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# Age structure at diagnosis affects aggression in a psychiatric inpatient population: Age structure affecting inpatient aggression



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## ABSTRACT

Study of inpatient aggression in psychiatric inpatient units (PIUs), where vulnerable patients interact intensely in small groups, is hampered by a lack of systematic monitoring of aggressive events in the context of group dynamics. Our current study examines the relationship between aggression and group structure in the PIU of a general tertiary-care hospital over a 9-month period. The severity of aggression was monitored daily using the Overt Aggression Scale (OAS). Clinical data including the daily number and mean age of subpopulations with different diagnoses were acquired. Cross-correlation function and autoregressive integrated moving average modeling were used to assess the effects of various group structure parameters on the incidence of aggressive events in the PIU. The daily total OAS score correlated positively with the daily mean age of patients with schizophrenia and bipolar disorder. By contrast, the OAS total score demonstrated a negative correlation with the daily mean age of patients with major depression. The age of the patients at diagnosis is an important group structure that affects the incidence of aggression in a PIU.

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## 1. Introduction

Aggression is a group behaviour. People may or may not be aggressive depending on which people are around them. Patients with severe mental illness are at high risk for demonstrating aggressive behaviour (Swanson, 1994; Eronen et al., 1996; Friedman, 2006; Douglas et al., 2009). Therefore, psychiatric inpatient units (PIU) are prone to experience aggressive episodes (Barlow et al., 2000) and both patients and the victims of aggression have reported feeling traumatised and demoralised after exposure to aggressive events (Menckel and Viitasara, 2002).

Most studies of aggressive psychiatric patients in PIUs have investigated patient-related factors affecting aggression in PIUs. The diagnosis and increased severity of symptoms of schizophrenia were found to increase the incidence of aggression in PIUs (Krakowski et al., 1999; van Dongen et al., 2012). Other diagnoses, such as bipolar disorder (Binder and McNiel, 1988; Barlow et al., 2000), substance abuse (Beck, 2004) and borderline personality

disorder (Brent et al., 1993; Estroff et al., 1994) also reportedly increased the risk of aggressive episodes in PIUs. By contrast, a diagnosis of depression decreases the incidence of aggression in PIUs (Ferguson et al., 2005). However, even patients with similar diagnoses demonstrate significantly different incidences of aggression depending on the group structure of the PIU (Caudill, 1958; Katz and Kirkland, 1990). Increased unit occupancy (Owen et al., 1998), crowding (Kumar and Ng, 2001; Chou et al., 2002) and high ratios of males, the physically ill and disoriented patients increased the risk of aggression in PIUs (Owen et al., 1998). Many factors, including staff–patient and patient–patient interactions, affected aggression in PIUs (Papadopoulos et al., 2012). The verbal aggression and following de-escalation defined by verbal interventions by staff to decrease the aggressive behaviors of the patients were the most frequently observed sequences related to aggression in PIUs (Bowers et al., 2013). Implementation of a violence prevention program, including education of staff and re-grouping of the patients according to symptom severity, significantly decreased the incidence of aggression in PIUs (Magnavita, 2011).

Aggression in PIUs results from complex interactions between the situational demands and various group structures, including changes in the demographic and clinical characteristics of the PIU

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(Daffern et al., 2007; Hamrin et al., 2009). In PIUs, patients closely interact with each other in a cramped space with new daily admissions and discharges. According to the social learning theory proposed by Bandura (Bandura, 1978), aggression is acquired by viewing aggressive models. Therefore, an aggressive event itself could be a predisposing factor to aggression in the PIU. A subculture in which people have repeated contact is an important source of aggression (Bandura et al., 1961; Bandura, 1978). Accordingly, the study of aggression in PIUs requires a continuous monitoring of the aggressive events and changes in the group characteristics of the patient populations. The aim of our current study was to identify the relationship between the daily occurrence of aggressive events and daily changes in the demographical and clinical characteristics of the patient population in a PIU.

## 2. Methods

### 2.1. Patients and setting

This study was conducted between May 2010 and February of 2011 at the PIU of the Department of Psychiatry, Ulsan College of Medicine, ASAN Medical Center, a tertiary referral hospital that admits approximately 100,000 patients annually and has the largest number of licensed beds in Seoul, Korea. The PIU of ASAN Medical Center is a closed unit with 42 beds. A large number of patients, usually more than 70% of the patients, are hospitalized involuntarily for acute treatment of symptoms via outpatient clinic or emergency room. The study participants included all inpatients admitted to the PIU during the study period. The investigation was carried out in accordance with the latest version of the Declaration of Helsinki and the study design was approved by the Institutional Review Board of Asan Medical Center, Seoul, Korea.

### 2.2. Assessment of ward aggression and the clinical characteristics of the patient population

Aggressive behaviors were closely monitored 24 hours a day by inpatient staffs, including nurses, doctors, and other professional disciplines. The occurrence and severity of aggression was measured daily using the Overt Aggression Scale (OAS) (Yudofsky et al., 1986; Kim and Lee, 1992). In the present study, the terms “aggression” and “aggressive behaviour” are used interchangeably and aggression is defined operationally by the items in the OAS. In the OAS, aggressive behaviors are divided into four categories, each with a 4-point Likert scale. The categories are verbal aggression, physical aggression against objects, physical aggression against self, and physical aggression against other people. Using the OAS, all behaviors exhibited during an aggressive episode and following therapeutic interventions are recorded immediately after the incidence. The daily total aggression score was defined by the sum of the individual total scores of the OAS measured during a day. The individual total OAS scores were calculated by adding the scores of the four subcategories of OAS, ranging from 0 to 16. The clinical diagnoses of these patients were made by a psychiatrist according to the fourth edition of the *Diagnostic and Statistical Manual of Mental Disorders: DSM-IV-TR* (American Psychiatric Association, 2000). All demographic data were acquired using the electronic medical recording system of the hospital (Park et al., 2008). The total number of patients and number of admissions and discharges from the PIU were determined each day. The number of patients with different diagnoses and their average age was determined daily. The clinical and demographic characteristics between the patients who did and did not demonstrate aggression were compared using a two-sample *t* test. Diagnoses and sex between the aggressive and non-aggressive groups were compared using a Chi-square or Fisher exact test. The distributions of quantitative variables, including age, number of admitted patients, and days admitted between the two groups were compared using Student's *t* test.

### 2.3. Time series analysis

The main objective of the present study was to assess the influence of changes in the group characteristics on aggression in PIUs. The group characteristics included the daily total number of patients, ratio of male to female patients, the number of admissions and discharges, and the number and mean age of the patients with each diagnosis, including schizophrenia, bipolar disorder, and major depressive disorder.

The age ratio of the patients with schizophrenia or bipolar disorder to the patients with depression was calculated as a proxy to represent the instability of the age structure in the inpatient population.

Cross-correlation function (CCF) and autoregressive integrative moving average (ARIMA) modeling were used to assess these changes. CCF modeling was used to

assess the group characteristics that affect the incidence of aggression because CCF quantifies any linear relationship between two equally spaced time series while taking into account time lag, in our case, group characteristics of the patient population and daily aggression measured using the total OAS scores. The CCF approach enabled us to calculate correlations at different times relative to the onset of the aggression, and therefore consider the distinct temporal dynamics of each of the group characteristics that affect aggression in the PIU. CCF modeling results were considered significant if they exceeded twice the estimated standard deviation of the null distribution within  $-7$  lags, corresponding to one week of group characteristics preceding the occurrence of aggression.

Because group characteristics and the occurrence of aggression could demonstrate serial dependencies or common trends, or both, that could lead to biased results in CCF modeling, ARIMA modeling was used to derive “pre-whitened” stationary residuals, from which pairwise CCF models were calculated (Gartner and Parker, 1990). Here, ARIMA was adopted as a stringent filtering technique to avoid spurious results (Bloom et al., 2007) because residuals of the ARIMA modeling represent portions of the time series, from which possible confounding factors are regressed out. The best-fit ARIMA model for each time series had the lowest Akaike information criterion from the array of ARIMA (*p*, *d*, *q*) models, in which *p*, *d* and *q* ranged between 0–3. CCF modeling was then used to assess the residual time series after ARIMA modeling, and any relationship between unanticipated changes, group characteristics and aggression was assessed. R was used for all statistical analyses (Team, 2009).

## 3. Results

### 3.1. Characteristics of the patients showing aggression

Among the 443 patients who were enrolled in this study, 126 (28.44%) demonstrated aggressive behaviours after admission. The daily average total aggression score was  $7.8 \pm 8.6$  points. Sixty-nine (33.66%) male patients of a total of 205 male patients demonstrated aggressive behaviours, while 57 (23.95%) female patients of 238 female patients demonstrated aggression; a difference that was statistically significant ( $P < 0.05$ ). Aggressive patients required longer hospitalizations than non-aggressive patients did ( $31.7 \pm 20.5$  vs.  $19.5 \pm 16.7$  days, respectively;  $P < 0.0001$ ). There was no significant difference between the ages of the aggressive and non-aggressive patients ( $36.8 \pm 16.4$  vs.  $38.5 \pm 17.22$  years, respectively;  $P = 0.3303$ ). The population was categorized into four diagnosis groups; bipolar disorder, major depression, schizophrenia and other diagnoses (including alcohol abuse, anxiety disorder, delusional disorder, organic brain syndrome, personality disorder, and schizoaffective disorder). Aggressive patients were most frequently diagnosed with bipolar disorder (39.7%), followed by other diagnoses (26.1%), schizophrenia (19.1%), and major depressive disorder (15.1%). This result was in contrast to non-aggressive patients, who were most frequently diagnosed with bipolar disorder (27.7%), followed by other diagnoses (26.6%), major depressive disorder (25.2%), and schizophrenia (20.5%) ( $\chi^2 = 8.9$ ,  $df = 3$ ,  $P < 0.05$ ).

### 3.2. Time series analysis

Fig. 1 shows the strong positive and negative correlations between the daily total aggression score and the mean ages of the patients with schizophrenia, bipolar disorder and major depression and the age ratio of the patients with schizophrenia or bipolar disorder to the patients with depression. The significant CCFs for group characteristics including the mean ages of the patients at different diagnoses and aggression are shown in Fig. 2. The daily total aggression score demonstrated significantly positive cross-correlations with several group characteristics, including the daily number of total patients, daily number of male patients, mean daily age of patients with schizophrenia, mean daily age of patients with bipolar disorder and the mean daily age of patients with major depression. As presented as asterisk labeled bars of Figs. 2 and 3, positive cross-correlations at negative time lags indicate that changes in the group structure, such as the

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