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Editorial

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EDITORIAL

Highlights of this issue

I hope this issue (Vol. 7; Issue 1) will provide a wealth of knowledge on mental health and be an enjoyable read. It will be great to have your active participation through feedback and contributions from researchers, students and clinicians to help us reach greater heights.

The invited editorial by Dr. Vikas Menon throws light on the research interface between psychiatry and medicine. It explores the changing paradigms at this research interface and discusses the implications of these changes for the practice of psychiatry. Genetic and functional neuroimaging studies have evolved to give us better understanding of the psychiatric disorders, which were once predominantly explained using psychological constructs. Technological advances have also heralded a new era in our understanding so much so that today we talk about precision psychiatry. This editorial piques our interest in what the future may hold.

Two original research articles look into the mental health aspects of the Student population- one at the collegiate level and one at the school level. The first research article by Jafri et al on the mental health of medical college students during the peak days of COVID 19. Postgraduate medical students and those studying in foreign universities had higher prevalence of depression than undergraduates and students studying in Indian universities. The various factors have been discussed by the authors.

The second article by Vijaya Raghavan et al looks into the prevalence and factors associated with depression and anxiety in school children in Chennai. The factors associated with the high prevalence of anxiety and depression has been brought out.

A cost of illness study by Dr. Jeyakumar Menon et al looking into the high financial and other burdens incurred in the care of Dementia patients is an interesting read. Apart from the indirect cost involved, the direct financial and social cost of burden is also increasing. As much of our population is moving towards the geriatric' margin, both the elderly spouseand their children have to brace for this impact.

Two interesting case reports are also published. One on acute psychotic presentation in Manganese toxicity and the other one upon Atropine induced delirium evolving in the treatment of a snake bite. Hope this issue informs and interests you, as we earnestly try to bring the issues regularly.

Honorary Editor,
IJMHNS.

EDITORIAL

The research interface between psychiatry and medicine: Evolving paradigms and their implications

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INTRODUCTION

The interface between psychiatry and medicine has long been an area of interest, with the recognition that biological, psychological, and social factors influence mental health disorders. The emergence of the liaison psychiatry subspecialty and the development of integrated, collaborative models to address co-occurring physical and mental health problems are a testament to this enthusiasm. Over the years, our understanding of psychiatric conditions and their underlying aetiology has evolved, leading to a paradigm shift in the approach to diagnosis and treatment. This editorial aims to explore the changing paradigms at the research interface of psychiatry and medicine and discuss the implications of these changes for the practice of psychiatry.

Historically, psychiatric disorders were primarily viewed through a psychological lens, with little consideration given to their biological underpinnings. However, advancements in medical research and technology have allowed for a deeper understanding of the biological aspects of mental health. The discovery of genetic markers associated with psychiatric conditions and the development of neuroimaging techniques have shed light on the intricate interplay between the brain and mental health disorders. This integration of biological and psychological perspectives has fuelled the emergence of a more holistic approach to psychiatry. It recognizes that mental health is not solely a result of environmental or psychological factors but also has a biological basis. This paradigm shift has enabled clinicians to identify better and treat the root causes of psychiatric disorders, paving the way for precision medicine.

Precision medicine is an innovative approach that aims to personalize treatment strategies based on an individual's unique genetic, physiological, and environmental factors.1 By leveraging the knowledge gained from the interface between psychiatry and medicine, precision medicine seeks to move away from a one-size-fits-all approach and provide targeted interventions that yield better outcomes. The advent of precision medicine, which has already made significant strides in other medical specialities, provides a framework for precision psychiatry. Genetic testing, biomarker analysis, and machine learning algorithms can help identify specific subtypes of psychiatric disorders and predict treatment response. This information allows clinicians to choose interventions that are more likely to be effective, reducing trial-and-error approaches and improving patient outcomes.

On a related note, integrating wearable devices, such as activity trackers and physiological sensors, provides real-time data on patients' physical and mental states. This continuous monitoring allows for early identification of symptom exacerbation patterns unique for every individual, referred to as 'relapse signatures', enabling timely interventions to prevent relapse or crisis. Precision

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psychiatry also considers individual variations in drug metabolism, optimizing medication selection and dosing to minimize side effects and maximize efficacy.

To give a specific example of how efforts in other branches of medicine can guide tailored approaches to treatment in psychiatry, consider seizures in neurology, a speciality most closely allied with psychiatry. Seizures have been classified as psychogenic and non-psychogenic based on clinical and physiological features.2 Likewise, based on cognitive and physiological markers, psychosis has been stratified into biologically informed subtypes or 'biotypes'.3 Such stratification has two advantages: first, it allows exploration of specific aetiological factors, and second, it yields treatment targets that can be tested, which the current approach of classifying psychiatric disorders based on clinical course and outcome characteristics does not permit. To cite another example, the National Institute of Neurological Disorders and Stroke (NINDS) has developed the Parkinson's Disease (PD) biomarker project aimed at discovering clinical and laboratory-based biomarkers of PD that can accelerate the development and testing of targeted interventions.4 The field of psychiatry would benefit from investment in similar approaches to accelerate biomarker discovery that may improve care and outcomes.

However, many challenges impede the achievement of precision psychiatry. Major mental illnesses, such as schizophrenia, are multifaceted, with a complex interplay of genetic, developmental, and environmental factors as well as downstream pathophysiological mechanisms. Considerable heterogeneity in clinical phenotypes, absence of 'sine qua non' alterations, and difficulties in accessing appropriate samples have slowed down success rates in biomarker discovery approaches for mental illness. Further, one cause can lead to many outcomes (multifinality), and many causes can yield the same outcome (equifinality). Nowhere are these more evident than in psychiatric genetics: a range of internalizing, externalizing, and psychotic disorders have been associated with 22q11.2 deletion syndromes, while de novo mutations, copy number variants, and gene-environment interactions have all been centrally implicated in the pathogenesis of complex behaviour traits.5 In fact, complex, multifactorial genetic liability in major mental illnesses is now virtually indisputable.

These complementary concepts of equifinality and multifinality are also part of the Research Domain Criteria (RDoC) project of the National Institute of Mental Health (NIMH), which envisages a paradigm shift in the conceptualization of psychiatric disorders from a categorical to a dimensional perspective. More specifically, the 'outcomes' of interest are no longer diagnostic categories as defined by major classificatory systems but cross-cutting cognitive, affective, and social processes referred to as domains and constructs.6 Importantly, this multi-component research framework emphasizes multidisciplinary and interdisciplinary collaboration to develop new avenues for improving our understanding of the aetiology of mental illness and uncover novel treatment targets. The RDoC provides a conceptual platform for combining basic neuroscience, clinical neuroscience, and psychiatry. Research through such an integrative framework can help us better understand the genetic, molecular, neural, physiological, and biochemical basis of complex behaviour traits and manage them better. If sustained, such efforts could eventually contribute to a psychiatric nosology consistent with a precision medicine-based approach for evaluating and managing mental disorders.

Therefore, as research in precision psychiatry continues to evolve, it is crucial to foster interdisciplinary collaboration between psychiatry and other medical specialities. This will facilitate the exchange of knowledge and expertise, leading to the development of innovative approaches to mental healthcare. The integration of artificial intelligence and machine learning algorithms, essentially interdisciplinary, may also play a crucial role in identifying patterns and predictors of treatment response, further refining precision psychiatry approaches.

Lastly, and on a related note, there has been an increasing focus on understanding the complexity of mental illness by breaking them into individual subsystems, each of which interacts with each other to drive mental illness. These include genomics, transcriptomics, proteomics, metabolomics, and clinical data. Each of these represents interdisciplinary research streams that can be combined to discover biomarkers for the diagnosis, treatment, and prognosis of mental disorders. To cite another relevant example from neurology, such approaches have identified multiple pathophysiological causal pathways for Alzheimer's disease (AD) involving neuroinflammation, oxidative stress, and amyloid-Beta accumulation, necessitating a multitarget approach for drug development in AD. Further, combining biologically rich multi-omics data with state-of-the-art machine learning approaches could increase the translation of psychiatric research from bench to bedside.

To sum up, the interface between psychiatry and medicine is undergoing a transformative shift driven by advancements in genetics, neuroscience, and technology. The synergy between disciplines can improve our

understanding of the etiological basis of complex mental illnesses and uncover new treatment targets. An important offshoot of this development will be precision psychiatry, which revolutionizes how psychiatric disorders are diagnosed and treated. The cited examples from neurology in this article show how much other fields have advanced in terms of precision treatments and how much psychiatry can learn from other fields to advance itself in this area. Today, precision treatments are feasible for some rare diseases in neurology (e.g., GRIN2A-related epilepsy), but psychiatrists can claim no such advancements. By embracing this paradigm shift, psychiatrists can strive towards better patient outcomes, reduced treatment burden, and a more comprehensive understanding of mental health.

As a parting note, insights from precision medicine approaches in psychiatry must be positioned in a larger ecosocial view of symptom circuits, socio-cultural, and interpersonal contexts. This integration will enable individualization and partnership of care, combining precision and person-centred approaches to deliver interventions that are likely to have optimum uptake and impact. Both these approaches need to be embraced to improve clinical decision-making and patient outcomes.

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ORIGINAL ARTICLE

Prevalence and sociodemographic correlates of depression and anxiety among secondary school students in Chennai, South India: A cross-sectional study

Hanisha Arulvendan, Chiranjeevi Arumugam, Angelin Lidiya, B Priyadharshni, Sarah Syed, G Sanjana, Savitha Sriram, Jothilakshmi Durairaj, Shiva Prakash Srinivasan, Vijaya Raghavan*

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Abstract:

Background: Anxiety and depression are common mental disorders affecting adolescents worldwide and in India. Various factors are associated with the prevalence of anxiety and depression among adolescents, which vary between geographic, socio-cultural, and economic backgrounds. Hence, the aim of the study was to estimate the prevalence of depression and anxiety and assess the socio-demographic factors associated with them among secondary school students in Chennai, south India.

Materials and methods: A cross-sectional study was conducted among grade 9 students from four schools in Chennai. Written informed consent was obtained from the parents/ guardian and assent from the students before recruitment into the study. The following tools were used to collect data: semi-structured proforma to collect the socio demographic details, perception of stress by Cohen's Perceived Stress Scale, mental wellbeing by The World Health Organisation- Five Well-Being Index (WHO-5) and anxiety and depression assessed using General Anxiety Disorder (GAD-7) and Patient Health Questionnaire (PHQ-9), respectively.

Results: A total of 569 students (323 (56.8%) boys, 246 (43.2%) girls) participated in the study. Prevalence of anxiety and depression among study participants was 46.3% and 39.6%, respectively. On the multivariate analysis, it was observed that students whose father had a blue-collar job and higher perceived stress were significantly more likely to have anxiety and depression.

Conclusion: Prevalence of anxiety and depression is high among adolescents in Chennai. The role of stress in the development of mental health issues indicates the need for positive mental health promotion, stress coping skills, and resilience training interventions in school settings.

Keywords: *depression, anxiety, prevalence, predictors, school students.*

INTRODUCTION

Adolescence is a critical and formative period in which individuals begin their transition from childhood to adulthood. Adolescents are at a higher risk of a range of mental health conditions due to the biological, cognitive, and psychosocial changes which occur during this vulnerable period. At the same time, mental health conditions negatively impact adolescent's development, quality of life, ability to fully participate in their communities and achieve their full potential.[1]

Mental disorders are the second leading cause of disease burden in terms of years lived with disability (YLDs) and the sixth leading cause of disability – adjusted life – years (DALYs) in the world, posing a serious challenge to health systems, particularly in low- income and middle – income countries.[2] Most mental disorders begin during youth (12–24 years of age), although they are often first detected later in life.[3] It is estimated that 10% - 20% of adolescents globally experience mental health conditions.[4] Globally, depression is the fourth leading cause of illness and disability among adolescents aged 15 -19 years and fifteenth for those aged 10 -14 years. Anxiety is the ninth leading cause of illness and disability among adolescents aged 15 – 19 years and sixth for those aged 10 – 14 years.[5]

Anxiety and depressive disorders are the most common mental health disorders among adolescents.[4, 6] The worldwide-pooled prevalence of any anxiety disorder is 6.5% and any depressive disorder is 2.6% in children and adolescents.[7] As per the National Mental Health Survey of India (2015- 2016), the prevalence of psychiatric disorders among adolescents (13 – 17) in India is 7.3%.[8] In an epidemiological study from India, 14.5% of adolescents were found to be suffering from anxiety disorders.[9] A study conducted among 400 adolescent students in a selected school in an urban area of Tirunelveli district, Tamil Nadu, India found the prevalence of depression and anxiety to be 73.6% and 86.5% respectively.[10] Anxiety and depression frequently co-occur and one often increases the risk of the other over time. They interfere with interpersonal relationships, academic achievement, and increase the risk of suicide and other mental disorders.[11]

With respect to the risk factors for anxiety and depression, studies have reported various education-related difficulties, adverse life events, relationship issues with parents or at home, family-related issues, economic difficulties, perceived rejection by peers, parents and teachers, substance abuse, child abuse and other factors.[3, 4, 12, 13] Considering the socio-cultural and demographic diversity of India, the policies, and interventions to manage the burden of mental disorders should be tailor-made to local contexts.

Therefore, a better understanding of the distribution and trends of mental disorders for each state of India is important.[2] Moreover, there is a need to understand the various risk factors associated with depression and anxiety among adolescents in different settings and regions. Hence, the objectives of the study were to estimate the prevalence of depression and anxiety among secondary school students in Chennai and to assess the socio-demographic factors associated with depression and anxiety among secondary school students in Chennai.

MATERIALS AND METHODS

Study site

Cross-sectional study was conducted among the secondary school students in the city of Chennai, Tamil Nadu, during the month of September and October 2019 after the approval from the institutional ethics committee of Schizophrenia Research Foundation. The schools were approached and convinced about the program and its logistics. The five schools which provided consent and approval for conducting the study were included.

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Study participants

All the students of class 9 were approached to take part in the study. As the students were <18 years, parental information sheet and parental consent form was sent to the parents. The opt-out method was used when obtaining the consent from the parents/guardian, where the parents/guardian who did not want their children to participate had to send the forms back stating so. After the consent from the parents/guardian, assent was obtained from the student before inclusion into the study. To maintain the anonymity and confidentiality, unique identification numbers were created for each participant. There was no exclusion criteria for the recruitment of the participants.

Tools used

Socio-demographic profile: Semi-structured proforma was developed to collect the socio demographic details. The socio demographic details are grouped into three broad categories namely basic information, education, and family details.

Perceived stress: The perception of stress was measured using Cohen's Perceived Stress Scale.[14] It is the most widely used scale for the measurement of perception of stress. PSS includes a number of direct questions that measures the level of experienced stress during the last month. The scores ranging from 0 to 4 for each question.

Psychological well-being: The psychological well-being of the students was assessed using the World Health Organisation- Five Well-Being Index (WHO-5).[15] The short self-reported and generic global rating scale measures the subjective mental well-being during the last 14 days. It consists of five positively phrased statements and have the scores ranging from 0 (none of the time) to 5 (All the time).

Anxiety: General Anxiety Disorder (GAD-7) is a self-administered patient questionnaire and was used to screen and measure the severity of generalized anxiety disorder.[16] The seven items in GAD-7 rates the severity of the symptoms over the last two weeks.

Depression: Patient Health Questionnaire (PHQ-9), 9 item scale was used to assess and monitor the severity of depression.[17] Each item is scored 0 to 3 providing a severity score of 0 to 27. The cut points were calculated from the score and each represents the severity, mild, moderate, moderately severe and severe depression.

Before administering the questionnaires to the students, they were explained about the purpose of the study, and assured of anonymity and confidentiality. Research assistants distributed the paper-based questionnaires to all the participants present in class on the day of administration and responses obtained. Questionnaire was administered both in English and Tamil based on the preference of the study participants. The time taken for the introduction and administration of questionnaire was around 1 hour 20 minutes.

Data analysis

The collected data were entered in Microsoft Excel and Statistical Package for Social Sciences (SPSS) Version 17.0 was used for the analysis of the collected data. The categorical variables were expressed in frequency and percentages and the continuous variables in mean. Chi-square test were used to find out the association between the Socio-demographic variables and Anxiety, Depression. It was considered that p-value < 0.05 statistically significant. Multivariate logistic regression was used to examine the association between different variables and anxiety & depression.

RESULTS

Socio-demographic profile of the study participants

A total of 569 students were included in the study. The mean age of the participants was 13.6 ± .6. Of the 569 participants, 323 (56.8%) of them were male. 561 (98.8%) of them did not discontinue school ever. Only few students (10, 1.8%) had already received a course on mental health via other available resources, while most of them did not receive any kind of structured information on mental health. The summary of the socio-demographic profile of the study participants is depicted in **Table 1**.

Variable	Category	Mean (SD), N (%)
Age		13.6 ± .6
Attendance in last 30 days		28.7 ± 2.4
Father's highest qualification		13.1 ± 3.1
Mother's highest qualification in years		12.8 ±3.2
Gender	Male	323 (56.8)
	Female	246 (43.2)

Variable	Category	Mean (SD), N (%)
Language (n=566)	Tamil	463 (81.8)
	English	8 (1.4)
	Hindi	14 (2.5)
	Telugu	20 (3.5)
	Others	61 (10.8)
Total no of years in education (n=567)	9	561 (98.6)
	10	1 (.2)
	11	5 (.9)
Discontinuation of school (n=568)	Yes	7 (1.2)
	No	561 (98.8)
Course on Mental health (n=563)	Received	10 (1.8)
	Not received	553 (98.2)
Parents living status (n=553)	Together	519 (93.9)
	Not together	34 (6.1)
Father's occupation (n=539)	White collar jobs	511 (94.8)
	Blue collar jobs	28 (5.19)
Mother's occupation (n=556)	White collar jobs	120 (21.58)
	Blue collar jobs	436 (78.5)
Household work of Parents (n=563)	Throughout the year	533 (94.67)
	Seasonally/once in a while	30 (5.33)
Monthly household income (n=564)	>126360	46 (8.2)
	63182-126360	90 (16)
	47266-63178	85 (15.1)
	31591-47262	100 (17.7)
	18953-31589	107 (19)
	6327-18949	111 (19.7)
	Less than or equal to 6323	25 (4.4)
Family history of mental disorders (n=568)	Yes	134 (23.6)
	No	434 (76.4)

Table 1. Socio demographic profile of the study participants (N = 569)

Prevalence of anxiety and depression among the study participants

Table 2 provides the prevalence of anxiety and depression among the study participants. The prevalence of anxiety was 46.3% (95%CI: 42.2-50.6 CI) and depression was 39.6% (95%CI: 35.6-43.8 CI).

Variable	N (%)	95% CI
Anxiety	259 (46.3)	42.1-50.6
Depression	224 (39.6)	35.6-43.8

Table 2. Prevalence of anxiety and depression among the study participants (N = 569)

Results from the univariate (**Supplementary Table 1a, 1b**) and multivariate logistic regression analysis (**Table 3**) showed blue collar occupation of the father, monthly household income and high perceived stress levels were statistically associated the prevalence of anxiety among the study participants. Whereas, gender, previous discontinuation of schools, parents living status, and school attendance in last 30 days were not significantly associated with the prevalence of anxiety. DISCUSSION

Variable	OR (95 % CI)	p-value
Gender		
Male	1	0.884
Female	1.04 (.61-1.77)	
Occupation of father (White collar job)	1	0.001
Occupation of father (Blue collar job)	7.76 (2.3-26.16)	
Household income		
More than 1,26,356	1	
63,182 – 1, 26,356	.34 (.12-.95)	0.040
47,266 – 63,178	1.06 (.38-2.91)	0.913
31,591 – 47,262	.81 (.31-2.11)	0.663
18,953 – 31,589	.52 (.19-1.43)	0.204
6,327 - 18,949	.56 (.21-1.47)	0.237
Less than or Equal to 6,323	1.42 (.36-5.7)	0.614
Mother's highest qualification	.96 (0.88-1.04)	0.275
Perceived stress	1.20 (1.14-1.27)	0.000
Well-being	.97 (.92-1.02)	0.262

Table 3. Multiple logistic regression analysis for factors associated with anxiety among the study participants

Factors associated with depression among the study participants

After univariate analysis (S**upplementary Table 2a, 2b**), multivariate logistic regression analysis was done to identify the factors associated with the prevalence of depression (**Table 4**). Results indicate that higher prevalence of depression was associated with students' fathers who has blue collar job and students who expressed high perceived stress. No gender differences were observed in the prevalence of depression among the study participants.

Variable	OR (95% CI)	p-value
Male	1	0.939
Female	.98 (.61-1.58)	
Occupation of Father (White collar job)	1	0.031
Occupation of Father (Blue collar job)	2.96 (1.11-7.93)	
Household income		
More than 1,26, 356	1	
63,182 – 1, 26,356	.70 (.28-1.76)	0.450
47,266 – 63,178	.72 (.28-1.86)	0.499
31,591 – 47,262	.72 (.29-1.76)	0.467
18,953 – 31,589	.49 (.20-1.22)	0.128
6,327 - 18,949	.46 (.19- 1.12)	0.086

Variable	OR (95% CI)	p-value
Less than or Equal to 6,323	3.73 (.95-14.74)	0.060
Perceived stress	1.19 (1.13-1.124)	0.000
Well-being	.96 (.92 – 1.01)	0.107

Table 4. Multiple logistic regression analysis for factors associated with depression among the study participants

The study aimed to estimate the prevalence of depression and anxiety and assess the socio-demographic factors associated with them among secondary school students in Chennai.

Our study found that the prevalence of anxiety was 46.3% and depression was 39.6% among secondary school students. As per the national mental health survey 2016, the prevalence of metal health problems in adolescents between the ages 13 – 17 was 7.3% and the rates were nearly double (13.5%) in urban metros.8 In comparison, a meta-analysis by Malhotra and Patra summarized that the prevalence of mental health problems in school settings was 23.3%.[18]

Previous studies from India have shown a wide variation in the prevalence of anxiety among the secondary school students, ranging from 17% to 85%.[19, 20, 21, 22] Previous studies carried out in India have reported an even greater prevalence of depression among school going adolescents.[23, 24, 25] Especially, study by Daya & Karthikeyan in 2018 reported that 73.6% of school going adolescents of Tirunelveli district, Tamilnadu have depression which is very higher than our findings.10 Jayanthi et al., in 2014 found school going adolescents in Tamil Nadu had 45.7% moderate, 25.4% mild, 19.6% severe and 9.3% minimal depression.26 The differences in the tools and their cut off scores used, the site of study, socio-economic status of the population and age group of study participants included could explain the variability in the results.

Many studies have identified the role of parent's SES (Socio Economic Status) in children's growth, development, and health outcomes.[27] SES is not only determined by the income but also by the occupational status and the level of education. Our study shows association between household income and anxiety and depression in the univariate analysis, however in the multivariate analysis only father's occupation which is also a part of SES has been found to have significant association with anxiety and depression among secondary school students. It was noted that students of fathers who are blue collar workers are more prone to anxiety and depression than students of fathers who are white collar workers. This possibly suggests that the parental occupation is a higher order factor that might be associated with the mental health of the students. Parent's occupation plays an important role in psychological wellbeing of the children. Specific working conditions influence certain psychological qualities, parent child relationships and other behaviours such as alcohol consumption and domestic violence.

A study conducted by Whitbeck, Les B., et al. in 1997 showed that the father's working conditions affect the fathers parenting behaviours.[28] Previous studies have observed the association between parenting styles adopted and depression and anxiety in children.[29, 30]

Our study shows significant association between the outcomes of anxiety and depression and stress. Many previous school-based cross-sectional studies among adolescents have also showed strong association between academic stress and anxiety and academic stress and depression.[31, 32]. Gender was not associated with the presentation of anxiety and depression among the students. This is unlike most of the other studies which have found a significant association between these internalizing disorders and female gender.[33, 34] There are few previous studies that showed no association between and gender and depression similar to our study.[13, 24] This may be related to the higher overall prevalence of anxiety and depression reported by the students which would suggest common adverse environmental circumstances that might be associated with both genders.

The present study has few limitations that include that this is a cross-sectional, school-based study that utilized self-administered screening questionnaires. Due to this, we would not be able to access the students who had dropped out of schools. The use of self-reported questionnaires may be associated with under or over reporting of symptoms. However, all students were given information about the availability and method to access mental health services. Students found it hard to answer specific socio demographic variables like monthly household income and educational qualification of parents, leading to errors.

In conclusion, results of this study indicate a high prevalence of internalizing symptoms of depression and anxiety among adolescents and shows a strong indication towards the link of mental health problems and social determinants of health. The role of stress in the development of mental health issues indicates the need for future mental health promoting interventions to focus on building stress coping skills in school settings. The role of paternal occupation and its effects on the child's mental health warrants further investigation. On a systemic level, addressing the modifiable risk factors and strengthening the protective factors would be essential to ensure the health and wellbeing of the students. More studies must be conducted in under privileged

communities, schools, rural areas, and in community settings to get good representation of the sample.

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CONFLICT OF INTEREST

Nil.

Competing interests

Authors have declared that no competing interests exist.

Authors' contributions

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

Consent

As per international standard or university standard, patients' written consent has been collected and preserved by the author(s).

Ethical approval

As per international standard written ethical approval has been collected and preserved by the author(s)

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ORIGINAL ARTICLE

Impact of COVID-19 outbreak on mental health of undergraduate and postgraduate medical students

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Abstract:

Background: The COVID-19 pandemic, the largest crisis of modern era has subjected medical students and healthcare workers to immense amount of stress due to myriad problems like exposure risk, health concerns and subsequent economic repercussions.

Aim: The aim of this study was to estimate the prevalence of depressive symptoms among medical students studying in the sub-continent and in foreign medical universities during the height of the COVID-19 pandemic.

Setting and design: This was a cross sectional study.

Materials and methods: A web-based survey was conducted using a specially constructed questionnaire pertaining to COVID-19 pandemic. Depressive symptoms were assessed using DASS-21 questionnaire and sleep quality with Pittsburgh Sleep quality index (PSQI), respectively.

Statistical analysis: Chi-square tests was used for proportions. Pearson's correlation analysis was done to evaluate the correlation between study DASS-21 subscales and PSQI. Multiple logistic regression was done to assess the association between study variables and the likelihood of having depressive symptoms.

Results: Postgraduate medical students and those studying in foreign universities had a significantly higher prevalence of depression than undergraduates and students studying in Indian universities, respectively. These two sub-groups also had poorer sleep quality ($P<0.001$). A statistically significant correlation ($P<0.001$) was observed between depressive symptoms and sleep quality. On multiple logistic regression, post-graduate medical students (OR=3.4), lockdown duration (OR=4.3), poorer PSQI(OR=1.2) and female gender (OR=4.1) had significantly higher odds to exhibit depression.

Conclusion: Post-graduate medical students and those studying in foreign medical universities had significantly higher prevalence of depression during the COVID-19 lockdown.

Keywords: *COVID-19, lockdown, depression, post-graduates.*

INTRODUCTION

The ongoing COVID-19 pandemic has not only posed new challenges among medical students studying in India but also among those studying in foreign countries. It is needless to say that expansion of higher education systems worldwide and the globalization of economies over the last few decades have led to a tangential rise in the number of students enrolled in educational institutions outside their native countries.

Undergraduate (UG) and postgraduate (PG) medical students face not only life events and stressors as other students, but also additional pressures, as they the frontline warriors involved in patient care and treatment. Some studies done on medical students during the pandemic have shown that they experience high levels of anxiety as they are more likely to encounter COVID-19 infected individuals and often lack sufficient information. The lack of adequate knowledge among medical students can lead to apprehension and significant increase in stress and anxiety levels.[1-3]

In India, the government declared had nationwide lockdown from 25th March 2020 in an effort to contain the spread of COVID-19 infection. However, most economists are of the opinion that lockdown for prolonged periods significantly impacts the nation's economy leading to loss of jobs and reduces the prospects of getting a new job. Undoubtedly, previous public health emergencies during SARS, MERS and Ebola outbreaks were associated with increased psychological distress in the affected population. [4] A study by Matthews et al reported that social distancing and isolation was strongly associated with anxiety, depression, self-harm, and suicidal tendencies. [5]

Students studying in foreign universities are inclined to experience countless challenges as they are devoid of the support of family and friends and home atmosphere. Moreover, financial concerns, uncertain immigration status, language barriers and perceived discrimination significantly add to the overall burden in daily life. A study by Lee at al found that internationalstudents have to face myriad challenges like the need to learn the norms and the languages of host countries, meet the rigours of academics, live alone, and manage finances, homesickness and often face racial prejudice and discrimination. [6]

Those students, who are less capable of adjusting to adverse circumstances, change and loss before leaving their home countries will tend to experience greater difficulty in adopting to life and study abroad.

The aim of the present study was to find out the prevalence of depressive symptoms among Indian under-graduate and post-graduate medical students studying in the sub-continent as well as foreign medical universities during the height of the second wave COVID-19 outbreak.

METHODS

Study setting and design

This was a cross sectional study among undergraduate and post-graduate students studying in regional medical colleges in the sub-continent and among those Indians students studying in foreign medical universities. The study was undertaken between April and July 2021 at the peak of the second wave of COVID-19 pandemic in India. The undergraduate medical course in India is Bachelor of Medicine and Bachelor of Surgery (M.B.B.S), which is of 4.5 years duration followed by compulsory rotatory internship of one-year duration. The post-graduated medical course is of 3-years duration. The duration of MBBS course for Indian students in Russia, Ukraine, Kyrgyzstan and China is about 6 years including one-year internship.

Selection of Study Participants

A letter was sent to the Dean of regional medical colleges and foreign medical universities to explain the study purpose and to request participation in the study. Three regional medical colleges and four foreign medical universities (two in Russia and one each in Ukraine, Kyrgyzstan and China) responded and agreed

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to participate in the study; after reviewing the protocol and potential risks and benefits, permission was granted to conduct the study among medical students who were willing.

Survey

In order to minimize the face-to-face interaction and to comply with social distancing norms, we developed a self-administered online questionnaire. This was a 12-point questionnaire assessing the impact of lockdown during the COVID-19 outbreak. The response of questions 9-15 were measured on a Likert scale of 1to 5 with one being the least and 5 being the maximum. A pilot assessment was first done on 10 responders. After assessment of the responses, changes were made in the questionnaire for simplification.

The survey was conducted via Google form whose link was sent through personal email IDs of the students which were collected from their respective institutional heads. A maximum of three e-mail reminders were sent. A written informed consent was obtained from all participants as per the tenets of the declaration of Helsinki.

Sociodemographic details such as age, gender, year of study, place of residence and gross monthly income of the family were collected. The mental health status was assessed using Depression Anxiety Stress Scale 21 items (DASS21). All records were kept anonymous and did not involve divulging any personal information

Estimation of mental health status

Mental health status of study participants was assessed using DASS-21. The Depression, Anxiety and Stress Scale - 21 Items (DASS-21) is a set of three self-report scales designed to measure the emotional states of depression, anxiety and stress. Each of the three DASS-21 scales contains 7 items, divided into subscales with similar content. The total sub scores range from 0 to 42 and is categorized into normal, mild, moderate, severe, and extremely severe. In this study, DASS21 sub scores were categorized dichotomously, with the participants being divided in to those who showed symptoms of depression, anxiety and stress and those who did not, based on the cut-off sub-scores of 9, 7 and 14 respectively. [7]

Estimation of sleep quality

Subjective sleep quality was assessed using PSQI which includes 21 items that assess seven components viz. subjective sleep quality, sleep duration, sleep latency, habitual sleep efficiency, use of sleep medications, sleep disturbance, and daytime dysfunction over the duration of 2 weeks prior to assessment. Global PSQI scores are obtained by summing up the seven individual sub scores and it ranges from 1 to 21 with higher scores (>5) denoting poor sleep quality.

SAMPLE SIZE CALCULATION

Our aim was to estimate the prevalence of unknown parameter(s) from the target population using a random sample. Sample size was calculated using formula,

$$N = \frac{Z^2 P (1-P)}{d^2}$$

In this formula, N is the sample size, Z is the statistic corresponding to level of confidence (standard normal variate), P is expected prevalence (that will be obtained from previous studies published or a pilot study conducted by the researchers in our region), and d is precision (corresponding to effect size).

According to a study conducted in India, the prevalence of depression among medical students is 7.6%. [8] Considering precision of 0.5, the level of confidence aimed for was 95%, the normal standard variate Z=1.96, the estimated sample size was calculated to be 385.

STATISTICS

All the collected data was transferred from google forms to an Excel spreadsheet and was quality-checked by a researcher to ensure accuracy and completeness. Statistical analysis was performed using IBM, SPSS Statistics version 26 (IBM Inc.). Descriptive data was summarized as frequencies and percentages for categorical variables, and mean ± standard deviation (SD) for continuous variables. P-value less than 0.05 was considered statistically significant. Chi-square tests/ Fischer exact test (whichever applicable) were used for proportions. Pearson's correlation analysis was done to evaluate the correlation between study variables (DASS-21 subscales and PSQI). Univariate analysis was done to determine whether there are any statistically significant association between demographic variables and outcome measures. After adjusting for potential confounders like age, gender and family income, multiple logistic regression was done to assess the association of independent variables on the dependent variables (DASS score, PSQI scores). For sub-group analysis, logistic regression model was constructed was to ascertain the effect independent variables on the likelihood of medical students having depression.

The mean overall PSQI score of the study sample was 4.1±3.2. The prevalence of disturbed sleep quality (PSQI>5) was 20%. The sleep quality did not significantly (P=0.070) differ between males and females (3.9±2.2 versus 4.5±4.2). Sleep quality was significantly

RESULTS

A total of 400 medical students completed the questionnaire. Out of these, 248(62%) were medical students studying in India and 152(38%) were studying in foreign medical universities. One hundred and ninety-two (48%) were pursuing postgraduate course and 208(52%) were pursuing undergraduate course. The mean age was 28.4±4.3(range, 19-36 years).

The mean age of males(n=232) was 28.7±4.3 and females(n=168) was 29±4.1 years, respectively (independent t-test, P=0.310).

The mean duration of lockdown for COVID-19 containment at time of survey was 6.4±0.8 months.

The details of information obtained from the general questionnaire are mentioned in Table 1.

Information (n, %)	YES	NO
Do you receive financial support from home?	360(90)	40(10)
Were you positive for COVID-19?	56(14)	344(86)
Was your family member positive for COVID-19?	48(12)	352(88)
Is COVID-19 a biological weapon?	152(38)	248(62)
Do you have interaction with COVID patients?	200(50)	200(50)
Will lockdown have impact on your job prospects?	224(56)	176(44)
Do you think online classes will affect clinical skills?	320(80)	80(20)
Are you concerned about well-being of your family?	120(30)	280(70)
Are you worried about surviving?	88(22)	312(78)

Table 1. General information questionnaire

The prevalence of depression in postgraduate medical students was 38.4% as compared to 9.6% in undergraduates (Chi-square test, P=0.001). The mean DASS-21 depression score in postgraduates was 8.5±5.3 as compared to 5.9±3.9 in undergraduates (independent t-test, P=0.001).

The mean DASS-21 depression score in males (7.4±4.6) did not significantly differ from females (6.7±46) medical students (independent t-test, P=0.162).

The relationship between study variables and depression, anxiety and stress scores are mentioned in table 2.

Group		Depression	P value	Anxiety	P value	Stress	P value
Gender							
Male	Mean±SD	7.4±4.6					
	0.162	9.2±4	0.002	8.3±3.7	0.001		
Female	Mean±SD						
	6.7±4.6						
		7.9±4.1		14.8±4.7			
Course							
PG	Mean±SD	8.5±5.3					
	0.001	8.42±4.5	0.219	13.6±5.3	0.001		
UG	Mean±SD						
	5.9±3.5						
		8.92±3.6		8.6±3.9			
Place of study							
India	Mean±SD	6.5±3.9	0.001	7.6±4.2	0.001	10.9±5.5	0.547
Abroad	Mean±SD	8.1±5.5		10.3±3.2		11.3±4.7	
Family income							
<50000 INR	Mean±SD	8.58±5.3	0.002	10.9±3.8	0.001	17.1±1.5	0.001
50000-100000 INR	Mean±SD	7.4±5.2		9.6±4.5		17.3±1.7	
>100000 INR	Mean±SD	6.8±4.3		8±3.9		8.9±4.3	

**Abbreviations: SD (standard deviation), PG (Postgraduate), UG (Undergraduate), INR (Indian national rupee).*

Table 2. Depression, anxiety and stress scores relationship with study variables

(P=0.001) disturbed in postgraduates (5.4±4.1) as compared to undergraduates (2.9±1.1). Medical students studying in foreign medical universities had a significantly (P=0.001) worse sleep quality as compared to medical students in India (4.7±3.2 versus 3.8±3.2).

There was a significant correlation (P<0.001) between PSQI, depression score (Pearson's correlation coefficient, r=0.264), anxiety score (r=0.251) and stress score (r=0.378), respectively.

The logistic regression model was statistically significant, $\chi^2(8) = 131.220$, $p < .001$. The model explained 41.9% (Nagelkerke R^2) of the variance in depression and correctly classified 81.5% of cases. Sensitivity was 49%, specificity was 91.8 %, positive predictive value was 65.2% and negative predictive value was 85%. Out of the 8 predictor variables (6 were statistically significant (lockdown duration, anxiety score, PSQI score, stress score and type of course). Lockdown duration (OR=4.3), type of course (OR=3.4), gender (OR=4.1), and PSQI score>5 (OR=1.2) had higher odds to exhibit depression.

Variable	B	Wald	P value	OR	95% CI of OR	
					Upper	Lower
Age	-.10	3.6	.057	.90	.81	1.0
Lockdown duration	1.4	15.0	.000	4.3	2	9.2
Anxiety	-.14	5.7	.017	.86	.76	.97
Stress	-.13	3.7	.053	.87	.75	1
PSQI	.111	4.1	.041	1.1	1.0	1.2
Gender	1.42	10.6	.001	4.1	1.7	9.7
Place of Study	.053	.019	.891	1.0	.50	2.2
Type of course	1.23	5.6	.018	3.4	1.2	9.5
Constant	-7.2	4.7	.029	.001		

† Variable(s) entered on step 1: Age, Lockdown duration, Anxiety Score, Stress Score, PSQI Score, Gender, Place of Study, Course (UG/PG).

TABLE 3. Odds Ratio in Logistic Regression Model

DISCUSSION

The present cross-sectional study evaluated the prevalence of depressive symptoms in undergraduate and post-graduate medical students studying within the country and in foreign universities at time of lockdown during the COVID-19 pandemic. Our study points to a high prevalence of mental health morbidity in the form of stress, anxiety and depression, among post-graduate students and those studying in foreign universities during COVID-19 lockdown. These two sub-groups also had significantly (P<0.001) poorer sleep quality. There was a signification correlation between depressive symptoms and poorer sleep quality (P<0.001). On binary logistic regression, post-graduate students (OR=3.4), lockdown duration (OR=4.3), PSQI>5(OR=1.2) and female gender (OR=4.1) exhibited higher odds to exhibit depression.

Lakhan et reviewed 16 studies estimating mental health during first 7 months of the COVID-19 pandemic. The study population comprised 113,285 participants from different countries. The authors reported that the prevalence of depression, anxiety and stress was 20%, 35% and 53% respectively.[9] The prevalence of depression among medical students in our study was 24%; this was marginally higher than the prevalence of depression in general population during the height of pandemic. Increased workload and higher risk of infection among medical students could lead to higher levels of stress, anxiety and depressive symptoms.

In a prospective longitudinal study, Saraswathi et al evaluated the impact of COVID-19 outbreak on mental health status of UG medical students. The authors reported a significant increase in the prevalence of anxiety and stress during COVID-19, irrespective of gender and place of study. On an adjusted logistic regression model, a PSQI score greater than 5, general COVID-19 but not academic apprehensions, direct interaction with affected patients had higher odds to exhibit poor mental health. [10] It is prudent to mention that stressors and stress levels

may differ between UG and PG students due to different types of challenges faced during the course of study and during the pandemic. Moreover, PG students have bigger/immediate concerns about career and future success; the pandemic has drastically impacted world economy with declining job opportunities. This could probably explain the higher prevalence of stress and depressive symptoms in PG students in our study.

An online cross-sectional survey (n=1014) in Pakistan reported that lack of COVID-19 awareness and female gender had increased likelihood having both anxiety and depressive symptoms. Psychological intervention is needed for undergraduate medical students to reduce psychological impact of pandemic. [11]

Maqbali et al conducted a meta-analysis of 93 published studies using a random effect model evaluating the prevalence of stress, anxiety and depression among nurses during COVID-19 pandemic. The authors reported that approximately one third of working nurses during the COVID-19 pandemic had psychological problems. The pooled prevalence of stress, anxiety and depression was 43%, 37% and 35%, respectively. [12] The prevalence of psychological problems during COVID-19 pandemic were significantly higher in medical students, nurses and other health care workers compare to general population. However, a longitudinal study is needed to substantiate psychological symptoms during and after infectious disease outbreaks.

Another meta-analysis by Salari et al evaluated 29 studies and sampled 22380 participants using random effects model and I2 index. The authors reported that prevalence of depression, anxiety and stress was 24.3%, 25.8% and 45%, respectively among front-line health care workers. [13]

Islam et al conducted a web-based survey to investigate depression and anxiety among Bangladeshi university students during the COVID-19 pandemic. Among 476 students, 15% of the students had moderately severe depression, whereas 18.1% were suffering from anxiety. Students pursuing PG course (OR=2.9) and those taking private tuitions during pre-pandemic period (OR=1.2) were identified as determinants of depression on binary logistic regression. [14] In our study, the observation that PG students had higher odds (OR=3.4) to exhibit depressive symptoms resembled this study, although the reported prevalence of depression was significantly higher (24% versus 15%).

International students including medical students studying in universities other than their native countries come across similar problems like homesickness [15], unfamiliar food [16], type and quality of housing [17], and financial problems [18]. These issues were stretched to their maximum during COVID-19 lockdown. This could probably account for higher prevalence of mental health problems during global lockdown.

The limitations of our study were that study population included students of only a few international universities and data obtained could not be considered representative of international students of all the countries. Psychological symptoms were self-reported through a web-based google questionnaire and not through a clinical interview; self-reported measures should be supplemented with clinical interviews for better reliability. The web-based questionnaire was more focused on COVID-19 pandemic so other factors affecting depression like presence of depressive symptoms at baseline, past history of depression or family history of depression could not be taken into consideration. Therefore, it is difficult to elucidate which factors, if any, contributed to the self-reported depressive symptoms. Lastly, as this was an online survey, we were unable to verify the identity of the respondents and this might have contributed to some bias in the study. We also did not have data regarding the prevalence of COVID-19 in the hospitals in which these respondents were studying.

The strength of our study was the independent variables were evaluated in a multiple logistic regression model for the likelihood of having depressive symptoms. Medline search did not reveal any study evaluating mental health of medical students studying in foreign students.

In conclusion, post-graduate students and those studying in foreign medical universities had significantly higher prevalence of depression during the COVID-19 lockdown. Medical students pursuing PG and those studying in foreign universities had a significantly higher prevalence of depression. Course type (PG versus UG), gender (male versus female) and duration of lockdown were the main determinants for the likelihood of having depressive symptoms on logistic regression model. The results of the current survey are concerning and there is a need for early intervention to tackle the immediate and longer-term consequences on the mental health of PG students and those studying in foreign universities.

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Authors' contributions

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

Consent

As per international standard or university standard, patients' written consent has been collected and preserved by the author(s).

Ethical approval

As per international standard written ethical approval has been collected and preserved by the author(s)

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ORIGINAL ARTICLE

Economic burden in patients with dementia attending a geriatric care clinic in chennai - a cost of illness study

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Abstract:

Background: Dementia is one of the major causes of dependency and disability among the elderly. With an increase in life expectancy, the burden of dementia is also on the rise especially in countries like India. There are economic concerns to the family as health expenses are majorly borne by them. There are few cost of illness studies for dementia from low- and middle-income countries. Our study aims to estimate the burden of costs of dementia in patients attending a geriatric clinic in a private hospital setting.

Methods: This retrospective observational study assessed the economic burden of dementia by estimating both direct and indirect costs of illness from the caregiver's perspective.

Results: Direct costs from medical services and social costs are higher when compared to indirect costs. Not all people have incurred social costs as many are provided care by the families and their inputs are not paid or accounted. The costs of informal care were under evaluated in the study.

Conclusion: The direct health care cost of illness of Dementia from caregiver perspective is more than one seventh of the per-capita income of Indian population provided indirect costs and direct social costs are not included. Evaluating various costs incurred in various health care settings is important to understand the economic burden of Dementia. There is a need for well-designed prospective studies to inform policy decisions towards better service development for persons with dementia.

Keywords: *Direct medical costs, Social costs, Indirect costs, LMIC nation*

INTRODUCTION

Dementia is a chronic progressive neurodegenerative disease that affects one or more cognitive processes of memory, thinking, comprehension, learning ability, calculation, language, and judgement and leads to functional impairment.[1] Dementia is the leading cause of dependency and disability among the elderly and poses significant health and economic burden to society.[2] Dementia is not only devastating to individuals who have it, but also to families and society. The huge cost of disease poses challenges to health systems in terms

of currently available resources and future ability to handle the predicted increase in disease burden.[3] There is a growing body of evidence on the costs of dementia globally suggesting that dementia is already imposing a huge economic burden.[4] However, most of the epidemiological cost of illness studies for dementia are conducted in high-income countries with better healthcare resources and the data remains sparse in low and middle-income countries(LMIC), where costs tend to be higher than global average and affordability is lesser.[5]

There is a need to estimate costs of dementia in various settings as it is crucial to understand its impact on families, governments, and their health and social care systems, which is fundamental for raising awareness, achieving proper prioritisation, and focusing efforts toward improving the lives of people with dementia and of their caregivers.[6,7] This cost-of-illness study aimed to analyze the total, direct, and indirect costs of dementia in a population of patients suffering from the illness, attending a tertiary specialty clinic in the private setting in Chennai, India.

METHODS

Study setting

This study was conducted in a Geriatric Care Clinic (GCC) in Chennai. The clinic is run by a multi-disciplinary team of Neuropsychiatrists, Psychologists and Psychiatric social workers. The study was approved by the Institutional Ethics Committee.

Study design

A retrospective cohort design was used to collect data of outpatients with dementia who had attended the GCC from January 2019 to December 2019. GCC maintains records of patients evaluated with documentation of socio-demographic information, clinical details, and investigations necessary for evaluation of the disease along with information on the functional ability of the patient and caregiver support available.

Procedure

The medical records in the GCC were screened for diagnosis of Dementia. The information on the utilization of health care and non-healthcare resources was extracted from the records. Some information about non-health resources was also obtained from the patient's caregiver through telephonic interviews after taking informed verbal consent.

Cost estimation

Costs of illness considered for this study were the standardized unit costs of services used to diagnose and manage dementia in the last year. The total costs include direct and indirect costs. Direct costs refer to money used for medical care (doctor consultation, investigations, medications) and social costs (nursing care, meals, rehabilitation care). Indirect costs refer to productivity loss secondary to illness (early retirement, decreased work productivity, excess leaves, etc) and unpaid inputs from caregivers (loss of wage days, lost leisure time, and caregiver burden).

Data collection

Data were collected through a structured proforma from the extracted medical records data. Demographic details (age, gender, and education), medical care costs, social costs, and indirect costs related to loss of wage days were collected in a semi-structured format, using the data available. Overall costs were calculated by adding direct and indirect costs incurred for the individual with dementia in the previous year from the caregiver perspective.

Data analysis

Descriptive statistics like frequency distribution for qualitative variables, central tendency (mean), and statistical variability (standard deviation) for quantitative variables were performed.

RESULTS

The analysis of the cost of illness in patients who had visited GCC in the previous year with the diagnosis of dementia was done from the caregiver perspective.

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Table 1 shows the socio-demographic and clinical characteristics of patients with Dementia. Of the 30 patients, 22 were males,19 had primary school level or less education. Majority of them lived with their families and were retired from formal employment.

SD variable	Mean (SD)	Range	N (%)
Age of the patient	71.06(9.7)	52-87 years	
Age at diagnosis of Dementia	67.5(8.3)	54-82 years	
Gender of the patient		Male Female	22(71%) 9(29%)
Education of the patient		Primary school or less Higher secondary school or more	19(61.3%) 12(38.7%)
Occupation of patient		Retired from work Informal work	22(71%) 9(29%)
Source of income		Absent Present	24(77.4%) 7(22.6%)
Living with spouse		Yes No	25(80.6%) 6(19.6%)
No. of children		less than or equal to one Two or more	16(51.6%) 15(48.4%)
Living arrangement		With family In rehabilitation home	28(90.3%) 3(9.7%)

Table 1: Sociodemographic and clinical characteristics of patients with Dementia

Table 2 shows resource consumption for patients with Dementia attending GCC in the last one year. Among indirect costs, productivity loss secondary to illness (early retirement, decreased work productivity etc) and unpaid inputs from caregivers (lost leisure time and caregiver burden) couldn't be computed due to non-availability of the data. Only loss of wage days for the caregiver was assessed in this study.

Cost of resources in a year consumed in Indian rupees		Mean(S.D)
Direct health care costs	Antidementia drugs	6939.13(6224.42)
	Medical tests-Haematological	2374.42(420.28)
	Medical tests-Imaging	7903.23(20880.94)
	Physician consultation	7290.32(502.89)
	Total direct medical costs	22720(7081)
Direct social costs	Meal	44593.55(7759)
	Transport	17224(21410)
	Nursing care	210000(42426)
	Rehabilitation	220000(34641)
	Total direct social costs	96101(96771)
Indirect costs	Wage loss for caregiver	12480(7078)

Table 2: Resource consumption for patients with Dementia attending GCC in one year

DISCUSSION

The study is one of the very few that is done in India, which has looked at the health care costs of dementia. Low- and middle-income countries (LMIC) have a different care pathway for people with dementia compared to advanced economies, and the support services are non-existent in most cases.8,9 The current study covered a population that visited a tertiary care treatment centre in the private sector. The direct health care total cost incurred in lieu of physician consultation, investigations, medication was around rupees 22720/-, which comes to one-seventh of the annual per capita income of an individual in India.10 The direct costs emerged to be most expensive category in this study, similar to the findings from another study done in a LMIC nation, Thailand.11 Notably, in our study, direct social costs exceeded direct medical costs for dementia patients, suggesting that the financial burden of non-medical care and support services could impede patients access to continued rehabilitation, nursing, and day care services. These findings highlight the need for targeted interventions and policy measures aimed at alleviating the economic burden on families and facilitating improved access to essential care services for individuals with dementia. While the medications and most of the basic investigations are provided free of cost in government settings, inconsistency in care and non-availability of resources lead to many seeking more expensive private care, escalating costs.

The direct social costs in dementia are seldom considered in public health policies in Indian setting, as most of the burden of care is borne by the immediate relatives, and it is considered as part of the routine expenses of care for the aged. Our study shows a wide discrepancy in this, primarily because of the difference in the socio-economic backgrounds of the family accessing care. Affluent families were more likely to keep additional specialized personnel for the care of the patient at home, where as lower- and middle-income families bore the entire burden on themselves, directly leading to increased care giver burden. The details of care giver burden were not however available for this study, as this was a retrospective review from the clinical records of the patient alone.

Wage loss for the caregiver in this study appears to be lesser than expected, but this is due to the fact that caregivers had regular salaried employment in most cases (especially children of the patients) and they could avail carer's leave. Spouses of the majority of the patients were retired and providing most of the day-to-day support. This assumes huge significance when it comes to daily wage earners form the primary carer, and is not reflected in the current study.

However, this study also throws light into the unique characteristics of the population under study. It shows how a serious condition like dementia impacts the society, with all the characteristics intrinsic to the urban population in India, where traditional family attitudes and care giving still form the back bone of care for the patients. This comes with a huge cost on physical and psychological wellbeing of the carers and it remains unnoticed and unpaid for. Introduction of carers pension is an important social support initiative that could be taken up by the government to mitigate this burden.

The study also highlights the urgent need for dementia care services in the public sector like day care centres, respite homes and nursing homes to cater to the escalating costs of care and diminishing supportive care from families for people with dementia.

Our study has many limitations. The sample studied is small, not representative of the full spectrum of persons with dementia in the society, as it was conducted in a tertiary care institution rather than in the community. The study being a retrospective record review, not all information were redeemable, especially related to caregiver burden, and indirect costs related to unpaid work. There is a wide variation in socio-economic backgrounds of the patients and their families. Provision of care by close family members makes it impossible to standardize costs incurred. The stage of dementia and utilization of existing support services from government were not evaluated in the study.

CONCLUSION

The availability and accessibility of support services for persons with dementia are minimal in LMIC like India. There is a huge variation in the costs incurred as affordability decides utilization when the services are not state sponsored. The cultural norms and attitudes towards elderly play a huge role in determining the societal costs and indirect costs in a country like India. There is a need for prospective epidemiological studies to understand the cost estimates of dementia to direct future service development and fund allocation for provision of care for persons with dementia.

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CONFLICT OF INTEREST

Nil.

Competing interests

Authors have declared that no competing interests exist.

Authors' contributions

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

Consent

As per international standard or university standard, patients' written consent has been collected and preserved by the author(s).

Ethical approval

As per international standard written ethical approval has been collected and preserved by the author(s)

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CASE REPORT

Acute psychotic presentation of Manganese Toxicity

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Abstract:

Manganese poisoning is a toxic condition due to excessive exposure to manganese which can present with neurological or psychiatric symptoms. Here we report a 51-year-old male with occupational exposure to manganese, brought to the Emergency Room with two days history of acute onset of behavioral disturbances. There was a history of taking Siddha medications for the last 4 months for polyarthralgia with minimal improvement. A diagnosis of organic psychotic disorder due to Manganese intoxication was made. MRI Brain plain and contrast were normal. The heavy metal screen was suggestive of high Manganese of 42 mg/ml and Cobalt of 4.4 ng/ml EEG was suggestive of generalized epileptiform abnormality. The patient was asked to refrain from further exposure to heavy metals and treated with Sodium valproate and neuro vitamins with gradual improvement in symptoms. This case report emphasizes the need for detailed evaluation and ruling out other medical conditions in a case presenting with first episode of psychosis.

Keywords: *depression, anxiety, prevalence, predictors, school, students, Chennai, south India*

INTRODUCTION

Manganese is an essential dietary trace element and useful for normal body functioning in humans. It regulates many functions of several enzyme systems by acting as catalyst. Beyond a certain level ingestion or inhalation of manganese leads to adverse health consequences.[1] The primary cause of excess manganese exposure in general population is inhalation of particulate matter containing Manganese. Hence people working in industries using manganese or living near to mining activities are most vulnerable to Manganese toxicity.[2]The acceptable range of manganese levels in blood is 4-15 mcg/L in blood, urine is 1-8 mcg/L, and in serum 0.4-0.85 mcg/L.[3] Any excess manganese in the

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body accumulates in brain, specifically in basal ganglia. A T1-weighted MRI of globus pallidus region of the basal ganglia in the brain typically shows a distinctive symmetrical high-signal lesion in the individuals with Manganese toxicity.[4]

The symptoms of manganese toxicity are usually insidious in onset and neurological symptoms and signs appear over months and years. The symptoms range from symptoms of irritability, aggressiveness, hallucinations, tremors, difficulty in walking, and facial spasms to a permanent neurological disorder. Manganese inhalation can even cause adverse cognitive effects like concentration and memory problems. When children in the formative years get exposed, they can have neurological, respiratory, and reproductive symptoms with neurodevelopmental problems.[5]

The neurological effects of manganese toxicity typically begin with feelings of weakness, lethargy and as the disease progresses more neurological signs appear. However, the presentation of Manganese toxicity is varied, not all individuals develop similar signs. The most common presentation is neurological extrapyramidal symptoms of slow and clumsy gait, speech disturbances, a masklike face, and tremors. In some individuals, the symptoms spontaneously disappear on cessation of exposure, in few the symptoms persist for many years post-exposure to Manganese and as the disease progresses, they develop severe muscle tension and rigidity and may be completely and permanently disabled.[6] In rare circumstances the presentation is a syndrome of psychological disturbances like hallucinations, and psychosis. Though Manganese neurotoxicity has some clinical similarities to Parkinson's disease, they have hypokinesia and tremor which are different from Parkinson's patients. They have tendency to fall back when pushed, less frequent resting tremor, more frequent dystonia, and don't typically respond to antiparkinsonian drugs.

Many studies have reported the subclinical neurological effects like decreased performance in neurobehavioral tests, impaired eye-hand coordination, hand steadiness, decreased reaction time, postural instability, and lower levels of cognitive flexibility in individuals having lower Manganese exposure levels. Most of the case reports regarding Manganese toxicity reported neurological symptoms and there are very few case reports of psychotic phenomena as a presentation of chronic Manganese ingestion.

CASE REPORT

A 51-year-old gentleman, a diploma holder in Information technology, employed in the heavy metal industry as a crane operator for more than two decades belonging to middle socioeconomic status Tamil speaking urban background, was brought to our emergency room by his family members with two days history of acute onset behavioral disturbances like muttering and smiling to self, making inappropriate gestures, spitting behavior with thoughts of reference and sleep disturbance. Further exploration of history revealed episodes of confused behavior with disorientation to time and place with probable visual hallucinations along with decreased sleep, decreased appetite in the last 2 months. There was no history suggestive of prior medical illness or substance abuse. He was on Siddha medications for the last 4 months for polyarthralgia with minimal improvement reported. As there was no personal or family history of psychiatric illness and acute presentation of behavioral disturbances in the background of fluctuating orientation, a central nervous system disorder was suspected.

On examination, the patient was having fluctuating sensorium, perplexed affect, though he was able to follow simple commands. He was having tremulousness of the whole body, rigidity in all four limbs, dysarthria.

MRI Brain plain and contrast were normal. The heavy metal screen was suggestive of high Manganese of 42 mg/ml and Cobalt of 4.4 ng/ml Blood investigations revealed low serum sodium levels of 129 mmol/liter, high serum uric acid levels of 50 mg/dL, low serum vitamin B12 levels of 142pg/ml. ECG and ECHO were normal. Blood viral markers were negative. Serum Procalcitonin, anti-TPO, Ammonia was normal. USG and CT abdomen were suggestive of fatty liver with hemangioma and cystitis of the urinary bladder. The autoimmune panel was negative. Other routine hematological and biochemical tests including complete hemogram, renal function test, and liver function test were normal except for slightly low total protein of 6.2 gm/dL EEG was suggestive of generalized epileptiform abnormality. The patient was treated with intravenous Vitamin B12, folate, thiamine, sodium valproate, and antibiotics. After 2 months of discharge, the patient was re-evaluated. There were no psychotic or mood symptoms. There were no signs or symptoms indicative of parkinsonian syndrome.

DISCUSSION

In our 51-year-old patient, an elevated serum manganese level of 42 mg/ml was found. It appeared to be caused by overexposure to manganese as he was working in the heavy metal industry for more than 20 years. There is no history suggestive of environmental exposure to Manganese other than occupational

exposure. Therefore, a diagnosis of organic psychotic disorder due to Manganese intoxication was made. An observational study on neuropsychiatric manifestations of chronic manganese poisoning reported psychotic disturbances are seen in both acute and insidious onset manganese poisoning but comparatively more in acute presentations.[7] The psychotic disturbances ranged from mild psychotic disturbances to florid psychosis. Most of them had spontaneous laughter or crying with disturbed sleep. In our case the patient presented with irritable mood, smiling to self and thoughts of reference along with insomnia. The neurological symptoms were fluctuating orientation with motor symptoms of tremors, rigidity, and dysarthria suggesting extrapyramidal involvement. Though there was no clinical history of seizures, given episodic fluctuations in orientation in the last two months and generalized epileptiform activity in EEG, Valproate treatment was initiated, and the patient responded well without any residual extrapyramidal symptoms. The neurological sequelae reported in the literature included predominantly extrapyramidal symptoms with permanent deficits and there were no reports of possible seizure activity secondary to manganese intoxication and complete recovery of extrapyramidal symptoms. Excess oral intake or inhalation of manganese can lead to accumulation of manganese which can have adverse effects on the respiratory, reproductive system, and neurological effects. However, the duration and mode of exposure will affect the presentation of symptoms.[8] In this case, he was asymptomatic till 4 months before the emergency room visit and presented with acute onset psychotic symptoms in the background of polyarthralgia, sleep disturbance, and irritability, and later fluctuating orientation and confused behavior. He was evaluated for the presence of neurological signs in the ER despite the psychotic presentation. He was treated with Siddha medications without significant improvement but continued to work which could have worsened the toxicity. As we did not test the medication for the content of manganese, we are unable to say if that was contributory. The sudden onset psychotic symptoms and extrapyramidal symptoms made the family seek medical consultation. Atypical presentation in terms of age, symptom profile, occupational exposure, presence of neurological symptoms, and absence of past or family history of psychiatric illness prompted us to do a detailed neurological and heavy metal screening.

CONCLUSION

Psychiatric symptoms can be produced by several medical or neurological conditions other than psychiatric disorders. Psychiatrists are usually asked to evaluate the patients presenting with first episode psychosis, presenting with disturbances of behavior, affect, or cognition. But often, because of the severity of symptoms or the imminent threat to the patient or their caregivers, detailed neuro-psychiatric evaluation gets delayed. Further treatment and management depend on the working diagnosis made. Hence failure to detect underlying medical/neurological conditions can lead to significant and unnecessary morbidity and mortality. This case highlights the importance of detailed history on occupational hazards and screening for heavy metal toxicities when patients present with acute psychiatric symptoms.

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Authors' contributions

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

Consent

As per international standard or university standard, patients' written consent has been collected and preserved by the author(s).

Ethical approval

As per international standard written ethical approval has been collected and preserved by the author(s)

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CASE REPORT

Atropine Induced Delirium in Young Female with unknown Snake Bite

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Abstract:

Venomous snakebites account for many deaths in developing countries. Administration of an Acetylcholinesterase Inhibitor (ACEI) has been recommended by WHO as a part of neurotoxic snakebite treatment. With atropine being used to reduce the undesirable muscarinic effects of ACEIs, adverse effects like delirium can occur. Delirium is characterized by acute decline in level of consciousness and cognition involving perceptual disturbances, abnormal psychomotor activity, and sleep cycle impairment. This case report describes a 17-year-old female with unknown snakebite who developed atropine induced delirium despite being under the cover of ACEIs and at a lower dose (4.5 mg) than usual for the drug to cause delirium. Though there are reports in literature about atropine induced delirium in organophosphate poisoning, to our knowledge none were reported in snakebite cases. Hence, clinicians need to be cautious while encountering such patients and should always consider the possibility of atropine induced delirium even in snakebite cases.

Keywords: *Atropine, Delirium, Snakebite*

INTRODUCTION

Venomous snake bites account for a large number of deaths in the developing countries.[1] Studies have reported that every year more than 5 million snake bites occur worldwide with an associated mortality rate of 125,000 persons per year. Mortality in India is estimated to be as high as around 30,000.[2]

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Snake venom has been shown to produce skeletal muscular paralysis causing a non-depolarizing block like action on the neuromuscular junction (NMJ).[3] Acetylcholinesterase inhibitors (ACEI) are hypothesized to reduce the neuromuscular block by increasing the amount of acetylcholine (ACh) at the NMJ. Currently WHO recommends administration of an ACEI like Neostigmine for the treatment of neurotoxic snakebite.[4] Intravenous administration of Atropine or glycopyrrolate along with ACEIs is usually done to reduce the undesirable muscarinic effects of ACEIs.[5]

Atropine causes competitive antagonism on the muscarinic acetylcholine receptors (M1-5).[6] M1 receptors are located primarily in the central nervous system and are involved in perception, attention and cognitive functioning. Hence delirium has been hypothesized to occur with antagonism of postganglionic M1 receptors.[7]

Though there are reports in the literature about atropine induced delirium in organo-phosphate poisoning, to our knowledge none were reported in cases of snake bite. With prior informed consent, we hereby report a case of 17-year-old female diagnosed with a case of unknown snake bite who developed atropine induced delirium despite being under the cover of Acetylcholinesterase inhibitors.

Case Report

Our patient, a 17-year-old unmarried female was admitted to Intensive care unit (ICU) with a history of unknown snake bite on her right leg while sleeping in her home at night. Morphology of the snake could not be described due to darkness in the room. Patient complained of headache, nausea and vomiting, burning sensation in both the eyes. On examination, the patient was conscious and oriented to time, place and person, with Glasgow Coma Score of 15/15, afebrile, pulse rate was 80 bpm, blood pressure was 96/60mm Hg, SpO2 was 99% on room air, BMI of 15.14 kg/m^2, single breath count was normal. The systemic examination was unremarkable. On local examination, two closely set puncture marks were seen on right leg, with local reactions of erythema and oedema. Clinically, no other haemorrhagic or neurological manifestations were observed. Patient was diagnosed with unknown snake bite.

In ICU, patient was given a stat dose of ten vials of Polyvalent Anti-Snake Venom (ASV) over 30 minutes, Injection Atropine 0.3mg (0.01mg/kg), Neostigmine 1.5mg, along with a short acting corticosteroid, an anti-histaminic and fluid therapy.

Her blood investigations showed pH - 7.37, PCO2 - 37.1, PO2 - 75.6, HCO3 - 21.6mmol/L. Creatine kinase was 95 U/L, Coagulation profile revealed Prothrombin time (PT)- 12.8 s (Control - 12.5), Activated Partial Thromboplastin Time (APTT) - 30.5 s (Control - 30.0) and International Normalized Ratio (INR) - 1.02. Liver function tests, renal function tests and complete blood count were within normal limits. Her Electrocardiogram and chest X-Ray did not reveal any abnormality.

Patient was then given 20 vials of ASV in 500ml of 5% Dextrose (5D) over 1 hour followed by 10 vials of ASV in 500ml of 5D over next 6 hours, Injection Neostigmine 1.5 mg half hourly for 5 cycles followed by 1.5mg 2 hourly with a total of 10.5mg over 7 hours. Injection Atropine was started at a dose of 0.6mg half hourly for 5 cycles followed by 0.6mg 2 hourly with a total of 4.2mg over 7 hours along with an antihistaminic, a short acting corticosteroid, antacid and fluids.

On Day 2 morning, she was afebrile, pulse rate was 140 bpm, pupils were dilated, and non-reactive, systemic examination was unremarkable. Patient was seen talking to self, speaking as if she was at home, telling her mother "To replace the emptied gas cylinder", "I'm going to take bath, put my clothes in the bathroom", she would talk as if she was interacting with her friend regarding studies (who was not present in the ward) and said she could see her friend. Mental status examination revealed that she was not oriented to time and place but was oriented to person, had auditory hallucinations and visual hallucinations.

Patient was given 10 vials of ASV in 500ml of 5D over 6 hours. Injection Neostigmine 1.5 mg 2 hourly with a total of 15 mg over 20 hours. Injection Atropine was given at a dose of 0.6mg 2 hourly with a total of 6mg over 20 hours along with supportive treatment. Her pupils were dilated and non-reactive, and heart rate was 130 bpm. Patient continued to be disoriented throughout the day, she was suspicious that her parents were talking about her (when they were not), she was also suspicious that someone may harm her and would ask her mother to be close to her revealing delusions of reference and persecution along with hallucinations on mental status examination.

On Day 3 early morning, a call for psychiatric consultation was noted. Blood investigations were repeated which were within normal limits. There was no past or family history of any psychiatric disorders. Patient's treatment chart and investigations were reviewed, and atropine induced delirium was suspected. Hence, it was advised to

stop Injection Atropine. The patient scored 9 on Naranjo Adverse Drug Reaction Probability Scale8 which suggests definite chance of adverse drug reaction. The patient was later continued on Injection Neostigmine 1.5mg, 8 hourly with supportive care.

After 3-4 hours of stopping atropine, patient's general condition was stable, she was oriented to place and person but not oriented to time, denied delusions but had fleeting auditory hallucinations. Towards evening, she was oriented to time, place and person, denied delusions or hallucinations. The patient was later discharged after 2 days with symptomatic improvement.

Discussion

We described a case of young female with a history of unknown snake bite who developed delirium after a day of atropine administration. Atropine toxicity can occur as a manifestation of an unusual sensitivity to a therapeutic dose (idiosyncrasy) or after an over-exuberant use in the treatment. Over-dosage of atropine may lead to manifestations such as dryness of mouth, flushing, dilated and non-reactive pupils, tachycardia and marked CNS disturbances which can range from disorientation to an active delirium.[9]

According to current FDA, the usual dose of parenteral atropine is 0.4 - 0.6mg (range: 0.3-1.2mg). Initial adult dose in muscarinic toxicity is 1-2 mg. Additional 2mg doses may be administered every 5-60 minutes until muscarinic symptoms and signs subside. Severe adverse effects such as ataxia, excitement, disorientation, hallucinations, delirium and coma can occur at dose of 10mg or more in an adult.[9] But our patient first developed symptoms and signs of delirium after a cumulative dose of 4.5mg of atropine over 8 hours. Gradually symptoms worsened when she was given an additional 6mg of atropine over next 20 hours.

Considering the presentation, the possibility of neurotoxicity due to snake bite can also be considered. But the patient received anti-snake venom and ACEI within 2 hours of snake bite, making this possibility remote. As the patient had temporal onset of symptoms following administration of atropine and subsequent resolution of symptoms occurred within 3-4 hours of stopping atropine, it suggests a remarkable association between the drug and the induced delirium. And these symptoms have occurred despite the patient receiving antimuscarinic agents in combination and at a lower dose (4.5 mg) than usual for the drug to cause these symptoms. Furthermore, other possible causes of delirium were ruled out with investigations.

Hence, clinicians need to be cautious while encountering such patients and should always consider the possibility of atropine induced delirium even in a case of snake bite. Limited research poses significant challenges in the management. There is a need for more research about proper guidelines for addressing such adverse events and atropine therapy in general.

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CONFLICT OF INTEREST

Nil.

Competing interests

Authors have declared that no competing interests exist.

Authors' contributions

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

Consent

As per international standard or university standard, patients' written consent has been collected and preserved by the author(s).

Ethical approval

As per international standard written ethical approval has been collected and preserved by the author(s)

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