

PREDICTION MODEL FOR THE REDUCTION OF YOUNG DRUG ABUSERS

By

MAHA MUGHAL



NATIONAL UNIVERSITY OF MODERN LANGUAGES

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By

MAHA MUGHAL

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Submitted by: Maha Mughal

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Name of Discipline

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Name of Research Supervisor _____

Dr. Basit Shahzad

Signature of Research Supervisor _____

Name of Dean (FE&CS)

Dr. Noman Malik

Signature of Dean (FE&CS) _____

February 9th, 2023

AUTHOR'S DECLARATION

I Maha Mughal

Daughter of Jaffar Ali

Registration # 53 MS/SE/F20

Discipline Software Engineering

Candidate of **Master of Science in Software Engineering (MSSE)** at the National University of Modern Languages do hereby declare that the thesis **Prediction model for the reduction of young drug abusers** submitted by me in partial fulfillment of MSSE degree, is my original work, and has not been submitted or published earlier. I also solemnly declare that it shall not, in future, be submitted by me for obtaining any other degree from this or any other university or institution. I also understand that if evidence of plagiarism is found in my thesis/dissertation at any stage, even after the award of a degree, the work may be cancelled and the degree revoked.

Signature of Candidate

Maha Mughal

Name of Candidate

9th February, 2023

Date

ABSTRACT

The problem of drug addiction is increasing day by day at alarming levels. The understanding of addictive disorders and psychiatric pathologies has become easier through new computational technologies and techniques. Collection and comparison of data has become more efficient through the usage of new emerging AI trends. Technique of digital phenotyping paves the way for capturing characteristics of different psychiatric disorders in patients. Likewise, machine learning is helping the doctors in the classification of patients based on different patterns detected through data.

Almost 40,000 people are becoming drug addicts in Pakistan annually. Drug addiction problem is caused due to many reasons like peer influence, curiosity or family disturbances. This research focuses on those drug addicts who have stepped in this social evil due to some family issues. The best possible solution for controlling this social evil is to bring awareness among the parents about the effects of their behaviors on the mental and physical health of the child. In order to do that predictive analysis was applied to forecast the upcoming trends and events in drug addiction due to family disturbances.

First systematic literature review was conducted for deducing the major family factors effecting the health of child from extensive literature. Six family factors were inferred parent child activities, family structure, parent child communication, parents involved in drugs, parent monitoring and supervision, and strategies for family management. After the SLR, survey was conducted from drug addicts in order to gather data for predictive analysis. During the survey age of the patients was limited to 13 till 25. Total 3528 patients have been selected for the study. However, twin cities have been targeted for the data collection purpose. After the collection, data was wrangled and labeled properly and three classification models were applied Naïve Bayes, Decision Tree, and Random Forest. Decision Tree had the maximum accuracy percentage of 96%. After that upcoming trends were depicted for the six factors. The current values of family factors are 747, 430, 1018, 296, 1497, and 437 respectively. The predicted values are 4455, 2321, 3895, 5353, 25417, and 9098 respectively. By reviewing these values it's evident that government needs to take quick actions against this social evil and parents need to be acknowledged about the impact of their actions on children.

TABLE OF CONTENTS

CHAPTER	TITLE	PAGE
	AUTHOR'S DECLARATION	4
	ABSTRACT	5
	TABLE OF CONTENTS	6
	LIST OF TABLES	9
	LIST OF FIGURES	10
	LIST OF ABBREVIATIONS	12
	ACKNOWLEDGEMENT	13
	DEDICATION	14
1	INTRODUCTION	
	1.1 Overview	15
	1.2 Background Study	18
	1.3 Motivation	22
	1.4 Research Questions	23
	1.5 Research Objectives	23
	1.6 Approach	24
	1.7 Scope of study	25
	1.8 Relevance to SDG,s	26
	1.9 Social Impact	26
	1.10 Key Takeaways	27

2	LITERATURE REVIEW	
2.1	Artificial intelligence and drug addiction problem	29
2.2	Contributing sociodemographic factors	32
2.3	Query String	34
2.4	Causative family factors	35
	2.4.1 Parental monitoring and supervision	36
	2.4.2 Parental involvement in child activities	36
	2.4.3 Parents involved in drug addiction	37
	2.4.4 Parent child communication	37
2.5	Programs for parental awareness	38
2.6	Key takeaways	39
3	METHODOLOGY	
3.1	Overview	41
3.2	Quantitative Research	41
3.3	Instruments of Quantitative research	42
3.4	Qualitative Research	44
3.5	Instruments of Qualitative Research	46
3.6	Mixed method research	47
3.7	Research Context and justification	48
	3.7.1 Systematic Literature Review	49
	3.7.2 Survey	49
	3.7.2.1 Objectives of conducting survey	49
	3.7.2.2 Types of questions	50
	3.7.2.3 Survey content validation	50
	3.7.2.4 Calculation of face validity index(FVI)	51
	3.7.2.5 Data collection	52
	3.7.2.6 Patients profile	53
	3.7.3 Classification	55
	3.7.3.1 Data wrangling	55
	3.7.3.2 Data labelling	56

	3.7.3.3 Prediction models	57
	3.7.4 Time series forecasting	58
	3.8 Summary	58
4	RESULTS	
	4.1 Introduction	59
	4.2 Systematic Literature review	59
	4.2.1 Results	59
	4.3 Data classification	61
	4.3.1 Prediction models	61
	4.4 Time series forecasting	63
	4.4.1 Indexing of data	63
	4.4.2 Training and prediction of factors	64
	4.5 Summary	71
5	DISCUSSION AND ANALYSIS	
	5.1 Introduction	72
	5.2 Discussion	72
	5.2.1 Predictions for young drug abusers due to family disturbances in upcoming years	73
	5.3 Summary	74
6	CONCLUSION AND FUTURE WORK	
	6.1 Conclusion	75
	6.2 Summary of Contribution	78
	6.3 Future Work	78
	REFERENCES	80

LIST OF TABLES

TABLE NO.	TITLE	PAGE
1.1	Table of methodology	24
2.1	Data sources and Literature Sources Description	34
3.1	Instruments of Quantitative research	42
3.2	Instruments of Qualitative research	46
3.4	The clarity and comprehension ratings on the item scale by 2 raters	51
4.1	Research questions and their results	60

LIST OF FIGURES

FIGURE NO.	TITLE	PAGE
1.1	Ten days amount of drugs that a person can have in grams in Portugal	22
2.1	Rate of increase in drug addicts	35
3.1	Methodology used for predictive analysis for six family factors	48
3.2	Historic data of drug addicts according to family factors	53
3.3	Gender wise illustration of data	54
3.4	Age wise categorization of data	54
3.5	Assigning weights to the attributes	56
3.6	Labelling of data	57
4.1	Illustrates the accuracy of classification using Naïve Bayes model	61
4.2	Illustrates the accuracy of classification using Decision Tree model	62
4.3	Illustrates the accuracy of classification using Random Forest model	62
4.4	Indexing of data	63
4.5	Comparison of predicted values and ground truth for PCC	64
4.6	Showing the increased amount of drug addicts due to PCC	64

4.7	Comparison of predicted values and ground truth for PCA	65
4.8	Showing the increased amount of drug addicts due to PCA	65
4.9	Comparison of predicted values and ground truth for PID	66
4.10	Showing the increased amount of drug addicts due to PID	66
4.11	Comparison of predicted values and ground truth for PMS	67
4.12	Showing the increased amount of drug addicts due to PMS	67
4.13	Comparison of predicted values and ground truth for FS	68
4.14	Showing the increased amount of drug addicts due to FS	68
4.15	Comparison of predicted values and ground truth for SFM	69
4.16	Showing the increased amount of drug addicts due to SFM	69
4.17	Showing future trends in the increased numbers of drug addicts due to defined family factors	70
5.1	Drug addicts rate of increase	73

LIST OF ABBREVIATIONS

PCC	Parent Child Communication
PMS	Parent Monitoring Supervision
PCA	Parent Child Activities
SFM	Strategies Family Management
PID	Parent involved in drugs
FS	Family Structure

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CHAPTER 1

INTRODUCTION

1.1 Overview

The usage of synthetic and non-synthetic drugs among youth is a constantly growing issue in Pakistan. Even with the strict laws of anti-narcotics in past three decades our country has faced enormous amount of increase in the number of drug addicts. Unfortunately, in current times Pakistan is one of the most drug affected countries in the world[1]. In last few years, one common practice that has led to collective deaths is the intake of injections containing cheap mixture of drugs with alcohol. On 22nd March 2016, an incident was reported, that more than 50 people were found dead due to the consumption of spurious alcohol in Sindh [2]. Many drugs like methamphetamine have direct effect on the behavior, making it violent and hostile. Usage of syringes and needles has increase the spread of hepatitis B, C and HIV/AIDS among the addicts. Drug addiction was never the problem in Pakistan, it started in early 1980's. The massive introduction of drugs in Pakistan is linked with the arrival of Afghan refugees in late 1970's in which some influential refugees were involved in local production and international trade of drugs. After the withdrawal of USSR troops from Afghanistan, it emerged as the major drug production country in 1990's. Afghanistan used Pakistan for drug trafficking in international markets, which made the drug access easy for the local markets of Pakistan and eventually started this social evil [3]. In Pakistan, the problems like poverty and upsurge of unemployment has increase the psychological stress and anxiety among the youth forcing them to seek refuge in drug abuse. Drug use disorder among the youth is because of numerous reasons for example, dysfunctional family structure, peer influence, or curiosity etc. Our society needs the awareness and proper knowledge about the drug addiction and its prolonged effects [4].

The current policies of government and ANF have failed to control this rapidly growing problem. The reasons behind their failure can be Pakistani society unwilling to follow the laws, police officers are misusing the laws against poor and addicts, and least interest of government officials in the treatment and rehabilitation of addicts. Combination of all these factors is leading our society towards destruction [5]. Many countries have almost same policies for combating drug trade, treatment for drug addicts, and to foster healthy citizens. Through surveys and statistics Pakistani government has recognized that drug trafficking is not the only problem but the increase levels of addiction among the citizens is also alarming. In current times, NIOC (national initiative against organized crime) has taken initiative against drug addiction among youth by raising awareness, different projects for students educating them about the prevention, treatment and rehabilitation from drugs, and establishing development programs on public sector level [6]. Unfortunately, in past decades all these steps were taken but no significant results were seen. The major problem in our society is corruption and our government officials lack the enforcement and implementation of these policies. The productive work of some officers is also being casually overshadowed by the higher authorities due to corruption. The important factor here is to identify the difference between drugs and crime. Flow of drugs can never run smoothly if the government officials are not involved. Criminals earn a large amount of profit from drug industry and so as government officials. They cut their half from the profit and allow illegal activities in the country. At this point we require laws that include the strict punishments for corrupt officials and an impartial body is needed to monitor and control the successful implementation of these laws in Pakistan [7].

On the other hand, Portugal has done immense efforts in reducing the amount of drug addicts and drug dealers. After the Second World War, Portugal was still running on authoritarian power. It was a country with firm catholic beliefs, traditions and a society with conservative thoughts. It was ruled under the authoritarian dictatorship of Antonio Salazar. In 1960's the counterculture movements celebrating drug intake as a fashion icon moved largely into Portugal. It was not late that until 1970's drugs became a serious issue in Portugal. Unfortunately, Portuguese possessed no proper knowledge about the use, effects, and causes of different drugs. They were unaware of the health risks and problems

(behavioral and social) caused by the intake of different drugs. The number of small groups and individual drug smugglers increased greatly in 1980's and authorities of Portugal found it impossible to solve this problem. In fact, in early 1990's drug issue of Portugal became a social concern worldwide. Authorities started treatment centers and some private treatment clinics for drug addicts but it was of no use on larger scale. In no time this issue was being discussed everywhere in streets, media, government meetings, and parliament. In 1998, government of Portugal went against the all typical and expected policies of crime and punishments, instead they came up with a new idea. The government immediately appointed a team of specialist doctors, psychologists, lawyers, and social activists and asked them to analyze the drug situation in Portugal and formulate a revolutionary strategy that can bring change at national level. After the long struggle of eight months, the team came up with the solution of decriminalization of drug possession and use. They suggested that we should limit the amount of drug possession for individuals. They recommended that government should focus on prevention and education, reduction in harm due to drugs, widening up the treatment programs with innovative improvements, and establish activities that can help the addicts in restoring their connection with their families, work and society. This policy encouraged the idea that drug use is not good and its possession in limited amount does not require high levels of imprisonment [8]. Team experts were of the view that many of the drug users were afraid to seek out medical help due to the fear of punishments or getting a criminal record effecting their career in future. The team suggested that decriminalization will work on humane considerations and as well as pragmatic ones. This policy created discussion commission forum in Portugal, in which commissions were placed under the ministry of health rather than ministry of justice, indifferent to other countries. This new approach forced the officials to think of drug abusers not as criminals but as patients. In current times in Portugal, when police stops the drug user they ask him about the drug dealer and give them a warning ticket and if that person is caught again than he is sent to the court and they give him a choice between treatment and prison. Through this innovative approach now Portugal is one of the countries where drug addicts are at minimum scale [9].

Artificial intelligence is used for the processing of large amounts of data and converting it into useful information by using innovative algorithms that detects patterns in

the data [10]. Artificial intelligence has revolutionized the field of health [11] [12]. It is being used for the predicting the desirable characteristics of new drugs[13] or to evaluate the response to the usage of certain drugs [14]. Artificial intelligence is being a helping hand in all the fields and likewise in the context of drug addiction problem, it provides tools for the analysis of large volumes of data. This data is majorly related to the consumption of drugs, sociodemographic factors, psychological and health variables, which are related to each other with great complexity. The major difference between the classical statistical and AI models is that it enables us to generate predictions on the basis of gathered data. In drug addiction problem AI models can help in awakening the society with the predictions of damage caused by the consumption of certain drugs. With the techniques of data mining we can find the relationship between drug use, sociodemographic variables, and health [15]. AI techniques can help in the detection of patterns between the association of sociodemographic and psychosocial variables with drug abuse or controlled substance use. Concluded results from these predictive models can help in designing more effective programs and social policies from the prevention of drug abuse. These predictive models are also cost efficient as they can automatically update their information on regular basis. There are plenty of AI techniques which can be used for the design and production of intelligent systems providing solutions for drug addiction problem. For example, big data, which includes data structures, data analytics and methods such as clustering, association rules, regression, classification, time series analysis and text analysis [16]. Machine learning field is mainly divided into two concepts supervised and unsupervised learning. Supervised learning includes k-Nearest neighbors, linear regression, logistic regression, support vector machines (SVMs), decision trees and random forests, naïve Bayes, and neural networks [17]. With the help of these algorithms, development of intelligent system for any sort of health problems have become efficient and cost effective.

1.2 Background study

Many researchers and government officials are working on drug addiction solution through artificial intelligence [18]. In this paper [19], the author has proposed a solution for the identification of drug addict through artificial neural networks. Using ANN technique,

a decision support system is developed for the identification of drug abuser. This procedure is done by inserting fifty variables at input layer while the output layer contains one neuron deciding whether the person is a drug addict or not. They formulated their results through experimentation which included 184 cases, gathered from addiction treatment center. Out of which 155 cases were drug addicts, giving the average of classification accuracy of 98.423%. Based on these results we can surely say that AI can be an innovative solution towards drug addiction problem. In another paper [20], author has suggested to use the method of observable signs and symptoms for the identification of behavioral changes. There are countless researches done on the drug addiction problem among the youth by using AI techniques. In another paper [21], authors implemented an expert system for the identification of drug addicts using decision tree algorithm. They proposed that individuals can test themselves through series of inquiries in the test. If the person feels hesitated then this program provides the option of performing the test by the family member. Through this expert system the doctors or psychiatrists can detect that if the person is dependent on drugs or not.

The origin of drug laws in Pakistan was started under the rule of General Zia-ul-haq which was based on the Hanafi School of Islamic jurisprudence. The first law that was made for drug use, drug possession, and production was called the Prohibition of Order of 1979. The law stated that any person found guilty of drug use, possession or production shall be punished with imprisonment. But unfortunately, there were many technical and procedural flaws with this law [22]. As this law was developed on the basis of Islamic rules, which included some harsh punishments. Hence, it was severely criticized by the civil societies, human rights organization and many NGO's. This criticism forced the Pakistani government to come up with the secular law called Control of Narcotics Substance Act (CNSA) in 1997. According to CNSA, the punishments were given on the basis of amount of the drugs found. The difference between PHO and CNSA was that PHO was developed under the influence of religious-political leaders and parties such as Jamat-e-Islami. PHO referred harsh punishments against the criminal offence and any person who intentionally took, possess, or sell intoxicants will be punished with imprisonment. CNSA in contrast to PHO is more liberal. According to the laws of CNSA drug use is not a criminal offence but its possession is an offence. This law of CNSA is specifically targeting the drug

traffickers. CNSA focused more on the treatment and rehabilitation of addicts and obligated the government for the identification and registration of drug users. According to our Islamic rules, Sharia prohibits the use of drugs because they can effect immensely on the physical and psychological health of a human being. Drug addiction can cause negligence towards society and family. It is important for an Islamic state to prohibit the use of all kinds of substance abuse. According to renowned Egyptian Sayyid Qutb, a Muslim society can only implement the Sharia when every Muslim has a true spirit and moral character for accepting the social order [23]. Many modern Muslim scholars take drug addiction as a psychological disorder that can only be cured through the attention of specialist doctors, family, religious communities and society. Islamic medical ethics give right to every person to get medical care that they need. Islam is a religion that is known for kindness and compassion. It is important to understand the cause of problem and act accordingly. Although, government made the secular law CNSA but still drug trafficking business and drug usage is flourishing day by day in Pakistan. The next step that was taken by the government of Pakistan was the development of ANF. A separate anti-narcotics force whose only job is to combat the reduction of supply and demand of intoxicants that enter Pakistan from the borders mainly Afghanistan. ANF was established in 21st February 1995. Although, all these forces and programs are working in Pakistan but still there is an increase of 40,000 drug addicts annually in Pakistan. Such large amount of increase in drug addicts annually show that even the laws of ANF have failed badly in controlling this social evil [24]. The problem with Pakistan is that rich people can get and use drugs for fun whenever they want without any legal penalties. Whereas, the poor drug addicts pay heavy price through fines and imprisonment. Discrimination among the poor and rich is being done in Pakistan in every field. Drug addicts who are from well-known families get private treatments with highly qualified specialists, whereas poor people are hardly getting any treatment from the government [25]. The laws of Pakistan need to be more effective and implemented in the society without any discrimination.

Portugal on 1st July 2001, imposed a nationwide law, which stated that all drugs are decriminalized but not legalized. Which makes the possession and usage of drugs legally prohibited but its violation does not come under the criminal record. These violations are carefully managed and comes under the administrative violations. Keeping in view that

drug trafficking in Portugal is still stated as a criminal offence. Portugal is the only EU member state where drugs are decriminalized and the results of this law has proved that it is indeed an effective law. When this law was passed, everyone thought that Portugal will become the free drug state. Where tourist will come for free drugs and will become a paradise for them but, the results were in contrast to that, and a dramatic decrease was seen in the death rate due to drug usage [26]. One of the major advantage of this law was that rate of ordinary crimes was getting low, because many addicts do shop lifting or street crimes for their next drug consumption. Portugal is using methadone treatment due which drug abuser does not have to steal but they can easily go to the center. Many countries well-documented the methadone treatment, that how it can help a state in reaching the point where there is zero crime rate. By decriminalizing the drugs, the government of Portugal also took an intelligent step. In streets of Lisbon drug consumption was visible hence, government hired some personals who would circulate soft drugs among the people causing minimal damage. Through these approaches great results were seen, in year 2000, the number HIV patients who were drug addicts was 1430 and in year 2017 it was 18 which is a remarkable change [27]. The Portuguese model for drug control has gained the international recognition. In the start of this law many parties raised concerns in International Narcotics Control Board that Portugal is going to fail badly and the number of drug suppliers and abusers will be out of control. But the results impressed everyone and forced them for praising the Portuguese model. The Portugal's law of 2000 also included the specific amount of drugs that a person can had before he can treated as a proper drug dealer. The amount of drugs for one person and dose for ten days is listed below in the graph [9]:

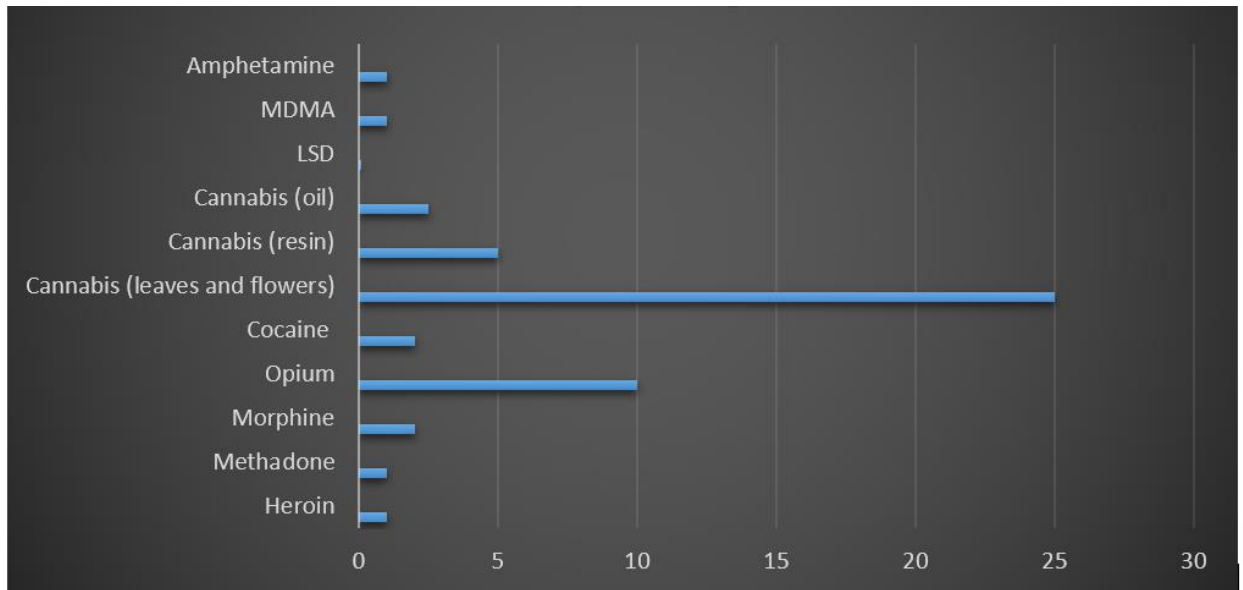


Figure 1.1: Ten days amount of drugs that a person can have in grams in Portugal

1.3 Motivation

Urban or rural, developed or underdeveloped, small or large, nearly every community is coping with drug abuse. Such communities are trying to combat this challenge, and some are successful in this regard but still it is a big risk for such communities that are unable to handle this social evil. In Pakistan, the drug intake on average starts at the age of 19. The study reported that, for all drug types, the average age of drug intake has been between 19 and 31 years of age. There is a continuous increase in drug abuse due to many reasons but the most important is family disturbances. Many parents fail to fulfil the physical, and psychological demands of their children, which is commonly due to lack of knowledge about family management.

Machine learning techniques can be used to analyze large amounts of data to forecast future trends in drug abuse and identify potential areas of intervention. These techniques can be used to analyze large amounts of data to gain insights into the underlying causes and dynamics of drug addiction. AI techniques can be used to find patterns in patient data that could be used to inform treatment plans and help predict which treatments might be more effective for a particular patient. Machine learning techniques can be used to analyze

patient data and predict the likelihood of a patient relapsing after treatment. It's useful in analyzing patient data and provide more accurate diagnoses of drug addiction, allowing for earlier intervention and improved patient outcomes.

The increasing levels of drug abusers in Pakistan require serious attention of government officials, as anti-narcotics have failed badly in managing this issue. There are many reasons behind the failure of ANF like, disinclined behavior of Pakistani community towards laws and policies, police officers using these laws for exploiting the poor and drug addicts, or carelessness of government towards the treatment and rehabilitation of drug abusers. The government of an Islamic state should develop such rules which are following the Sharia and should be accordance to the current times. The laws of CNSA should be reformed according to the teachings of Sharia and needs of modern society.

1.4 Research questions

RQ1: What are the family factors that lead a child towards drug abuse?

RQ2: How to acquaint parents with the factors causing family disturbances?

RQ3: What are the predictions for young drug abusers due to family disturbances in upcoming years?

1.5 Research objectives

- To identify the factors that are making disturbances among the family members. As we know family disturbances is a bigger term, and we need to factorize that term for more understanding of this problem.
- To develop the sense among the parents that their every single behavior has great impact on their children. By those behaviors children are developing their personalities and traits, leading them towards ambiguous future.

- To identify the future implications of parents' behaviors on their children, physically and psychologically. To identify the consequences of this problem if not treated in time by predicting the increase percentage of drug addicts.

1.6 Approach

In order to achieve the desired goals following methodologies will be used:

Table 1.1: Table of methodology

Research Method	Objective	Types of Data	Advantages
Survey	To gather information relevant to the research.	It is quantitative method and also data gathered from this will be primary.	It is a first-hand information which will eliminate the fear of fake resource.
Predictive Analysis	To predict trends for upcoming years.	It uses quantitative data, also data will be primary.	Accuracy.
Internet research	To get information from internet relevant to the research topic.	It is both qualitative and quantitative method, also data gathered from this will be secondary.	Great amount of data is available on the internet which will be great for the analysis of the data.

Library research	To gather information relevant to the research topic.	It is both qualitative and quantitative method, also data gathered from this will be secondary.	Great amount of data is available on the internet which will be great for the analysis of the data.
Focus group	To get feedback on collected data and its analysis.	It is qualitative method and also data gathered from this will be primary data.	It's a best possible way for gathering the feedbacks related to the data analysis and for making improvements in the research work.

1.7 Scope of study

At the initial stage of the thesis the scope is being narrowed down to the rehab centers and NGO's of Islamabad and Rawalpindi. The data gathered from the surveys and interviews will be analyzed by using machine learning algorithms. After the analysis a prediction of upcoming years will be deduced informing about the family factors causing the increase in the percentage of drug abuse among adolescents.

1.8 Relevance to SDG's

My research will be in relevance to three sustainable development goals, which are as follows:



The word sustainability means maintenance at certain level or rate. The rate of drug addicts can only be sustained through awareness and knowledge. Only the eradication of this social evil can lead the cities and communities of Pakistan towards sustainability.



The predictions at the end of this research will provide awareness among the parents regarding the impact of their behaviors towards children. It will help them in improving their parental skills eventually leading children towards a healthy well-being and good health.



Drugs among the students are effecting their studies at immense level. Students mostly take drugs for scoring good grades, pressurized by their parents. Once parents are well informed about their positive behaviors towards children and types of drugs, we as a society can easily improve our quality of education.

1.9 Social impact

At international level drug trafficking is one of the largest illegal business. Almost \$400 billion dollars are being earned annually through this social evil. This trade benefits the drug smugglers, gangsters, corrupt police forces and politicians. Drug addiction can damage the society; the way termite eats away the wood. It effects the stability of the families, trustworthy government officials, policies and laws, and a healthy work environment [28]. This evil can only be eliminated by awareness among the parents

preventing their children from its intake. Eventually decreasing the selling rate of drugs in the society.

1.10 Key takeaways

The problem of drug addiction is increasing day by day at alarming levels. The understanding of addictive disorders and psychiatric pathologies has become easier through new computational technologies and techniques. Collection and comparison of data has become more efficient through the usage of new emerging AI trends. Technique of digital phenotyping paves the way for capturing characteristics of different psychiatric disorders in patients. Likewise, machine learning is helping the doctors in the classification of patients based on different patterns detected through data. On the other hand, Pakistani laws are failing to control this social evil. Portugal, after the implementation of an innovative change of decriminalization of drugs they remarkably controlled the situation of drug addiction in their country. A complete comparison of laws and policies of Pakistan and Portugal is discussed in this paper.

Even the laws of anti-narcotics have somehow failed in controlling the problem of drug addiction in Pakistan. Almost 40,000 people are becoming drug addicts in Pakistan annually. On the other hand, Portugal by decriminalizing the drugs managed the death rate of drug addicts and also the number of people going to jail because of drug trafficking. Pakistan is in a state where immediate remedies are required for controlling this social evil. Obviously, as an Islamic nation we cannot apply the decriminalization exactly like Portugal. But with the appropriate changes and reforms according to Sharia in decriminalization laws we can manage this problem of drug addiction. The overall conclusion deduced from the research papers shows that new AI based technologies like computerized adaptive testing (CAT) can immensely improve the assessment and interventions in the field of addictive disorders. There are many laws in Pakistan for drug trafficking but government officials have badly failed in order to implement those laws. The only solution that seems accurate is to inform parents with the thorough knowledge of types of drugs, usage, and educating them about the impacts of their behavior on mental

health of children. Artificial intelligence techniques and models are appearing more reliable solution for the drug addiction problem rather than traditional counselor-facilitated methods. Machine learning or data mining techniques have proven to be more suitable for better detection, and in the education of individuals regarding substance abuse through different predictive models. These innovative solutions have encouraged the doctors for generating new hypothesis developed from new technologies for assisting drug dependent individuals and eventually helping the society and their families. AI based tools should be taught properly to the health care individuals and they should properly manage the data of the patients without initiating any security breach. Included researches in this paper encourages for more progression in drug addiction treatment and assessment through AI and ultimately it will be leading towards better preventive measures. At the end of the research, predictions will be made on different family factors which will aware the parents with the alarming situations, and maybe we can bring some change in our society.

CHAPTER 2

LITERATURE REVIEW

2.1 Artificial intelligence and drug addiction problem

Artificial intelligence has revolutionized many industries with its unique algorithms and techniques. For some time, many developers are trying to transform the knowledge of medical industry through AI. In which addiction problem and its treatment is one of the issue to be solved from the priority list. AI has opened new ways and opportunities for the drug addicts to help them in becoming sober [29]. One of the ways through which AI have improved the fields of addiction treatment is through behavioral recognition and predicting the patterns in emotions and behaviors. These techniques are helping the doctors in understanding the working of a human brain in more precise way. For behavioral analytics, there are three main machine learning techniques available. Task-driven supervised learning and data-driven unsupervised learning are the first two categories. In supervised learning, mapping functions are used to predict dependent variables from independent variables [30]. It contains two main subtypes: regression and classification. Unsupervised learning does not need a particular outcome variable, in contrast to supervised learning. The two main categories of unsupervised learning are clustering and dimensionality reduction. Additionally, for improved predictive performance, learning approaches combine many learning techniques in a homogenous or heterogeneous manner. Another machine learning method is reinforcement learning, which is more technical in terms of implementation. Reinforcement learning applies goal-oriented algorithms with a focus on the interactive environment to train machines via rigorous trial-and-error processes. Positive reinforcement is accumulated, while negative reinforcement is avoided [31]. These algorithms are also good matches for the psychology's reinforcement learning theory.

Through these techniques and methods many psychiatrists can diagnose the brain state of an addict and its effective treatment [32].

Drug addiction is one of the most common problem faced by Pakistan in current times. Revolution in drugs has increased curiosity among the students leading them towards drug abuse. It is a chronic disease effecting the brain, heart and other parts of the body. Basically, drug addiction starts from smoking and it acts as an initial step towards drug abuse [33]. Mainly, there are two categories of drugs synthetic drugs and natural drugs. Synthetic drugs are developed by using man-made chemicals whereas, natural drugs are established by using natural herbs and plants. Addiction of both drugs is equally injurious to health. Synthetic drugs include LSD and methamphetamine, synthetic marijuana, synthetic stimulants in form of bath salts and N-bomb [34]. On the other hand, natural drugs include opium poppy, Tequila, cocaine, penicillin, and sassafras root. All these new types of designer drugs are causing curiosity among the youth leading them towards a great destruction. And lack of knowledge among the parents is like icing on the cake. As a nation we all know that “drugs are injurious to health” but, we lack the knowledge about the new forms of drugs. Students are taking drugs in form of cartoon shape stickers in front of their teachers and parents [35]. According to Anti-Narcotics-Force there are different factors behind drug addiction among youth which are parents’ negligence, drugs are easily available on low cost, rapid change in culture and social norms leading towards drug abuse as a false solution, economic issues and frustration, existence of drug dens, lack of drug knowledge among the society, and laziness of government in taking actions against drug mafia [36]. Drug abuse is not only increasing the levels of morbidity but also the levels of mortality. For instance, in year 2015 almost 450,000 people were dead due to the usage of drugs [35]. Every day in Pakistan approximately, 700 people die due to drug problems and cannabis is the most commonly used drug among the population because, it is cheap and easily available [37].

Intake of drugs among students can be due to many reasons, like peer influence, family disturbances, curiosity, stress and tension, and mental health disorder. Sometimes families put immense pressure on a child for scoring good grades, and usually parents

compare the results among the siblings, which becomes a mental torture for some children. Hence, they tend towards the usage of stimulant drugs and their constant use can lead towards hallucinations, panic attacks, depression or psychosis [38]. Many students fail to handle the family pressures and move towards drug abuse. According to many researchers' family provides a mish mash of stimuli to the child which can affect his physical and psychological development. Though the society, media, friends and educational institutes also play an important role in the physical and psychological development of the child but, family plays the main role. The sole purpose of parents should be to raise a child in a healthy and positive manner to make him a better person. Many researches have been performed for indicating the difference between behavioral traits in a child raised in positive and negative environments. The results of those researches concluded that children who were raised in a negative environment had low self-esteem and had some conduct disorders. These negative environments at home can be due several reasons. Researches show that parents who are drug addict, it's most likely that their children will also follow the same line and will lack some basic personality traits. Drug addiction among parents can directly affect the well-being of a child. Another reason for negative environment at home can be that parents are self-centered. They are totally focused on their careers and social life, thus cutting the emotional and psychological needs of their children. Which eventually leads a child towards drug abuse. Interviews conducted from drug addicts mostly tell one common reason that they didn't had a good relation with their family. It's obvious that a children spend most of their time at home and if they are not getting a positive environment they will eventually develop bad behavioral traits leading towards destruction [39].

The rate of drug addiction has raised to this level because of its easy availability. Students can easily get drugs from their van or bus drivers and drugs are also being available through online websites. Designer drugs are most popular because with slight change of chemical used in its manufacturing the chemist makes the drug legal for the market. The increase amount of drug addicts has also captured the attention of important government bodies and they are working immensely on its eradication. Many awareness campaigns are being organized by the ANF in different educational institutes. But, the point is to eliminate this problem from root which can only be done when each and every government servant is loyal towards his or her job, and our country is free of corruption.

Family disturbances is a larger term which includes many factors. For example, social norms, religion, or lack of communication etc. In my thesis I will be focusing on these factors describing family disturbances which are leading our students towards drug abuse.

2.2 Contributing sociodemographic factors

Drug abuse is a social evil that is increasing day by day in our youth. Majority of the adolescent and youth (age between 13 – 25 years) have been reported drug addicts belonging to a school/college or university. It has become an escalating problem which is greatly effecting the physical abilities, mental health and social skills of students. Policies and proper health awareness campaigns should be designed for the knowledge of the parents and teachers. They should know about the different varieties of drugs so that they can help their children on time. Awareness among students, parents and practice of religious values can be a solution to our problem [40]. According to the existing studies, a child in stress can easily be tempted towards a bond where he can learn about the methods of drug use. This bond can be formulated with family members, some religious organizations, educational institutes, and influence of social circle. All these factors play an important part in the growth of a child. A child can get highly affected by the negative or positive impact of these factors. According to studies, drug abuse among adolescents is mostly because of family disturbances and peers who are indulged in drugs. When child is not getting a positive atmosphere from home he tries his best to satisfy his inner urge which can easily lead towards drug abuse. According to studies there are different family characteristics that can influence adolescent towards drug use. The most common family characteristics are, family bonding at low-level, parents failing to manage the family properly (in terms of personality development according to our culture and religion), constant conflicts among the family members, and parents having drug addiction problem causing behavioral problems. If a child is suffering from any of these factors at home, then they are at high risk for drug abuse. The associated problem with this is the easy availability of drugs. Children tend to have peers who are drug abusers or drug sellers, tempting them towards destruction. The question here is that how can parents' save their children from such companies? According to studies, students who are religious are not easily allured towards drugs even in tough situations. Which proves that religion plays an important role

in the upbringing of a child. Proper regulation of Islamic values can be the solution of our problem. A child who knows about right and wrong according to Islamic rules will never dare to indulge himself in bad habits. He will be mature enough to choose better company to hang out with.

Religion is known as a set of beliefs and values that one has to practice through his or her life. Religion is a fundamental need of every person. According to studies, religious values have enlightened people with the prevention of drugs like alcohol, marijuana, amphetamines and depressants. Maybe proper education of religious values to the children can help the nation in getting rid of this damaging disease. Proper involvement of children in religious organization with proper parental guidance can help in many ways for achieving the drug free nation goal. Firstly, if students are involved in religious organization their social network will have mostly those peers who avoid drugs completely. Religious activities can help students in developing attitudes which are against the usage of drugs. Secondly, if students are associated with some religious organizations they will try their best to fulfil the goals and objectives of that organization providing them a better way of living a life. Such values can assist students in developing personal maturity and sense against drug use. Thirdly, according to research, parents involving their children in religious activities becomes an important prevention strategy against drugs and strengthening the family teachings. Religious activities can be in two forms, privately and publically and both the forms are effective in a child's growth. Families can make their bond stronger by doing private religious activities like offering prayers, personal commitments, and following religious rules and principles. Such activities can highly become helpful in the prevention of drug addiction [41].

Family disturbance is one of the main reason behind the drug addiction. Almost 25% of the youth population is involved in drug abuse [2]. Pakistan is a collectivistic culture in which the family is given priority as social and financial support, thus ignoring the individual level need. Mostly in joint families a child needs to get the approval from the elders of the family for his or her decisions. In Pakistani society a strong bond to mother is observed and fathers are mostly seen as the authority figure which is alarming. Because

mothers usually spent most of their time at home and they don't know much about the outside world as compare to fathers. Almost 79.4% of women are house wives having minimal contact with the outside world. Children poor communication with their parents can also be a key factor in drug addiction. Unconditional ad positive parental support can strengthen self-esteem and self-confidence among the children, and its absence can reduce them immensely. According to data collected from 20 people which were in rehab, almost 75% of victims are living in a joint family system. One respondent, who had relapsed three times and was in the facility for his fourth treatment, stated that he had relapsed because of his constant fights with his father. It is a common trend among the families that when a child is angry parents stop communicating with him or her, which has inordinate negative effects. According to statistics, almost 60% of drug addicts have faced this issue. Another factor enlightened in this survey results was that parents of victims were well aware of the proper family management techniques but still somehow they were unable to implement them [42].

2.3 Query string

The data source and search strings used in this systematic literature review are defined below in table 2.

Table 2.1: Data sources and Literature Sources Description

Data sources	Search strings	Number of papers
IEEE	“Family Disturbances” AND	50
Springer	“Parents behavior” AND “Drug	25
Elsewhere	Addiction” OR “Drug Abuse”	25
Wiley	AND “Youth” AND “Adolescents” AND “Effects on health” OR “Deviant Behaviors”	13

2.4 Causative family factors

Drug abuse has been an issue since decades. With every passing day there is a rapid increase in the number of drug abusers worldwide. Unfortunately, Pakistan is also suffering immensely from this problem. According to UN reports, every year 40,000 people in Pakistan are becoming drug addicts Fig. (1), making Pakistan one of the most drug affected countries in the world [43].

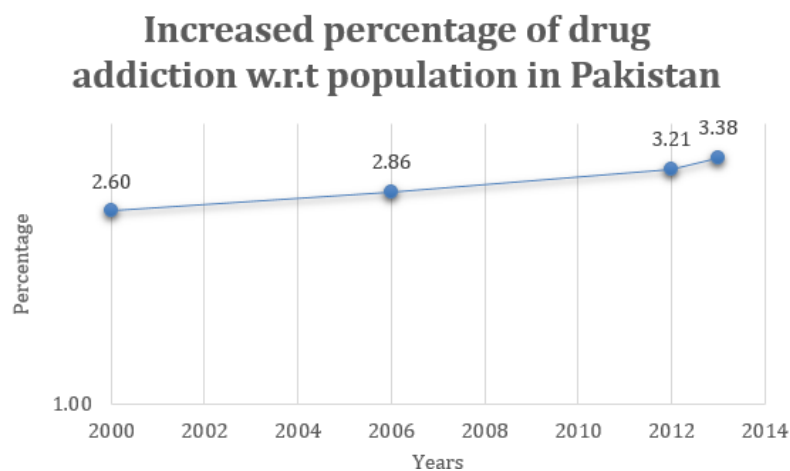


Figure 2.1: Rate of increase in drug addicts

The disturbing factor is that most of the drug abusers are students between the ages of 13 to 25. Various research show that, consumption of drugs starts from smoking as it is legal and easily available worldwide, influencing the youth to try new drugs, ultimately making them drug addicts [44]. Drug abuse is a phenomenon which can instantly affect the overall personality of an individual. It brings a rapid change in the psychological and behavioral aspects of a person. According to the survey conducted in year 2011 rate of drug abuse in our youth is 26% [45]. The study [46] shows various reasons answering why the young adults and adolescents take drugs. This includes peer relationship, curiosity, stress, and disoriented family. On the other hand, some of the users take drugs for the recreational purposes.

Multiple factors are influencing youth towards drug abuse. Change in the social and ecological systems of a human can easily impact on the physical and mental health of a child [47]. Within this development process of a child, parents play the basic and the most important influential role [48]. Major components that are included in this system are parent child communication [49], parent monitoring and supervision, involvement of parents in children activities and their peer relationships [50], strategies for family management, family structure [51] (parents divorced, separated, any sibling is a drug addict, any of the parent living in foreign countries, joint family system etc.) and parents involved in drug abuse [52].

2.4.1 Parental monitoring and supervision

Parental knowledge and monitoring plays a vital role in the development of the child health [52]. The term parental monitoring can be defined as a set parenting behaviors involving track of activities and whereabouts of a child [53]. Parental knowledge includes the results of monitoring methods and effects of these methods on a child. Evidence shows that low level of these monitoring behaviors encourages children towards the early use of alcohol and drugs [54]. Parental monitoring act as a protective factor for children by helping them in avoiding risk factors like substance abuse and peers influence towards drug intake [55]. Studies show that peer influence is one of the main reason for drug abuse and correct parental monitoring can help in overcoming this factor [56].

2.4.2 Parental involvement in child activities

Parental behaviors and peer relations are those factors which are contextual in nature and can predict the drug abuse in adolescents [57]. Research shows that inadequate parental monitoring can easily push adolescents for developing relations with deviant peers [58]. On the other hand, peer influence for drug addiction depend on the level of monitoring applied by the parents on the children [59]. Results of a research [60] showed that positive parental behaviors helped the adolescents in developing the sense of self-efficacy which

aided the children in refusing the alcohol offers from peers. This clearly demonstrates that parental monitoring can protect children from deviant peers.

2.4.3 Parents involved in drug addiction

According to research [61] [62], another major family factor that effects the adolescents towards drug abuse is parent alcoholism habits. Many research results showed that parental alcohol use is directly associated with the teen drug abuse. Furthermore, results proved that negative parental behaviors has a direct impact on the physical and mental health of a child. Positive parent-teen relation includes affective communication, parental monitoring, which acts as a protective factors in the growth of a child [63]. However, only positive communication is not enough for deterring a child from drug abuse. Teens require a proper guidelines about the consequences of substance abuse [64]. For instance, a study showed that children that have spent more time with their parents and had a high frequency of communication regarding substance abuse were at low risk of becoming an addict [50].

2.4.4 Parent child communication

Another study showed that children who hesitated in sharing their drug related problems with their parents were at high risk for substance abuse [65]. Keeping in the view that findings, it is obvious that enhancing the quality and level of parent-child communication can be a target solution for the substance abuse among adolescents [66]. According to research [67], almost 78% of drug victims started using drugs due to family stress and disturbances which is a large amount. Henceforth, there is a need to control this social evil that is on the rise in our young generation. For this purpose, parents need to understand the consequences of a disoriented families and its effects on the children mental health [68]. Both the parents should learn about the different types of drugs, and behavioral changes of a child after using them. In our modern era parents need to understand the importance of religion and its implementation in life. They need to understand that Islamic

values can help in developing a strong personality of a child. Different factors making a family disoriented, parents need to comprehend those factors and should learn about their influence on children in negative ways [69]. So, that they can provide every healthy positive way of growth to their children and ultimately helping the nation towards a constructive growth [70].

2.5 Programs for parental awareness

According to the above studies, it is evident that we need proper guidance programs for parents. Which will help them in understanding the importance of positive parental monitoring and control. Removing the communication barriers between the children and parents is a suitable solution for this social evil [71]. Prevention programs can help in indicating positive effects of active parent participation in the life of a teen. Through these programs awareness can be provided to the parents regarding drugs and its usage [72]. Studies show that prevention programs which include factors like parent training, skills for building a successful family, behavioral issues among children can really help parents in building a healthy family [73]. So far, according to literature it has been observed that families that have followed prevention and intervention parenting approaches are at lower risk for child substance abuse [74]. According to studies [75], [76], family education and family intervention programs have a great impact in controlling the drug abuse problem among children. Families dealing with substance use disorders among their children should give utmost priority to the family therapy sessions. It is considered as an effective choice for treatment and prevention of SUDs among adolescents. Studies with evidence demonstrates that technique of family therapy has significantly reduced the adolescent drug abuse and their delinquent behaviors [77]. Studies show that family therapy also helped drug addicts in reversing their habit of committing crimes [78], adolescents are less involved in the drug abusing gangs [79], and also helping in the reduction of mental health problems [80]. From above discussion it is evident that family therapy and proper prevention programs seems to be an effective solution for the drug addiction problem among youth [81].

2.6 Key takeaways

Drug abuse is a social evil that is increasing day by day in our youth. Majority of the adolescent and youth (age between 13 – 25 years) have been reported drug addicts belonging to a school/college or university. According to UN reports, almost 7.6 million people of Pakistan are drug addicts which is an alarming situation for the government officials. Drug abuse is such a problem that has completely corroded our youth and it needs to be fixed on immediate levels. Adolescents are the most vulnerable, and are easily tempted towards drugs due to high level of curiosity. Parents play an important role in our culture and society. Children are effected the most by the behaviors of their family. Many parents fail to understand that their behaviors are the main cause behind the drug addiction problem in their children. In Pakistani culture, most of the children are afraid to communicate with their fathers because they are scared. And mothers also play a significant role for this cause by hiding the bad deeds of their children from fathers. Eventually, children are out of parental control causing bigger problems. Family environment is the first and the most important guide for a child, if parents are taking drugs obviously they are making a pathway for their children towards drug abuse. Proper family management strategies should be used by the parents for a better future of their children.

With the help of SLR following family factors were deduced which had an impact in influencing adolescents towards drug abuse. The factors were low parent child communication, incompetent parent monitoring and supervision, less involvement of parents in children activities and their peer relationships, ineffective strategies for family management, and parental involvement in drug abuse. All these factors play a major role in the development process and have great influence on the mental and physical health of a child. The end result of this research points towards one lacking point which is less parental knowledge regarding drug abuse and successful family management. There is a need of proper guidance system and prevention programs through which parents can acquaint themselves with the effective handling of child behaviors and their problems. These prevention programs can be started at school, college and university level which will guide the parents and children about the consequences of drug abuse.

Urban or rural, developed or underdeveloped, small or large, nearly every community is coping with drug abuse. Such communities are trying to combat this challenge, and some are successful in this regard but still it is a big risk for such communities that are unable to handle this social evil. In Pakistan, the drug intake on average starts at the age of 19. The study reported that, for all drug types, the average age of drug intake has been between 19 and 31 years of age. There is a continuous increase in drug abuse due to many reasons but the most important is family disturbances. Many parents fail to fulfil the physical, and psychological demands of their child, which is commonly due to lack of knowledge about family management.

There are many laws in Pakistan for drug trafficking but government officials have badly failed in order to implement those laws. The only solution that seems accurate is to inform parents with the thorough knowledge of types of drugs, usage, and educating them about the impacts of their behavior on mental health of children. The conclusion made from above research is that our community needs proper prevention programs for educating parents and children about the consequences of drug abuse. These programs can easily be initiated at school, college and university level. Parent's behaviors and actions have a great impact on the health of a child, and our society is failing to understand this factor. With the help of proper guidelines and prevention programs we can educate parents about effective handling techniques and positive attitude towards children.

CHAPTER 3

METHODOLOGY

3.1 Overview

Research Methodology refers to the discussion regarding the specific styles chosen and used in a research paper. This discussion also encompasses the theoretical generalities that further give the information not only regarding the selection of methodology selection but also on how it should be applied. In other words, you should draw attention towards these theoretical concepts in relation to the methodologies in a broader knowledge framework and explain their applicability in examining the purpose, problem and questions of your study. Therefore, the discussion that forms your academic composition's research methodology also incorporates an expansive literature review about analogous styles, used by other Authors to examine their research subject. A Research Methodology also represents the specialized way involved in conducting the research. Details regarding the styles not only concentrate on characterizing and defining them, but also explain your chosen ways.

3.2 Quantitative research

Quantitative research can be defined as a methodical examination of a phenomenon by gathering quantifiable data and performing statistical, mathematical, or computational techniques. Quantitative research collects data from existing and implicit clients using sampling styles and transmitting out online surveys, online polls, questionnaires. The conclusions of which can be portrayed in the form of numerical, after careful understanding

of these figures to forecast the future of a product or service and make changes consequently.

An illustration of quantitative research is the survey administered to extrapolate the time taken by a doctor to tend to a patient when the patient walks into the medical center. A patient satisfaction survey template can be administered to inquire questions such as:

- Time taken by a doctor to review a patient's history
- The frequency by which a patient walks into a hospital? and;
- Other related questions.

Quantitative outcome research is governed in the social lore using the statistical styles used above to collect quantitative data from the research study. In this research approach, researchers and statisticians emplace mathematical armatures and suppositions that pertain to the quantum under question. Quantitative research templates are objective, elaborate, and at various times, investigational. The results achieved from this research system are logical, statistical, and unprejudiced. Data collected using a structured system and conducted on larger samples represents the entire population.

3.3 Instruments of quantitative research

Table 3.1: Instruments of Quantitative research

Name	Definition	Example	Advantages
Survey	Research via survey is the most essential tool for all quantitative outcome research methodologies and studies. Surveys are	Surveys are used to ask questions to a sample of respondents, using distinct types, such as online polls, online surveys, paper	Multiple questions asked at the same time. Large amount of data can be collected in minimal time.

	used for collecting data from numerous respondents.	questionnaires, web-intercept surveys, etc.	Analysis and calculation of data is simplified.
Correlational research	Correlation research is conducted to establish a correlation between two close entities and how one influences the other and what are the changes that are eventually observed.	They may reveal the statistical relationship between high-income earners and relocation; that is, the more people earn, the more likely they are to relocate or not.	Classification of results is easy. A positive correlation shows that both variables increase or decrease simultaneously. A negative correlation indicates that when one variable increases, the other will decrease. If the coefficient is zero, then this result indicates that there is no correlation between the two variables.
Casual-comparative research	Researchers use this quantitative research method to determine the cause-effect equation between two or more variables, where one variable is contingent on the other	For example: 1. The effect of good education on a first-year student. 2. The effect of extensive food provision in the villages of Africa.	Allows researchers to study cause-and-effect relationships under conditions where experimental manipulation is difficult or impossible.

	independent variable. The independent variable is established but not swayed, and its impact on the dependent variable is examined.		
Experimental research	It uses an analysis to either prove or disprove the statement. This research method is used in natural sciences.	Evaluation of schooling methods practiced by two different teachers on the same group of students.	Conclusions drawn from experimental research are specific and concise. High level of control for the researchers. Easy to combine with other research methods.

3.4 Qualitative research

Qualitative research is defined as a market research system that focuses on carrying data through open-ended and conversational communication. This system isn't only about "what" people suppose but also "why" they suppose so.

Consider a convenience store looking to enhance its clientele. A methodical observation concluded that the number of men visiting this store are more. To determine why women weren't visiting the store is to conduct an in- depth interview of implicit clients in the group.

On successfully surveying female clients, visiting the near stores and promenades, and choosing them through haphazard sampling, it was known that the emporium doesn't have enough items for women and so there were modest number of women visiting the store, which could only be understood only by face-to-face interaction with them and deducing why they didn't visit the store, because there were further male products than female ones. Qualitative research is predicated on the disciplines of social sciences like psychology, sociology, and anthropology. Thus, the qualitative research styles allow for in-depth and further questioning of interviewees based on their responses, where the interviewer also tries to understand their encouragement and passions. Understanding how your followership takes decisions can help decide conclusions in market research. Qualitative research methods are designed in a manner that help reveal the behavior and insight of a target audience with reference to a peculiar motive. There are several types of qualitative research methods like

- An in- depth interview,
- Focus groups,
- Ethnographic research,
- Content analysis,
- Case study research etc.

The results of qualitative methodologies are more descriptive, and the conclusions can be drawn fluently from the data that's gained. Qualitative research methods arose in the social and behavioral sciences. Now our world is more complicated and it's delicate to understand what people think and perceive. Online qualitative research methods make it easier to understand that as its further communicative and descriptive.

3.5 Instruments of qualitative research

Table 3.2: Instruments of Qualitative research

Name	Definition	Example	Advantages
One-on-one interviews	It is a personal interview that is carried out with one respondent at a time. This is solely a conversational method and invites opportunities to get details in depth from the respondent.	HR manager interviewing the employees for performance appraisal.	This method provides a great opportunity to gather precise data about what people believe and what their motivations are.
Focus group	A focus group is also one of the normally used qualitative research methods used in data collection. A focus group usually includes a limited number of respondents (6-10) from within your target market. The main objective of the focus group is to find answers to the “why” “what” and “how” questions.	A focus group of parents of preschoolers meets to discuss childcare needs.	Understanding the met and unmet needs of the customer. Discovering of decision-making process.

Case study research	A case study is a research approach that is used to generate an in-depth, multi-faceted understanding of a complex issue in its real-life context. It is an established research design that is used extensively in a wide variety of specialties, particularly in the social sciences.	A case study about the car company might be used to generalize about similar companies in the automobile industry.	It is one of the simplest ways of conducting research as it involves a deep dive and thorough understanding of the data collection methods and inferring the data.
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3.6 Mixed method research

Multi-methodology or multimethod research includes the use of further than one system of data collection or research in a research study or set of affiliated studies. Mixed styles research is more specific in that it includes the mixing of qualitative and quantitative data, styles, methodologies, and/ or paradigms in a research study or set of affiliated studies. One could argue that mixed styles exploration is a special case of multimethod exploration. Another applicable, but less frequently used marker, for multi or mixed research is methodological pluralism. All of these approaches to professional and academic research emphasize that mono- system exploration can be enhanced through the use of multiple data sources, styles, research methodologies, perspectives, outlooks, and paradigms.

3.7 Research context and justification

Following are the research contexts which are being used, along with their justifications. Below is the diagram showing the complete methodology of predictive analysis done for this project.

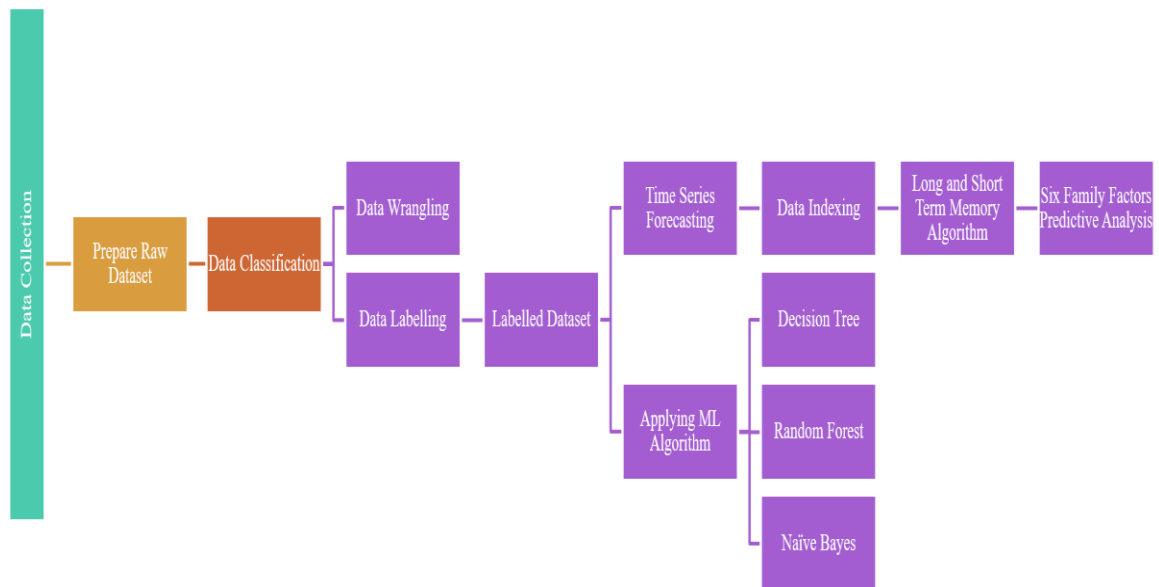


Figure 3.1: Methodology used for predictive analysis for six family factors

According to the flowchart first step is the data collection, which was gathered through google forms containing survey questions based on the six family factors abstracted from SLR. Second step was to transform the raw data into labelled form useful for machine learning algorithms. First, three ML algorithms were applied for testing the accuracy of classification. Second, this labelled data was used for time series forecasting. In which LSTM algorithm was used for making the prediction of drug addicts due to six family factors in upcoming year. Below paragraphs mention the complete justification of the above mentioned steps.

3.7.1 Systematic literature review (SLR)

A systematic literature review (SLR) identifies, selects and critically assesses research in order to answer a properly formulated question. The systematic review should follow a defined protocol or plan where the criteria is clearly stated before the review is conducted. It is a comprehensive search which is conducted over multiple databases and grey literature that has been written by other researchers. It involves a well thought research questions which have to be answered.

A complete systematic literature review was conducted following the Kitchenham guidelines. And through these guidelines 113 articles were fetched from year 1995 till 2022, from different data sources like IEEE, Springer, Elsewhere, and Wiley. These fetched articles were filtered through selection process and by inclusion and exclusion criterion. Total 50 papers were deduced which were mapped exactly with the research questions. The purpose of conducting SLR was to identify the family factors which play role in influencing youth towards drug abuse. There are many reasons for drug addiction like, peer influence, family disturbances, or curiosity. Family disturbances is a larger term and in order to factorize it SLR technique was used.

3.7.2 Survey

A survey is a method of gathering data using relevant questions from a sample of people with the aim of understanding population behavior as a whole. Surveys provide a systematic approach for collecting data and insights for everyone engaged in that specific field.

3.7.2.1 Objectives of conducting survey

Following are the objectives for conducting survey:

- To gather data from drug addicts related to their reasons for starting drugs.

- To deduce common family factors which influenced drug addicts towards substance abuse.

3.7.2.2 Type of questions

There are different types of survey questions that are used according to the demand of the research. For example Multiple choice questions, Rating scale questions, Likert scale questions, Matrix questions, Dropdown questions, Open-ended questions, Demographic questions, or Ranking questions etc.

According to the need of research Likert scale and Dichotomous scale questions are suitable choice for gathering data because once surveys are done, the collected data will be used as an input for the AI algorithm for making predictions of increased percentage of young drug abusers in upcoming years due to family factors.

3.7.2.3 Survey content validation

Content validation is an important step for validating the questions of a survey generated according to the requirements of the research. Survey questions are then being validated by the experts of that particular field. In the following research, survey questions were to be validated by the psychologist or a psychiatrist. As they are the appropriate experts for the survey questions developed for drug addicts. Two experts were chosen and both of them were clinical psychologists.

3.7.2.4 Calculation of face validity index (FVI)

Face validity index checks the value of clarity and comprehension of item (I-FVI), scale (S-FVI/Ave) and universal agreement (S-FVI/UA). Mathematical formulas are used to calculate the values. Formula for I-FVI is agreed item/ number of raters, formula for S-FVI/Ave is sum of proportion of clarity and comprehension/ number of items, and formula for S-FVI/UA is sum of number of score/ number of items. Table below shows the clarity and comprehension ratings on the item scale by 2 raters.

Table 3.4: The clarity and comprehension ratings on the item scale by 2 raters

Item	Rater 1	Rater 2	Raters in agreement	I-FVI	UA
Q1	1	1	2	1	1
Q2	1	1	2	1	1
Q3	1	1	2	1	1
Q4	1	1	2	1	1
Q5	1	1	2	1	1
Q6	1	1	2	1	1
Q7	1	1	2	1	1
Q8	1	1	2	1	1
Q9	1	1	2	1	1
Q10	1	1	2	1	1
Q11	1	1	2	1	1
Q12	1	1	2	1	1
Q13	1	1	2	1	1
Q14	1	1	2	1	1
Q15	1	1	2	1	1
Q16	1	1	2	1	1
Q17	1	1	2	1	1
Q18	1	1	2	1	1

Q19	1	1	2	1	1
Q20	1	1	2	1	1
Q21	1	1	2	1	1
Q22	1	1	2	1	1
Q23	1	1	2	1	1
Q24	1	1	2	1	1
Q25	1	1	2	1	1
Q26	1	1	2	1	1
Q27	1	1	2	1	1
Q28	1	1	2	1	1
			S-FVI/Ave	1	1
Proportion clarity and comprehension	1	1	S-FVI/UA		1

According to the calculation and responses of experts the proportion of items is 1. The average of scale face validity index is 1 and it's the same value for universal agreement.

3.7.2.5 Data collection

The first step in the predictive analysis is to collect data and then convert it into format understandable by the computer language. Hospitals and rehab centers were shortlisted in order to collect data from them. Most of the rehab centers had their branches all over the Pakistan. Survey questions were distributed in the rehab centers and hospitals in order to get required data including some historical data as well. The data was collected from December 2021 to September 2022. In total information of 3528 patients was gathered but hospitals and rehab centers refused to give any personal information of the patient like name, address or mobile number. Data was collected in simple English after that it was

converted into numbers and labels for the application of predictive analysis. Below graph shows the increase in the amount of drug addicts from year 2021 to September 2022.

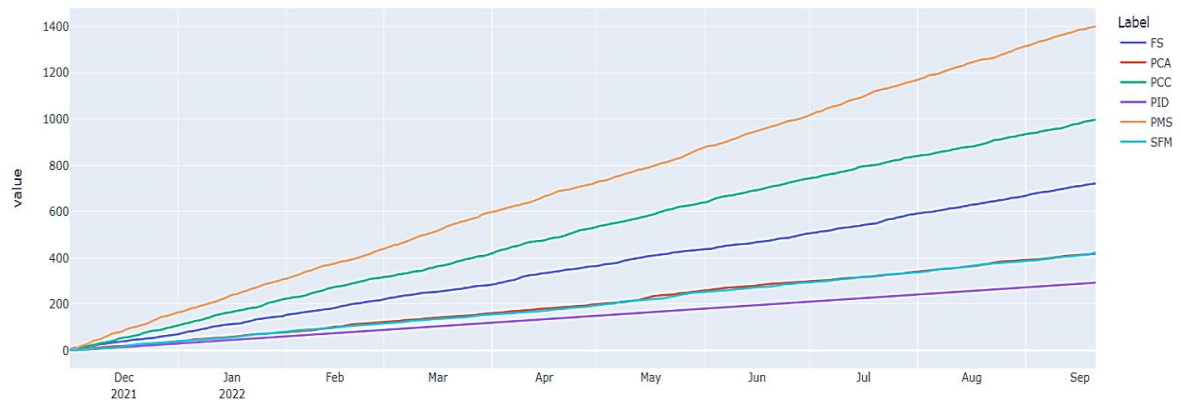


Figure 3.2: Historic data of drug addicts according to family factors

3.7.2.6 Patients profile

Data collection is an important step of a research which can be done through qualitative and quantitative methods. In this research collection of data was needed for predicting the number of increased percentage in drug addicts due to family disturbances. And the best possible approach for doing this was through quantitative surveys. The survey contained total twenty eight questions with the Likert scale and Dichotomous scale approach. Each question was well structured and formulated according to the six family factors deduced from systematic literature review.

Different hospitals and rehab centers were selected for collecting the data from the patients. Hospitals were having less drug addicts as compared to the rehab centers. They all belonged to different cities of Pakistan. Drug addiction problem among youth is due to many reasons hence survey was taken from only those patients which were drug addicts due family issues. Most of the addicts had a low monitoring and supervision of parents, and low communication with the parents which led them towards drug abuse. The amount of male patients was much more than the amount of female patients. Figure below illustrates the amount of patients according to gender.

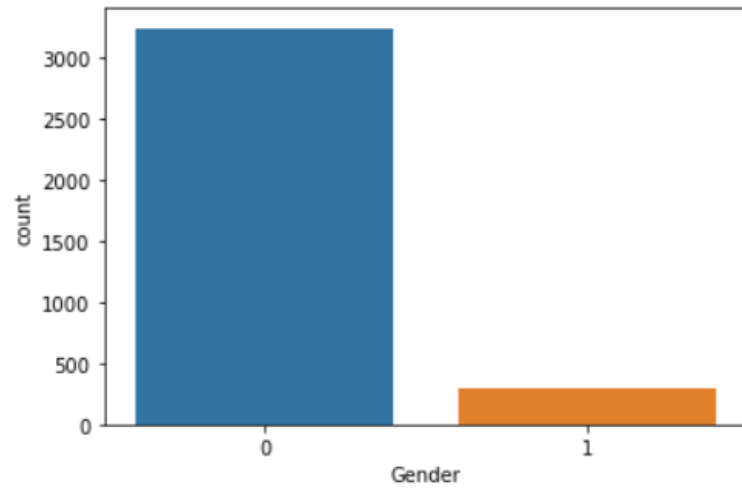


Figure 3.3: Gender wise illustration of data

In above figure 2 is representing the amount of female patients and 0 is representing the amount of male patients. During the survey age of the patients was limited to 13 till 25. Figure 3 below categorizes the data according to age.

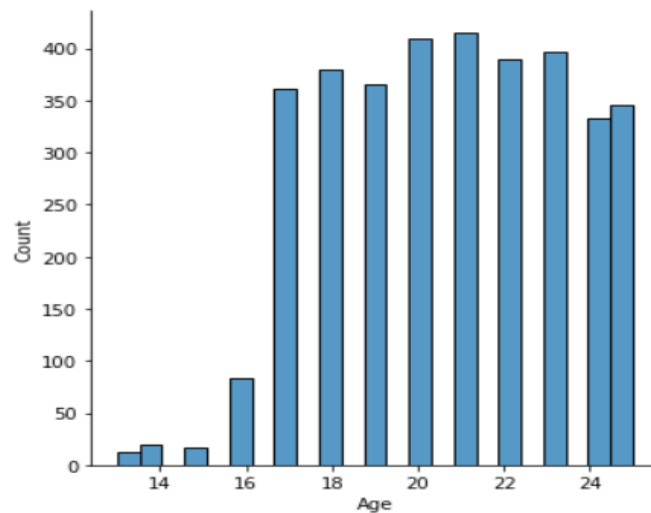


Figure 3.4: Age wise categorization of data

Maximum number of patients were between the age group of 20 to 22 and minimum number of patients were between the age group of 13 to 16.

3.7.3 Classification

After the collection of data the next step is to classify the data by using proper steps. As its evident the collected data is not labelled, no classes are defined properly, collection of data is unsupervised, and no proper time indexing is performed on the data. Hence, the main purpose of data classification is to achieve the above mentioned steps.

3.7.3.1 Data wrangling

Data wrangling also called data cleaning which converts the raw form of data into more useable form. It uses variety of process in order to convert, clean and munge the data. After collecting the data from the patients it was converted into numerical form for the ease of processing. Gender was assigned two values 0 and 1. Number 0 was used for males and 1 for female and its figure is shown in the above section. Age was specified from 13 to 25 as discussed in the above section. There were six family factors and each family factor had its own questions mentioned in the questionnaire. Both the questions and the family factors were encoded. The encoding of family factors is mentioned below:

- PCC = Parent Child Communication
- PMS = Parent Monitoring Supervision
- PCA = Parent Child Activities
- SFM = Strategies for Family Management
- PID = Parent involved in drugs
- FS = Family Structure

3.7.3.2 Data labelling

After the encoding of data, the next step was to label the data and assigning the weights to the attributes of each class. In order to do that every scale was assigned weight. Likert scale was assigned for following weights, strongly agree = 4, agree = 3, neutral = 2, disagree = 1, and strongly disagree = 0. Dichotomous scale was assigned for the following weights, yes = 1, and no = 0.

	Gender	Age	Month	PCC1	PCC2	PCC3	PMS1	PMS2	PMS3	PMS4	...	FS9	FS10	FS11
0	0	13	24	2	4	3	3	2	4	4	...	0	1	1
1	0	13	2	4	2	3	1	3	3	3	...	1	1	1
2	0	13	11	2	2	1	3	2	4	4	...	0	0	1
3	0	13	10	4	3	3	3	2	3	3	...	0	1	1
4	0	13	12	2	2	2	1	4	3	3	...	1	1	1
...
3524	0	25	11	3	2	4	1	2	4	3	...	0	0	1
3525	0	25	15	3	4	3	2	2	4	4	...	0	1	1
3526	0	25	18	4	2	1	1	4	4	4	...	1	0	1
3527	0	25	13	3	3	1	1	4	3	3	...	0	1	1
3528	0	25	17	2	4	2	2	4	3	3	...	1	1	1

Figure 3.5: Assigning weights to the attributes

After assigning the weights to the attributes weighted percentage was calculated for every response. The percentage was calculated by adding the attribute weight of each class and dividing the achieved sum with the total number of attributes. This step was done for the each response. Based on weighted percentages, the patient can be determined that in which class he or she belongs the most (PCC, PMS, PCA, SFM, PID, FS). Below figure shows the labelling of the data.

PCC	PMS	PCA	SFM	PID	FS	Label
75.00	81.25	100.00	70.83	0	63.64	PCA
75.00	62.50	8.33	58.33	0	90.91	FS
41.67	81.25	58.33	62.50	0	72.73	PMS
83.33	68.75	25.00	62.50	0	72.73	PCC
50.00	68.75	16.67	66.67	25	81.82	FS
...
75.00	62.50	25.00	70.83	75	54.55	PCC
83.33	75.00	50.00	62.50	50	72.73	PCC
58.33	81.25	25.00	83.33	50	81.82	SFM
58.33	68.75	25.00	66.67	50	81.82	FS
66.67	75.00	91.67	70.83	75	81.82	PCA

Figure 3.6: labelling of data

3.7.3.3 Prediction models

At this step the data is in proper supervised form, and it means it is properly classified in form of labels, attributes, and weighted percentages. This form of data can easily be used in supervised learning models. Hence, the purpose of using prediction models is to check the accuracy of classification of data. Now there are number of prediction models but according to literature decision tree, random forest and naïve Bayes models are most commonly used. The working of prediction model includes the splitting of data in testing and training. After looking at the data 20% of data was used for testing and all the labels were removed from the testing data, where as 80% of data was used for training. As a result, the testing data was assigned the labels by the model and which were compared to the real data to check the accuracy and decision tree model showed the highest value of accuracy.

3.7.4 Time series forecasting

The main goal that needs to be achieved from the data is to predict the future trends of drug addicts due to six family factors. In order to do that time series forecasting technique was the best suitable solution. Time series forecasting is a machine learning technique used for making scientific predictions based on time stamped data. It involves different AI models which uses historical data analysis for making observations and deducing future strategic decisions. During the development of survey time stamp was already implemented through google forms which was automatically included in the excel sheet. The data was converted into Year, Month, and Date format for making the technical analysis to forecast the drug addicts growing due to family factors. In time series forecasting LSTM (long-short term memory) algorithm was suitable for use by looking at the data. LSTM uses the previous data as an input and as an output gives us the predicted trends. In this case previous data was of nine months on which model was trained and predicted outcome of next coming year was generated. The first step in LSTM was the indexing of data representing the number of patients belonging to every label in form of date, month and year. After the indexing splitting of data was performed. The data was split in 20 80 percent for testing and training accordingly. Every family factor was tested and trained separately and for accuracy of algorithm the results were matched with the ground truth. At the end a complete graph was generated showing the predicted values of each family factor.

3.8 Summary

In this Chapter complete description of research methodologies have been presented. For example, qualitative research and its types, quantitative research and its types and mixed methods. After the description of research methodologies, justification of research context is provided. In this research, SLR and survey are being used for indicating family factors influencing youth towards drug abuse and gathering data from drug addicts accordingly. After that complete process of data classification and time series forecasting is mentioned in detail.

CHAPTER 4

RESULTS

4.1 Introduction

In this chapter results of systematic literature review, survey, classification and time series forecasting has been mentioned in detail. The purpose of conducting systematic literature review was to accumulate the major family factors causing drug addiction problem among youth. In total six family factors were deduced from the literature. The purpose of conducting survey was to gather data from drug addicts to apply predictive analysis for generating predictions for upcoming years.

4.2 Systematic literature review

Drug abuse has been an issue since decades. With every passing day there is a rapid increase in the number of drug abusers worldwide. Unfortunately, Pakistan is also suffering immensely from this problem. There are many reasons for drug abuse among youth and one of them was family disturbances. The core purpose of systematic literature review was to understand the factors involved in the term family disturbances.

4.2.1 Results

Following table shows the complete results deduced from systematic literature review.

Table 4.1: Research questions and their results

Research questions	Results
1. What are the family factors that lead a child towards drug abuse?	<ol style="list-style-type: none"> 1. Parent child communication. 2. Parent monitoring and supervision. 3. Involvement of parents in children activities and their peer relationships. 4. Strategies for family management. 5. Parents involved in drug abuse. 6. Family structure (parents divorced, separated, any sibling is a drug addict, any of the parent living in foreign countries, joint family system etc.).
2. How to acquaint parents with the factors causing family disturbances?	<ol style="list-style-type: none"> 1. Guidance programs for positive parental monitoring and controlling. 2. Directing parents to remove communication barriers with the children. 3. Awareness about drug types and its usage. 4. Family therapy sessions. 5. Prevention programs.

The table shows the results deduced from the literature. After studying the literature, term family disturbances can be factorized into six family factors which played an important role in influencing youth towards drug abuse. The survey questions are revolving around these family factors. For acquainting the parents many strategies came forward through SLR and have been mentioned in the above table.

4.3 Data classification

Data classification is a process of organizing data into classes or labels with their relevant attributes which makes the process of sorting, retrieving and understanding of data easy. A well classified data make the steps of finding and retrieving from data easy.

4.3.1 Prediction models

Artificial intelligence includes supervised and unsupervised learning models. In this scenario for finding the accuracy of classification the models of supervised learning were used. The models have been selected on the bases of nature of data and targeted variables. Three models Naïve Bayes, Decision Tree, and Random Forest have been implemented for finding the accuracy of classification relative to the labels (family factors). The data splitting was done according to 80, 20 for the training and testing respectively. Below figures show the accuracy of the three models.

Naive Bayes Model				
[] nb = GaussianNB() nb.fit(X_train,y_train)				
y_pred_nb = nb.predict(X_test)				
print(classification_report(y_test, y_pred_nb))				
	precision	recall	f1-score	support
FS	0.24	1.00	0.39	6
PCA	0.97	0.83	0.90	130
PCC	0.95	0.86	0.90	147
PID	0.88	0.97	0.92	230
PMS	0.92	0.86	0.89	114
SFM	0.83	0.81	0.82	79
accuracy			0.88	706
macro avg	0.80	0.89	0.80	706
weighted avg	0.91	0.88	0.89	706

Figure 4.1: illustrates the accuracy of classification using Naïve Bayes model

According to the results Naïve Bayes had the accuracy of 88%.

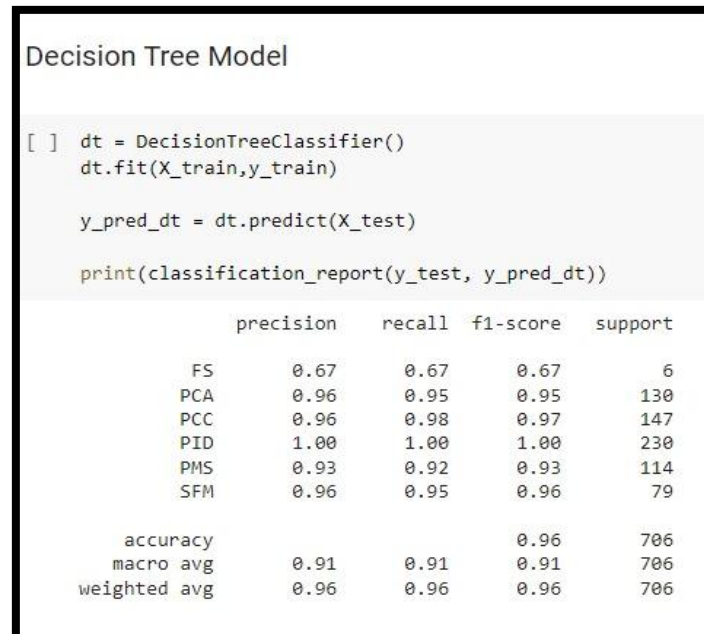


Figure 4.2: illustrates the accuracy of classification using Decision Tree model

According to the results Decision Tree model had the highest accuracy of 96%.

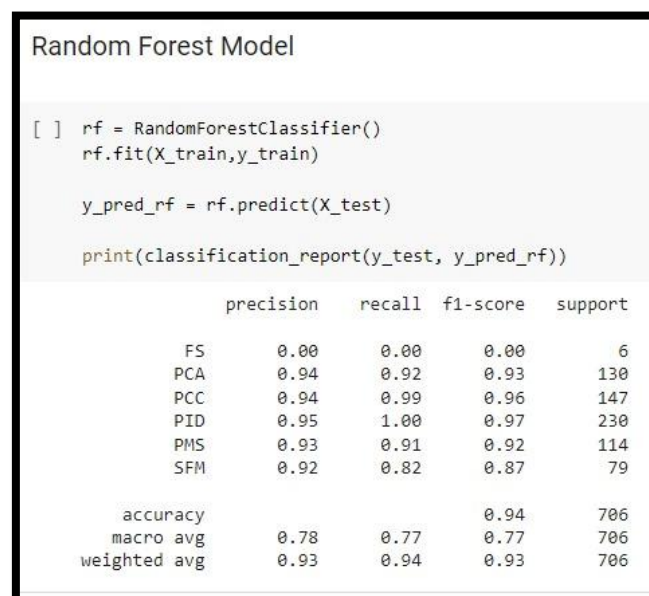


Figure 4.3: illustrates the accuracy of classification using Random Forest model

According to the results Random Forest had the accuracy of 94%.

4.4 Time series forecasting

Time series forecasting is a machine learning technique used for making scientific predictions based on time stamped data. It involves different AI models which uses historical data analysis for making observations and deducing future strategic decisions.

4.4.1 Indexing of data

The first step in time series forecasting is to index the data by showing the number of patients attended per data according to the labels. Figure below shows the indexing of data according to the classes.

Label	FS	PCA	PCC	PID	PMS	SFM
datetime						
2021-12-01	3.0	1.0	4.0	0.0	4.0	0.0
2021-12-02	9.0	4.0	6.0	0.0	5.0	0.0
2021-12-03	11.0	5.0	9.0	0.0	10.0	1.0
2021-12-04	13.0	6.0	11.0	1.0	18.0	2.0
2021-12-05	14.0	7.0	15.0	2.0	23.0	3.0
...
2022-09-17	711.0	413.0	984.0	288.0	1387.0	412.0
2022-09-18	715.0	414.0	989.0	289.0	1388.0	413.0
2022-09-19	717.0	415.0	991.0	290.0	1394.0	414.0
2022-09-20	719.0	416.0	994.0	291.0	1397.0	418.0
2022-09-21	721.0	417.0	997.0	292.0	1400.0	422.0

Figure 4.4: indexing of data

4.4.2 Training and prediction of factors

Predictions for every factor were made separately to understand the values properly and merge them in a one single graph. Below graphs shows the comparison of predicted data with the ground truth and next graph shows the predicted values for the upcoming year for parent child communication respectively.

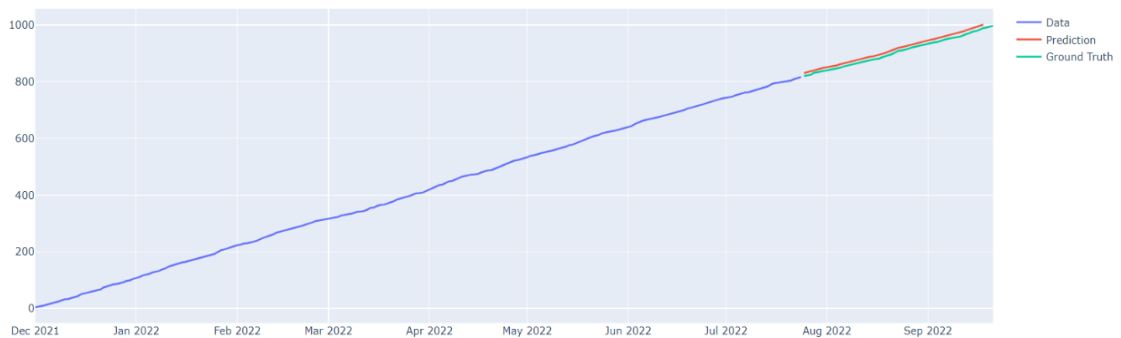


Figure 4.5: Comparison of predicted values and ground truth for PCC

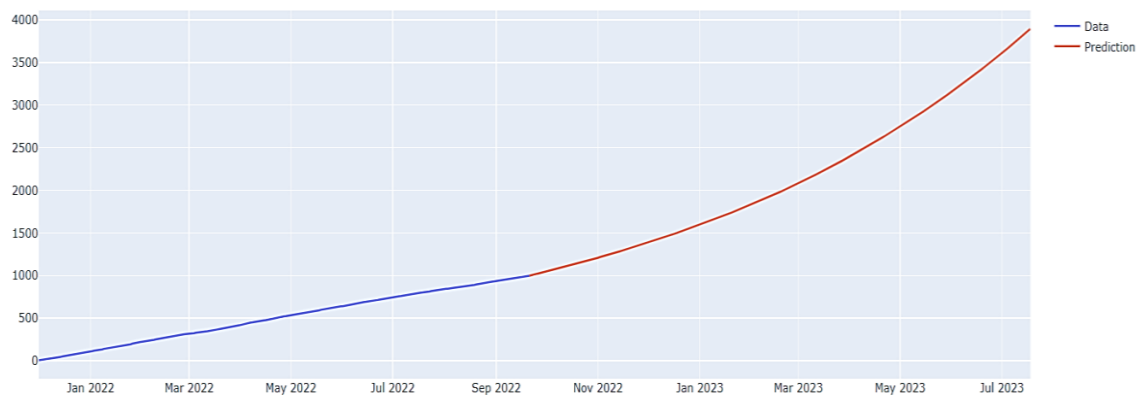


Figure 4.6: showing the increased amount of drug addicts due to PCC

As it's clear and evident that how the values change from January 2022 to July 2023. In 2022 the value of addicts due to parent child communication were 997 and it jumped to 3895. In our society parents tend to ignore the importance of parent child communication. Which brings a lot of barriers between the families. Mostly in Pakistan both mother and father are working in order to run a family smoothly. But unfortunately, they ignore their children and such types of lacks increases the urge in a child to fulfil his or her void with drugs or friendships with bad influence. Below graph shows the increased numbers of addicts due to involvement of parents in child day to day activities PCA.

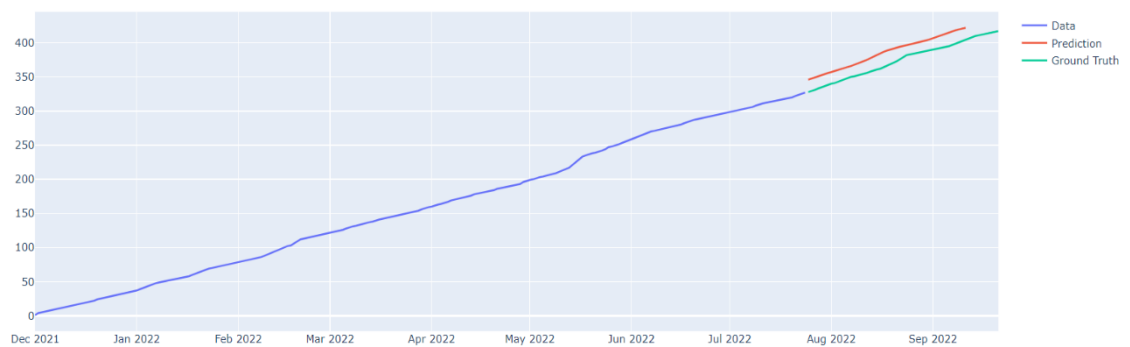


Figure 4.7: Comparison of predicted values and ground truth for PCA



Figure 4.8: showing the increased amount of drug addicts due to PCA

According to the graph in 2022 the number of addicts were 417 and increased to 2321 in year 2023. It is essential for the parents to take part in child's day to day activities, with this it will increase the level of trust and bond between the parents and child. By giving them proper time and care their minds nourish in positive way and they tend to avoid all the bad habits of the society. Below graph shows the values of family factor parent involved in drugs PID.

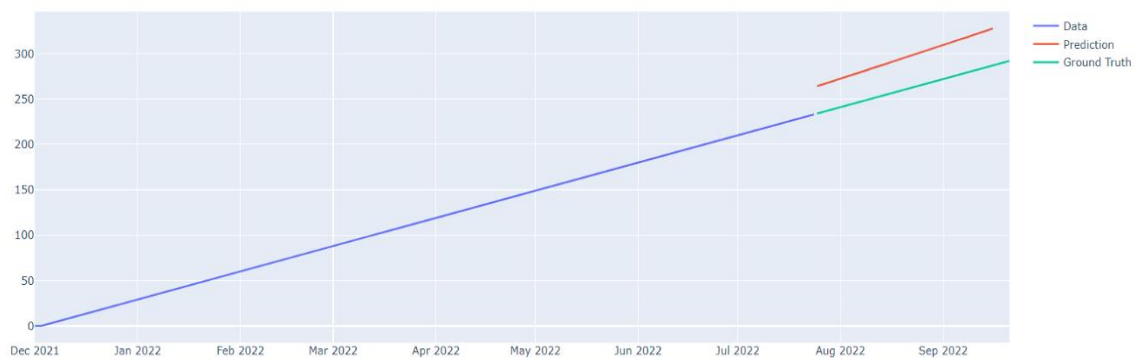


Figure 4.9: Comparison of predicted values and ground truth for PID

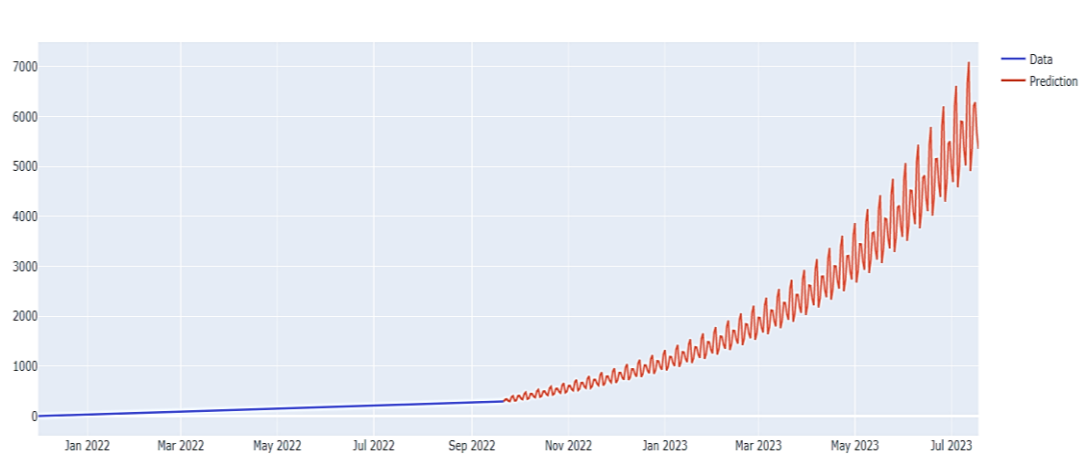


Figure 4.10: showing the increased amount of drug addicts due to PID

Sadly, in our society this drug addiction problem has spread its ways so much that even parents themselves are involved drugs. If any of the parent is taking drugs in front of

children it will affect the child's mental health in devastating ways. According to the graph the amount of drug addicts due to PID were 292 which will increase to 5353 in year 2023. such habits of parents creates depression and tension among the children which ultimately motivates them towards drug abuse. Below graph shows the number of drug addicts due to parent monitoring and supervision.

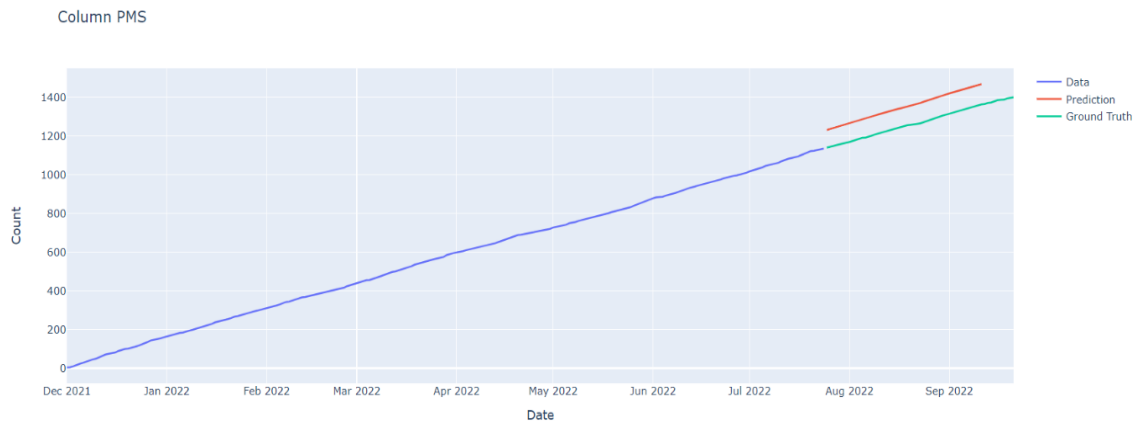


Figure 4.11: Comparison of predicted values and ground truth for PMS

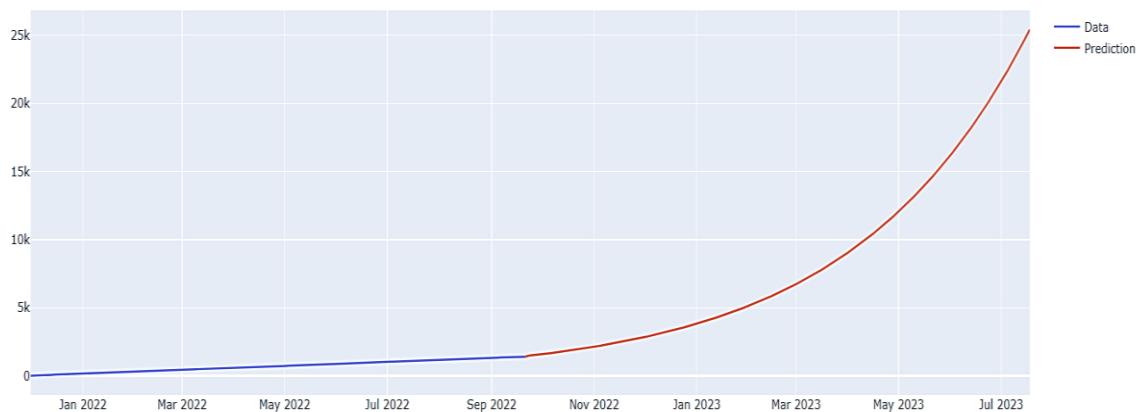
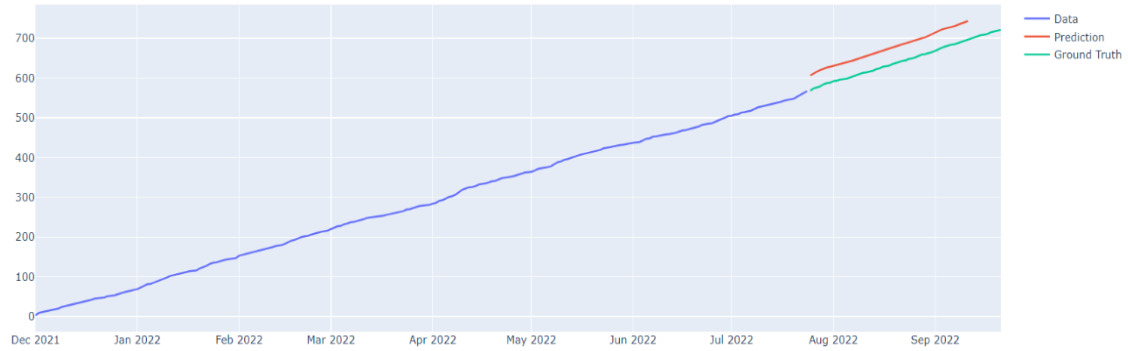


Figure 4.12: showing the increased amount of drug addicts due to PMS

During the process of predictive analysis this family factor had the highest number of drug addicts. According to the graph the amount of drug addicts in year 2022 were 1400 and it will increase to 25417 in year 2023. Parent monitoring and supervision includes many factors like strictness in house, parental control on social media and television, monitoring the activities of the children with their peers etc. All these factors play a vital role in growth



of a child. If parents fail to keep track of the friends of a child he or she can indulge themselves in bad influences. Parents who have no check on the social media apps and mobile phones they also failed to protect their children from drug abuse. Because looking at different new objects creates curiosity in the mind of a child motivating them to try those things. All these factors should be taken care before its' too late. Below is the graph showing the increased number addicts due to family structure.

Figure 4.13: Comparison of predicted values and ground truth for FS

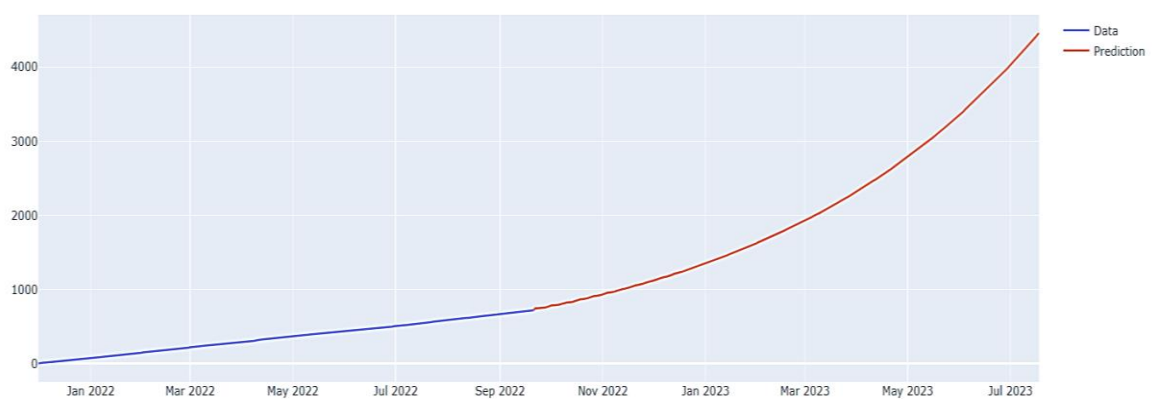


Figure 4.14: showing the increased amount of drug addicts due to FS

According to the graph the mount of addicts in year 2022 were 721, and it will increase to 4455 in year 2023. Family structure is broader term including factors like parents divorced, separated, one of the parent is living in another country, parents are

educated or not etc. All these factors put a direct effect on the mental and physical health of a child. If parents are divorced or separated a child will always be in a state of confusion that to whom he should address during the state of difficulty. Parents who are living in a joint family also effects the child mental health, because in joint family system parents have seek approval from their parents and everything of children is discussed in front of the whole family which damages the self-esteem of a child and they are left with no privacy. Below is the graph showing the increased amounts of drug addicts due to strategies used by parents for management of the family.

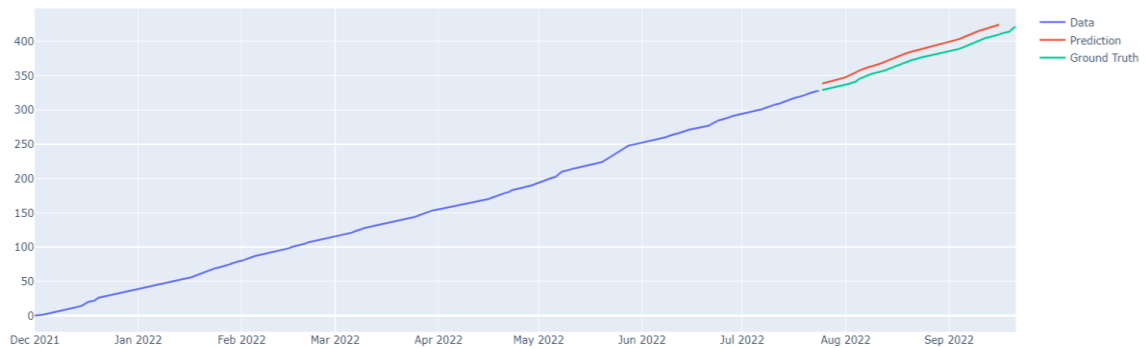


Figure 4.15: Comparison of predicted values and ground truth for SFM

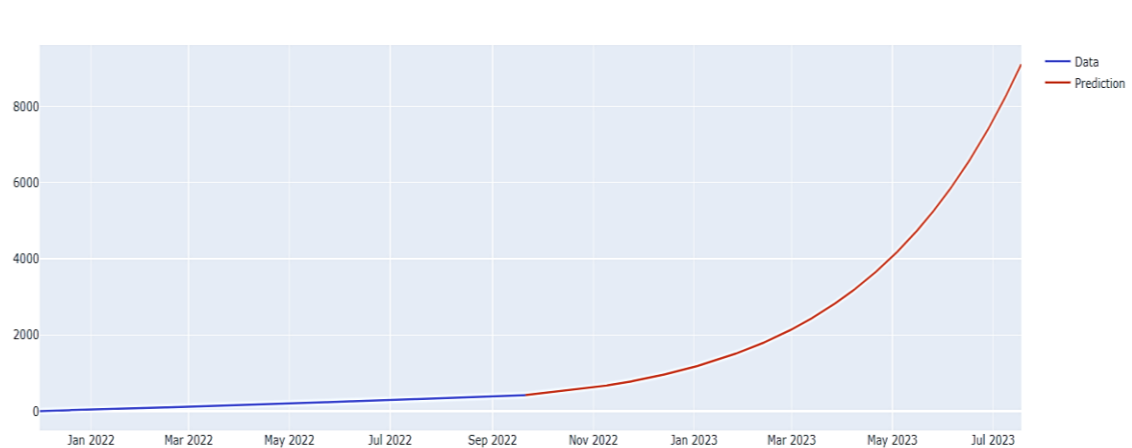


Figure 4.16: showing the increased amount of drug addicts due to SFM

According to graph the amount of drug addicts in year 2022 were 422, and will increase to 9098 in year 2023 due to strategies used by the parents for the management of a family. Family management includes the cultural, social, Islamic and educational growth of children. Appropriate management techniques used for above mentioned factors can bring positive attitudes and thinking among children. Social and cultural growth help them in understanding the norms of their society and surroundings. Islamic teachings will help them in following the right path and it will develop the sense of right and wrong. Education is key to success in every aspect of life. Good educational strategies help children in developing the sense of confidence and flourishing their careers in right directions. By looking at the graphs it's evident that quick government actions are needed in order to control the situation.

After predicting values for factors separately a cumulative graph was generated showing the predicted values by using LSTM.

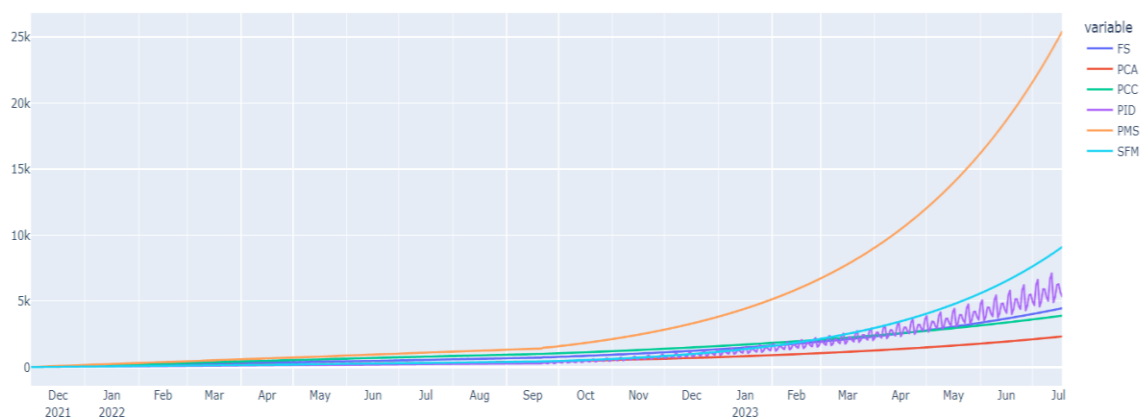


Figure 4.17: showing future trends in the increased numbers of drug addicts due defined family factors

4.4 Summary

In this chapter, results of research are being discussed in a systematic way. First the results of systematic literature review are mentioned, and it included the main six family factors causing the issue of drug addiction among youth. Secondly, methods of acknowledging parents with the types and usage of drugs and its prevention are mentioned. Next the results and steps of predictive analysis are being discussed. First the complete process of data classification was discussed including data collection, data wrangling and data labelling are defined. After that prediction models are described for checking the accuracy of classification, and it showed that Decision Tree model has the highest accuracy value. After that every factor is predicted separately by using time series forecasting technique including LSTM algorithm and its graphs have been shown above. Every family factor was increased with big numbers. The current values of Family Structure was 721 and its predicted value was 4455, Parent Child Activities was 417 and its predicted value was 2321, Parent Child Communication was 997 and its predicted value was 3895, Parent Involved in Drugs was 292 and its predicted value was 5353, Parent Monitoring and Supervision was 1400 and its predicted value was 25417, and Strategies for Family Management was 422 and its predicted value was 9098.

CHAPTER 5

DISCUSSION AND ANALYSIS

5.1 Introduction

In this chapter discussion and analysis has been mentioned about the results deduced from the predictive analysis. It showed the future trends and events that are likely to occur in near future if proper measures are not taken. It showed the increase number of drug addicts due to defined six family factors and the major problem causing factor is parent monitoring and supervision according to the values.

5.2 Discussion

Family disturbances and issues can cause a lot of mental damage to a child. Constant argue among the parents or low level of monitoring and supervision on a children can spoil their future in many ways. A healthy family structure and living style can prevent our youth from becoming drug addicts. As it's evident that the amount of drug addicts is increasing at alarming levels with every passing time. Software industry with its adverse methods and technology can help the society in the prevention of such dangerous social evil. With the techniques of artificial intelligence, it's easy to predict and forecast the disastrous trends of future. According to the above values, every family factor can cause a lot of change in the value of drug addicts if not controlled on time.

5.2.1 Predictions for young drug abusers due to family disturbances in upcoming years

The current values of Family Structure, Parent Child Activities, Parent Child Communication, Parent Involved in Drugs, Parent Monitoring and Supervision, and Strategies for Family Management are 747, 430, 1018, 296, 1497, and 437 respectively. The predicted values for Family Structure, Parent Child Activities, Parent Child Communication, Parent Involved in Drugs, Parent Monitoring and Supervision, and Strategies for Family Management in upcoming year are 4455, 2321, 3895, 5353, 25417, and 9098 respectively. These increased numbers are (as illustrated in Figure 9) at alarming stage and need to be addressed on immediate levels. AI has made our ways easy and with its new techniques prevention programs and behavioral analysis can be done on children for judging their deviant traits. Ultimately, helping families in understanding their flaws and to ensure effective means to overcome them. It has become a need of our society to start awareness programs in schools, colleges, and universities alarming the parents with the diverse effects of family disturbances on the youth. Parents should be helped with the family therapies and prevention programs to help them in improving their parental strategies and monitoring methods.

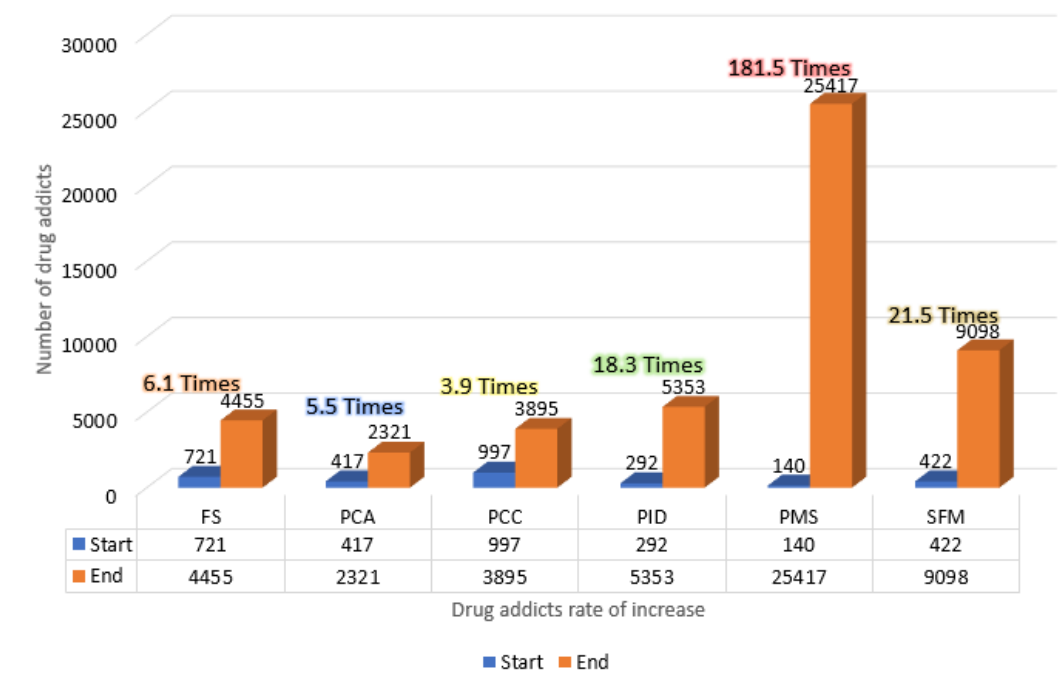


Figure 5.1: Drug addicts rate of increase

Figure 9 shows the rate of increase in drug addicts in Pakistan regarding coming year. The research question three as mentioned in the introduction gets the evidence from the prediction analysis. As it shows that every year the percentage get increased. For instance, FS will get 6.1Times higher rate in the coming year as compared to present year. The literature also supports the fact that FS can lead an individual towards drug addiction. Likewise rate of increase in PCA is 5.5Times, and in PCC the rate is 3.9Times in coming years. SFM gets the rate of 21.5 Times higher values. The most influential family disturbance factor is PMS. Which gets the highest rate of increase in the coming year which is 181.5 as compared to other factors. As it shows lack of parent monitoring can lead towards drastic effects on child's behavior and personality.

5.5 Summary

In this chapter analysis and discussion has been done on the results achieved from predictive analysis using Decision Tree model, as it had the highest accuracy percentage. According to the results the current values of Family Structure, Parent Child Activities, Parent Child Communication, Parent Involved in Drugs, Parent Monitoring and Supervision, and Strategies for Family Management are 747, 430, 1018, 296, 1497, and 437 respectively. The predicted values for Family Structure, Parent Child Activities, Parent Child Communication, Parent Involved in Drugs, Parent Monitoring and Supervision, and Strategies for Family Management in upcoming year are 4455, 2321, 3895, 5353, 25417, and 9098 respectively. The highest factor which needs the most attention is parents monitoring and supervision. The increased amount due parents monitoring and supervision is 25417 which a shocking amount in just a few period of time. Parents and government should take some actions to control this social evil. Parents should focus more on family therapy sessions, prevention programs and educational session regarding drug types and its usage. On the other hand, government should focus more on capturing these drug providers and should strictly follow the rules for stopping the drugs manufacturing and transportation through borders. Most of the drugs are manufactured and delivered to Pakistan from Afghanistan. Strict rules should be followed for controlling this drug mafia system. Only then we can control this social evil.

CHAPTER 6

CONCLUSION

6.1 Conclusion

New computational technology and methodologies have made it simpler to comprehend psychiatric diseases and addiction illnesses. Utilizing new, emerging AI trends has improved the efficiency of data collection and comparison. Artificial intelligence is providing a helping hand in various disciplines, and in the context of the drug addiction problem, it offers tools for the analysis of vast volumes of data. This information mostly relates to drug use as well as sociodemographic, psychological, and health aspects that are intricately connected to one another. The main distinction between traditional statistical models and AI models is that the latter allows us to make predictions based on obtained data. AI models can aid in educating society about the harm that using certain pharmaceuticals might bring by forecasting the effects. The association between drug usage, sociodemographic factors, and health can be discovered using data mining approaches.

In Pakistan, the problem of youth drug use, both synthetic and non-synthetic, is continually getting worse. The psychological tension and worry among Pakistan's youth have increased due to issues like poverty and the rise in unemployment, driving them to turn to drug usage for solace. There are several causes for the drug use disorder that affects young people, including dysfunctional families, peer pressure, curiosity, and other factors. Our culture has to be informed about drug addiction, including its long-term implications. The use of artificial intelligence to treat drug addiction is the focus of numerous researchers and government representatives. The use of methodologies, such as ANN, and the

development of expert systems employing decision support systems, together with the evaluation of an individual based on observable signals, are reported in the literature. Every region in a country like Pakistan has its own customs and social mores. At the young age of 19, drug use is growing among our youngsters. As a result, research questions have been developed for this study in order to identify different family system patterns and the issues that exist within them. Which ultimately pushes the young person to use drugs.

Henceforth, systematic literature review on family-oriented factors triggering substance abuse among youth has been conducted following the Kitchenham guidelines. The review includes 50 primary research studies to answer the research questions mentioned in Chapter 1. The survey shows low parent-child communication, inefficient parental monitoring and supervision, parental engagement in drug use, parental absence from children's activities and peer interactions are the main contributing variables. All of these elements have a significant impact on a child's mental and physical health and play a significant role in the development process see detail discussion in Chapter 2.

In order to answer the third research question (see chapter 1) we have done an extensive survey. Which falls under the umbrella of quantitative research. The content validation of the survey has done by two clinical psychologists having 10+ job experience in the field. Likert scale and Dichotomous scale has been used for data collection. Total 28 number of questions has been included in the survey. Each question has been well structured and formulated according to the six family factors deduced from systematic literature review. During the survey age of the patients was limited to 13 till 25. Total 3528 patients have been selected for the study. The hospitals and rehabilitation centers name has not been disclosed on their request. However, twin cities has been targeted for the data collection purpose.

Data has been collected during the 9 months tenure, started from December 2021 to September 2022. Pandas, Numpy Libraries used for EDA(Exploratory Data Analysis). Seaborn Matplotlib and Plotly has been used for graphical presentation of the data. While, Tensorflow, keras and importantly TimeseriesGenerator is used for Forecasting the data.

In the first step data is converted to numerical form for ease of processing. Where gender has assigned values 0 and 1. Secondly data is encoded in order to extract the details of six family factors from the questionnaire. Encoding includes PCC = Parent Child Communication, PMS = Parent Monitoring Supervision, PCA = Parent Child Activities, SFM = Strategies Family Management, PID = Parent involved in drugs, FS = Family Structure. Thirdly, labelling has been done as overall score of every factor has been calculated based on questions of each factor. For every patient the maximum value containing factor has been assigned as labeled (class). Fourthly, the selection of classification models has made based on the nature of data and targeted variable. Three models Naïve Bayes, Decision Tree, and Random Forest has been implemented for classification of drug addict factor of patients. The data splitting was 80, 20 for training and testing respectively. DT has achieved the highest accuracy of 96% following by RF with 94% and then NB with 88% of accuracy. The major limitation during the predictions was that it required a lot of data in order to analyze the results for a large period of time. That much amount of data was hard to collect and it became a limitation to the research and analysis was limited to only upcoming year month July 2023.

It can be clearly seen that more than 90% of the drug addicts were male while females are only 10 percent approximately. From the targeted age band, 20-21 age fellows' young people are more likely to involve towards drug addiction. But alarmingly underage youngsters can also be seen in the graph. PMS is the major Sub-factor causing in the increase of drug addicts. PCC and FS are also at the dangerous level, spotting the high numbers of drug addicts. The current values of FS, PCA, PCC, PID, PMS, and SFM are 747, 430, 1018, 296, 1497, and 437 respectively. The predicted values for FS, PCA, PCC, PID, PMS, and SFM in upcoming year are 4455, 2321, 3895, 5353, 25417, and 9098 respectively. These increased numbers are at alarming stage and need to be addressed on immediate levels.

6.2 Summary of contribution

With the help of artificial intelligence techniques now we can predict the upcoming trends and events of different scenarios. For solving the problem of drug addiction the best possible solution seems to be awareness among the parents. Through the trends of future parents will understand the effects of their behaviors on the health of child. One way or the other every reason of drug addiction is somehow linked with the family issues. Whether its poor parental monitoring providing a free hand to a child or low communication gaps leading a child into false hands. With the help of future trends parents can control and manage their behaviors accordingly. The predictions at the end of this research will provide awareness among the parents regarding the impact of their behaviors towards children. It will help them in improving their parental skills eventually leading children towards a healthy well-being and good health. Drugs among the students are effecting their studies at immense level. Students mostly take drugs for scoring good grades, pressurized by their parents. Once parents are well informed about their positive behaviors towards children and types of drugs, we as a society can easily improve our quality of education. The word sustainability means maintenance at certain level or rate. The rate of drug addicts can only be sustained through awareness and knowledge. Only the eradication of this social evil can lead the cities and communities of Pakistan towards sustainability.

6.3 Future Work

In future, this research could be improved by adding an intelligent system which can detect the deviant behavior of a child which could predict the tendency of his or her becoming a drug addict in the future. This research can also be improved by developing a model which could detect the reason of drug addiction and those reasons could include peer influence, curiosity, family disturbances, depression or tension etc. Each reason or factor will have its own survey question taken from the drug addict and it could be used as an input for the intelligent system and as an output it will show the reason or class where the drug addict belongs. This will help the psychologists and psychiatrists immensely for the

correct treatment of the patients. The basic problem which is faced by the psychologist is in predicting the reason for the deviant behavior of the patient. With the help of AI software's psychologists and psychiatrists can get an idea about the leading point. Artificially intelligent software's are helping in every field via its education, medical, banking or any other field. Hence, using its unique technology as a nation we can easily overcome this social evil.

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