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Perceived Factors Analysis for Depression and Suicidal Ideation among Bangladeshi University Students Using Association Algorithm

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Depression stands as a prominent and prevalent mental health issue, representing a significant global public health concern. Its emergence can be attributed to diverse factors. Suicide stands as a prominent global cause of death, eliciting concern on a widespread scale. This study was to analyze the perceived factors for depression and suicidal ideation among Bangladeshi university students in Bangladesh. There are so many factors such as Loneliness, Hopelessness, Helplessness, Relationship Issues, Grade problems, Academic Pressure, Parental problems, Money problems, Social Comparison, Social Media Influence, Family Expectations, Lack of Sleep, Uncertain Future, Health Issues, Bullying, Substance Abuse and Unemployment etc. These factors vary among male

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and female students. Apriori association algorithm were used to calculate support, confidence and lift of factors sets. Frequent factors sets and relationship were found from the work using Apriori association algorithm. The work is an online survey-based study about psychological and stress status of participants and statistical analysis is used for concluding the results. The research participants are Bangladeshi university students, Data collection carried out by online questionnaire. The findings from data analysis indicated that academic pressure (72.41%), uncertain future (56.32%), hopelessness (48.28%), family expectation (47.13%), financial crisis (42.53%), loneliness (41.38%) and unemployment (37.93%) are the key factors. The prevention of suicides is achievable. Hence, identifying depression and forecasting the potential for suicide risk serves as a means to prevent instances of self-harm within the university student population.

Keywords: Suicidal ideation; suicidal tendency; depression; factors; apriori; university students.

1. INTRODUCTION

Depression is one of the leading and common mental health problems. It is the most alarming global public health issue. It may arise from various factors, including a lack of understanding about the condition. Depression is marked by enduring feelings of sadness, hopelessness, diminished self-worth, heightened anxiety, sleep disturbances, feelings of guilt, tendencies toward self-harm, and ideation of suicide [1-3]. Depression not only affects one's ability to live normally, but it also is a burden to society in general [4,5].

Early detection of depression is an efficient solution. It would help student to take proper steps against depression. Suicide means actually killing themselves. Suicidal behaviors are frequently accompanied by hopelessness, depression, or self-destructive behavior. Suicidal behaviors are individuals experiencing repeated thoughts of killing themselves life (suicidal ideation), planning to kill themselves (suicide plan), and actual efforts to kill themselves (suicide attempt) [6,7].

Suicide is a leading cause of death worldwide. It is a concerning issue nowadays for all of us. The suicidal incident is a curse for the family and society. The impact of suicide incidents on family and society is inevitable. In most cases, suicide ideation is the result of depression [8,9].

Recently, Bangladeshi university students have been considered to be highly suicide-prone. A large number of students committed suicide in Bangladesh. All of them were meritorious and talented. It is a major concern for all of us that Bangladeshi university students are making such a dangerous decision to commit suicide.

Suicides are preventable. So, detecting depression and predicting suicide risk is a way to stop suicidal incidents among university students [10].

This research employs Apriori association algorithm to identify and analysis the factors for depression and suicidal tendency among university students in Bangladesh.

In this work, data analysis and association were used to detect depression factors and improve suicide risk predictions among Bangladeshi university students to save lives and make precautions.

1.1 Motivation

The value of a life is invaluable. Every person has a right and wants to live a peaceful life in this beautiful world. University students are the most meritorious person in any country. They are the assets of a nation. A nation will not progress without the contributions of university students. They are proud of their own family. So, the value of the life of students is priceless.

Nowadays, a large number of students are suffering from depression. There are many factors behind this problem like a failure, family, economic instability, high expectation, etc. Depression destroys the student's career, happiness, and dream. It is a big problem for a person, family, and nation.

It's widespread and daily news of suicide incidents by Bangladeshi university students. In most cases, suicide ideation is the result of depression. We lost a meritorious life in a suicide incident, a family lost their beloved member, and deprived a nation of the services.

Day by day, suicidal cases are increasing among university students. It's high time to be aware and concerned to stop it.

We can save many lives by stopping suicide cases. If we can predict the suicidal incident, it's very much possible to stop it by precaution. As depression is a significant reason for suicide, we can detect depression and its level among students by analyzing the related factors to make it easier for suicide prediction.

This work is significant and well-timed for Bangladeshi university students to discover the factors for depression. By analyzing the perceived factors for depression and suicidal ideation, the variation of impact of factors were found. This work will help save lives and take precautions against students' depression and suicide ideation.

1.2 Objectives

Depression and suicidal ideation seize our young generation. University students are noticeably suffered from deadly depression and later on commit suicide. We hope our young and future generations will live peaceful and active life.

The objectives of this study are to stop suicidal tendency among Bangladeshi university students by identifying and analyzing the factors of depression and suicidal ideation.

This work will be effective and helpful:

i. To find high risk factors for depression and suicidal ideation among university students in Bangladesh.
ii. To detect less risk factors for depression among students.
iii. To make comparison of factors for depression among university student.
iv. To identify the factors which are responsible for suffering from depression.
v. To associate the factors and find frequent factors set for depression and suicidal ideation.
vi. To prevent suicide incidents by taking precaution about suicidal risk factors.
vii. To make gender-based comparison on factors for male and female.
viii. To take care of the mental health of students.
ix. To create opportunities to arrange motivation sessions or counseling for proper and needed students.
x. To save the valuable lives of meritorious university students.
xi. To save the career of students who are suffering from depression.
xii. To make the ultimate fulfillment of the dreams of students and their families.

This work analyzes and associates the perceived factors for depression and suicidal ideation that will help to take precautions for victim students.

2. LITERATURE REVIEW

There are some previous works based on factors detection of depression and suicidal ideation. Various models and approaches are used in these, which are mentioned here.

M Ashraful Islam et al. [11] in 2018, studied to explore the factors of depression among Malaysian university students. They found that second year students are more depressed than first year students. They also found that family background is a key factor of depression.

Karl Peltzer et al. [12] in 2014, studied the risk factors of depression among Western Nigeria. They surveyed 820 university students and found sleeping problem as a risk factor of depression.

In 2020, Kumar et al. [13] exhibited various models to detect early suicidal ideation using Twitter data through sentiment analysis and supervised learning methods. This work used 60,188 positive and negative tweets, and among these, 86.42% were suicidal tweets. They proposed additional keywords of n-grams as search key phrases and used Vader sentiment analysis for data separation.

Sparsh Sharma & Surbhi Sharma in 2020 [14] analyzed the depression and suicidal tendencies using sentiment analysis on social networking sites of persons affected by Corona Virus Disease called COVID-19's lockdown. They proposed a Sentiment Analysis Framework that can extract the emotions and sentiments of people from Twitter and report the location and required pieces of information to the authority to save lives from the pandemic.

In 2021, Jung et al. [15] implemented a suicidality detection model for Twitter data using a machine learning approach. They randomly selected 20,000 tweets and analyzed metadata and text features to build this effective model. They studied Metadata features to understand their possibility and importance in suicidality

detection models. By integrating metadata and text features, they obtained the model of good performance (F1 score of 0.846) that can help humans to detect suicidality using social media posts.

In 2021, Roy et al. [16] developed SAIPH to predict future risk of suicidal thought by using Twitter data. They used the Tweepy package in python and accessed the Twitter API, allowing access to the past nine days of publicly available Twitter content for a given query.

In 2018, Katchapakirin et al. [17] developed a depression detection algorithm for the Thai language on Facebook, which people use as a tool for sharing opinions, feelings, and life events using Natural Language Processing (NLP) techniques. They studied that Facebook behaviors could predict depression levels.

Rumana Rois et al. [18] surveyed 355 students of Bangladeshi universities in 2021. They used Boruta algorithm and prediction models to detect the factors and predict the problem accurately.

In 2022, Uwasila Binte Munir et al. [19] built data set by a questionnaire through social media. They used Pearson's chi-squared test and back elimination method to identify the key feature variables. They used six ML classifiers to detect the presence of depression.

In 2023. Sultan Mahmud et al. [20] surveyed among university students in Bangladesh and 2391 students were participants. They used five machine learning models to predict suicidal behaviors among university students. They found that Support Vector Machine is the best model to predict suicidal risks among university students in Bangladesh.

To summarize, the previous literature indicates that online behaviors and activities could predict depression, its level, and suicide prediction. This work collects data from Bangladeshi university students and analyze these perceived factors for depression and suicidal ideation.

3. METHODOLOGY

This research work was carried out among Bangladeshi university students. It has gone through several processes like questionnaire creation, data collection, preprocessing and analysis.

3.1 Data Collection

This study carried out to collect data by online questionnaire system. There were some questions to answer and submit the google form. This questionnaire was distributed to university students. Questionnaire is set to know the gender, study year, CGPA and factors which are responsible for depression and suicidal ideation as responders' opinion.

Table 1 shows the dataset sample. The questionnaire consisted of four key research questions. RQ1: What is your gender? It inquired about gender, requiring respondents to choose male or female. RQ2: What year of study are you in? In response to this question the participants choose one from the options called first year, second year, third year and fourth year. RQ3: What's your CGPA? The participants select one option from the three options as CGPA less than 3.00, greater than 3.50 and 3.00 to 3.50. RQ4: What factors do you think are responsible for depression and suicidal ideation among university students in Bangladesh? The responders can select multiple options for this question and also can add others option. The options are Loneliness, Hopelessness, Relationship Issues, Helplessness, Grade Problems, Parental Problems, Financial Crisis, Academic Pressure, Social Comparison, Social Media Influence, Family Expectations, Lack of Sleep, Uncertain Future, Health Issues, Bullying, Substance Abuse, Unemployment, Job Pressure, Working Environment, Monotony and Sexual Frustration.

Table 1. Sample Dataset

Gender	Study Year	CGPA	Factors
Male	Second Year	3.00-3.50	Academic Pressure, Family Expectations
Female	First Year	<3.00	Uncertain Future
Female	Fourth Year	3.00-3.50	Loneliness, Financial Crisis, Academic Pressure
Male	Third Year	>3.50	Unemployment, Job Pressure

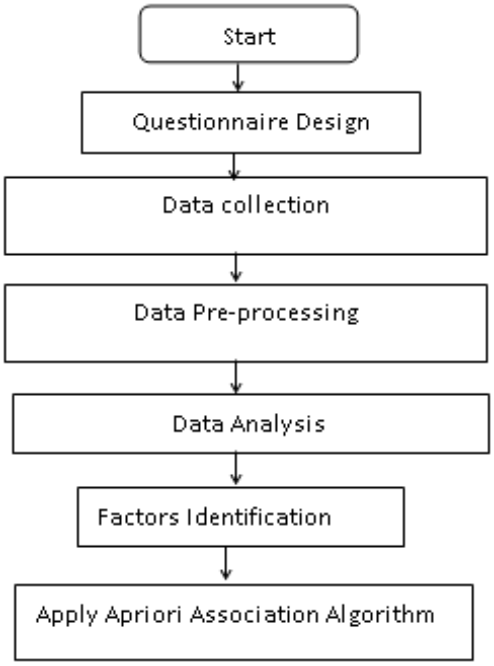

Fig. 1. System structure

3.2 Model

In the depression and suicidal ideation factors identification stage, a factors list is created from the data which are collected from university students.

A questionnaire was designed to collect data from university students. After completion of the questionnaire design, it deployed to the Bangladeshi university students. Fig. 1 shows the system architecture.

When data collection was completed, the data cleaning and normalization process has held. Then data analyzed to identify the depression factors. From the data analysis approach, a factor list of depression found for Bangladeshi university students. This factors list refers the reasons for depression and suicidal ideation among students. From the factors analysis, it will be found that how many students think any factors as the reason for depression and suicidal ideation.

Apriori association algorithm is applied to find out the factors list with related support, confidence and lift value. Support, confidence and lift can be defined by –

Support {x} = Number of sets with x / Total number of factors sets

Confidence {x -> y} = Support {x, y} / Support {x}

Lift {x -> y} = Support {x, y} / (Support {x} * Support {y})

Antecedent support computes the proportion of transactions that contain the antecedent A, and consequent support computes the support for the itemset of the consequent C for Support {A -> C}. This algorithm also makes a relationship between antecedent support and consequent support for various factors length. Using the association algorithm, the frequent factors set will be found.

4. RESULTS AND DISCUSSION

The collected data using questionnaire is analyzed to get findings. The research has 348 participants, using Google Form circulated to Bangladesh university students. Among these participants there are 56.32% male and The following Table 1 shows the profile background of respondents among university students in Bangladesh.

4.1 Percentage of Factors

In this work, there were 21 options and students can choose multiples. This work found that 72.41% of the surveyed student thinks academic

pressure is a reason of depression and suicidal event. Second most 56.32% students think uncertain future is key reason.

Table 2. Summary of Data

Items	Frequency	Percentage (%)
Gender		
Male	196	56.32%
Female	152	43.68%
Study Year		
First Year	88	25.29%
Second Year	64	18.39%
Third Year	136	39.08%
Fourth Year	60	17.24%
CGPA		
>3.5	104	29.89%
3.0-3.5	184	52.87%
<3.0	60	17.24%

According to the surveyed 48.28%, 47.13%, 42.53%, 41.38% and 37.93% students' opinion hopelessness, family expectations, financial crisis, loneliness and unemployment respectively are responsible for depression and suicidal ideation among university students. Fig. 2 shows the graphical representation of Table 3.

4.2 Gender Based Percentage of Factors

Percentage of factors for depression and suicidal ideation differs based on gender. Male students thinking and female students thinking varies in some points. In this work, there were 56.32% male and 43.68% female students are is survey who can choose multiples options from the factors. This study found that most of the students, 40.23% and 32.18% of the surveyed male and female student respectively thinks academic pressure is a primary reason of depression and suicidal event. Table 4 shows the gender-based percentage of various factors for depression and suicidal ideation.

Table 3. Percentage of various factors for depression and suicidal ideation

Factors	Percentage (%)
Loneliness	41.38%
Hopelessness	48.28%
Relationship Issues	31.03%
Helplessness	22.99%
Grade Problems	35.63%
Parental Problems	8.05%
Financial Crisis	42.53%
Academic Pressure	72.41%
Social Comparison	28.74%
Social Media Influence	17.24%
Family Expectations	47.13%
Lack of Sleep	26.44%
Uncertain Future	56.32%
Health Issues	12.64%
Bullying	20.69%
Substance Abuse	6.90%
Unemployment	37.93%
Job Pressure	27.59%
Working Environment	12.64%
Monotony	18.39%
Sexual Frustration	1.15%

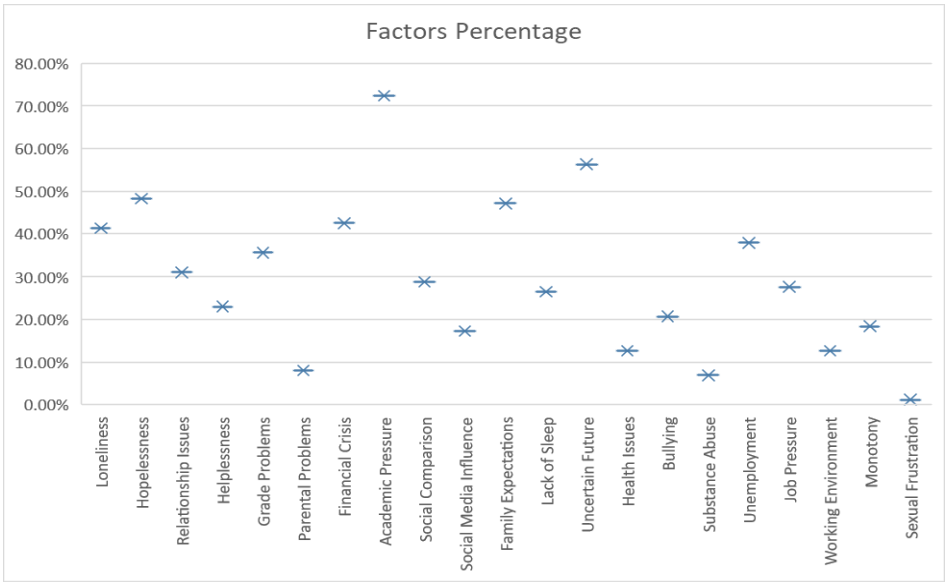

Fig. 2. Graphical representation for percentage of various factors

Table 4. Gender based percentage of various factors for depression and suicidal ideation

Factors	Male (%)	Female (%)
Loneliness	20.69%	20.69%
Hopelessness	21.84%	26.44%
Relationship Issues	17.24%	13.79%
Helplessness	13.79%	9.20%
Grade Problems	13.79%	21.84%
Parental Problems	5.75%	2.30%
Financial Crisis	28.74%	13.79%
Academic Pressure	40.23%	32.18%
Social Comparison	17.24%	11.49%
Social Media Influence	13.79%	3.45%
Family Expectations	28.74%	18.39%
Lack of Sleep	11.49%	14.94%
Uncertain Future	29.89%	26.44%
Health Issues	9.20%	3.45%
Bullying	9.20%	11.49%
Substance Abuse	4.60%	2.30%
Unemployment	25.29%	12.64%
Job Pressure	17.24%	10.34%
Working Environment	9.20%	3.45%
Monotony	10.34%	8.05%
Sexual Frustration	1.15%	0.00%

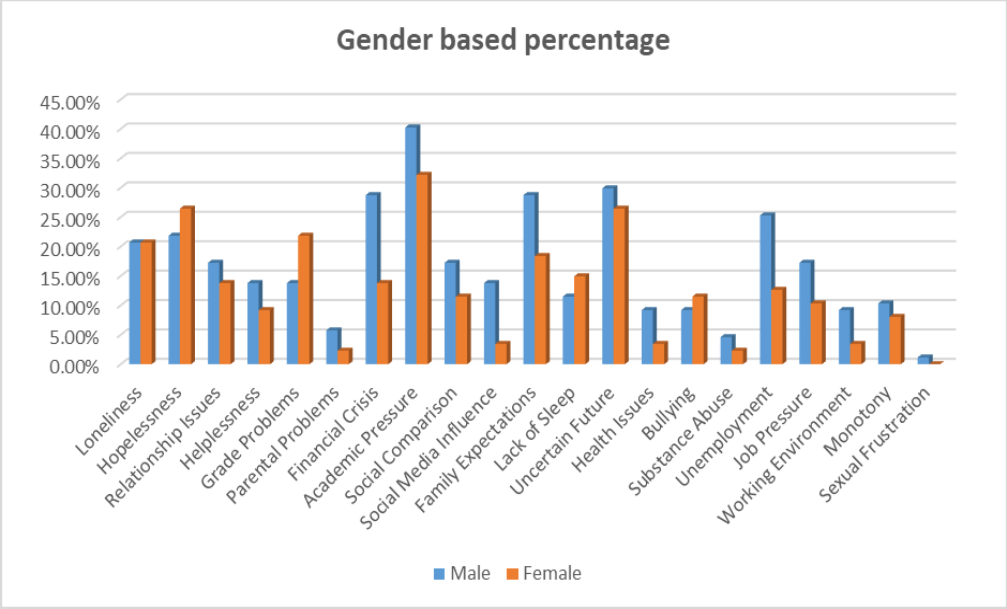

Fig. 3. Graphical representation for gender percentage of various factors

Second most 29.89% male students think uncertain future is key reason but 26.44% female students think hopelessness as a reason. 28.74% male students have opinion about financial crisis as a factor but only 13.79% female students think financial crisis as a factor. 25.29% male students have opinion about unemployment but only 12.64% female students have opinion about unemployment as a factor. Fig. 3 shows the graphical representation of Table 4.

4.3 Apriori Association Rule on Factors

Using the Apriori association rule, the support is computed for single items means single factors. Table 5 shows the single factors list with the support value.

Fig. 4 shows the scatter plot of antecedent support and consequent support for the association rule which have minimum support 0.005 and maximum length 2.

Fig. 5 shows the scatter plot of antecedent support and consequent support for the association rule which have minimum support 0.005 and maximum length 3.

Fig. 6 shows the scatter plot of support, confidence and lift for the association rule which have minimum support 0.005 and maximum length 2. Here X axis refers to the support, Y axis refers to the confidence and Size means the lift.

Fig. 7 shows the scatter plot of support, confidence and lift for the association rule which have minimum support 0.005 and maximum length 3. Here X axis refers to the support, Y axis refers to the confidence and Size means the lift.

This work found the support list for single factors, association factors frequent list, scatter plot of antecedent support and consequent support for maximum length 2 and 3, also found the scatter plot of support, confidence and lift for maximum length 2 and 3.

Table 5. Support for single factors

Factors	Support (Single Factor)
Loneliness	0.021277
Hopelessness	0.021277
Relationship Issues	0.021277
Helplessness	0.021277
Grade Problems	0.063830
Parental Problems	0.063830
Financial Crisis	0.191489
Academic Pressure	0.255319
Social Comparison	0.234043
Social Media Influence	0.148936
Family Expectations	0.489362
Lack of Sleep	0.319149
Uncertain Future	0.638298
Health Issues	0.148936
Bullying	0.255319
Substance Abuse	0.063830
Unemployment	0.489362
Job Pressure	0.425532
Working Environment	0.170213
Monotony	0.255319
Sexual Frustration	0.936170

From the Apriori association algorithm, this work found some associations. The following associations are of frequent factors for higher support.

Family Expectations -> Financial Crisis
Monotony -> Uncertain Future
Social Media Influence -> Unemployment
Uncertain Future -> Family Expectations
Unemployment -> Family Expectations
Job Pressure -> Unemployment
Job Pressure -> Uncertain Future
Financial Crisis -> Parental Problems
Financial Crisis -> Social Comparison
Monotony -> Bullying
Social Media Influence -> Bullying
Social Media Influence -> Family Expectations
Social Media Influence -> Financial Crisis
Unemployment -> Financial Crisis
Job Pressure -> Social Media Influence
Social Media Influence -> Monotony
Job Pressure -> Monotony
Unemployment -> Monotony

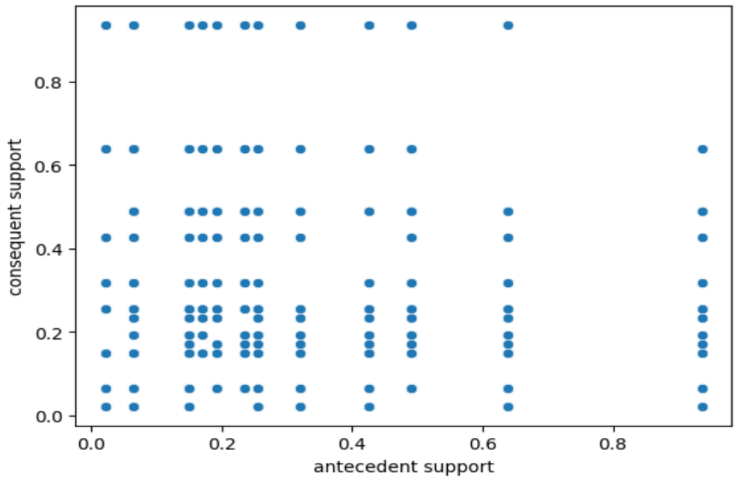

Fig. 4. Scatter plot of antecedent support and consequent support (Max Length 2)

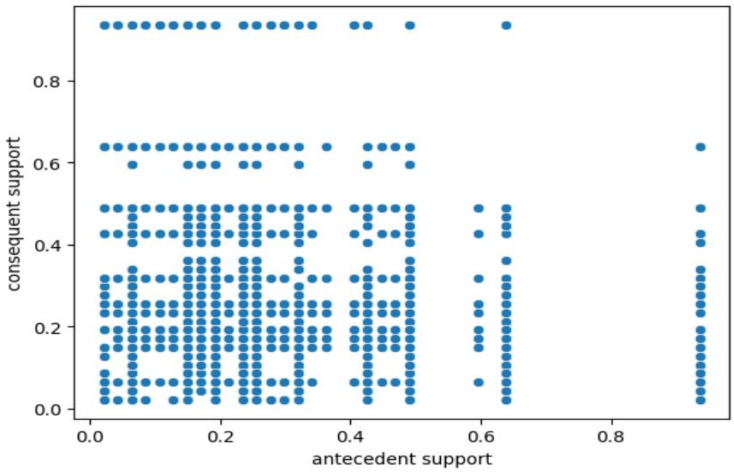

Fig. 5. Scatter plot of antecedent support and consequent support (Max Length 3)

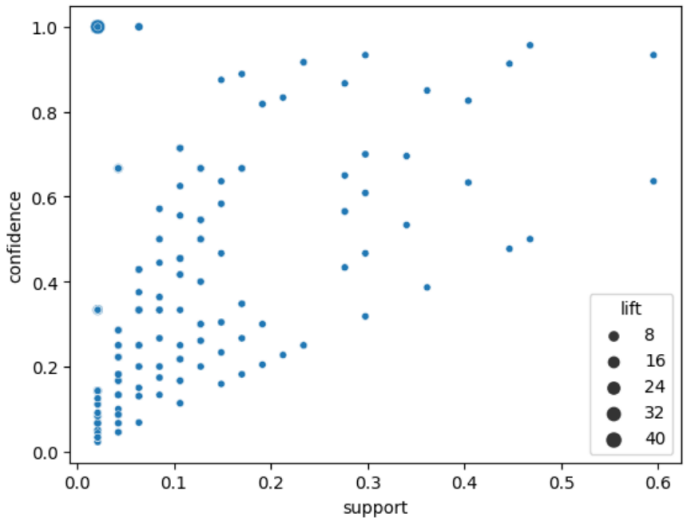

Fig. 6. Scatter plot of Support, Confidence and Lift (Max Length 2)

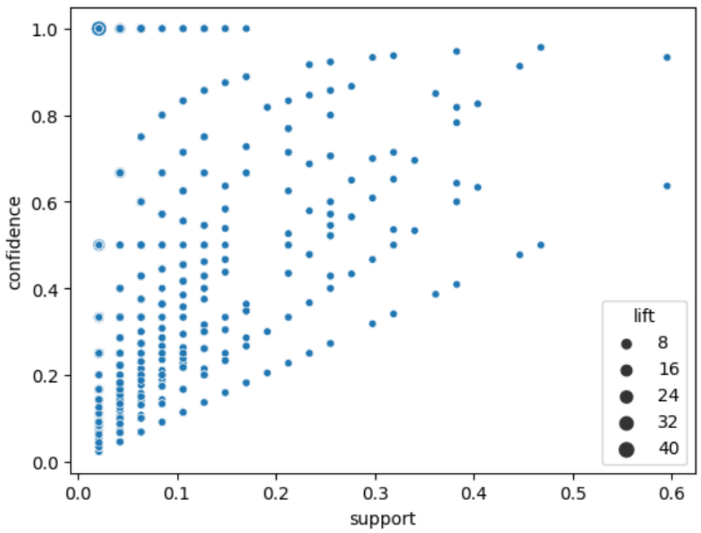

Fig. 7. Scatter plot of Support, Confidence and Lift (Max Length 3)

5. CONCLUSION AND FUTURE WORK

This study found that Academic Pressure, Uncertain Future, Hopelessness, Family Expectations, Financial Crisis, Loneliness, Unemployment, Grade Problems, Relationship Issues and Social Comparison are the key factors for depression and suicidal ideation among university student in Bangladesh. These factors percentage varies based on gender male and female. Academic Pressure, Uncertain Future, Financial Crisis, Family Expectations, Unemployment, Hopelessness, Loneliness and Relationship Issues are the key factors according to male students. On the other hand, Academic Pressure, Hopelessness, Uncertain Future, Grade Problems, Loneliness, Family Expectations, Lack of Sleep and Relationship Issues are the key factors according to female students. We can save many students lives by concerning and stopping suicide cases. Depression and suicidal incident are very much possible to stop it by precaution and taking proper steps on the factors. In future, we can work on student's mental health, depression to stop suicidal incidents.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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