (α) =0.05

Augmented Dickey-Fuller Test

Dickey-Fuller = -4.3056, Lag order = 2, p-value = 0.01259

Alternative hypothesis: stationary

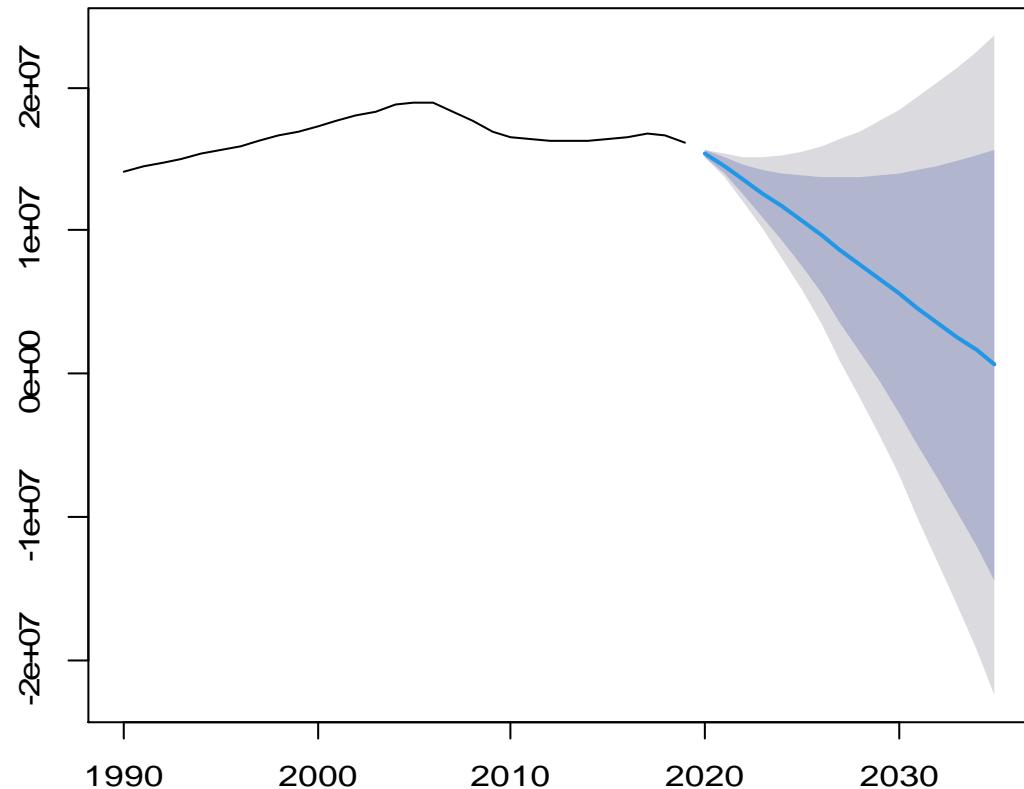
The forecasted values from 2020-2035

Point	Forecast	Lo 95	Hi 95
2020	15383861	15078517.3	15689205
2021	14521639	13687795	15355482
2022	13593204	12018404.8	15168003
2023	12628938	10126868.9	15131008
2024	11645283	8052091.6	15238474
2025	10651135	5821160.1	15481109
2026	9651308	3453365.4	15849250
2027	8648409	962837.7	16333979
2028	7643846	-1639754.7	16927447
2029	6638384	-4346111.3	17622880
2030	5632435	-7149588.6	18414459

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2031	4626223	-10044733	19297178
2032	3619867	-13026969	20266704
2033	2613435	-16092384	21319254
2034	1606961	-19237577	22451499
2035	600464.2	-22459557	23660486

Forecasts from ARIMA(1,2,0)



Interpretation

In the above graph we can see a decreasing trend in the AUD. This means that according to our forecast in future AUD may gradually decrease.

Conclusion

In correlation analysis we observe that AD-AUD, AD-DD are highly correlated, AD-DUD, DUD-DD, AUD-DD and AUD-DUD are moderately correlated.

In time series analysis we observe that AD is decreasing, DUD is increasing, DD is continuous and AUD is decreasing in future.

CHAPTER 4

STATISTICAL ANALYSIS USING NON-PARAMETRIC TESTS

In this chapter, we discuss about the theoretical aspects of the Wilcoxon rank sum test and Kruskal-Wallis test. We carry out of the statistical analysis to achieve the objectives given in chapter 1.

In section 4.1, we explain Wilcoxon rank sum test which is used to test the means of mental health disorder in India and China. Section 4.2 we explain the statistical analysis using Wilcoxon rank sum test. Section 4.3 we explain about the Kruskal-Wallis test. Section 4.4 we explain the statistical analysis using Kruskal-Wallis test.

4.1 WILCOXON RANK SUM TEST

Wilcoxon rank sum test is used to two independent sample. As the Wilcoxon rank sum test does not assume normality in the data, it can be used when this assumption has been violated and the use of the dependent t-test is inappropriate. It is used to compare two sets of scores that come from the same participants. This can occur when we wish to investigate any change in scores from one time point to another, or when individuals are subjected to more than one condition.

For this test we use the following null hypothesis:

H_0 : the observations come from the same population

From a practical point of view, this implies:

H_0 : if one observation is made at random from each population (call them x_0 and y_0), then the probability that $x_0 > y_0$ is the same as the probability that $x_0 < y_0$

Wilcoxon Rank Sum Test Assumptions:

The assumptions of the Wilcoxon rank sum test are as follows (note that the difference is between a data value and the hypothesized median or between the two data values of a pair):

- The two samples are independent of one another.
- The two populations have equal variance or spread.
- The two populations are normally distributed.

Limitations:

There are few limitations when using these tests. Sample sizes may range from a few to several hundred. If your data are discrete with at least five unique values, you can often ignore the continuous variable assumption. Perhaps the greatest restriction is that your data come from a random sample of the population. If you do not have a random sample, your significance levels will probably be incorrect.

Wilcoxon Rank Sum Test Statistic: The Wilcoxon rank sum test is a popular, nonparametric substitute for the t-test. It assumes that the data follow a non-symmetric distribution. The test is computed using the following steps.

1. Subtract the hypothesized mean, μ_0 , from each data value. Rank the values according to their absolute values.
2. Compute the mean and variance using the formulas.

$$\mu = \frac{n_1(n_1 + n_2 + 1)}{2} \quad \sigma^2 = \frac{n_1 n_2 (n_1 + n_2 + 1)}{12}$$

The correlation coefficient for the Wilcoxon Rank Sum test is given by the formula

$$r = \frac{z}{\sqrt{n_1 + n_2}}$$

where the z-score is

$$z = \frac{|W - \bar{W}|}{s_W}$$

The significance of the test statistic is determined by computing the p-value using the standard normal distribution. If this p-value is less than a specified level (usually 0.05), the null hypothesis is rejected in favor of the alternative hypothesis. Otherwise, no conclusion can be reached.

4.2 Comparison of average mental health disorders of India and China

Here we have taken data of mental disorder in India and China, that is, from 2007-2019 in order to test the equality of means of mental health disorders in India and China. We make use of Wilcoxon rank sum test.

H_0 : There is no difference between the means of mental health disorder in India and China.

H_1 : There is a difference between the means of mental health disorder in India and China.

Level of significance (α)=0.05

Table 4.1 Mental health disorder in India and China.

CHINA(*10 ⁸)	INDIA(*10 ⁸)
1.37	1.08
1.36	1.07
1.35	1.64
1.35	1.06
1.35	1.07
1.36	1.09
1.36	1.10
1.37	1.11
1.38	1.13
1.39	1.14
1.41	1.16
1.42	1.16
1.42	1.16

Wilcoxon rank sum test

Data: India and China

W = 0, p-value = 1.923e-07

Alternative hypothesis: true location shift is not equal to 0

Interpretation: Since p-value (1.923e-07) <0.05, hence the Wilcoxon rank sum test is significant therefore we reject the null hypothesis at 5% level of significance.

Conclusion: There is a significant difference between means of mental health disorder in India and China.

4.3 KRUSKAL-WALLIS TEST:

The Kruskal-Wallis H test (sometimes also called the "one-way ANOVA on ranks") is a rank-based nonparametric test that can be used to determine if there are statistically significant differences between two or more groups of an independent variable on a

continuous or ordinal dependent variable. The Kruskal-Wallis one-way ANOVA is a non-parametric method for comparing k independent samples. It is roughly equivalent to a parametric one-way ANOVA with the data replaced by their ranks. Since ranking is conditional upon your observed values, so is this test. The null and alternative hypothesis in this case are,

- Null hypothesis: The samples are from identical populations.
- Alternative hypothesis: The sample comes from different populations.

The Kruskal-Wallis is also used as a test of equality of medians or even means. In the latter case, in addition to the distributional assumptions mentioned above, observations are also assumed to be distributed symmetrically.

- The null and alternative hypothesis in this case are,
- Null hypothesis: Null hypothesis assumes that the k samples median are equal. (i.e $H_0: M_1 = M_2 = \dots = M_K$)
- Alternative hypothesis: Alternative hypothesis assumes that some among the k samples median are different.

The outcome of the Kruskal-Wallis test tells you if there are differences among the medians of some of the k groups, but doesn't tell you which groups are different from other groups. In order to determine which groups are different from others, Mann Whitney U test can be conducted.

Kruskal-Wallis Test Assumptions:

- The assumptions of the Kruskal-Wallis test are similar to those for the Mann-Whitney test.
- Samples are random samples, or allocation to treatment group is random.
- The two samples are mutually independent. (Independence within each sample and mutual independence among samples)
- The measurement scale is at least ordinal, and the variable is continuous.
- If the test is used as a test of dominance, it has no distributional assumptions. If it used to compare medians, the distributions must be similar apart from their locations.

Procedure for carrying out the test:

- Combine the observations in the k samples into a single pooled 'null' sample, retaining the information on the source of each observation.
- Under each observation, write down X or Y or Z etc. (or some other relevant symbol) to indicate which sample they are from.

4.4 Statistical analysis using Kruskal-Wallis test

For the analysis of various mental health disorder, we have chosen India, China and Pakistan from neighboring countries to check the median.

a) AD

Here we have taken data of various mental disorders in India, China and Pakistan. That is, from 2007-2019 in order to test the equality of medians of India, China and Pakistan.

H_0 : There is no difference between median of anxiety disorder in India, China and Pakistan.

H_1 : There is a difference between median of anxiety disorder in India, China and Pakistan.

Level of significance (α)=0.05

Table 4.2.1 AD in India, China and Pakistan.

ADI	ADC	ADP
33603149	47109786	5856503
35059557	47374932	6007714
36410014	47640929	6178501
37398719	47771490	6333690
38133782	47626818	6490242
38859453	47339859	6648444
39578021	46906468	6808884
40163624	46601817	6991919
40745739	46707349	7159428
41324938	47794868	7310366
41766716	48883150	7463833
41931911	48968319	7640218
41539100	48605267	7818008

ADI- Anxiety disorder in India

ADC-Anxiety disorder in China

ADP- Anxiety disorder in Pakistan

Kruskal-Wallis rank sum test

Data: weight by group

Kruskal-Wallis chi-squared = 33.8, df = 2, p-value = 4.575e-08

Interpretation- Since p-value ($4.575e-08 < 0.05$), hence the Kruskal Wallis test is significant therefore we reject the null hypothesis at 5% level of significance.

Conclusion: There is a difference between median of AD in India, China and Pakistan.

b) DUD

H_0 : There is no difference between median of drug used disorder in India, China and Pakistan.

H_1 : There is a difference between median of drug used disorder in India, China and Pakistan.

Level of significance (α)=0.05

Table 4.2.2 DUD in India, China and Pakistan.

DUDI	DUDC	DUDP
5324443	9152758	973287
5403014	8798202	995564
5601541	8439250	1035601
5677693	8212864	1058605
5751325	8258986	1063373
5822589	8305238	1048769
5891874	8351300	1032808

5959764	8396724	996056
6026701	8581772	1017077
6490135	9049916	1038520
6961119	9662948	1081112
7033740	9708005	1061141
7105372	9893107	996200

DUDI-Drug used disorder in India

DUDC- Drug used disorder in China

DUDP- Drug used disorder in Pakistan

Kruskal-Wallis rank sum test

Data: weight by group

Kruskal-Wallis chi-squared = 34.1, df = 3, p-value = 1.887e-07

Interpretation: Since p-value (1.887e-07<0.05), hence the Kruskal Wallis test is significant therefore we reject the null hypothesis at 5% level of significance.

Conclusion: There is a difference between median of drug used disorder in India, China and Pakistan.

c) DD

H_0 : There is no difference between median of depression disorder in India, China and Pakistan.

H_1 : There is a difference between median of depression disorder in India, China and Pakistan.

Level of significance (α)=0.05

Table 4.2.3 DD in India, China and Pakistan.

DDI	DDC	DDP
50996328	40379817	6779447

49107393	40065657	6883124
47491322	39882264	6985919
47026112	39832389	7105216
47635970	40056081	7260271
48099649	40418827	7416293
48672001	40782182	7593054
49362389	41143947	7753609
49916806	41361327	7937193
50331656	41573051	8084165
50869718	41635939	8253877
51129878	41830080	8531577
51240666	41866484	8879178

DDI-Depression disorder in India

DDC-Depression disorder in China

DDP-Depression disorder in Pakistan

Kruskal-Wallis rank sum test

Data: weight by group

Kruskal-Wallis chi-squared = 34.1, df = 3, p-value = 1.887e-07

Interpretation: Since p-value ($1.887e-07 < 0.05$), hence the Kruskal Wallis test is significant therefore we reject the null hypothesis at 5% level of significance.

Conclusion: There is a difference between median of depression disorder in India, China and Pakistan.

d) AUD

H_0 : There is no difference between median of alcohol used disorder in India, China and Pakistan.

H₁: There is a difference between median of alcohol used disorder in India, China and Pakistan.

Level of significance (α)=0.05

Table 4.2.4AUD in India, China and Pakistan.

AUDI	AUDC	AUDP
18339747	15344330	2282190
17649846	15566049	2351591
16926394	15925682	2422253
16539368	16015084	2494003
16378772	16242672	2548428
16328565	16333636	2603194
16266695	16424223	2658525
16324570	16653502	2695209
16376905	16882174	2752092
16556466	17109997	2850839
16733460	17478568	2931478
16637500	17988362	3013642
16123730	18352431	3075228

AUDI-Alcohol used disorder in India

AUDC-Alcohol used disorder in China

AUDP-Alcohol used disorder in Pakistan

Kruskal-Wallis rank sum test

Data: weight by group

Kruskal-Wallis chi-squared = 26.842, df = 3, p-value = 6.355e-06

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Interpretation: Since p-value ($6.355e-06 < 0.05$), hence the Kruskal Wallis test is significant therefore we reject the null hypothesis at 5% level of significance.

Conclusion: There is a difference between median of alcohol used disorder in India, China and Pakistan.

APPENDIX

Table 1 Mental health disorder in Eastern Asian countries from 2007-2019.

		2007				2008		
	AD	DUD	DD	AUD	AD	DUD	DD	AUD
china	47109786	9152758	40379817	15344330	47374932	8798202	40065657	15566049
japan	3610683	1079350	3096707	783814	3547667	1079725	3059220	784086
southkorea	1721122	411892	1049345	1676991	1745977	418051	1072178	1854179
northkorea	919157	135455	694205	178994	923785	136137	692839	182326
mongolia	51358	15822	111015	101418	52112	16055	111856	107381
		2009				2010		
	AD	DUD	DD	AUD	AD	DUD	DD	AUD
china	47640929	8439250	39882264	15925682	47771490	8212864	39832389	16015084
japan	3483846	1092719	3021047	771331	3432081	1092610	3007891	784108
southkorea	1776508	419453	1095513	1638335	1803461	421138	1109822	1630051
northkorea	925834	139242	693765	185655	930401	139928	694732	186571
mongolia	52941	16310	113369	112567	53854	16591	115052	116140
		2011				2012		
	AD	DUD	DD	AUD	AD	DUD	DD	AUD
china	47626818	8258986	40056081	16242672	47339859	8305238	40418827	16333636
japan	3405223	1092241	2994026	783844	3364698	1091600	2979427	783384
southkorea	1832130	423182	1125167	1632986	1862256	425515	1141383	1641989
northkorea	935122	140638	698257	189985	942424	138884	701858	190965
mongolia	54853	17176	117186	118017	56211	17513	119485	118920

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		2013				2014		
	AD	DUD	DD	AUD	AD	DUD	DD	AUD
china	46906468	8351300	40782182	16424223	46601817	8396724	41143947	16653502
japan	3323337	1090671	2964058	795548	3293934	1089433	2947878	807462
southkorea	1892999	427939	1157952	1651340	1918040	430167	1169043	1659939
northkorea	949814	139605	705505	194450	957208	140324	709136	195451
mongolia	57347	17867	122188	119594	58802	18229	124661	120545
		2015				2016		
	AD	DUD	DD	AUD	AD	DUD	DD	AUD
china	46707349	8581772	41361327	16882174	47794868	9049916	41573051	17109997
japan	3276420	1087874	2943658	806306	3257963	1085988	2938555	804909
southkorea	1931277	437079	1179096	1666997	1855797	438458	1167521	1672257
northkorea	962022	141029	712702	198952	961691	144254	713676	199931
mongolia	60269	18590	127134	122336	65100	18949	129895	125922
		2017				2018		
	AD	DUD	DD	AUD	AD	DUD	DD	AUD
china	48883150	9662948	41635939	17478568	48968319	9708005	41830080	17988362
japan	3238569	1096523	2932563	803267	3230936	1093939	2925650	814094
southkorea	1778155	439429	1154779	1675962	1780775	445194	1156480	1555620
northkorea	961247	147493	717121	203439	968330	148188	720499	201842
mongolia	70372	19305	132647	130779	71964	19655	134417	136002
		2019						
	AD	DUD	DD	AUD				
china	48605267	9893107	41866484	18352431				
japan	3222252	1078313	2917787	824592				

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southkorea	1787764	445660	1162815	1296001				
northkorea	980447	148864	726352	202763				
mongolia	73211	19996	135457	143197				

Table 2 Mental health disorders in Southern Asian countries from 2007-2019.

			2007			2008		
	AD	DUD	DD	AUD	AD	DUD	DD	AUD
india	33603149	5324443	50996328	18339747	35059557	5403014	49107393	17649846
pakistan	5856503	973287	6779447	2282190	6007714	995564	6883124	2351591
bangladesh	4750591	470779	6676506	1626328	4733177	490634	6739004	1645067
iran	5371637	542157	3466953	263945	5502802	548117	3562758	252422
afghanistan	1303536	138213	1382128	119242	1336214	144156	1413836	121978
nepal	817860	100254	1387724	319229	831997	101333	1413329	322666
srilanka	805587	123021	597246	198420	813348	121902	595523	195843
bhutan	21808	2327	27193	17287	22029	2418	27335	17529
maldives	12703	1776	10994	2045	13017	1820	11128	2129
			2009			2010		
	AD	DUD	DD	AUD	AD	DUD	DD	AUD
india	36410014	5601541	47491322	16926394	37398719	5677693	47026112	16539368
pakistan	6178501	1035601	6985919	2422253	6333690	1058605	7105216	2494003
bangladesh	4727963	496144	6829280	1678135	4751929	516514	6906530	1697117
iran	5629797	561521	3653534	247944	5723971	567971	3725007	250793
afghanistan	1374309	153332	1448135	124937	1415497	157602	1488461	128416
nepal	846831	102157	1435581	327979	856319	102650	1447908	329561
srilanka	823051	122753	595656	193186	830731	123597	599747	190460
bhutan	22317	2442	27540	17704	22553	2468	27763	17960

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maldives	13394	1908	11344	2226	13825	1975	11630	2341
	2011				2012			
	AD	DUD	DD	AUD	AD	DUD	DD	AUD
india	38133782	5751325	47635970	16378772	38859453	5822589	48099649	16328565
pakistan	6490242	1063373	7260271	2548428	6648444	1048769	7416293	2603194
bangladesh	4806595	522456	7000910	1701714	4877485	543621	7097269	1691264
iran	5806600	574689	3798919	246295	5884557	581657	3875196	249282
afghanistan	1463706	165646	1535988	132517	1523791	171388	1589230	137110
nepal	865319	102757	1441297	327199	871750	102559	1414232	326569
srilanka	838378	124431	603795	189706	847996	125249	609818	186847
bhutan	22879	2565	28079	18164	23222	2596	28554	18311
maldives	14383	2055	12024	2435	15015	2185	12473	2542
	2013				2014			
	AD	DUD	DD	AUD	AD	DUD	DD	AUD
india	39578021	5891874	48672001	16266695	40163624	5959764	49362389	16324570
pakistan	6808884	1032808	7593054	2658525	6991919	996056	7753609	2695209
bangladesh	4934194	549941	7195063	1695652	5006363	556263	7293221	1684239
iran	5973241	581263	3961766	244742	6065570	588740	4043713	247890
afghanistan	1587664	180710	1648976	141986	1651855	186876	1705248	143494
nepal	880179	102284	1380832	325693	890588	102243	1356061	322872
srilanka	857517	123978	615759	183901	866881	124731	621577	182939
bhutan	23651	2628	28978	18537	24016	2660	29409	18695
maldives	15709	2286	12966	2701	16444	2393	13486	2828
	2015				2016			
	AD	DUD	DD	AUD	AD	DUD	DD	AUD
india	40745739	6026701	49916806	16376905	41324938	6490135	50331656	16556466

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pakistan	7159428	1017077	7937193	2752092	7310366	1038520	8084165	2850839
bangladesh	5062704	578148	7375297	1687568	5134257	584515	7472319	1721951
iran	6153789	588692	4105142	251175	6134384	596730	4169153	254605
afghanistan	1710356	192716	1758535	147978	1765613	205222	1808073	152147
nepal	899601	102657	1350752	324180	913325	106327	1363172	329888
srilanka	873955	125448	627241	181900	882889	128229	630635	182884
bhutan	24384	2693	29843	18852	24680	2799	30131	19302
maldives	17150	2502	14011	2957	17879	2663	14598	3091
		2017			2018			
	AD	DUD	DD	AUD	AD	DUD	DD	AUD
india	41766716	6961119	50869718	16733460	41931911	7033740	51129878	16637500
pakistan	7463833	1081112	8253877	2931478	7640218	1061141	8531577	3013642
bangladesh	5189776	590836	7553120	1756540	5260881	597094	7649256	1823557
iran	6115081	613122	4219244	258156	6200455	621682	4237251	261761
afghanistan	1811176	214147	1854731	159703	1862313	211880	1903202	163556
nepal	928458	107767	1384397	334355	946825	109573	1413214	342768
srilanka	891603	128881	635954	183814	897977	129495	638986	184690
bhutan	24976	2833	30494	19757	25348	2867	31006	19388
maldives	18665	2780	15190	3276	19339	2888	15729	3507
		2019						
	AD	DUD	DD	AUD				
india	41539100	7105372	51240666	16123730				
pakistan	7818008	996200	8879178	3075228				
bangladesh	5331610	603271	7744693	1891336				
iran	6318039	638437	4228608	265324				
afghanistan	1913500	197817	1951542	167384				
nepal	969835	111574	1447601	351887				

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srilanka	906259	130075	643977	185516				
bhutan	25793	2900	31745	18238				
maldives	19858	2973	16194	3770				

Table 3 Mental health disorders in South eastern Asian countries from 2007-2019.

		2007				2008		
	AD	DUD	DD	AUD	AD	DUD	DD	AUD
indonesia	8295760	1045684	5739644	1115396	8429817	1059614	5792556	1153802
philippines	4157355	482790	2548056	706303	4236032	490871	2572526	718126
vietnam	1768185	503976	2220909	939615	1785239	508836	2242329	991799
thailand	2283281	595639	2018553	820658	2301972	578820	2022542	818331
malaysia	1279906	154978	967277	144290	1307328	157969	983220	147074
cambodia	622438	58824	425447	101232	634491	59700	429011	102740
laos	262172	28536	167053	52316	268470	29024	168701	52606
singapore	138732	38918	102103	30219	143752	41072	105545	31998
timor-leste	39072	5493	29952	7255	39895	5594	30396	7494
brunei	11624	3187	6224	3600	11762	3225	6260	3642
		2009				2010		
	AD	DUD	DD	AUD	AD	DUD	DD	AUD
indonesia	8566478	1073792	5846204	1169241	8706032	1088254	5900755	1209171
philippines	4306500	499036	2615321	730072	4388249	507421	2659260	742338
vietnam	1802810	513844	2255689	1036398	1829727	519009	2269565	1064409
thailand	2326966	568368	2026065	815775	2345107	571158	2029290	813060
malaysia	1334055	160863	998461	146996	1359627	163607	1012668	149503
cambodia	646896	60603	432674	105702	659793	61542	437953	107342
laos	274843	29513	170317	53493	280588	29996	172477	54368

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singapore	148998	42713	108769	33276	153935	44128	112373	34379
timor-leste	40715	5694	30725	7735	41444	5796	31165	7873
brunei	11863	3225	6296	3685	12009	3303	6374	3731
	2011				2012			
	AD	DUD	DD	AUD	AD	DUD	DD	AUD
indonesia	8848687	1103022	6005342	1225580	8993952	1118033	6087067	1242259
philippines	4463121	516078	2704632	755003	4549552	524948	2760839	767980
vietnam	1875186	533228	2292882	1084231	1957682	538812	2307909	1104564
thailand	2356391	567154	2039055	816972	2374259	569822	2048646	820815
malaysia	1383841	166176	1037165	151850	1406900	171502	1069709	154061
cambodia	671814	62528	443513	110515	685813	63556	450804	112331
laos	286910	30468	175828	54589	293226	30289	179802	55423
singapore	157909	45267	114747	35266	160547	46177	116517	35438
timor-leste	42300	5900	31836	8015	43281	6005	32404	8271
brunei	12165	3346	6456	3779	12329	3391	6583	3790
	2013				2014			
	AD	DUD	DD	AUD	AD	DUD	DD	AUD
indonesia	9165713	1107943	6194411	1233846	9312175	1122564	6301663	1250128
philippines	4637076	533906	2807952	781085	4724117	542771	2864624	794054
vietnam	2060084	553591	2332342	1116257	2155275	559454	2357046	1137252
thailand	2391873	579228	2051150	817734	2409044	581729	2060006	821265
malaysia	1429243	173867	1105085	156185	1451517	176213	1140904	158293
cambodia	700227	64613	458303	114200	714847	65680	464345	117614
laos	300246	30744	183811	56255	306757	31207	187905	57102
singapore	163067	46902	117801	35995	165216	47520	118801	36469
timor-leste	44286	6112	33099	8419	45212	6224	33821	8573
brunei	12537	3438	6754	3842	12703	3483	6884	3893

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		2015				2016		
	AD	DUD	DD	AUD	AD	DUD	DD	AUD
indonesia	9456827	1136886	6407905	1266078	9599119	1203159	6460443	1281626
philippines	4809532	551411	2910226	806694	4882566	559785	2964785	829310
vietnam	2205715	565330	2391069	1149196	2228642	580571	2415923	1161141
thailand	2425623	590945	2068307	824574	2434687	586256	2076037	834553
malaysia	1474196	181626	1165432	163463	1497411	187176	1181359	165697
cambodia	726403	66742	471852	119515	739439	69372	479295	121400
laos	312790	31683	191449	57974	319701	32860	194422	58874
singapore	167205	48092	120231	36908	168478	48621	122118	38445
timor-leste	46177	6340	34453	8733	47186	6584	35116	8901
brunei	12862	3527	6971	3942	13014	3568	7052	3988
		2017				2018		
	AD	DUD	DD	AUD	AD	DUD	DD	AUD
indonesia	9739156	1270325	6536879	1296790	9877043	1284819	6638230	1338353
philippines	4964162	578451	3007946	841383	5044611	586583	3060895	853211
vietnam	2251495	586524	2440697	1182508	2273994	592385	2465086	1203879
thailand	2450028	588283	2076295	837439	2464710	590142	2082854	840084
malaysia	1517907	189738	1197529	167965	1538568	192321	1216982	170251
cambodia	750841	70441	488287	121672	763740	71499	493994	125123
laos	326097	33375	197466	59796	332597	33895	201253	60729
singapore	170670	49660	123865	39956	172149	49515	125514	40878
timor-leste	48238	6714	35806	9076	49324	6847	36518	9256
brunei	13116	3651	7131	4033	13255	3689	7292	4118
		2019						
	AD	DUD	DD	AUD				

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indonesia	10013146	1299003	6819764	1380190				
philippines	5135540	594641	3124570	875745				
vietnam	2305444	598065	2488722	1234715				
thailand	2485633	591817	2081805	849432				
malaysia	1559150	194894	1242847	175724				
cambodia	776516	72541	501191	130244				
laos	340549	34413	204329	62374				
singapore	172389	49917	127696	41211				
timor-leste	50561	6983	37371	9569				
brunei	13389	3726	7539	4246				

Table 4 Mental health disorders in Western Asian countries from 2007-2019.

		2007				2008		
	AD	DUD	DD	AUD	AD	DUD	DD	AUD
turkey	3256431	222662	3075518	361826	3288549	232381	3084335	366177
iraq	1454176	111645	1021551	122809	1487413	113543	1038918	122059
saudiarebia	1166046	93183	1080419	110812	1203817	98376	1115796	116498
yemen	1047100	59591	1070510	87258	1077094	61298	1101175	89758
syria	1113182	61623	816996	87464	1161319	66125	855491	90922
jordon	319645	24396	283990	26898	335691	26226	293074	28193
azerbaijan	234682	39259	247768	225085	237308	39698	250541	231133
urabemirates	265877	45649	234416	36396	303430	53880	265856	41828
israel	249921	55462	337564	65733	271706	57571	344021	66698
lebanon	306540	29558	254100	20500	318285	30494	253484	20488
oman	128872	9034	109475	11957	133146	9353	113339	12379
palestina	216372	16153	276851	15777	222531	16584	283853	16198
kuwait	114684	10767	106421	11018	122176	11686	112615	11686

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georgia	111672	19168	143757	93338	110609	19056	142921	93624
armenia	98536	15250	90031	64811	97696	15120	89555	63968
qatar	54952	4630	52515	6214	64506	5603	61202	7471
bahrain	53039	4247	51693	5594	57181	4570	55063	6019
cyrus	74779	6595	34677	19359	76034	6706	35043	19685
		2009				2010		
	AD	DUD	DD	AUD	AD	DUD	DD	AUD
turkey	3323578	242493	3095349	363739	3370438	245912	3117293	368868
iraq	1523988	115893	1060418	124585	1570376	118968	1088556	127891
saudiarebia	1240972	103858	1153092	119836	1283325	106944	1192834	123397
yemen	1107810	65298	1130326	92318	1139219	67149	1162374	94935
syria	1193891	69979	875803	93306	1206984	70496	882273	93995
jordon	353624	27573	303993	29641	373243	29046	318055	31225
azerbaijan	240066	41052	252560	237389	242973	41549	255619	242973
urabemirates	337280	60964	294526	46712	365085	65835	316350	50445
israel	291916	60396	350874	67586	304143	61710	356303	69057
lebanon	331617	31766	256053	20696	345724	32690	263008	21298
oman	139495	10067	118499	12943	146901	10645	125003	13991
palestina	228754	17414	290890	16622	234821	17845	297683	17034
kuwait	130614	12413	119048	12413	139123	13164	126258	12865
georgia	109578	18950	141710	93924	109036	18856	141009	93869
armenia	96751	15018	88953	63538	96390	15250	88621	63013
qatar	73811	6620	69839	8606	82607	7425	77780	9653
bahrain	60794	4977	57950	6399	63656	5212	60058	6701
cyrus	77196	6808	35358	19875	78328	6898	35826	20138
		2011				2012		
turkey	AD	DUD	DD	AUD	AD	DUD	DD	AUD

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iraq	3429800	257051	3158060	374561	3501134	261279	3202530	380720
saudiarebia	1637659	119829	1139909	132119	1725250	124371	1218198	133938
yemen	1325750	115897	1232467	127204	1373196	119535	1274069	131197
syria	1171333	71423	1197522	97611	1204080	73420	1231001	97893
jordon	1199555	71678	872787	92760	1173191	71536	850257	87887
azerbaijan	395403	31418	334867	32950	418251	33978	352722	34787
urabemirates	246035	42073	259754	245120	249220	42618	264043	245514
israel	383817	69785	331031	52786	394003	72219	339153	53935
lebanon	309217	63640	359381	69630	313736	64727	357902	70058
oman	362581	35894	276227	22369	384865	38763	294048	23812
palestina	155078	11704	132320	14955	165457	12593	141670	16441
kuwait	240680	18258	302925	17429	246435	18663	306666	17390
georgia	148265	14256	134009	13623	158401	15070	141991	14400
armenia	108147	18773	140795	93455	107699	18695	140618	91849
qatar	96652	15246	88885	62133	96910	15286	89700	60857
bahrain	90596	8347	85099	10586	97945	9224	91576	11420
cyrus	65569	5368	61479	6774	66687	5460	62267	6760
	79189	6862	36220	20247	80021	6924	36775	20317
		2013				2014		
	AD	DUD	DD	AUD	AD	DUD	DD	AUD
turkey	3576089	265739	3249609	379627	3652944	278025	3305412	386146
iraq	1826954	129313	1313020	139260	1923628	134207	1404008	141089
saudiarebia	1424468	126219	1319285	135234	1471630	132941	1360331	139125
yemen	1237238	77956	1264900	100588	1270516	80053	1298921	103294
syria	1133593	68525	820338	84187	1092706	67359	789592	78585
jordon	442136	35780	370576	35780	464671	38351	387077	37459
azerbaijan	251531	43173	269363	244022	253800	44676	273762	244294
urabemirates	399189	72663	341242	53348	402660	72792	342768	53442

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israel	317902	65746	355802	70387	32074	6744	35368	7136
lebanon	409772	42574	313981	25426	433890	45706	332462	26922
oman	178452	13553	152475	17318	192100	14498	163507	18525
palestina	252211	19067	308980	17767	258189	19486	310447	18157
kuwait	168561	15869	150224	14811	177903	16609	157603	15133
georgia	107291	19029	140895	90691	106936	18966	140832	89180
armenia	97359	15357	90695	59401	97857	15727	91449	57957
qatar	104445	9814	97202	11917	110418	10329	102303	12542
bahrain	67461	5392	62727	6838	68407	5478	63463	6814
cyprus	80757	7092	37176	20246	81467	7144	37680	20280
		2015			2016			
	AD	DUD	DD	AUD	AD	DUD	DD	AUD
turkey	3722294	282706	3353206	392647	3775858	303346	3360753	399139
iraq	2002719	135175	1472692	145846	2053856	135459	1515680	150104
saudiarebia	1512933	136386	1395578	142730	1544308	145995	1421023	145995
yemen	1303696	82143	1335493	105992	1333959	84221	1366561	108673
syria	1056448	64791	761290	75589	1025229	66369	740540	73355
jordon	483715	39846	402169	38920	497778	42039	411790	40128
azerbaijan	256927	45227	278097	246342	258979	45759	281372	250216
urabemirates	407567	73177	344580	52799	410947	73952	348228	53358
israel	325523	68615	356639	71806	329225	70548	360850	72981
lebanon	452062	48342	346885	27437	463957	51029	355185	28200
oman	204406	15362	173681	19630	212763	16573	181408	20604
palestina	264503	19928	312059	18570	270722	20860	310125	19006
kuwait	186026	17644	164163	15726	192303	18597	169354	16223
georgia	106641	18914	140444	88532	106410	20077	140139	89545
armenia	98299	15798	92155	57634	98655	16149	92782	57842
qatar	115457	10776	106477	13085	119182	11414	110157	13537

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bahrain	70239	5762	64889	6859	72715	5988	67297	7129
cyrus	82082	7198	38080	20317	82498	7255	38265	20478
	2017				2018			
	AD	DUD	DD	AUD	AD	DUD	DD	AUD
turkey	3828696	316354	3374444	405582	3894686	321126	3417114	419934
iraq	2099201	138945	1554685	153966	2148438	142204	1591151	161421
saudiarebia	1568996	148955	1446522	148955	1600881	151662	1476181	151662
yemen	1363906	86288	1397308	111339	1399285	88346	1433484	113995
syria	1003516	66673	724856	71802	996370	66086	725249	71169
jordon	508864	44036	420791	41101	519193	44844	431498	41854
azerbaijan	260901	47258	284530	256963	262668	47758	289532	266648
urabemirates	416488	74000	352924	54077	424726	75122	359235	54897
israel	333876	73370	366851	75019	339451	73757	372977	77110
lebanon	469855	52509	358017	28641	462324	52817	352574	29495
oman	221165	17731	188970	21463	230366	18352	197043	22216
palestina	277238	21363	310469	19464	283998	21883	317552	19938
kuwait	197127	19469	173601	16630	202315	19859	178318	16963
georgia	106231	20845	139904	90597	106478	20815	140503	92068
armenia	98945	16196	93055	58601	99178	16235	93570	60511
qatar	122340	12261	113076	13896	125454	12518	115996	14187
bahrain	76049	6425	70371	7470	80198	6749	74078	7847
cyrus	82814	7314	38576	20527	83486	7611	39246	20931
	2019							
	AD	DUD	DD	AUD				
turkey	3971249	317033	3470672	425491				
iraq	2201348	145446	1623494	165101				
saudiarebia	1634609	154208	1514669	157635				

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yemen	1437683	90402	1469761	116648				
syria	1008845	66574	742551	71695				
jordon	528319	45458	444475	43437				
azerbaijan	265260	48229	295403	280331				
urabemirates	435765	76210	367372	55692				
israel	345035	73267	380816	80934				
lebanon	440137	52103	338672	29480				
oman	238800	18905	205467	22885				
palestina	291413	22416	325785	20922				
kuwait	206988	20194	183008	17249				
georgia	106314	20783	141485	94723				
armenia	99675	16268	94352	63295				
qatar	128576	12744	119230	14727				
bahrain	84520	7057	77463	8206				
cyrus	84020	8030	40512	21574				

Table 5 Mental health disorders in Central Asian countries from 2007-2019.

		2007				2008		
	AD	DUD	DD	AUD	AD	DUD	DD	AUD
uzbekistan	576740	122421	916799	666515	585692	127084	925504	646471
kazakhstan	353298	135038	580978	617093	356898	136414	583726	639244
tajikistan	175154	30369	206936	182923	178806	31003	210530	186737
turkmenistan	117370	25325	160715	154384	119446	25666	161893	156957
		2009				2010		
	AD	DUD	DD	AUD	AD	DUD	DD	AUD
uzbekistan	594988	129101	937387	631473	604537	131173	949580	618795

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kazakhstan	359364	137970	587174	657764	365676	139770	593208	671219
tajikistan	183382	31668	213578	190747	187432	32368	218295	194960
turkmenistan	121192	26041	163259	159253	123111	26453	165334	161265
	2011				2012			
	AD	DUD	DD	AUD	AD	DUD	DD	AUD
uzbekistan	614313	133294	964934	605619	624328	138412	983610	588988
kazakhstan	371040	140171	601909	672819	376909	140713	613106	663360
tajikistan	191668	33099	223228	197056	196871	33862	229158	196871
turkmenistan	125730	27423	168157	161431	128537	27920	171207	157510
	2013				2014			
	AD	DUD	DD	AUD	AD	DUD	DD	AUD
uzbekistan	634572	140683	999750	574706	645040	143004	1019284	562888
kazakhstan	383088	141317	624859	648695	389309	141881	636736	636736
tajikistan	202301	34657	235346	195853	207971	35487	241808	195592
turkmenistan	131476	28442	174407	151868	135018	28972	177656	147591
	2015				2016			
	AD	DUD	DD	AUD	AD	DUD	DD	AUD
uzbekistan	655707	145369	1036140	559825	669709	147776	1053299	572240
kazakhstan	395370	142333	648407	636107	401195	144430	657960	652611
tajikistan	213887	36352	248548	197824	219188	38120	254709	202728
turkmenistan	138019	30053	181428	146923	140993	30577	184027	151185
	2017				2018			
	AD	DUD	DD	AUD	AD	DUD	DD	AUD
uzbekistan	680743	150211	1070652	588060	691744	152638	1084706	620296
kazakhstan	406801	146448	667153	672577	412191	148389	675994	685154

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tajikistan	224671	39073	261968	210462	230251	40044	269385	218420
turkmenistan	143366	31091	187124	156609	145687	31595	190154	162070
	2019							
	AD	DUD	DD	AUD				
uzbekistan	705809	155014	1101589	666231				
kazakhstan	419262	150267	680837	695679				
tajikistan	236754	41013	276834	229297				
turkmenistan	147958	32682	193118	167567				

1) Correlation

```
rm(list=ls())
```

```
AD=c(26372990,26827323,27188280,27543895,27895254,28242932,28390356,28225381,28035799,28027570,28316225,28810003  
,29410232,30122277,30725758,31444512,32400519,33603149,35059557,36410014,37398719,38133782,38859453,39578021,4016  
3624,40745739,41324938,41766716,41931911,41539100)
```

```
AUD=c(3842422,3921602,4000951,4080577,4160648,4337652,4420644,4403960,4485728,4567456,4648932,4730000,4810596,48  
90702,4970343,5049484,5128140,5324443,5403014,5601541,5677693,5751325,5822589,5891874,5959764,6026701,  
6490135,6961119,7033740,7105372)
```

```
DD=c(35280423,37255220,39191132,40898510,42362962,43472909,44206436,44840321,45367020,45882170,46594982,47622504  
,48871278,50240846,51510830,
```

```
52445774,52330334,50996328,49107393,47491322,47026112,47635970,48099649,  
48672001,49362389,49916806,50331656,50869718,51129878,51240666)
```

```
DUD=c(14147100,14438626,14730774,15023943,15318750,15615546,15914317,16214580,16617582,16920348,17222181,176300  
02,18039734,18340132,18751750,18935564,18880878,18339747,17649846,16926394,16539368,16378772,16328565,16266695,16  
324570,16376905,16556466,16733460,16637500,16123730)  
length(AD)  
length(AUD)  
length(DD)  
length(DUD)  
cor(AD,AUD)  
cor(AD,DD,method="spearman")  
cor(AD,DUD,method="spearman")  
cor(DD,DUD,method="spearman")  
cor(DD,AUD,method="spearman")  
cor(AUD,DUD,method="spearman")  
##SIGNIFICANCE TEST  
cor.test(AD,AUD,method="spearman")  
cor.test(AD,DD,method="spearman")  
cor.test(AD,DUD,method="spearman")  
cor.test(DD,DUD,method="spearman")  
cor.test(DD,AUD,method="spearman")  
cor.test(AUD,DUD,method="spearman")  
plot(AD,AUD)  
plot(AD,DD)  
plot(AD,DUD)  
plot(DD,DUD)  
plot(DD,AUD)  
plot(AUD,DUD)
```

```
title(main="scatter diagram",outer=T)
2) ARIMA FORCASTING
rm(list=ls())
ls()
library(timeDate)
library(timeSeries)
library(forecast)
library(tseries)
library(xts)
library("readxl")
library(readxl)
data1=read.csv('c:/users/lenovo/desktop/bind.csv');
d1=data1[,c("year","AD")]
d1;
class(d1);
ad1=ts(d1$AD,start=c(1990,1),end=c(2019,1));
class(ad1);
ad1;
summary(ad1);
plot(ad1,col="blue");
adf.test(ad1)
plot((log(ad1)));
diff1=diff(log(ad1),difference=1);
adf.test(diff1)
plot(diff1)
diff2=diff(log(ad1),difference=2)
```

```
adf.test(diff2)
plot(diff2)
diff3=diff(log(ad1),difference=3)
adf.test(diff3)
plot(diff3)
arimamodel=auto.arima(ad1,ic="aic",trace=T);
arimamodel
myforecast=forecast(arimamodel,h=5);
myforecast;
plot(myforecast);
#rm(list=ls())
#ls()
data1=read.csv('c:/users/lenovo/desktop/bind.csv');
d12=data1[,c("year","DUD")]
d12;
class(d12);
dud1=ts(d12$DUD,start=c(1990,1),end=c(2019,1));
class(dud1);
dud1;
summary(dud1);
plot(dud1,col="blue");
adf.test(dud1)
plot((log(dud1)));
diff1=diff(log(dud1),difference=1);
adf.test(diff1)
plot(diff1)
```

```
diff2=diff(log(dud1),difference=2)
adf.test(diff2)
plot(diff2)
arimamodel=auto.arima(dud1,ic="aic",trace=T);
arimamodel
myforecast=forecast(arimamodel,h=16);
myforecast;
plot(myforecast);
#rm(list=ls())
#ls()
data1=read.csv('c:/users/lenovo/desktop/bind.csv');
d13=data1[,c("year","DD")]
d13;
class(d13);
dd1=ts(d13$DD,start=c(1990,1),end=c(2019,1));
class(dd1);
dd1;
summary(dd1);
plot(dd1,col="blue");
adf.test(dd1)
plot((log(dd1)));
diff1=diff(log(dd1),difference=1);
adf.test(diff1)
plot(diff1)
diff2=diff(log(dd1),difference=2)
adf.test(diff2)
```

```
plot(diff2)
diff3=diff(log(dd1),difference=3)
adf.test(diff3)
plot(diff3)
diff4=diff(log(dd1),difference=4)
adf.test(diff4)
plot(diff4)
diff5=diff(log(dd1),difference=5)
adf.test(diff5)
plot(diff5)
arimamodel=auto.arima(dd1,ic="aic",trace=T);
arimamodel
myforecast=forecast(arimamodel,h=16);
myforecast;
plot(myforecast);
#rm(list=ls())
#ls()
data1=read.csv('c:/users/lenovo/desktop/bind.csv');
d14=data1[,c("year","AUD")]
d14;
class(d14);
aud1=ts(d14$AUD,start=c(1990,1),end=c(2019,1));
class(aud1);
aud1;
summary(aud1);
plot(aud1,col="blue");
```

```
adf.test(aud1)
plot((log(aud1)));
diff1=diff(log(aud1),difference=1);
adf.test(diff1)
plot(diff1)
diff2=diff(log(aud1),difference=2)
adf.test(diff2)
plot(diff2)
diff3=diff(log(aud1),difference=3)
adf.test(diff3)
plot(diff3)
diff4=diff(log(aud1),difference=4)
adf.test(diff4)
plot(diff4)
arimamodel=auto.arima(aud1,ic="aic",trace=T);
arimamodel
myforecast=forecast(arimamodel,h=16);
myforecast;
plot(myforecast);
```

3) Wilcoxon rank sum test

```
rm(list=ls())
ls()
india=c(108263667,107219810,106429271,106641892,107899849,109110256,110408591,111810347,113066151,114703195,11633
1013,116733029,116008868)
india
```

```
china=c(137022178,136304448,135844707,135649132,135997966,136482751,136822132,  
137286435,138011775,139990886,141817976,142336484,142231342)  
china  
length(china)  
length(india)  
wilcox.test(india,china)
```

4) Kruskal-Wallis test

```
###AUD  
rm(list=ls())  
ls()  
weight = c (47109786, 47374932,47640929,47771490,47626818,47339859,46906468,  
46601817,46707349,47794868,48883150,48968319,48605267, 33603149,35059557,  
36410014,37398719,38133782,38859453,39578021,40163624,40745739,41324938,  
41766716,41931911,41539100,5856503,6007714,6178501,6333690,6490242,6648444,6808884,6991919,7159428,7310366,746383  
3,7640218,7818008)  
group=c("ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl")  
group  
df = data.frame(weight, group)  
df  
#print(df)  
myData = df  
print(myData)  
print(levels(df$group))  
myData = df
```

```
result = kruskal.test(weight ~ group,
data = myData)
print(result)
#### DUD
rm(list=ls())
ls()
weight = c(9152758,8798202,8439250,8212864,8258986,8305238,8351300,8396724,
8581772,9049916,9662948,9708005,9893107,5324443,5403014,5601541,5677693,
5751325,5822589,5891874,5959764,6026701,6490135,6961119,7033740,7105372,
973287,995564,1035601,1058605,1063373,1048769,1032808,996056,1017077,
1038520,1081112,1061141,996200)
group = c ("ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl",
"ctrl","ctrl","ctrl","ctrl","ctrl1","ctrl1","ctrl1","ctrl1","ctrl1",
"ctrl1","ctrl1","ctrl1","ctrl1","ctrl1","ctrl2","ctrl2","ctrl2","ctrl2",
"ctrl2","ctrl2","ctrl2","ctrl2","ctrl2","ctrl2","ctrl2")
df = data.frame(weight, group)
df
#print(df)
myData = df
print(myData)
print(levels(df$group))
myData = df
result = kruskal.test(weight ~ group,
data = myData)
print(result)
###DD
```

```
rm(list=ls())
ls()
weight = c(40379817,40065657,39882264,39832389,40056081,40418827,40782182,
41143947,41361327,41573051,41635939,41830080,41866484,40379817,40065657,
39882264,39832389,40056081,40418827,40782182,41143947,41361327,41573051,
41635939,41830080,41866484,6779447,6883124,6985919,7105216,7260271,
7416293,7593054,7753609,7937193,8084165,8253877,8531577,8879178)
group = c ("ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl",
"ctrl","ctrl","ctrl","ctrl","ctrl1","ctrl1","ctrl1","ctrl1",
"ctrl1","ctrl1","ctrl1","ctrl1","ctrl1","ctrl2","ctrl2","ctrl2",
"ctrl2","ctrl2","ctrl2","ctrl2","ctrl2","ctrl2","ctrl2")
df = data.frame(weight, group)
df
#print(df)
myData = df
print(myData)
print(levels(df$group))
myData = df
result = kruskal.test(weight ~ group,
data = myData)
print(result)
###AUD
rm(list=ls())
ls()
weight=c(15344330,15566049,15925682,16015084,16242672,16333636,16424223,16653502,16882174,17109997,17478568,17988
362,18352431,18339747,17649846,16926394,16539368,16378772,16328565,16266695,16324570,16376905,16556466,16733460,1
```

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```
6637500,16123730,2282190,2351591,2422253,2494003,2548428,2603194,2658525,2695209,2752092,2850839,2931478,3013642,3  
075228)  
group=c("ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl","ctrl")  
df = data.frame(weight, group)  
df  
#print(df)  
myData = df  
print(myData)  
print(levels(df$group))  
myData = df  
result = kruskal.test(weight ~ group,  
data = myData)  
print(result)
```

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