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Seasonal Variation of Violence in Psychiatric Patients and the General Population

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ABSTRACT – *Background:* Both among psychiatric patients and in the general population, seasonal variation of mood symptoms and aggression has been described.

Aims: To investigate seasonal variations in violence among acutely admitted psychiatric patients and in the general population.

Methods: The monthly frequency of 512 patient-staff incidents 1990-june 1997 in an acute psychiatric hospital and 3.431 violent incidents among the general population 1991-1997, in the same area, were analysed for monthly variations in frequencies.

Results: There was a correlation ($r = 0.63$ $N = 12$ $p < 0.05$) between incidents at the hospital and incidents recorded by the police. Incidents at the hospital correlated with the monthly change of day length with a lag of one month ($r = 0.71$ $N = 12$ $p < 0.01$), but not with the mean monthly day length.

Conclusions: The correlation of monthly frequency in the two groups could be induced by a change in activity common for the two groups.

Introduction

Several authors have described a seasonal variation of psychiatric symptoms and of human behaviour. Criminal violence, both assaults, sexual offences and homicides, has shown a seasonal variation in some studies (Fux & Zabow 1993, Michael & Zumpe 1983, Schreiber *et al.* 1997, Tiihonen, Räsänen & Hakko 1997). Frequencies of aggression and violence in psychiatric hospitals have shown seasonal variations both with

one (Wynn 1996) and two (Roitman, Orev & Schreiber 1990) yearly peaks. This seasonal variation could be tied to people with mood disorders (D'Mello, McNeil & Msibi 1995, Roitman, Orev & Schreiber 1990). The aims of this study were to examine if there was any seasonal variation of violence among psychiatric patients acutely admitted to hospital, if such a variation correlated with violence in the general population and if violence among acutely admitted psychiatric patients correlated with the day length or the change of day length.

Methods

Setting

The city of Trondheim in Norway has 140,000 inhabitants and is situated at 63°25'N. The day length varies between 4 hours in midwinter and 21 hours at midsummer. From the 10th of May until 1st of August the day is more than 18 hours long. The mean temperature varies between -2.8 C in January and 13.8 °C in july.

The rate of serious violent crimes in Trondheim is low. In the years 1985 until 1997 there were 20 homicides.

Population 1

One part of the study took place in a Norwegian psychiatric hospital, which receives all acute psychiatric admissions from its catchment area. The area consists of a population of 130,000 persons of which half live in the city of Trondheim and the rest in its rural surroundings. Acute admissions to other psychiatric hospitals for inhabitants of this catchment area only happened if inhabitants at the time of admission temporarily stayed outside the catchment area only happened if inhabitants at the time of admission temporarily stayed outside the catchment area.

The hospital has two acute wards that jointly admitted about 500 patients each year. Diagnoses were mostly psychoses, but also some severe personality disorders. Forty percent of the patients were admitted voluntarily.

The two wards have 22 beds each and both are divided into a locked and an open area. One of the wards has a small seclusion area with two beds. Most patients' rooms have two to four beds. The nursing-staff: patient ratio was 1.2:1.

Population 2

The Police district in this study covers the city of Trondheim. The police in Trondheim record all reported violent incidents, including información about the date of the incidence. The number of all violent incidents is reported to Statistics Norway at the end of the same month.

Assessments

As in many hospitals in Scandinavia, our staff documents injuries systematically with the Staff Observation of Aggression Scale (SOAS) (Palmstierna & Wistedt 1987). This scale describe the seriousness of the methods used to inflict injury, the aim of the attack, the consequence of the attack, as well as the time and date of the incident. The consequence of the attack for the staff member was scored in six groups: felt threatened, pain < 10 min, pain > 10 min, visible injury, need for treatment, and need for treatment by physician. Most of the incidents resulted in little or no physical harm. The staff was required to report every incident concerning patient – staff aggression in the staff-member at least felt threatement from January 1990 to June 1997.

All reports not related to patient-staff incidents were first excluded. Since Palmstierna, Lassenius and Wistedt (1989) and Lion, Snyder and Merril (1981) found the consistency of incidence reports best for the more serious incidents, the reports that had not resulted in pain were also excluded.

The number of admittances to the hospital each month from January 1992 until June 1997 were obtained from the hospital records.

Every episode of violence in the city reported to the police was recorded for legal purposes by the police department. At the end of each month the numbers were reported to Statistics Norway. Most of the incidents were assaults, even if all homicides, attemped murder and infliction of grievous bodily harm were included. Reports from January 1991 until December 1997, were obtained from Statistics Norway. Except where otherwise stated, the monthly number of episodes denotes the sum of episodes in that month for the seven years.

Records of day length (time from sunrise to sunset) for Trondheim was obtained from Institute of Theoretical Astrophysics, University of Oslo. The mean monthly day lengths were calculated. The monthly changes of day length were analysed by subtracting the mean day length in one month from the mean day length in the preceding month.

Statistics

To test if the seasonal variation were stable through the seven years, the monthly numbers of violent incidents each year were correlated year by year with the sum of monthly incidents for the seven years. In all other tests, monthly means the sum of episodes for that month through the seven years.

The Chi-Square test for multinomials was used as an overall measure of deviations between months. The null hypothesis was that incidents occur with a probability proportional to the length of the time interval. Based on the expectation that the number of episodes would be the same every day during the seven years, the expected number of episodes in one month was calculated taking into account different number of days in each month and leap years. The 95% confidence intervals were calculated with the method described by Wonnacott and Wonacott (1990) and used by Tiihonen, Räsänen and Hakko (1997). The 95% confidence intervals for the observed/expected ratio for one month must not include 1 to conclude that the frequency for that month differs from the expected frequency. Pearson's correlation was calculated to test variance between the monthly numbers of violent episodes in the department and in the city. Pearsons correlations were also calculated both with the mean monthly day length, and with the absolute values of the monthly change of day length, both with lags of one and two months because of the assumption that the effect of light might not be inmediate. Tests of significance were twosided.

Results

From January 1990 until June 1997, 512 incidents of patient-staff violence that at least resulted in pain were recorded at the hospital.

The mean yearly number of episodes for each month varied between months significantly divided from the expected (Chi sq = 31.40 df = 11 $p < 0.001$).

From January 1991 to December 1997, the police recorded 3431 episodes of violence.

The mean yearly number of episodes for each month varied between 31 in April and 51.29 in May, and the differences in frequencies between months significantly divided from the expected (Chi sq = 59.30 df = 11 $p < 0.001$).

Except for 1995, each year's monthly number of episodes recorded by the police correlated with the monthly sum of the episodes through the seven years. (Mean r = 0.67, range r = 0.37 to r = 0.84, SD = 0.1517). Tthe monthly numbers each year from the department were too small for this procedure.

The expected and the observed frequencies of violence for the hospital and the police records for each month are shown in table I.

The seasonal profiles of variations in violence frequencies are shown in figure 1. The patient-staff incidents had a maximum of frequency in May and June and a smaller peak from October to December. There were nadirs from January to April and from July to September. The incidents recorded by the police had one maximum in May and another from September to December. There were nadirs in April and July and low values from January to April and from June to August.

The monthly numbers of patient-staff incidents and violent episodes recorded by the police had a significantly positive correlation ($r = 0.63$ N = 12 $p < 0.05$).

The correlation between number of incidents and number of admittances was not significant ($r = -0.13$ N = 12 $p > 0.2$). The variations in patient-staff incident frequencies could thus not be explained by variations in admittance frequencies.

Table II shows that there was a significant correlation between the monthly change of day length using a lag of one month and the monthly number of incidents in the hospital ($r = 0.71$ N = 12 $p < 0.01$). The corresponding correlation with violent episodes reported to the police was also high, but not significant ($r = 0.47$ N = 12 $p > 0.2$)

Table I
Observed and expected monthly frequencies of 512 violent incidents in psychiatric hospital 1990 - June 1997 and observed and expected monthly frequencies of 3,431 violent episodes recorded by police 1990-1997

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Patient-staff incidents												
Observed incidents	39	31*	41	34	54	65*	36	27*	34	49	51	51
Expected incidents	46	42	46	45	46	45	41	41	39	41	39	41
Deviation (%)	-16	-26	-12	-24	16	45	-11	-34	-13	21	30	26
Police reports												
Reported episodes	268	239	249*	217*	359*	283	271	272	325*	305	317*	326*
Expected	291	263	291	282	291	282	291	291	282	291	282	291
Deviation (%)	-8	-9	-15	-23	23	-0	-7	-7	15	5	12	12

* Outside 95% Confidence interval.

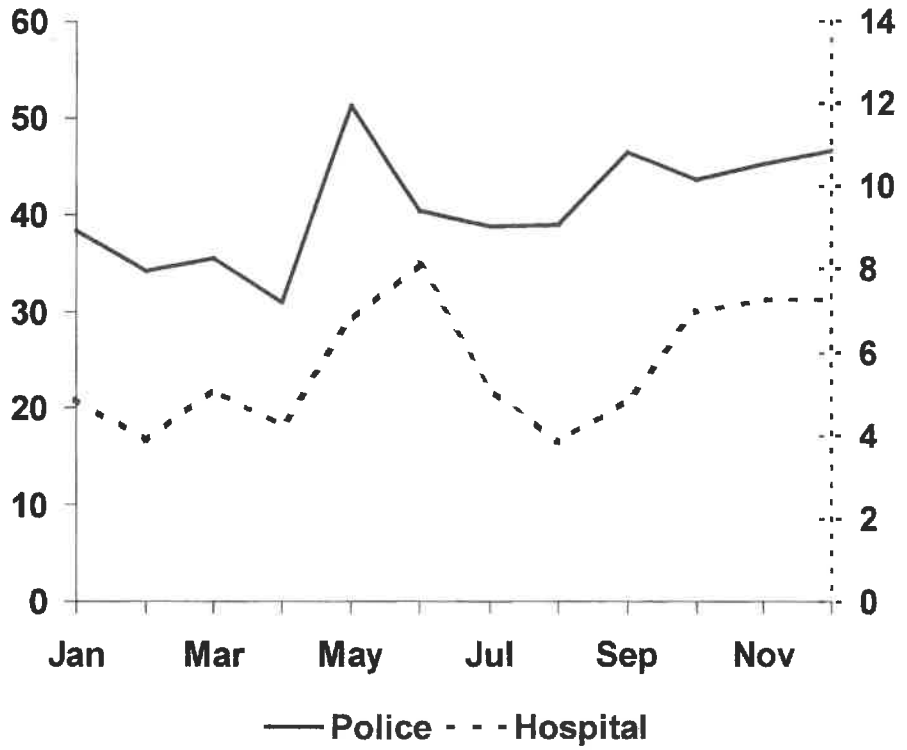

Figure 1. Mean number of monthly incidents for one year. The scale for patient-staff incidents 1990-June 1997 is on right y-axis, and police records of violence 1991-1997 is on left y-axis.

Table II
Two sided correlations (Pearsons'r) between monthly number of violent episodes and mean monthly day length, and the monthly change of day length. Both with a lag of one and two months. Hospital is the patient-staff records and Police is the police records

Time variable	Hospital	Police
Day length	-0.018	-0.52
Day length, lag one month	0.064	0.178
Day length, lag two months	0.132	0.393
Change of day length	-0.062	-0.101
Change of day length, lag one month	0.711*	0.472
Change of day length, lag two months	0.558	0.229

* $p < 0.01$.

Discussion

Our main findings indicate that there is a distinct yearly pattern of patient-staff incidents in the psychiatric hospital and of violence in the general population and that there is a correlation between these events. The patient-staff incident frequencies were not closely related to number of admittances to the hospital.

The monthly number of violent episodes among the patients also varies clearly with the preceding month's change of day length.

At least two hypotheses of the daily photoperiod as explanation for seasonal variations in mood and human behaviour have been presented: 1. Variation in the day length causes behavioural changes. This would probably give one peak of aggression each year with summer and winter as extremes 2. The amount of change in day length with maxima at the equinoxes causes behavioural changes. This would result in two peaks of aggression through the year.

Anderson (1989) indicated high temperatures in summer and the seasonal variation in temperature as an explanation for seasonal change in aggression. This would result in a summer peak. The role of temperature would be expected to be of less importance and the role of the light more important at higher latitudes.

The correlation between the monthly number of incidents at the hospital and in the general population raises the possibility of a common etiological factor. The two peaks in this seasonal variation and the correlations with the monthly change of day length could indicate change of light exposure as such an etiological factor.

It is documented that variations in mood affect large parts of the population at high latitudes (Haggag *et al.* 1990, Kasper *et al.* 1989). Clinical seasonal affective disorder may be the extreme of mood variations affecting large parts of the population. This could be expressed in real affective episodes and in changes in mood as well as in aggression in the general population. For all the aspects of seasonal variation of mood it seems that most of the affected persons have elevated mood and activity in summer and lower mood and activity in winter. There has been described however a minority of individuals with seasonal changes who are hypomanic in early winter and depressed in early summer.

Reports with two peaks in seasonal variation in mood or human behaviour indicate that the peak in late spring/early summer is greater both for aggression (Roitman, Orev & Schreiber 1990), elevated mood (Okawa *et al.* 1996), mania (D'Mello, McNeil & Msibi 1995), suicide (Hakko, Räsänen & Tiihonen 1998) and mania-related aggression (D'Mello, McNeil & Msibi 1995) than the peak in autumn.

In a study of acute emergency admittance from Heathrow airport, there was a preponderance of agitated conditions in those who had extended their circadian rhythm by travelling westwards, and a preponderance of depressive states in those who came from the west (Jauher & Weller 1982). It seems that changes in the circadian rhythm represent a stress, but that the tendency to become agitated and aggressive may be greater when the awake/light period lengthens and the sleep time shortens.

The yearly pattern may also consist of two independent curves with separate peaks. One may be related to social patterns with increased travelling and social activities (including inebriation) during early summer, and one related to the advancing winter

darkness and harsh weather in October often resulting in reduced social interactions.

We believe that our findings should have implications. The psychiatric acute departments could prepare themselves for the periods of the year with most incidents of aggression. The police could prepare for busier times in the periods with high frequencies for violence.

A more detailed study involving patient characteristics could indicate subgroups which may be more vulnerable to seasonal effects than others. Roitman, Orev and Schreiber (1990) found a circannual rhythm of aggression among patients with affective disorders, but not among patients with schizophrenia. Studies of disturbances in circadian rhythms could explore the role of changes in day-night rhythms in both aggression and in other psychiatric symptoms.

References

ANDERSON, C.A., Temperature and aggression: Ubiquitous effects of heat on occurence of human violence. *Psychol Bull, 106:* 74-96, 1989.

D'MELLO, D.A., McNEIL, J.A. and MSIBI, B., Seasons and bipolar disorder. *Ann Clin Psychiatry, 7:* 11-18, 1995.

FUX, M. and ZABOW, A.A., Aggressiveness in subjects referred for examination by court order: a retrospective study (1988-90) in the southern district of Israel. *Med Sci Law,* 12: 393-401, 1993.

HAGGAG, A., EKLUND, B., LINAKER, O. and GÖTESTAM, K.G., Seasonal mood variation: an epidemiological study in northern Norway. *Acta Psychiatr Scand, 81:* 141-145, 1990.

HAKKO, H., RÄSÄNEN, P. and TIIHONEN, J., Seasonal variation in suicide occurrence in Finland. *Acta Psychiatr Scand, 98:* 92-97, 1998.

JAUHER, P. and WELLER, P., Psychiatric morbidity and timer zone changes: A study from Heathrow airport. *Br J Psychiatry, 140:* 231-235, 1982.

KASPER, S., WEHR, T., BARTKO, J., GAIST, P. and ROSENTHAL, N., Epidemiological findings of seasonal changes in mood and behaviour. *Arch Gen Psychiatry, 46:* 823-833, 1989.

LION, J., SNYDER, W. and MERRIL, G.L., Underreporting of assaults on staff in a state hospital. *Hosp Community Psychiatry, 32:* 497-498, 1981.

MICHAEL, R. and ZUMPE, D., Sexual Violence in the United States and the Role of Season. *Am J Psychiatry, 140:* 883-886, 1983.

OKAWA, M., SHIRAKAWA, S., UCHIYAMA, M., OGURI, M., KOKSAKA, M., MISHIMA, K., SAKAMOTO, K., INOUE, H., KAMEI, K. and TAKAHASHI, K., Seasonal variation of mood and behaviour in a healthy middle-aged population in Japan. *Acta Psychiatr Scand, 94:* 211-216, 1996.

PALMSTIERNA, T., LASSENIUS, R. and WISTEDT, B., Evaluation of the Brief Psychopathological Rating Scale in relation to aggressive behavior by acute involuntarily admitted patients. *Acta Psychiatr Scand, 79:* 313-316, 1989.

PALMSTIERNA, T. and WISTEDT, B., Staff observation aggression scale, SOAS: presentation and evaluation. *Acta Psychiatr Scand, 76:* 657-663, 1987.

ROITMAN, G., OREV, E. and SCHREIBER, G., Annual rhythms of violence in hospitalized affective patients: correlation with changes in the duration of the daily photoperiod. *Acta Psychiatr Scand, 82:* 73-76, 1990.

SCHREIBER, G., AVISSAR, S., TZAHOR, Z., BARAK-GLANTZ, I. and GRISARU, N., Photoperiodicity and annual rhythms of wars and violent crimes. *Med. Hypotheses, 48:* 89-96, 1997.

TIIHONEN, J., RÄSÄNEN, P. and HAKKO, H., Seasonal variation in the occurrence of homicide in Finland. *Am J Psychiatry, 154:* 1711-1714, 1997.

WONNACOTT, T. and WONACOTT, R., *Introductory Statistics,* Johm Wiley & Sons., New York, pp. 550-555, 1990.

WYNN, R., Polar day and polar night: month of year and time of day and the use of physical and pharmacological restraint in a north Norwegian university psychiatric hospital. *Arctic Med Res, 55:* 174-181, 1996.

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