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EXPLORING CO-MORBIDITY PATTERNS AMONG MIDDLE SCHOOL STUDENTS: A COMPREHENSIVE ANALYSIS

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ABSTRACT:

Background & Purpose: The objective of this study was to identify the various combinations of patterns of co-morbidity among middle school students in Jammu Province to address the difficulties of these interconnected diseases

Method: This cross-sectional study was conducted in 10 districts of Jammu province, focusing on students from 70 government middle schools within the age group of 11-15 years. The study investigated 10 disorders, including five learning disorders i.e., Dyslexia (Dys-L), Dysgraphia (Dys-G), Dyscalculia (Dys-C), Dysphasia (Dys-P), and Dyspraxia (Dys-Pr), as well as Anxiety (Anx), Attention Deficit Hyperactivity Disorder (ADHD), Obsessive Compulsive Disorder (OCD), Autism Disorder (AD), and Tic disorder (TD). A self-constructed battery, known as the Identification Battery on Co-morbid conditions (IBCC), was administered on 1084 students out of which 224 students were identified with co-morbid conditions.

Result: The findings of the study indicated that the prevalence of the Dys-L & Dys-C; Dys-L, Dys-G& Dys-C; Dys-L, Dys-G, Dys-C & Dys-P; and Dys-L, Dys-G, Dys-C, Anx. & ADHD were highest among 16.07%, 39.28%, 4.01% and 2.23% of students with Combinations of two, three, four & five disorders respectively. The present study also includes a discussion on the pattern matrix of co-morbid conditions, examining primary & secondary disabilities. The prevalence of primary and secondary disabilities among middle school students varies significantly.

Conclusion: These findings have enormous promise for guiding educators, policymakers, and healthcare professionals in developing focused treatments and support systems that are customized to the different needs of students with co-morbid disorders.

Keywords: Patterns, Co-Morbidity, Middle School Students, Pattern Matrix, Learning Disorders, Combinations of Disorders and Jammu Province.

1. INTRODUCTION

Co-morbidity, or the presence of two or more disorders in an individual, is becoming a better recognized phenomenon in the field of education. Understanding the patterns of co-morbidity among school-aged children is critical for designing tailored interventions and support systems that effectively meet their different needs. Middle school is a vital developmental time in which students may confront a variety of difficulties, such as learning problems. Children with learning disabilities manifest higher rates of all internalising (Anxiety and Depression) and externalising disorders (ADHD, ODD & CD) as compared to the children without learning disabilities (Johnson, 2005).

This study conducts a detailed investigation of co-morbidity patterns among middle school students to address the difficulties of these interconnected diseases. Wang & Kuo (2003) reported 0.56 % prevalence rate of Tic disorder among the participants with ADHD (36%), self-injurious behaviour (27%) and obsessive compulsive disorder (18%) were commonly found patterns of co-morbid students which was also supported by Gau et al. (2010) and Kim et al. (2010)

This study uses an evidence-based approach to give educators, policymakers, and healthcare professionals with a better understanding of the particular issues that students with co-morbid conditions confront. An individual can better adapt educational tactics and support services by recognizing prevalent co-morbidity patterns, enabling a more inclusive learning environment that allows every student to thrive academically and socially. The challenges students encounter in their academic lives prompt the essential inquiry of whether these issues are being acknowledged and if they are receiving appropriate support. To address this concern, it becomes crucial to educate teachers and parents about ADHD and its potential co-morbid conditions and how they may impact academic performance (Alqahtani, 2010). Whereas Debes et al., (2010) reported that the students with tic disorder experience educational difficulties but these co-morbid conditions worsen the educational problems of these students. The goal of this comprehensive study is to increase the understanding of co-morbidity patterns among middle school students, paving the way for more focused therapies that promote each individual's holistic well-being and academic performance. We can promote a more inclusive and supportive educational environment by recognizing the interconnection of diverse conditions, encouraging students to overcome barriers and realize their full potential.

Among students, co-morbidity disorders manifest in various types, each presenting a unique combination of conditions. Extensive research has identified several combinations, such as learning disability and ADHD (Bandla et al., 2017; Singh et al., 2017; Sahu et al., 2019; Visser et al., 2020), learning disability & conduct behavior (Missiry et al., 2016 and Darweesh et al., 2020), Tic & OCD (Diniz et al., 2004 and Nakatani et al., 2011), and Tourette syndrome & ADHD (Debes, 2010). It is noteworthy that the availability of specific disorders varies among students, with some exhibiting more than one distinct disorder, while others may experience two or more than two different disorders simultaneously. This diversity underscores the complex and individualized nature of co-morbidity patterns observed among students. The poor children faced a significantly higher risk of having three or more co-morbidities compared to privileged children, with a 3.8 times greater likelihood 30% vs. 8% (Larson et al., 2011)

STATEMENT OF PROBLEM

Exploring co-morbidity patterns among middle school students: A Comprehensive Analysis

OBJECTIVE

The primary objective of this study was to discern and characterize the diverse patterns of co-morbidity that exist among students attending government middle schools within the geographical region of Jammu Province.

DELIMITATION

The scope of this study was confined to a subset of the student population, specifically the 224 individuals who were identified as having co-morbid conditions out of the total 1084 students enrolled across 70 government middle schools within the jurisdiction of Jammu Province in the Union Territory of Jammu & Kashmir, India. The deliberate selection of this specific group allowed for a focused examination of the co-morbidity patterns prevalent among students within the defined geographical and educational context. By limiting the study to this subset, the research aimed to provide nuanced insights into the interplay of various disorders within the unique educational landscape of government middle schools in the specified region, contributing to a more comprehensive understanding of co-morbid conditions among middle school students in Jammu Province.

2. MATERIAL AND METHOD

The research methodology employed in this investigation was a cross-sectional study that incorporated a descriptive survey approach. The target population for this study encompassed students attending government middle schools located within the geographical area of Jammu Province, specifically within the larger region of Jammu & Kashmir. The selection of these schools was conducted meticulously through a multistage sampling technique, which included representation from all districts in the Jammu region, such as Rajouri, Poonch, Khistawar, Jammu, Samba, Doda, Udhampur, Reasi, Ramban, and Kathua.

To collect the necessary data, a specialized Self-Constructed instrument known as the Identification Battery on Co-morbid Conditions (IBCC) was administered to a total of 1084 middle school students within the region. Subsequently, among this group of participants, 224 students were successfully identified as having co-morbid conditions through the application of the IBCC.

STATISTICAL TECHNIQUE

A descriptive analysis approach based on percentages was employed in the study.

3. RESULTS AND DISCUSSION

The finding of the study regarding 10 disorders i.e. Dyslexia (Dys-L), Dysgraphia (Dys- G), Dyscalculia (Dys-C), Dysphasia (Dys-P), and Dyspraxia (Dys-Pr), Anxiety (Anx), Attention Deficit Hyperactivity Disorder (ADHD), Obsessive Compulsive Disorder (OCD), Autism Disorder (AD), and Tic disorder (TD) have been discussed under the following headings.

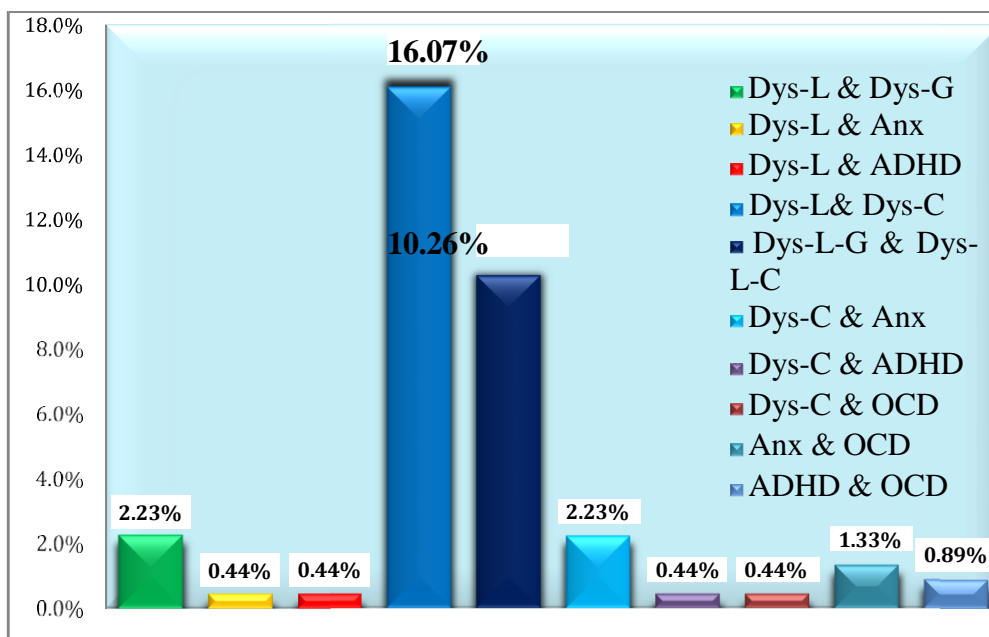
Patterns of Co-morbid Conditions with respect to Combinations of different Disorders

The following sections comprehensively explore and analyze the various patterns of Co-morbid Conditions, specifically focusing on the combinations involving Combinations of two, three, four, and five disorders, providing an in-depth discussion of each combination.

Patterns of co-morbid conditions with respect to Combinations of Two Disorders

Figure -1 illustrates the prevalence of co-morbidity with Combinations of two disorders among government middle school students.

Figure -1 No. of Students w.r.t. different Combinations of Two Disorders

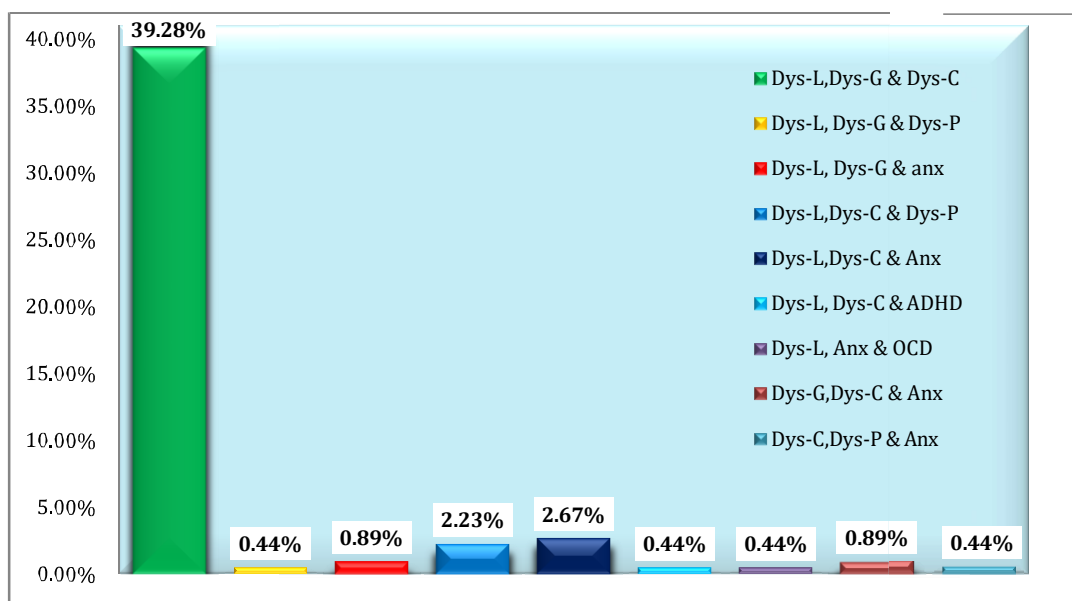


The most frequently encountered co-occurring disorders were found to be Dyslexia (Dys-L) and Dyscalculia (Dys-C), which were observed in approximately 16.07% of students exhibiting co-morbid conditions. This notable combination was succeeded by the pairing of Dysgraphia (Dys-G) and Dyscalculia (Dys-C), which accounted for a proportion of 10.26 among the student population with co-morbid conditions. Furthermore, combinations like Dyslexia (Dys-L) and Dysgraphia (Dys-G), as well as Dyscalculia (Dys-C) and Anxiety (Anx), were identified among approximately 2.23% of students with co-morbid conditions. Additionally, the co-occurrence of Anxiety (Anx) and Obsessive-Compulsive Disorder (OCD) was observed in approximately 1.33% of the affected student population. The combinations of Attention Deficit Hyperactivity Disorder (ADHD) with OCD was observed in 0.89% of students, and Dyslexia (Dys-L) with Anxiety (Anx), Dyslexia (Dys-L) with ADHD, Dyscalculia (Dys-C) with ADHD, and Dyscalculia (Dys-C) with OCD were observed at a lower frequency, with each combination found in approximately 0.44% of students presenting co-morbid conditions. Noteworthy that

Patterns of Co-morbid Conditions with respect to Combinations of Three Disorders

Figure -2 displays the prevalence of co-morbidity with Combinations of three disorders among government middle school students.

Figure -2 No. of Students w.r.t. different Combinations of Three Disorders

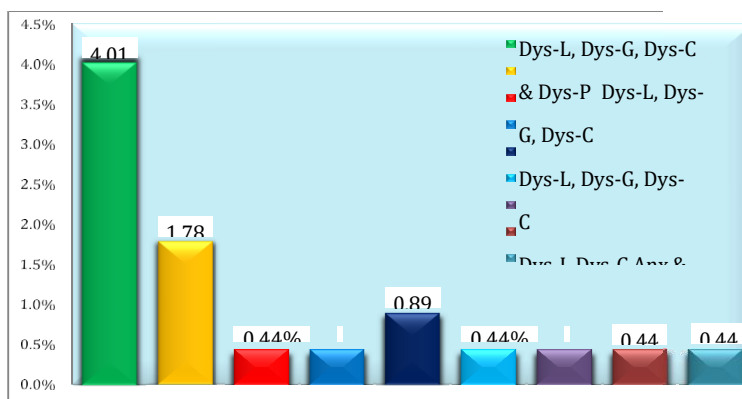


The most prominent co-occurring conditions were found in the triad of Dyslexia (Dys-L), Dysgraphia (Dys-G), and Dyscalculia (Dys-C), collectively present in a substantial 39.28% of the student population manifesting co-morbid conditions. This primary combination was closely followed by the trio of Dyslexia (Dys-L), Dyscalculia (Dys-C), and Anxiety (Anx), accounting for approximately 2.67% of students. Further, the combination of Dyslexia (Dys-L), Dyscalculia (Dys-C), and Dysphasia (Dys-P) was identified among roughly 2.23% of students with co-morbid conditions. Additional co-occurrence patterns, such as Dyslexia (Dys-L), Dysgraphia (Dys-G), and Anxiety (Anx), as well as Dysgraphia (Dys-G), Dyscalculia (Dys-C), and Anxiety (Anx), were found in approximately 0.89% of the students. Moreover, combinations like Dyslexia (Dys-L), Dysgraphia (Dys-G), and Dysphasia (Dys-P), Dyslexia (Dys-L), Dyscalculia (Dys-C), and Attention Deficit Hyperactivity Disorder (ADHD), Dyslexia (Dys-L), Anxiety (Anx), and Obsessive-Compulsive Disorder (OCD), as well as Dyscalculia (Dys-C), Dysphasia (Dys-P), and Anxiety (Anx), were each observed in 0.44% of the students presenting with co-morbid conditions.

Patterns of Co-morbid Conditions with respect to Combinations of Four Disorders

Figure -3 illustrates the prevalence of co-morbidity among government middle school students with different Combinations of four disorders

Figure -3 No. of Students w.r.t. different Combinations of Four Disorders

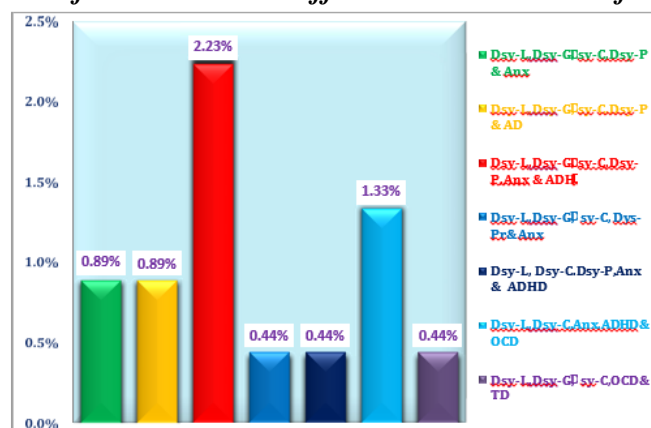


The most frequently occurring combination of disorders observed in this study was the quartet consisting of Dyslexia (Dys-L), Dysgraphia (Dys-G), Dyscalculia (Dys-C), and Dysphasia (Dys-P), which was found to manifest in approximately 4.01% of students presenting co-morbid conditions. Following closely, the grouping of Dyslexia (Dys-L), Dysgraphia (Dys-G), Dyscalculia (Dys-C), and Anxiety (Anx) was identified in roughly 1.78% of students. A similar proportion of 0.89% was noted for the combination of Dyslexia (Dys-L), Dysgraphia (Dys-G), Dyscalculia (Dys-C), and Tic Disorder (TD).

Furthermore, several other combinations were also observed among the student population with co-morbid conditions, each accounting for approximately 0.44% of the total. These included the sets of Dyslexia (Dys-L), Dysgraphia (Dys-G), Dyscalculia (Dys-C), and Attention Deficit Hyperactivity Disorder (ADHD); Dyslexia (Dys-L), Dysgraphia (Dys-G), Dyscalculia (Dys-C), and Autism Disorder (AD); Dyslexia (Dys-L), Dysgraphia (Dys-G), Anxiety (Anx), and ADHD; Dyslexia (Dys-L), Dyscalculia (Dys-C), Dysphasia (Dys-P), and Anxiety (Anx); Dyslexia (Dys-L), Dyscalculia (Dys-C), Anxiety (Anx), & ADHD and Dyslexia (Dys-L), Dyscalculia (Dys-C), Anxiety (Anx), and Obsessive-Compulsive Disorder (OCD);

Patterns Five Disorders of Co-morbid Conditions with respect to Combinations of **Figure -4** displays the prevalence of co-morbidity among government middle school students with different Combinations of five disorders

Figure -4 No. of Students w.r.t. different Combinations of Five Disorders



The most prevalent co-occurring condition pattern identified in this study featured a combination of Dyslexia (Dys-L), Dysgraphia (Dys-G), Dyscalculia (Dys-C), Anxiety (Anx), and Attention Deficit Hyperactivity Disorder (ADHD), collectively found among approximately 2.23% of students with co-morbid conditions. Following closely, the combination of Dyslexia (Dys-L), Dyscalculia (Dys-C), Anxiety (Anx), Attention Deficit Hyperactivity Disorder (ADHD), and Obsessive-Compulsive Disorder (OCD) were discerned in roughly 1.33% of the student population. Additionally, various other combinations were observed among the cohort of students presenting with co-morbid conditions, with each contributing to the extent of approximately 0.89% of the total sample. These encompassed configurations such as Dyslexia (Dys-L), Dysgraphia (Dys-G), Dyscalculia (Dys-C), Dysphasia (Dys-P), and Autism Disorder (AD), as well as Dyslexia (Dys-L), Dysgraphia (Dys-G), Dyscalculia (Dys-C), Dysphasia (Dys-P), and Anxiety (Anx). Furthermore, Dyslexia (Dys-L), Dysgraphia (Dys-G), Dyscalculia (Dys-C), Dyspraxia (Dys-Pr), and Anxiety (Anx), Dyslexia (Dys-L), Dyscalculia (Dys-C), Dysphasia (Dys-P), Anxiety (Anx), and Attention Deficit Hyperactivity Disorder (ADHD), and Dyslexia (Dys-L), Dysgraphia (Dys-G), Dyscalculia (Dys-C), Obsessive-Compulsive Disorder (OCD), and Tic Disorder (TD) were also observed, each accounting for approximately 0.44% of students presenting co-morbid conditions.

PATTERN MATRIX OF CO-MORBID CONDITIONS

Table-1 illustrates that despite the high prevalence of co-morbidity, different patterns of co-morbid conditions are observed among students. The importance of addressing primary disorders proactively to prevent the emergence of co-morbid conditions, as these can significantly hinder a child's overall development (Larson et al., 2011). The table -01 demonstrates the following:

Disorders ▼	Dys- L	Dys- G	Dys-C	Dys- P	Dys- Pr	Anx	ADHD	OCD	AD	TD
Dys-L n=185	-	125	173	22	2	30	16	6	3	4
Dys-G n=151		-	142	14	1	18	7	1	3	3
Dys-C n=207			-	22	2	34	15	7	3	4
Dys-P n=23				-	1	6	2	1	2	0

Dys-Pr					-	2	1	0	0	0
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Table -1 Pattern Matrix of Co-morbid conditions w.r.t. Primary and Secondary disorders

n=02										
Anx n=42					-	12	9	0	0	
ADHD n=19						-	5	0	1	
OCD n=13							-	0	1	
AD n=03								-	0	
TD n=04										-

- For "Dys-L" as a primary disability, it has a prevalence of 82.58% (185). The secondary prevalent disabilities associated with it are Dys-G (67.56%), Dys-C (93.51%), Dys-P (11.89%), Dys-Pr (1.08%), Anx (16.21%), ADHD (8.64%), OCD (3.24%), AD (1.62%), and TD (2.162%) among middle school students.
- For "Dys-G" as a primary disability, it has a prevalence of 67.41% (151). The secondary prevalent disabilities associated with it are Dys-L (82.78%), Dys-C (94.03%), Dys-P (9.27%), Dys-Pr (0.66%), Anx (11.92%), ADHD (4.63%), OCD (0.662%), AD (1.986%), and TD (1.986%) among middle school students.
- For "Dys-C" as a primary disability, it has a prevalence of 92.410% (207). The secondary prevalent disabilities associated with it are Dys-L (83.57%), Dys-G (68.5%), Dys-P (10.62%), Dys-Pr (0.96%), Anx (16.42%), ADHD (7.24%), OCD b(3.38%), AD (1.44%), and TD (1.93%) among middle school students.
- For "Dys-P" as a primary disability, it has a prevalence of 10.26% (23). The secondary prevalent disabilities associated with it are Dys-L (95.65%), Dys-G (60.86%), Dys-C (10.62%), Dys-Pr (4.34%), Anx (26.0%), ADHD (8.69%), OCD (4.34%), AD (8.69%), and TD (0%) among middle school students.
- For "Dys-Pr" as a primary disability, it has a prevalence of 0.89% (02). The secondary prevalent disabilities associated with it are Dys-L (100%), Dys-G (50%), Dys-C (100%), Dys-P (50%), Anx (100%), ADHD (50%), OCD (0%), AD (0%), and TD (0%) among middle school students.
- For "Anx" as a primary disability, it has a prevalence of 18.75% (42). The secondary prevalent disabilities associated with it are Dys-L (71.42%), Dys-G (42.85%), Dys-C (80.95%), Dys-P (14.28%), Dys-Pr (4.76%), ADHD (28.57%), OCD (21.42%), AD (0%), and TD (0%) among middle school students.
- For "ADHD" as a primary disability, it has a prevalence of 8.48% (19). The secondary prevalent disabilities associated with it are Dys-L (84.21%), Dys-G (36.84%), Dys-C (78.94%), Dys-P (10.5%), Dys-Pr (5.26%), Anx (63.15%), OCD (26.3%), AD (0%), and TD (5.26%) among middle school students.
- For "OCD" as a primary disability, it has a prevalence of 5.80% (13). The secondary prevalent disabilities associated with it are Dys-L (46.15%), Dys-G (7.69%), Dys-C (53.8%), Dys-P (7.69%), Dys-Pr (0%), Anx (69.23%), ADHD (38.4%), AD (0%), and TD (7.69%) among middle school students.
- For "AD" as a primary disability, it has a prevalence of 1.33% (03). The secondary

prevalent disabilities associated with it are Dys-L (100%), Dys-G (100%), Dys-C (100%), Dys-P (66.66%), Dys-Pr (0%), Anx (0%), ADHD (0%), OCD (0%), and TD (0%) among middle school students.

- For "TD" as a primary disability, it has a prevalence of 1.78% (04). The secondary prevalent disabilities associated with it are Dys-L (100%), Dys-G (75%), Dys-C (100%), Dys-P (0%), Dys-Pr (0%), Anx (0%), ADHD (25%), OCD (25%), and AD (0%) among middle school students.

4. CONCLUSION

In conclusion, the data presented in Table 1 and Figure 1, 2 & 3 emphasizes the significant prevalence of co-morbidity among government middle school students. These graphs shed light on the various combinations of co-morbid conditions observed among the students, highlighting the complexity and diversity of these conditions. Figure 2 reveals the most common prevalent pair of co-occurring disabilities to be Dsy-L, Dsy-G, & Dsy-C, impacting 39.28% of students with co-morbid conditions. The subsequent combinations also offer valuable insights into the patterns of co-morbidity among the students. Figure 3 extends the analysis to Combinations of four disorders, with the Dsy-L, Dsy-G, Dsy-C, & Dsy-P combination being the most prevalent, affecting 4.01% of students. Again, these findings underscore the importance of understanding the unique combinations of disabilities that students may face. Figure 4 explores co-morbidity with Combinations of five disorders, with the Dsy-L, Dsy-G, Dsy-G, Anx, & ADHD combination as the most prevalent among 2.23% of students. The prevalence of various other combinations further illustrates the diverse nature of co-occurring disabilities. Table-1 reinforces the high prevalence of co-morbidity and presents a comprehensive overview of the secondary disabilities associated with each primary disability. To foster awareness among students and the concerned individuals, a clear understanding of primary conditions and their associated co-morbidities is crucial (Bougeard et al., 2021).

This understanding is crucial for designing effective intervention strategies and support systems to cater the needs of students with co-morbidity as multidisciplinary tailored approach is needed for these students (Duke et al., 2021). Overall, these findings provide valuable information to educators, policymakers, and healthcare professionals, enabling them to develop inclusive and tailored approaches to address the unique challenges faced by students with co- occurring disabilities effectively (Islam et al., 2021). The children with ADHD showed higher level of co-morbid internalising disorders i.e. anxiety and depression (Baxter & Rattan, 2004). Further, research and analysis in this area will undoubtedly contribute to enhancing the overall well-being and educational experience of these students in the future.

Educational Implication

- Understanding of the co-morbidity patterns among middle school students is vital for designing customized interventions and support systems that cater to their diverse needs. Educators and healthcare experts should work together to develop tailored approaches to meet the unique issues that students with co-occurring conditions confront.
- Use evidence-based ways to acquire a deeper understanding of the challenges that students with co-morbid disorders face. This will allow educators, politicians, and healthcare experts to make more informed judgments about how to provide suitable instructional strategies and support services.
- Recognize common co-morbidity patterns to build a more inclusive learning environment. Schools may establish an environment in which all children can succeed

intellectually and socially by understanding the interconnections of many variables.

- Acknowledge the complexity of co-morbid conditions and the individualized nature of each student's challenges. Focus on promoting each student's holistic well-being, taking into account their unique combination of disabilities.
- Encourage collaboration and information sharing among educators, healthcare professionals, and policymakers to exchange ideas and best practices in managing co-morbidity. Collaboration will improve the efficacy of therapies and support systems.
- Raise awareness of co-morbidity and its impact on learning and well-being among students, teachers, and parents. Training and workshops on detecting and supporting students with co-morbid conditions can improve their educational experience overall.
- Encourage further research and analysis in the field of co-morbidity among middle school students. Continued research will provide a deeper understanding of the challenges they face and contribute to enhancing their overall well-being and educational success.

By implementing above recommendations, educational institutions can create an environment that fosters the growth and development of all students, regardless of their co-morbid conditions. To foster awareness of positive mental health, utilizing sensitization programs and conducting psychological evaluations can be employed as effective strategies (Dike et al., 2021). Understanding and addressing the diverse needs of students with co-occurring disorders will contribute to a more inclusive and supportive educational system. The studies suggested that there is a need for further research in relation to specific co-morbidity combinations as many of them remained unexplored (Srivastava et al., 2010) as various risk factors are associated with co-morbid conditions, and these factors can significantly impact the quality of life for individuals (Reilly et al., 2021). To foster awareness of positive mental health, utilizing sensitization programs and conducting psychological evaluations can be employed as effective strategies.

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STATEMENT AND DECLARATION

The material is original, has not been published elsewhere and has not been submitted for publication elsewhere.

COMPLIANCE WITH ETHICAL STANDARDS

- No funds, grants, or other support was received.
- The authors have no relevant financial or non-financial interests to disclose.
- Ethics Approval: This study is exempted from review by Institutional Ethical Committee, Lovely Professional University, Phagwara, Punjab, India by stating that study poses less than minimal risk to participant.

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