# Association of Symptoms-Based Iron Deficiency Anemia to Anxiety and Depression Related Criteria Symptoms among the 3rd Year Medical Technology Students of the University Of Santo Tomas during the COVID-19 Pandemic

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**Abstract: -** Iron deficiency anemia (IDA) is a common disease, which include symptoms such as fatigue, weakness, lightheadedness, pallor, and palpitations wherein fatigue is said to be significant to depression and anxiety since it can be described as a condition, which affects the cognitive, emotional, and spiritual functions that may lead to the impairment of school performance and disturbed social relationships. The study aims to associate symptoms-based IDA to anxiety and depression related criteria symptoms among the third year Medical Technology students of the University of Santo Tomas (UST) amid the COVID-19 pandemic. The responses of 160 3rd year UST Medical Technology students were gathered through an online survey questionnaire with regards to screening symptoms-based IDA as well as both anxiety and depression symptoms. Using the Spearman correlation method of analysis, association between symptoms-based IDA with the level of anxiety and depression was determined. Results showed that among the 160 respondents, a total of 1060 symptoms were manifested by the respondents. Moreover, a period prevalence of 78% (124) of the 160 respondents for depression related criteria symptoms and 75% (120) for anxiety related criteria symptoms were observed based on the cutoff scores. There is a significant association between the number of IDA symptoms with the levels of both anxiety and depression symptoms in females than in males where there is no association. It also showed that more IDA symptoms shown mean a more severe level of anxiety and depression symptoms. Furthermore, symptoms of IDA are experienced more by females. It can be deduced that an increase in the number of IDA symptoms experienced by the students also means an increase in the level of anxiety and depression symptoms.

**Key Words: —** ***Symptoms-based IDA, anxiety related criteria symptoms, depression related criteria symptoms, COVID-19 pandemic.***

## I. INTRODUCTION

Iron deficiency anemia is a common disease that arises with the imbalance of iron intake, iron stores, and iron loss that cannot fully support the erythrocyte production [1]. Some symptoms of this disease include fatigue, weakness,

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Lightheadedness, headache, pallor or jaundice, tachycardia, palpitations, chest pain, dyspnea, cold distal extremities, and claudication [2]. A study conducted in Bangladesh by [3] states that iron deficiency anemia is common among university students due to poor dietary habits. Lack of awareness of the importance of iron from the diet or as supplementation during menstrual blood loss is the most common cause of IDA among females. Moreover, sleep deprivation is prevalent in the general population of students in modern society. This is due to the heavy workload, academic demands, and the student's attitude itself. Although iron deficiency anemia is not always fatal to life, the effects of this

disease are affecting the overall lifestyle and performance of an individual, especially for university students. Short term memory status was associated with IDA in students [4].

Symptoms of depression are divided into psychological, physical, and social symptoms that may include continuous low mood, lack of energy, unexplained aches and pains, changes in appetite or weight, and fewer social activities with people. Symptoms of anxiety may include restlessness, easily tiredness, and having sleeping problems. There is a significant association among children and adolescents between iron deficiency anemia and psychiatric disorders. Anxiety is one of the disorders that has increased the risk of iron deficiency anemia among the participants.

Iron is one of the nutrients that the body needs to properly function cognitive processes [5]. Body mass index is one of the measures of nutrient intake of an individual. Studies have shown that lower weight individuals are more likely to have iron deficiency anemia compared to higher weight individuals because of low nutrient intake that may be associated with loss of appetite due to depression.

Anxiety and depression are common mental health problems in the Philippines. According to the National information on mental health services in the Philippines, 14% of the 1.4 million Filipinos with disabilities were identified with mental health problems as of 2010. However, with the change of lifestyle of the people, a significant rise of anxiety and depression were seen among college students due to the new environment that they cope up with, including new people in their lives, being away from their family and friends, and the new culture that they live in. The average onset of having mental health problems ranges from 18 to 24 years old and almost 70% of individuals with an anxiety disorder will experience symptoms before reaching the age of 22 [6]. The common activities of modern students that contribute to having iron deficiency anemia may include irregular eating schedules, inappropriate meals, especially when living in the city of the university, and irregular sleeping patterns.

Students are challenged every day with the academic workloads given to them. Because of this, stress is not new for the students. Moreover, due to these academic requirements, students are seen as stressed individuals [7]. Academic stressors for students pertaining to the requirements of the university needed by students to be accomplished. Stress is a feeling that sometimes comes out as negative feelings. Due to the heavy academic workload, students tend to be more anxious and be more nervous. There are individuals with anxiety having depression at the same time, and vice versa [8].

Based on the above study, the researchers have the questions: (1) is there a significant association between symptoms-based iron deficiency anemia with anxiety and depression related criteria symptoms? (2) How prevalent is symptoms-based iron deficiency anemia among the 3rd year Medical Technology students during the COVID-19 pandemic? (3) How prevalent are anxiety and depression related criteria symptoms among the 3rd year Medical Technology students with symptoms-based iron deficiency anemia during the COVID-19 pandemic? The researchers hypothesized that symptoms-based iron deficiency anemia is associated with anxiety and depression related criteria symptoms. The study aims to associate symptoms-based iron deficiency anemia to anxiety and depression related criteria symptoms among the third year Medical Technology students of the University of Santo Tomas (UST) amid the COVID-19 pandemic.

## II. METHODS

### *2.1 Sampling and Study Site*

The subjects were third-year Medical Technology students from the University of Santo Tomas in Sampaloc, Manila. The study used a quantitative correlational method to measure the association between iron deficiency anemia symptoms and anxiety and depression symptoms among UST third year Medical Technology students during the COVID-19 pandemic. This study used two stages of purposive sampling. Purposive in nature due to the inclusion criteria set, including only those with at least five IDA symptoms and do not take IDA medications. For stage 1, the entire third year Medical Technology population was asked to complete a symptom-based IDA questionnaire. Those who met the criteria for inclusion were considered stage 2 responders. The second questionnaire's minimal sample size was calculated using Cochran's sample size formula for categorical data and its correction formula. The sample size per sex was computed.

The IDA questionnaire was given to 945 third-year students, 435 of whom responded. Only 186 had five or more IDA

symptoms and were considered for stage 2 sampling. Using Cochran's calculation, 125 students should potentially complete the anxiety and depression survey. Thirteen (13) out of 186 were taking IDA medications. To compute, 13 minus 186 is equal to 173. The anxiety and depression questionnaire was given to 173. The researchers used the anxiety and depression questionnaire on all 173 to meet the 125 target. The poll had 164 respondents, of which 160 were usable for analysis. Nine students did not respond, one refused to participate in the poll, and three took IDA drugs. The data analysis used 160 respondents. The study was conducted during the first two quarters of 2021.

### *2.2 Questionnaire*

General Anxiety Disorder-7 (GAD-7) and Patient Health Questionnaire-9 (PHQ-9) were employed by the researchers to measure anxiety and depression respectively. GAD-7 consists of seven questions used to identify the level of anxiety one has. PHQ-9 consists of nine questions used to identify the level of depression one has. A questionnaire was used to quantify the symptoms of iron deficiency anemia which consists of a total of 12 symptoms, 4 more symptoms were added based on a study [2].

The dissemination of questionnaires was conducted in two stages. Stage 1 started with the whole third-year Medical Technology population and ended up with a total of 186 respondents. Stage 2 was disseminating the anxiety and depression questionnaires, by email, to the respondents from the first stage. Stage 2 resulted in 160 total respondents. Those who were dropped from stages 1 and 2 were those who did not answer the questionnaire or meet the criteria.

### *2.3 Analysis*

Spearman correlation was used to find the association between symptoms-based IDA with the level of anxiety and depression in the study's male, female, and general population. Spearman correlation ranks two variables utilized in non-normal distributed continuous data, ordinal data, and to test whether the null hypothesis is retained or rejected [9].

### *2.4 Limitations of the Study*

The limitations of the study revolved around centralizing on symptoms-based IDA rather than one needing a clinical diagnosis. The respondents were only third-year medical technology students of the University of Santo Tomas of the school year 2020-2021 are the sole respondents for this research. Other departments, faculties, and colleges of the University of Santo Tomas were not taken into consideration due to the differences in the workload of students. Other universities and colleges were also excluded from this research.

### *2.5 Ethical Considerations*

Participants were given information about the nature of the study and written informed consent was collected by the researchers. The participation of the respondents of this study was voluntary and was given the right to withdraw their participation at any time. The researchers practiced confidentiality, anonymity, and nondiscriminatory with the participants involved. Full transparency and honesty were employed due to the nature of the study.

## III. RESULTS

The result for the study contains seven different tables. Table 1 contains the stage 1 sampling which is the prevalence of IDA symptoms among 3rd year Medical Technology students. Table 2 contains the symptoms-based IDA that compares the prevalence based on biological sex. Table 3 and 4 contains the responses of the 160 stage 2 sample respondents that present the symptoms of depression and anxiety respectively. Table 5 to 7 contains the Spearman Correlation data in the categories of male , female and total students in general respectively. The results in Table 5 to 7 indicate the decision whether to retain or reject the null hypotheses.

Table.1. Summary of Stage 1 Sampling. Prevalence of Iron Deficiency Anemia (IDA) Symptoms Present in 3rd Year Medical Technology Students

| No. of IDA Symptoms | Male | Female | Total | % |
|---|---|---|---|---|
| 0 | 26 | 39 | 65 | 15 |
| 1 | 12 | 24 | 36 | 8 |
| 2 | 19 | 31 | 50 | 11 |
| 3 | 14 | 39 | 53 | 12 |
| 4 | 12 | 33 | 45 | 10 |
| 5 | 15 | 37 | 52 | 12 |
| 6 | 11 | 37 | 48 | 11 |
| 7 | 6 | 29 | 35 | 8 |
| 8 | 1 | 20 | 21 | 5 |
| 9 | 1 | 18 | 19 | 4 |
| 10 | 0 | 6 | 6 | 1 |
| 11 | 0 | 3 | 3 | 1 |
| 12 | 0 | 1 | 1 | 0 |
| 13 | 0 | 1 | 1 | 0 |
| Total | 117 | 318 | 435 | 100 |
| Percentage | 27 | 73 | 100 | |

Table 1 presents the distribution of the 435 respondents in the Stage 1 Sampling according to biological sex and number of IDA symptoms. Majority (57%) or 249 of the respondents reported to have experienced zero to four IDA symptoms in the last six months. Of these, 83 are males and 166 are females. Meanwhile, 186 or 43% of the respondents experienced at least five IDA symptoms in the last six months. These 186 were the potential respondents for the Stage 2 sampling in this study. Out of the 186, there were 34 males and 152 females. For the Stage 2 sampling, the 186 respondents were screened according to whether they are currently taking IDA medications and, on their willingness, to be part of the next stage. Twenty-six (26) respondents of the 186 were found to have taken IDA medication or declined the Stage 2 anxiety and depression form. Hence, a total of 160 respondents were included in the Stage 2 of the sampling.

Table.2. Prevalence of Symptoms-Based Iron Deficiency Anemia (IDA) Among 3rd Year Medical Technology Students by Sex

| IDA Symptoms | Male Respondents | % of Male | Female Respondents | % of Female | Total No. of Respondents | % of Total 160 Respondents |
|---|---|---|---|---|---|---|
| Dizziness and fatigue after physical activity | 30 | 91 | 113 | 89 | 143 | 89 |
| Pale nails | 2 | 6 | 34 | 27 | 36 | 23 |
| Frequent minor infections | 4 | 12 | 15 | 12 | 19 | 12 |
| Shortness of breath | 16 | 48 | 66 | 52 | 82 | 51 |
| Taste disturbance | 5 | 15 | 10 | 8 | 15 | 9 |
| Headache | 33 | 100 | 124 | 98 | 157 | 98 |
| Ice craving | 3 | 9 | 35 | 28 | 38 | 24 |
| Flattened brittle nail | 2 | 6 | 11 | 9 | 13 | 8 |
| Angular stomatitis (swollen, red patches in the corners on the outside of your lips) | 1 | 3 | 14 | 11 | 15 | 9 |
| Glossitis (tongue inflammation) | 1 | 3 | 2 | 2 | 3 | 2 |
| Ringing in the ears | 20 | 61 | 74 | 58 | 94 | 59 |
| Weakness | 31 | 94 | 114 | 90 | 145 | 91 |
| Lightheadedness | 28 | 85 | 121 | 95 | 149 | 93 |
| Cold distal extremities | 6 | 18 | 42 | 33 | 48 | 30 |
| Palpitation | 12 | 36 | 91 | 72 | 103 | 64 |
| **Total Instances of Symptoms** | **194** | | **866** | | **1,060** | |

Table 2 shows that of the 33 male respondents, 194 instances of IDA symptoms over the last six months were reported. Meanwhile, the 127 female respondents reported 866 instances of IDA symptoms over the last six months. With 157 respondents or 98% who reported, headache is the most prevalent IDA symptom. All the 33 males reported to have experienced headache while 124 or 98% of females experienced the same IDA symptom. Second most prevalent is lightheadedness with 149 respondents or 93% reporting to have experienced it in the last six months. Lightheadedness as an IDA symptom was experienced by 28 or 85% of the male respondents and 121 or 95% of the female respondents. Weakness as an IDA symptom came in as third most prevalent with 145 or 91% respondents reported to have it in the last six months. Among the male respondents, 31 or 94% experienced weakness in the last six months. Ninety-five (95) percent or 149 female respondents also experienced weakness. Dizziness and fatigue after physical activity was the fourth most prevalent IDA symptom with 143 or 89% of the respondents reported to have it in the last 6 months. Dizziness and fatigue after physical activity in the last six months was experienced by 30 or 91% of the male respondents and 113 or 89% of the female respondents. Table 2 shows the complete details.

Table.3. Symptoms of Depression among 3rd Year Medical Technology Students

| Over the last 2 weeks, how often have you been bothered by any of the following problems? | Not at all | | Several days | | More than half the days | | Nearly everyday | | Interquartile Range | Weighted Mean | Interpretation |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % | No. | % | | | |
| Little interest or pleasure in doing things | 6 | 4 | 60 | 38 | 56 | 35 | 38 | 24 | 1 | 1.79 | More than half the days |
| Feeling down, depressed, or hopeless | 14 | 9 | 63 | 39 | 51 | 32 | 32 | 20 | 1 | 1.63 | More than half the days |
| Trouble falling asleep, or sleeping too much | 13 | 8 | 32 | 20 | 38 | 24 | 77 | 48 | 2 | 2.12 | More than half the days |
| Feeling tired or having little Energy | 6 | 4 | 28 | 18 | 56 | 35 | 70 | 44 | 1 | 2.19 | More than half the days |
| Poor appetite or overeating | 27 | 17 | 48 | 30 | 47 | 29 | 38 | 24 | 1 | 1.60 | More than half the days |
| Feeling bad about yourself - or that you are a failure or have let yourself or your family down | 18 | 11 | 45 | 28 | 49 | 31 | 48 | 30 | 2 | 1.79 | More than half the days |
| Trouble concentration on things, such as reading the newspaper or watching television | 27 | 17 | 45 | 28 | 42 | 26 | 46 | 29 | 2 | 1.67 | More than half the days |
| Moving or speaking so slowly that other people could have noticed? Or the opposite - being so fidgety or restless that you have been moving around a lot more than usual | 75 | 47 | 51 | 32 | 20 | 13 | 14 | 9 | 1 | .83 | Several days |
| Thoughts that you would have be better off dead or of hurting yourself in some way | 82 | 51 | 48 | 30 | 19 | 12 | 11 | 7 | 1 | .74 | Not at all |

Interpretation: Not at all (0-0.75), Several days (0.76-1.5), More than half the days (1.51-2.25), Nearly everyday (2.26-3.00)

The 160 surveyed 3rd year Medical Technology students were asked about nine problems related to depression using the Patient Health Questionnaire – 9 (PHQ-9).

Table 3 presented details of the findings. Based on the responses, weighted mean and interquartile range for the symptoms of depression, the respondents on average, experienced having little interest or pleasure in doing things, feeling down, depressed or hopeless, trouble falling asleep or sleeping too much, feeling tired or having little energy, poor appetite or overeating, feeling bad about yourself – or that you are a failure or have let yourself down and trouble of concentration on things such as reading the newspaper or watching television for more than half a days in the last two weeks.

Respondents on average, experienced having the problem related to moving or speaking so slowly that other people could have noticed or being so fidgety or restless that they have been moving around a lot more than usual for several days in the last two weeks and did not experience of having the occurrence of thoughts that they would have been better off dead or hurting themselves in some way in the last two weeks.

The symptom of feeling tired or having little energy is the most prevalent symptom of depression among 3rd year Medical Technologists with a weighted mean of 2.19 and interpreted as more than half days of the past 2 weeks.

The second most prevalent symptom of depression is the experience of trouble falling asleep or sleeping too much with a weighted mean of 2.12 which is more than half days of the past 2 weeks.

Little interest or pleasure in doing things and feeling bad about themselves as failure and letting their family down are the third and fourth most prevalent symptoms of depression with a weighted mean of 1.79 which is interpreted as more than half days of the past 2 weeks.

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Table.4. Symptoms of Anxiety among 3rd Year Medical Technology Students

| Over the last 2 weeks, how often have you been bothered by any of the following problems? | Not at all | | Several days | | More than half the days | | Nearly everyday | | Interquartile Range | Weighted Mean | Interpretation |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % | No. | % | | | |
| Feeling nervous, anxious or on edge | 16 | 10 | 39 | 24 | 58 | 36 | 47 | 29 | 2 | 1.85 | More than half the days |
| Not being able to stop or control worrying | 22 | 14 | 43 | 27 | 43 | 27 | 52 | 33 | 2 | 1.78 | More than half the days |
| Worrying too much about different things | 11 | 7 | 42 | 26 | 47 | 29 | 60 | 38 | 2 | 1.98 | More than half the days |
| Trouble relaxing | 30 | 19 | 40 | 25 | 50 | 31 | 40 | 25 | 1.25 | 1.63 | More than half the days |
| Being so restless that it is hard to sit still | 43 | 27 | 46 | 29 | 44 | 28 | 27 | 17 | 2 | 1.34 | Several days |
| Becoming easily annoyed or irritable | 13 | 8 | 62 | 39 | 45 | 28 | 40 | 25 | 1.25 | 1.70 | More than half the days |
| Feeling afraid as if something awful might happen | 16 | 10 | 60 | 38 | 46 | 29 | 38 | 24 | 1 | 1.66 | More than half the days |

Interpretation: Not at all (0-0.75), Several days (0.76-1.5), More than half the days (1.51-2.25), Nearly every day (2.26-3.00)

The 160 surveyed 3rd year Medical Technology students were asked about nine problems related to anxiety using the General Anxiety Disorder – 7 (GAD-7). Table 4 presented details of the findings. Based on the responses, weighted mean and interquartile range for the symptoms of anxiety, the respondents on average, experienced 'feeling nervous, anxious, or on edge', 'not being able to stop or control worrying', 'worrying too much about different things', 'trouble relaxing', 'becoming easily annoyed or irritable', and 'feeling afraid as if something awful might happen' for more than half a days in the last two weeks except for 'being so restless that it is hard to sit still', that it was only experienced several days in the last two weeks.

The symptom of 'worrying too much about different things' is the most prevalent symptom of anxiety among 3rd year Medical Technologists with a weighted mean of 1.98 and interpreted as more than half days of the past 2 weeks. The second most prevalent symptom of anxiety is 'feeling nervous, anxious or on edge' with a weighted mean of 1.85 which is more than half

days of the past 2 weeks. 'Not being able to stop or control worrying' and 'becoming easily annoyed or irritable' are the third and fourth most prevalent symptoms of anxiety with a weighted mean of 1.78 and 1.70 respectively, which is interpreted as more than half days of the past 2 weeks.

Table.5. Spearman Correlation between IDA and Levels of Depression and Anxiety among the 33 3rd Year Medical Technology Male Students

| Items for Correlation | Spearman rho Coefficient | p-Value | Interpretation |
|---|---|---|---|
| IDA and Depression | .0426 | .814 | Retain the null hypothesis. |
| IDA and Anxiety | .0773 | .669 | Retain the null hypothesis. |

Table 6. Spearman Correlation between IDA and Levels of Depression and Anxiety among the 127 3rd Year Medical Technology Female Students

| Items for Correlation | Spearman rho Coefficient | p-Value | Interpretation |
|---|---|---|---|
| IDA and Depression | .313 | .0003* | Reject the null hypothesis. |
| IDA and Anxiety | .212 | .0166* | Reject the null hypothesis. |

*Significant at 0.05 level of significance

Table.7. Spearman Correlation between IDA and Levels of Depression and Anxiety among the 160 3rd Year Medical Technology Students

| Items for Correlation | Spearman rho Coefficient | p-Value | Interpretation |
|---|---|---|---|
| IDA and Depression | .290 | .0020* | Reject the null hypothesis. |
| IDA and Anxiety | .220 | .0052* | Reject the null hypothesis. |

*Significant at 0.05 level of significance

Table 5 to Table 7 delineate the results of the Spearman correlation between IDA and levels of depression and anxiety among the 33 male respondents, 127 female respondents, and the 160 total respondents, respectively.

Based on the results of the 33 male respondents both null hypothesis is to be retained for both the correlation symptoms-based IDA and levels of depression (Spearman correlation coefficient: 0.0426, p-value = 0.814, level of significance = 0.05) and anxiety (Spearman correlation coefficient: 0.0773, p-value = 0.669, level of significance = 0.05). For the 127 female respondents both null hypothesis is to be rejected based on the results for both the correlation between symptoms-based IDA and levels of depression (Spearman correlation coefficient: 0.313, p-value = 0.0003, level of significance = 0.05) and anxiety (Spearman correlation coefficient: 0.212, p-value = 0.0166, level of significance = 0.05).

For the whole population, both the null hypothesis for both the correlation between symptoms-based IDA and levels of depression (Spearman correlation coefficient: 0.290, p-value = 0.0020, level of significance = 0.05) and anxiety (Spearman correlation coefficient: 0.220, p-value = 0.0052, level of significance = 0.05) are both rejected.

## IV. Discussion

The study sought to determine the association between symptoms-based IDA with anxiety and depression related criteria symptoms and their respective prevalence among the 3rd year UST Medical Technology students during the COVID-19 pandemic. The study was done by knowing the prevalence of the following: symptoms-based IDA symptoms, anxiety, and depression related criteria symptoms. The association between these variables was evaluated after learning their respective prevalence. A total of 1060 instances of Symptoms-based IDA were exhibited by the 160 surveyed students. There are 186 students (43%) who showed at least five IDA symptoms in the last six months; however, only 160 are included for analysis. Depression related criteria symptoms has an overall period prevalence of 78%, while anxiety related criteria symptoms has a period prevalence of 75% based on their corresponding cut-off scores. Depression and anxiety related criteria symptoms' prevalence are interpreted on the basis of several studies [10]. The increase in the levels of both depression and anxiety of 3rd year UST Medical Technology students during the pandemic is consistent with the finding on Bangladeshi students having heightened depression and anxiety during the COVID-19 pandemic [11]. Symptoms-based IDA, anxiety and depression, are based on the six-month and the two-week time frame respectively, which served as the students' reference point when evaluating their experiences.

The result of the study is consistent with the findings [12], where half of the population with IDA are female students; thereby, both research indicates that female students are more inclined to develop IDA symptoms. However, such results are in contrast to the report [13], where it is said that more males have IDA. One of the main factors that may have contributed to this inclination to female students is menstruation. A study on females with IDA aged 18-40 found that 24 out of 35

patients experience heavy menstruation [14]. It is also said that heavy menstrual bleeding is the most common cause of ID and IDA ([15], [16]). The majority of both male (93%) and female (70%) students experience between five to seven IDA symptoms. In comparison, none of the males showed more than 10 of the IDA symptoms and only a small percentage of females did (6.8%). Only a small percentage showed 10 to 13 symptoms because some symptoms (i.e., glossitis, flattened brittle nail, taste disturbance, and angular stomatitis) are particular to IDA and other more severe conditions. Such symptoms rarely occur to supposedly healthy students who regularly attend university.

Among the IDA symptoms listed in Table 2, headache, lightheadedness, weakness, and dizziness accompanied by fatigue after physical activity are the four most common IDA symptoms experienced by the third-year students in this study. These findings contrast with the report [4], in which the four most common are flattened brittle nails, glossitis, ringing in the ears, and dizziness with fatigue after physical activity. Note that headache, lightheadedness, weakness, and dizziness with fatigue after physical activity may also manifest in other unrelated conditions such as in allergies, flu, colds, vomiting, diarrhea and dehydration [17]. As seen in many respondents, symptoms including palpitations, shortness of breath, fatigue, dizziness, and headaches are also anxiety-related [18]. The presence of at least five symptoms would be enough to conclude that the person has symptoms-based IDA no matter how common such symptoms occur in other conditions [4]. However, it is also a fact that these four most common symptoms are not specific to IDA only. This non-specificity is primarily why the study is not a basis for diagnosis, and whatever the results are would still warrant a clinical check-up.

The symptoms of depression of the surveyed respondents had a corresponding cut-off score based on the study wherein a PHQ-9 score of $\geq 10$ is the cutoff result for depression [10]. This cutoff score was used because it maximized the combined specificity and sensitivity according to semi structured interviews. Additionally, patients who scored $\geq 10$ in the PHQ-9 screened positive for major depression [19]. The respondents scored an average of 14.36 in the PHQ-9. Out of 160 surveyed respondents, 124 (78%) of the students scored $\geq 10$ symptoms of depression cut-off score. Female students are observed to be more depressed than male students [20]. Additionally, females can manifest higher rates of depression due to their expressiveness [21].

For the symptoms of anxiety, a cutoff score of 8 was used as it provided the most reasonable sensitivity (0.83 at 95% confidence interval) and sensitivity (0.84 at 95% confidence interval). Based on the obtained results, 120 (75%) out of 160 of the students, who participated in the study, have experienced symptoms of severe anxiety level in the past two weeks. The table also includes the symptoms that the students may have experienced associated with anxiety and how frequently they felt it. The participants experienced nearly all the symptoms for more than half the days except for 'being so restless that it is hard to sit still'.

However, anxiety and depression symptoms are not deemed the direct cause of anemia, but both clinical presentations can be matched. The risk for psychological disorders, as mentioned, is higher for patients with anemia. Moreover, anxiety and depression symptoms are expressed as adverse effects of IDA. It is also observed that behavior concerning anxiety and depression is significantly increased in patients diagnosed with IDA.

The number of symptoms per individual linked with the grade for both PHQ-9 (depression questionnaire) and GAD-7 was used as the ordinal data for the symptom-based IDA (anxiety questionnaire). Both the null hypothesis for the male population were retained however, for the female, and general population, the hypotheses were rejected meaning there is an association for the female, and general population but none for the male population. It was found that the percentage of anemic males was 36.7 percent, while the percentage of anemic females was 63.3 percent, in a study of the incidence of IDA among university students in Bangladesh [3]. Only four out of 85 male students who had their blood tested were anemic, according to a study on the frequency of anemia among students at a Saudi Arabian institution [22].

IDA, on the other hand, is more common in women, as seen by the fact that of the 49 women examined, 67.35 percent had hemoglobin levels less than 12 mg/dL. As a result, the findings of this study are comparable to other IDA prevalence studies in terms of the number of males and females, which revealed that IDA is more prevalent in females.

Psychological problems were experienced during the COVID-19 pandemic and had a significant effect on the people. According to a study regarding the comparison between gender differences in anxiety and depression using social media, the study used the simple PHQ-2 and GAD-2 [23]. Both two-item questionnaires showed that females experience more serious physiological problems due to more severe stress and anxiety symptoms than males who had a better resilience to stress among the social media users in China. Women aged 14-25 years of age have twice the prevalence of depression than men, and women have a greater risk for major depression globally in this age group—the gap in the prevalence between the two biological sexes changes in the age of puberty in females [24]. It shows that males are more resilient to psychological problems and are less likely to be anemic compared to females, leading to a non-correlated association between IDA to anxiety and depression in the study. Females correlated with symptoms-based IDA to anxiety, and depression symptoms in the study group are more likely to acquire or develop IDA, anxiety, and depression.

The association between Iron Deficiency Anemia and Depressive disorder was seen in adult patients in a secondary health care facility in Karachi, Pakistan. The results showed that the severity of depressive order increases with the degree of IDA among the 200 patients [25]. The study established a similar association between IDA and psychiatric disorders [21]. Subsequently, patients taking IDA medications or supplementations are less at risk for psychiatric disorders. The overall result of the study was an association between symptoms-based IDA to anxiety and depression symptoms among the 160 3rd year Medical Technology students. The number of IDA symptoms was correlated with the score from the depression and anxiety questionnaires; the Spearman rho coefficient and the increase in the IDA symptoms show an increase in both levels of depression and anxiety.

However, the association of IDA to depression and anxiety was correlated by the applied methods of the researchers through questionnaires which needs further confirmation through clinical tests. Further laboratory testing is needed to evaluate and screen iron deficiency anemia, including complete blood count, reticulocyte count, iron profile, peripheral blood smear, and other tests such as bone marrow analysis [2]. The method used for anxiety and depression was an initial screen, and further psychiatric tests must be applied to confirm the diagnosis of anxiety and depression. The final results show that a high prevalence of symptom-based IDA was found on 3rd-year Medical Technology students at the same time having significant levels of symptoms of both anxiety and depression during the COVID-19 pandemic.

## V. CONCLUSION

Based on the results of the study, a significant correlation exists between symptoms-based iron deficiency anemia and anxiety and depression related criteria symptoms. However, this holds true only for female students. In addition to this, symptoms of iron deficiency anemia are experienced more by female students. Among the one-hundred sixty respondents (160), a total of one-thousand sixty (1060) symptoms were manifested by the respondents. In addition to this, a period prevalence of 78% (124) of the 160 respondents for depression related criteria symptoms and 75% (120) for anxiety related criteria symptoms were observed based on the cutoff scores. It can be deduced that an increase in the number of iron deficiency anemia symptoms experienced by the students also means an increase in the score of anxiety and depression symptoms.

*Recommendations:*

The researchers' study relied on surveys and answers on questionnaires sent out regarding screening of depression and anxiety to produce results. This method was chosen due to the current setup the researchers had. Therefore, it is recommended that a better method be chosen to get more accurate results such as laboratory evaluation on screening IDA. It is preferable if the participants to be included in the study are clinically diagnosed with IDA, anxiety, and depression and can provide their diagnosis to assess association better.

Another recommendation would be to use a non-probability sampling technique (i.e., random sampling) instead of a probabilistic method to minimize sampling bias. It is also recommended to include other programs in other universities as well for research of this nature, to have a wider scope of participants to be included in the study.

The questionnaire used in the study was only limited to the symptoms of the students at the time of pandemic. It is

suggested to include questions (e.g., specific practices and lifestyle questions such as sleep deprivation, diet, and lifestyle changes) on the possible risk factors of IDA, anxiety, and depression for a more thorough evaluation and understanding of why such issues happen within the population.

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