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Effect of Seasonal Change on the Admission of Patients with Schizophrenia in a Tertiary Care Center: A Retrospective Cross - Sectional Observational Study

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Abstract: ***Background: Since the 18th century, seasonal patterns in symptom severity and hospitalization have been seen in patients with schizophrenia [1]. It may be due to climatic conditions and their effect on biological pathways. In this study we aimed to evaluate the effect of seasonal change on admission of patients with schizophrenia in a tertiary care center. Methods: It is a retrospective, cross - sectional observational study. Patients included in study were diagnosed as having schizophrenia as per DSM 5 with history of hospitalization in the past 3 years. Seasonal distribution of patient's admission was done as per Indian Meteorological Department designation. The data were collected and analysis of monthly admission rates of patients was done. Difference in seasonal annual admission rates and factors affecting it were analyzed. Results: Maximum number of participants were of age group (31 - 60) years i. e.68.2% which was significantly more than other groups (p<0.05). In total 68.3% admissions were of men which was significantly more than women (p<0.05). Statistically significant difference was found between population of rural (59.8%) and urban area (40.2%) (p<0.05). More admissions were seen in the summer season i. e.35.2% of total population as compared to other seasons (p<0.05). Conclusion: Significant seasonal variation is present among admissions of patients with schizophrenia. More admissions were present in the summer season of male patients having the age group 31 - 60 years and residents of rural areas.***

Keywords: Schizophrenia, seasonality, admissions, biological rhythm

Key Message: This study will help in understanding the effects of climate change on mental health with factors contributing to worsening of psychotic symptoms. Effects of biological rhythm on psychiatric symptoms and its importance can be evaluated.

1. Introduction

Since the time of Hippocrates, 2400 years ago, the notion that seasonally changing climatic conditions influence human health and behavior has been developed [1]. Schizophrenia is a disorder characterized by symptoms such as hallucination, delusion and also negative symptoms such as apathy, associability and avolition. Disorganized speech and disorganized behavior can also be seen. It can also sometimes present with catatonic symptoms. It impairs the functionality and social life of patients [2] . Various studies have been conducted and some data suggest admissions of patients with schizophrenia to psychiatric facilities were more during summers [3]. It can be due to various factors like stress of vacation, family being away, less staff support in community and health services as well as specific climatic factors such as ambient temperature, relative humidity and photoperiod. These are assumed to contribute to the emergence of psychotic exacerbation and to the observed higher incidence of summer admissions [4]. It is hypothesized that various climatic factors may contribute to the emergence of symptoms in patients with schizophrenia and consequently may increase their admission rates to psychiatric hospitals. Since climatic conditions can not be controlled and it can influence the mental health, so there is need of further understanding of its effect on the patients with schizophrenia. Various literature on climatic factors that affect exacerbation of schizophrenia symptoms have been reviewed and they provide limited information which substantiates the need for further study. Many studies in this field have been conducted across the globe but not much literature is available from India.

Hence this study aims to evaluate the effect of seasonal change on admission of patients having schizophrenia. Objectives of our study will be to determine the admission rate of patients with schizophrenia and study the association of seasonal change with admission rates, along with evaluation of the factors affecting it.

2. Material and Methods

This study was conducted after approval by the Institute's ethics committee. It was a retrospective, cross - sectional observational study. It was conducted in the In - patient psychiatry department of a tertiary care hospital which provides service to the major part of Gujarat along with population from Madhya Pradesh, Rajasthan and Maharashtra. Data were collected from MAY 2017 to FEBRUARY 2020. All hospital records were evaluated with permission of the hospital administration and medical records department. Patients having age more than 18 years of any sex, diagnosed as having schizophrenia as per Diagnostic and statistical manual 5 (DSM5) [5] and admitted in the hospital

within last 3 years with availability of documents were included in the study. Patients with schizophrenia who were admitted before 3 years and had comorbid major medical, surgical or psychiatric disorders were excluded.

Demographic details were collected as per semi structured performa. All records were in paper form consisting of their indoor admission files. Diagnostic and statistical manual 5 (DSM 5) [5] was used for diagnosing patients with Schizophrenia as it is routinely used by the center for its clinical work. The data set collected included the sex, age, location (rural or urban), year and season of admission as climatic conditions and its influence can be evaluated with above factors. Data was collected by a single investigator.

Seasonal distribution of patient admission was done as per Indian Meteorological Department designation such as;

- Winter – December to February
- Summer – March to May
- Monsoon – June to September
- Autumn season – October to November [6].

Analysis of monthly admission rates of patients was done. Difference in seasonal annual admission rates and factors affecting it were analyzed. Efforts were made to avoid selection bias by random selection of data. There was no predetermined study sample size. Subjects who were admitted in the last 3 years were included after considering the exclusion and inclusion criteria. Total 3, 467 admissions were there in the 3 years of specified time period of the study out of which 1, 947 participants were included in the study sample considering the exclusion and inclusion criteria.

Data were entered into Microsoft Excel (Microsoft Corporation, Redmond, Washington, USA, 2016) spreadsheet and coded. Statistical analyses were performed using Statistical Package for Social Sciences (SPSS) Statistics for Windows, Version 22.0 (IBM Corp., USA, 2015). In case of any missing data, patients were personally contacted and with their due consent data was collected. Continuous variables such as age were divided into various age groups. Categorical data was represented in the form of Frequencies and proportions. Chi - square test or Fischer's exact test (for 2x2 tables only) was used as a test of significance. P value (Probability that the result is true) of <0.05 was considered as statistically significant after assuming all the rules of statistical tests. Seasonality patterns were shown by presenting observed and expected percentage of hospitalizations by month within a year. Expected percentage by month was calculated by multiplying the sum of all admissions by proportion of days of a specific month and then compared to the observational percentage of admission.

3. Results

Maximum number of participants were of age group (31 - 60) years 1, 328 (68.2%) which was significantly more than other groups (p<0.05). In total 1, 330 (68.3%) admissions were of men which was significantly more than 617 (31.7%) admissions of female gender (p<0.05). More admissions were seen in the summer season 686 (35.2%), followed by rainy 518 (26.6%), winter 462 (23.7%) and minimum admissions were in autumn season 281 (14.4%) of total population. Statistical significant differences were present among seasonal admissions (p<0.05). More admissions were seen of patients from rural areas 1165 (59.8%) which was significantly more (p<00.005) as compared to urban area 782 (40.2%). Year 2019 - 2020 had maximum admissions of 748 (38.4%) patients having schizophrenia. Descriptive data are summarized in table 1.

Significant seasonal variations were found in the total sample (p<0.05). Hospitalization peaks were in April and May. In comparison to other seasons, summer had more admissions (35.2%) and least admissions were there in autumn season (14.4%). Distribution of subjects according to season can be seen in graph 1.

Age groups 31 - 60 years which were the majority in the study population had maximum admission in summer season 488 (71.1%). There was no significant association (p=0.087) found between the age groups and different seasons. Distribution of subjects according to age and season are shown in table 2.

Statistically significant association (p=0.034) was found in between sex and season. Distribution of subjects according to sex and season shown in table 3. In total there were more male admissions 1330 (68.3%) with maximum admissions 496 (72.3%) seen in the summer season.

More admissions were from rural areas 1165 (59.8%) with maximum admissions in summer season 416 (60.6%). There was no statistically significant association (p=0.846) found between locality and admissions in different seasons. Distribution of subjects according to locality and season depicted in table 4.

4. Discussion

Hospital admission peaks were found in summer with least admission in Autumn season. In a study conducted by Clarke et al., 1998 [3]; Shiloh et al., 2005 [4] the summer peak of admissions was seen similar to our study. In the study of Strous et al., 2001 [7] an early spring peak was seen. Whereas winter peak was seen in a study conducted by Davis et al 2000 [8] and no seasonal pattern was found in another study of Modai et al., 1994 [9]. . Our findings might imply that schizophrenia symptoms may be temperature - sensitive and also influenced by duration of photoperiod. It could potentially be worsened by excessive environmental heat stress. Contribution of factors such as sleep deprivation, increased life events and poor social support (due to vacations, family being away and lack of health staff) during summer season might have had increased the observed admission rates [8, 9, 10]. Variations in the occurrence of schizophrenia symptoms along the course of the year can be assumed to underlie climatic conditions and their influence on biological mechanisms including melatonergic and serotonergic interactions [11]. Some studies have also suggested possible influence of public holidays and religious festivities on admission rates of patients having schizophrenia [7, 12, 13] .

Significant association between sex and seasonal patterns were found with more male admissions in summer season

representing more hospital visits by men. Admission rates of men were more may be because men were over - represented in the total sample. There has been some evidence for sex - specific seasonal patterns in hospitalizations due to schizophrenia showing more male admissions [7].
In our study more admissions were seen from rural localities, explaining that high vulnerability in mental health of rural communities can be seen in extremes of weather. Some studies have shown more prevalence of schizophrenia in urban areas with increased admission rates, which is contradictory to our findings. [14]

In our study decreased admission was seen in the autumn season in the months of October and November. Analyzing periods of decreased hospital admissions might help to understand the role of potential protective factors in preventing or delaying hospitalizations due to specific social factors. [15]

Most studies have been conducted based on national health care data which has over selection and possible misclassification of data, which has been avoided in our study. Most studies are from other countries while our study addressed this question in the Indian population. Hence findings might defer to other studies considering the different climate and social lifestyle of Indians.

Few imitations are there in our study. The 3 - year database from only one tertiary care hospital was used. There are different regions in the world which have distinctly specific weather patterns, therefore, it is difficult to generalize the results. Calculations of the number of inpatient stays per individual patient and assessments of psychopharmacological treatment were not done. Readmissions of patients were not taken into consideration.

5. Conclusion

There was an association between hospital admissions for schizophrenia and seasonality with peaks of cases occurring in the hot weather of the summer season. There were gender and age group differences where a significantly higher number of men and middle aged patients (31 - 60 yrs of age) were admitted for schizophrenia in times of hot weather and mainly from rural areas. In the planning of mental health care, the results can be used as an indication of expected peaks of mental ill health in relation to season and as a guide for resource allocation and preparedness of mental health workers [17]. This study results may pave the way for future research in this field. Further investigation is warranted at genetic, environmental and clinical levels aiming for the development of specific markers and potential new treatment options of schizophrenia [18].

Declaration of conflicting interests;

The authors declare no conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Legends to Figure and Tables;

Table 1: Sociodemographic and clinical variables

Sociodemographic variable	Category	Number	Frequency
Age	0 - 17 years 18 - 30 years 31 - 60years >60years	46 344 1328 229	2.4% 17.7% 68.2% 11.8%
Sex	Male Female	1330 617	68.3% 31.7%
Location	Rural Urban	1165 782	59.8% 40.2%
Year	2017 - 2018 2018 - 2019 2019 - 2020	653 546 748	33.5% 28.0% 38.4%
Season	Summer Rainy Autumn Winter	686 518 281 462	35.2% 26.6% 14.4% 23.7%

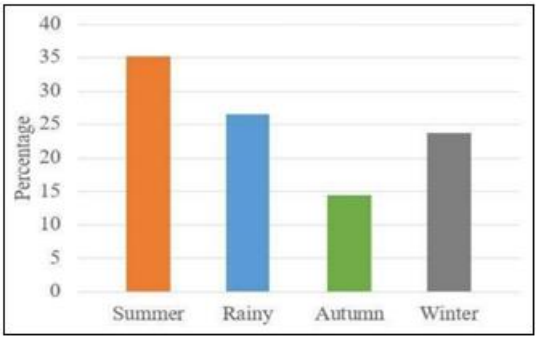

Figure 1: Graph Showing distribution of subjects according to season

Table 2: Distribution of subjects according to age and season

Age group	Summer	Rainy	Autumn	Winter	Total
0 - 17 years	11 1.6%	15 2.9%	3 1.1%	17 3.7%	46 2.4%
18 - 30 years	117 17.1%	103 19.9%	51 18.1%	73 15.8%	344 17.7%
31 - 60years	488 71.1%	341 65.8%	191 68.0%	308 66.7%	1328 68.2%
>60 years	70 10.2%	59 11.4%	36 12.8%	64 13.9%	229 11.8%
Total	686 100.0%	518 100.0%	281 100.0%	462 100.0%	1947 100.0%

There was no significant association (p=0.087) found between the age groups and different seasons.

Table 3: Distribution of subjects according to sex and season

Sex	Summer	Rainy	Autumn	Winter	Total
Male	496 72.3%	341 65.8%	192 68.3%	301 65.2%	1330 68.3%
Female	190 27.7%	177 34.2%	89 31.7%	161 34.8%	617 31.7%
Total	686 100.0%	518 100.0%	281 100.0%	462 100.0%	1947 100.0%

Statistically significant association (p=0.034) was found in between sex and season.

Table 4: Distribution of subjects according to locality and season

	Summer	Rainy	Autumn	Winter	Total
Rural	416 60.6%	302 58.3%	171 60.9%	276 59.7%	1165 59.8%
Urban	270 39.4%	216 41.7%	110 39.1%	186 40.3%	782 40.2%
Total	686 100.0%	518 100.0%	281 100.0%	462 100.0%	1947 100.0%

There was no statistically significant association (p=0.846) found between locality and admissions in different seasons.