Hipp K, Repo-TIihonen E, Kuosmanen L, Katajisto J & Kangasniemi M. 2020. PRN medication events in a forensic psychiatric hospital: a document analysis of the prevalence and reasons. International Journal of Forensic Mental Health.

Abstract

The aim of this study was to describe and explain the prevalence and reasons for as needed medication (pro re nata, PRN) in a forensic psychiatric hospital. We reviewed the documents of 67 long-term inpatients (87% male) over the one-year study period and identified 8626 PRN events. Virtually all of the patients received PRN for physical reasons, just over half for psychiatric reasons, and just over one-third for insomnia. The number of PRN events per patient was unevenly distributed. The prevalence of PRN events for both psychiatric reasons (26%) and insomnia (14%) were associated with female gender, more severe psychiatric symptoms, and lower daily functioning. Half of the patients did not receive PRN for psychiatric reasons. It is likely that the use of such medication was successfully mitigated with scheduled medication and psychosocial approaches. The high number of PRN events for physical reasons (60%) was not explained by the patient characteristics and urgent research is needed on this aspect. Protracted PRN use should be recognized in clinical practice, and consider more structured solutions to develop PRN protocols and evidence-based care should be considered. Future research should examine how PRN is integrated with patients' regular treatment and non-pharmacological methods.

Keywords: document analysis, forensic nursing, pro re nata medication, psychiatric hospitals

PRN medication events in a forensic psychiatric hospital: a document analysis of the prevalence and reasons

This paper focuses on the prevalence of and reasons for forensic inpatients' pro re nata (PRN) medication. PRN medication is prescribed so that it can be taken as needed when acute physical and psychiatric health problems arise. It is part of the pharmacological treatment that patients receive and is used in addition to, or instead of, scheduled medication. PRN is prevalent in psychiatric inpatient settings (Douglas-Hall & Whicher, 2015; Vaismoradi, Amaniyan, & Jordan, 2018) and studies have indicated that 70-90% of patients receive psychotropic PRN, medication used for psychiatric conditions (Baker, Lovell, & Harris, 2008b; Curtis, Baker, & Reid, 2007; Martin, Arora, Fischler, & Tremblay, 2017; Stewart, Robson, Chaplin, Quirk, & Bowers, 2012). PRNs are also frequently used in forensic inpatients' care, which promotes patients' wellbeing and daily functioning and protects society from dangerous offenders (Felthous & Saß, 2014; Kumpula, Gustafsson, & Ekstrand, 2019; Mental Health Act, 1990). One forensic hospital study found that 37% of patients received sedative PRNs over a two-week period (Haw & Wolstencroft, 2014).

Studies have indicated that most PRN medication is administered to a minority of psychiatric inpatients (Curtis et al., 2007; Martin et al., 2017; Stewart et al., 2012). However, studies have found different results with regard to the demographic background of these patients (Wright, Stewart, & Bowers, 2012). Increased PRN use has been associated with both male (Nicholls, Brink, Greaves, Lussier, & Verdun-Jones, 2009) and female patients (Haw & Wolstencroft, 2014), and one review concluded that patients from non-White ethnic groups were more likely to receive PRN (Wright et al., 2012). However, a study that audited medical records did not find any ethnic differences (Hales & Gudjonsson, 2004). One study carried out in a forensic setting reported that young patients received sedative PRN more often than older patients (Haw & Wolstencroft, 2014), but another study found no significant correlation between age and PRN use (Hales & Gudjonsson, 2004). Staff have indicated that PRN was just as likely to be given at any time during admission

(Barr et al., 2018). However, other articles reported that decisions were influenced by how well staff knew patients (Jimu & Doyle, 2019) and that increased PRN use was associated with a shorter stay (Haw & Wolstencroft, 2014).

The use of PRN by forensic patients has been associated with emotionally unstable personality disorders (Haw & Wolstencroft, 2014), even though staff have suggested that the patient's diagnosis does not influence PRN use (Barr, Wynaden, & Heslop 2018). However, two other studies reported that mental healthcare staff suggested that the patients' psychotic illnesses and symptoms were relevant (Jimu & Doyle, 2019; Usher, Baker, Holmes, & Stocks, 2009). It has also been noted that using PRN medication for patients with substance use disorders is problematic as they may have a tendency for drug-seeking behavior due to their substance misuse history (Baker, Lovell, Harris, & Campbell, 2007; Usher et al., 2009). Despite this, staff who took part in one study said that they were likely to use PRN when patients got agitated because of alcohol or drug withdrawal (Barr et al., 2018).

Studies have indicated that PRN medication can be used for several reasons. Psychotropic PRN has been used to prevent and manage psychiatric symptoms and insomnia (Vaismoradi et al., 2018), and the main indication for its use in psychiatric hospitals has been reported to be when patients presented as agitated (Martin et al., 2017; Molloy, Field, Beckett, & Holmes, 2012; Stewart et al., 2012). It has also been suggested that PRN played a significant role in controlling anti-social and conflict behavior (Patel, Frankel, & Tampi, 2019; Stewart et al., 2012) and managing aggressive incidents (Maguire, Daffern, Bowe, & McKenna, 2018). One study found that psychotropic PRN was the most frequently used intervention among patients with a high risk of violence (Kaunomäki, Jokela, Kontio, Laiho, Sailas, & Lindberg, 2017).

PRN is also used for physical reasons, such as pain, constipation, and nausea (Vaismoradi et al., 2018). People with a severe mental illness are more likely to have physical health problems and

associated medication needs than the general population (Byrne, 2018; Keinänen, 2018). However, there has been limited research on the use of PRN by psychiatric inpatients for physical reasons. One study reported that the most common reason was headaches and found that aggressive patients were more likely to receive PRN for physical reasons (Goedhard, Stolker, Nijman, Egberts, & Heerdink, 2007).

PRN is given orally in more than 90% of cases (Curtis et al., 2007; Goedhard et al., 2007; Haw & Wolstencroft, 2014) and the use of intramuscular injections has been reported in 6-7% (Curtis et al., 2007; Haw & Wolstencroft, 2014). The most typical time for PRN administration has varied between studies, from evening (Curtis et al., 2007) to night (Haw and Wolstencroft, 2014; Stewart et al., 2012).

PRN practices have been indicated to differ between forensic and other acute mental health settings (Barr et al., 2018), because forensic patients tend to have long-term admissions and complex and severe health problems (Askola, Nikkonen, Putkonen, Kylmä, & Louheranta, 2016). The length of the patients' admission is not limited, but their discharge is based on a prognostic assessment of their condition and whether they pose a risk of violence (Felthous & Saß, 2014; Mental Health Act, 1990). Patients in forensic care have been diagnosed with schizophrenia and other severe psychiatric illnesses (Kumpula et al., 2019), which may lead to a prevailing need for medication, including PRN. Forensic mental health nurses play a significant role in planning and making decisions on PRN, evaluating its effectiveness, and documenting effectiveness and the entire medication process (Barr et al., 2018).

Although PRN administration has been researched, studies have not tended to focus on its use by inpatients in forensic facilities (Haw & Wolstencroft, 2014). Earlier studies have mostly reviewed the use of PRN in acute psychiatric care (Wright et al., 2012) and one study compared forensic and non-forensic patients (Barr et al., 2018). Furthermore, studies have focused on medication used to

treat psychiatric conditions (Vaismoradi et al., 2018) and excluded medication used for physical reasons, even though they have been reported to be administered as frequently (Goedhard et al., 2007).

Our aim was to fill those gaps in knowledge and to describe and explain the prevalence of PRN events in a forensic hospital based on medical records. The study covered both psychiatric and physical reasons and we used the term PRN events to cover occasions on which PRN was documented to be considered, administered, or both. This knowledge can be used to develop awareness of PRN medication in long-term forensic psychiatric settings.

The research questions were:

- What is the prevalence of PRN events and how is PRN medication administered to forensic long-term inpatients?
- What psychiatric and physical reasons for PRN events are documented?
- What patient characteristics are associated with the prevalence and reasons for PRN events?

Materials and methods

We conducted a retrospective, cross-sectional study of patients admitted to a forensic psychiatric hospital in Finland in 2018. An observation sheet was developed, based on previous literature, and data from medical records was analyzed using statistical methods.

Research setting

This study was conducted in one of the two state hospitals in Finland that provides forensic psychiatric services and mental examinations for the whole country. The hospital has 284 beds for adults and 13 beds for individuals under 18. The patients are treated by 537 full-time and part-time interdisciplinary staff. These include the following full-time equivalent posts per year: 19.5 medical professionals, 28 head nurses, 169 registered nurses, 145 practical nurses, 12 psychologists, six social workers, and 14 occupational therapists. In Finland, registered nurses have a degree from a

university of applied sciences and practical nurses have a lower level degree from a vocational institution (Ensio, Lammintakanen, Härkönen, & Kinnunen, 2019).

Patients who are admitted to the hospital fall into three categories and the percentages quoted related to the end of 2017. The first is forensic patients (51%), who have committed a criminal offence, but their sentence was waived because they lack criminal responsibility. Their average stay is six years and nine months. The second is dangerous or difficult-to-treat patients (42%), who have been transferred to the hospital from municipal hospitals, due to violent and dangerous behavior, and their average stay is five years and two months. The third includes patients undergoing mental examinations (7%) to evaluate whether they lack criminal responsibility and need psychiatric treatment.

All the patients show clinical similarities, regardless of which category they fall into. More than 80% of patients have been diagnosed with schizophrenia and most have substance abuse problems and decreased ability to control their aggression. The severity of the patient's symptoms, and their effect on their behavior, is regularly assessed with the Global Assessment of Functioning (GAF). The GAF scale comprises 10 items, each based on a 10-point scale, that covers the patient's psychological, social, and occupational functioning (Monrad Aas, Sonesson, & Torp, 2018). In addition, the risk of violent behavior is assessed with the Violence Risk Screening -10 (V-RISK-10) tool. The tool comprises 10 assessment items that cover the patient's historical, clinical, and future risk and these are scored on a scale that ranges from 0-2 points (Bjørkly, Hartvig, Heggen, Brauer, & Moger, 2009).

Both scheduled medication and unscheduled PRN medication are used to treat patients. PRN medication is prescribed by physicians and mostly administered by registered nurses who need at least six months' work experience. PRN administration is confirmed by two registered nurses. Non-pharmacological methods, such as psychosocial interventions, occupational and cognitive behavior

therapy, and group activities, are the preferred first-line treatment before PRN. Furthermore, hospital staff are instructed to avoid the sustained use of benzodiazepines and the use of short-acting benzodiazepines due to their addictive nature.

Recruitment

After receiving ethical approval from the Committee on Research Ethics of the University of Eastern Finland and a research permit, a researcher (X.X.) contacted a head nurse and a pharmacist who informed all the hospital's head nurses about the study. We included adult patients who had been treated for more than one year and who were capable of providing informed consent to review their records. Two recruitment strategies were used. We held meetings in all 13 adult wards to inform patients about the study and gave them the chance to discuss the study with a researcher on a one-to-one basis and enroll. We also left study leaflets on the wards for patients who were not able to attend the meetings and encouraged them to contact the head nurses if they were willing to participate.

Informed consent was provided by 79 patients and, after consulting their physicians, we excluded one patient who was incapable of providing consent. We also excluded 10 patients who had been in hospital for less than one year and one who was discharged before the data collection. The final cohort comprised 67 patients.

Data collection

An observation sheet was developed to collect the data from patient documents, based on previous literature (e.g. Hipp, Kuosmanen, Repo-Tiihonen, Leinonen, Louheranta, & Kangasniemi, 2018; Stewart et al., 2012; Wright et al., 2012). This comprised 35 items: 10 on background information, 13 on PRN events, seven on planning PRN medication, and five on patient education. The items were evaluated by a head nurse and the study's steering group. Two pilot tests were carried out. First, we analyzed the data of eight (11.9%) patients to identify pertinent items that

were consistently reported in each patient's documents and removed variables that did not produce comparable or collectable data, due to irregular documentation. Then we tested the revised sheet with data from five patients (7.5%) and no further changes were needed.

The revised observation sheet comprised 14 questions on patient characteristics and seven questions on PRN events. The patient characteristics included their demographics and their clinical and admission characteristics. The demographics reported by this paper include age, gender, language, and level of education. It also reports clinical characteristics, including whether the patients were forensic or dangerous or difficult-to-treat, their primary diagnosis, any substance use disorder diagnosis, and their GAF and V-RISK-10 values. The admission characteristics included length of stay and any neurostimulation therapy, namely electroconvulsive therapy or transcranial direct current stimulation. We have used the questions on PRN events to report the time and reason for the PRN event and by what route medication was administered.

We collected up-to-date data from the electronic patient information system in spring 2018. The researcher (X.X.) extracted the characteristics for each patient and the GAF and V-RISK-10 values throughout the year. The average values were used in the analysis. The written data on patient characteristics were classified into 2-5 categories. (Table 1).

The researcher also reviewed the nursing notes from 1 April 2017 to 31 March 2018 to identify PRN medication events in which medication was considered, administered, or both. We defined PRN as medication used on an as-needed basis and accepted voluntarily. We included stat medication, which is medication that is prescribed to be administered immediately on one occasion. We reviewed all PRN medication, except non-pharmacological throat lozenges, nicotine products, and non-pharmacological lotions and creams. PRN events were identified for each patient so that we could calculate the proportion of patients who received PRNs and make comparisons based on patient characteristics.

The PRN event times were grouped into four shifts: morning (06.00–11.59), afternoon (12.00 to 17.59), evening (18.00–23.59), and night (00.00 to 05.59). There were eight categories for the administration route: oral administration; topical medications; eye, ear, and nose medications; rectal administration; inhaled medication; injections; other routes; and a combination of routes. We noted the reason for the PRN administration as recorded by nurses. In the absence of such a record, we based the reason on the indication in the prescription. There were 54 cases when the documented reason indicated both psychiatric symptoms and insomnia and we categorized those as psychiatric reasons. We grouped the reasons into 10 categories for the data analysis (Table 2).

Data analysis

We collected the data from the 67 medical records, placed them into an Excel spreadsheet (Microsoft Office, WA, USA) and exported it to SPSS version 24 (IBM Corp, NY, USA) for further analysis. Descriptive statistical methods were used to depict patient characteristics and PRN events. We chose nonparametric tests for the analyses, because the continuous variables were not normally distributed. We used a p-value of .05 as the cut-off for statistical significance. To determine the associations between discrete variables, such as time and the reason for the PRN event, we used cross-tabulation with Pearson's chi-square test and Fisher's exact test. The latter was chosen if more than 20% of the cells had expected frequencies of less than five. We used Spearman's correlation (r_s) to discover relationships between continuous variables, such as age and the number of PRN events. The Mann-Whitney U and Kruskal-Wallis tests were used to compare differences between the groups. These comparisons were made between the patient characteristics and also between the patient characteristics and PRN administration.

Research ethics approval

The study was reviewed and approved by the Committee on Research Ethics of the University of Eastern Finland and the hospital board. In line with the research permit, we obtained both oral and

written informed consent from the participants after they had been given adequate time to consider whether they wanted to take part.

Results

Characteristics of the patients

The data comprised the medical records of 67 patients (86.6% male) with a mean age of 43 years (range 21-72 years). More than half had only attended primary school (53.7%) and a further third (34.3%) had completed secondary school. Most were native Finnish speakers and the others were able to speak Finnish (Table 1).

Two-thirds (62.7%) were forensic patients, including just one female, and the rest were dangerous or difficult-to-treat patients, including eight females. Forensic patients were statistically significantly older (*Mdn* = 46 years) than dangerous or difficult-to-treat patients (*Mdn* = 41 years) (Z = -2.045, p = .041). The patients had been in the hospital from one to 29 years (Table 1). There was a statistically significant positive correlation between the length of admission and the patient's age (r_s = .650, p < .001) and older patients had usually stayed in the hospital longer.

The most common primary diagnosis was schizophrenia (68.7%) followed by schizoaffective disorders (20.9%), delusional disorders (6.0%), and mood disorders (4.4%). The majority (70.1%) had a diagnosed substance use disorder. The patients received between one and eight scheduled medications for psychiatric indications and two-thirds of patients had up to three PRN medication prescriptions on their chart for psychiatric reasons (Table 1).

GAF values ranged from three to 31 out of a possible 100, with low values indicating low function (Table 1). These scores implied that the patients had severe psychiatric symptoms, serious impairments in reality testing or communication, and inabilities in daily functioning. The GAF values were statistically significantly higher among forensic (*Mdn* = 17) than dangerous or difficult-

to-treat patients (*Mdn* = 12) (Z = -2.416, p = .016) and were higher in those with diagnosed substance use disorders (*Mdn* = 17) than other patients (*Mdn* = 9) (Z = -3.137, p = .002).

V-RISK-10 values ranged from 7 to 20, and this denoted a high risk of violence as the scale only goes up to 20 (Table 1). The V-RISK-10 values were associated with age (r_s = .284, p = .020), suggesting that older patients had been assessed as more violent. A negative correlation between the V-RISK-10 and GAF values (r_s = -.355, p = .020) indicated that patients with low functioning posed a higher risk of violence.

Table 1 goes about here

PRN events

Prevalence of PRN events. The 67 patients had 8626 events in which PRN was either considered, administered, or both, over the one-year study period. The maximum was 726 per patient (Table 1). However, the events were unevenly distributed among the patients. More than half occurred in 13% of the patients, half of the patients had less than 50 events, and one patient had no events at all. PRNs were documented to be used by 25% of patients on at least 50% of the days.

PRN medication was taken 97.6% of the time it was offered or requested. On 211 occasions, it was recorded as considered but not administered, because staff refused the patient's request or the patient refused to take the medication that was offered.

Timing of PRN events. The time of PRN event was documented in most cases (97.4%) and the frequency of events increased during the day: morning (20.2%), afternoon (31.5%), and evening (40.2%). Nighttime administration was rarest, at 8.2%. (Figure 1.)

Figure 1 goes about here

Route of PRN medication. PRN medication was administered orally in 96.6% of events, followed by inhaled medication in 1.7% of events. Rectal suppositories, topical medication, and

eye, nose, or ear medication were each used in less than 0.5% of events and injections were only used five times.

Reasons for PRN events. The reason for the PRN event was documented in most cases (93.8%) and more than half (59.6%) were associated with various physical issues. Only one of the 67 patients did not receive any physical PRN. The maximum number of PRN events for physical reasons was 708. The most common reason was pain, which accounted for 42.9% of all PRN events. Only three patients did not receive any PRN pain relief. The maximum number of pain-related PRN events was 673. Other typical physical reasons for PRN were fever and flu, heartburn, bowel disfunction, shortness of breath, and extrapyramidal symptoms. They accounted for 15% of events (Table 2).

Psychiatric reasons were the second most common reason for PRN events (26.0%). Just over half of the patients had at least one PRN for psychiatric reasons (*Mdn* = 14, range 1-385). The most common psychiatric reason for medication was anxiety (65.7%). Psychotic symptoms were described in 21.3% of cases, meaning that the documentation indicated that the nurse had concerns about the state of the patient's mental health or the patient had described psychotic symptoms. In one-quarter of these cases, the records mentioned hallucinations. Aggression was the reason in 2.8% events, but violent behavior was only documented three times. Psychiatric reasons also included depressive moods, such as suicidal thoughts and hopelessness. The most infrequently documented reason for psychiatric PRN was hypomania (Table 2). Some of the psychiatric PRN medication (1.0%) had been administered when the patient had described physical symptoms. Patients who frequently had PRN events for psychiatric reasons also had significantly more PRN events for insomnia ($r_s = .585$, $p < .001$) and physical reasons ($r_s = .453$, $p < .001$).

Insomnia was a reason for PRN in 14.3% of events. Only four patients had more than 100 events for insomnia and the maximum number was 270. The use of this medication was occasional in the majority of cases and most patients (62.7%) did not use any medication for sleeping problems.

Table 2 goes about here

The reasons for PRN events varied in relation to the time of day ($p < .001$) (Figure 1). PRN events for psychiatric reasons were most common in the afternoon (55.6%) and rarest at night (3.9%). PRN for insomnia was mostly used in the evening (87.7%). PRN events for physical reasons occurred more equally during the day. Nighttime events were less frequent for all physical reasons~~; heartburn and bowel disfunction were more common (13.4%) than other reasons, each of which accounted for less than 10%.~~

Patient characteristics associated with PRN events

The prevalence of PRN events per patient was examined in relation to gender, level of education, age, status, primary diagnosis, any substance use disorder, length of stay, GAF value, V-RISK value, and any neurostimulation therapy received. The associations are described in Table 1. ~~A negative correlation (*r*$_s$) indicates a relationship in which one variable increases as the other decreases.~~

All PRN events. The patients who received neurostimulation therapy had statistically significantly more PRN events than patients without this treatment. There was also a statistically significant link between PRN and dangerous or difficult-to-treat patients, as they had more events than forensic patients. (Table 1.)

PRN events for physical reasons, psychiatric reasons, and insomnia. When we reviewed the prevalence of PRN events for physical reasons, we found that it was not associated with any patient characteristics (Table 1).

We found that female patients were more likely to have PRN events for both psychiatric reasons and insomnia than males. The number of PRN events for psychiatric reasons and insomnia was also higher among dangerous or difficult-to-treat patients than forensic patients. Patients who had received neurostimulation therapy had more PRN events for psychiatric reasons and insomnia. The GAF value was the characteristic that was most significantly related to the frequency of PRN events for psychiatric reasons and insomnia, as they were more common in patients with low GAF values. (Table 1.)

Discussion

This study produced new knowledge about how frequently PRN medication was used among long-term inpatients in a forensic psychiatric hospital. We found that PRN was commonly administered to this patient group and it was particularly used to alleviate patients' pain, anxiety, and sleeping problems. However, the number of PRN events per patient was unevenly distributed and higher among dangerous or difficult-to-treat patients and patients who received neurostimulation therapy. PRN for both psychiatric reasons and insomnia were also associated with female gender and low daily functioning. PRN events for physical reasons were not related to patient characteristics.

Prevalence of PRN events

All but one of the 67 patients received PRN during the study period, which strengthen the previous knowledge that PRN is commonly used in psychiatric inpatient settings (Douglas-Hall & Whicher, 2015; Vaismoradi et al., 2018). We reviewed PRN events over one year, in contrast to earlier studies that explored shorter periods, usually in acute units. Previous studies indicated that PRNs were used more frequently at the beginning of psychiatric hospital admissions (Baker, Lovell, & Harris, 2008a) and we demonstrated that the use of PRN was also common among long-term forensic inpatients.

PRN was mainly administered orally, similar to previous studies. However, we found that intramuscular injections were exceptional, unlike other studies (Curtis et al., 2007; Haw & Wolstencroft, 2014). Our result can partly be due to that we only included patients who were willing and capable of giving informed consent but also to the fact that national policy in Finland is to avoid chemical sedation.

The prevalence of PRN events increased towards evening, particularly for insomnia, which understandably occurs at that time of day. We found that PRN for psychiatric reasons was most frequent in the afternoon, perhaps due to diurnal variations noted for psychiatric symptoms (Crowe, Daly, Delaney, Carroll, & Malone, 2018). However, the literature produced inconsistent results about the daily fluctuation of PRN administrations (Haw & Wolstencroft, 2014; Curtis et al., 2007; Stewart et al., 2012). Disparities may have resulted from different medication protocols and treatment approaches.

Reasons for PRN

In our study, just over half of the patients received PRN for psychiatric reasons, which was lower than the 70-90% reported by studies that lasted two weeks to three months (Baker et al., 2008b; Curtis et al., 2007; Haw & Wolstencroft, 2014; Martin et al., 2017; Stewart et al., 2012). The lower percentage could have been due to the hospital's medication protocol, which aims to reduce PRN use for psychiatric reasons by optimizing scheduled medication and non-pharmacological methods. Furthermore, only 37% of patients had used PRN for insomnia and most of them had only used it occasionally for this problem. When we compared our results to previous studies, we noticed that melatonin was the most common PRN regimen for insomnia and that benzodiazepines were rarely used, unlike in earlier PRN studies (Baker et al., 2008a; Molloy et al., 2012). This could have been due to the hospital's policy of avoiding benzodiazepines and the lack of withdrawal symptoms in long-term inpatients, which could trigger the need for PRN in acute settings (Barr et al., 2018).

It should be noted that almost a half of the patients did not receive PRN for psychiatric reasons. This was significant, particularly because the patients we reviewed were diagnosed with psychotic illnesses and the majority were aggressive and difficult to treat. It has been reported that staff may be keen to administer psychotropic PRN to this patient group (Goedhard et al., 2007; Kaunomäki et al., 2017; Maguire et al., 2018). Nurses have implied that appropriate dosing of scheduled medication (Barr et al., 2018) could reduce the use of psychotropic PRN. Considering the severity of the mental illnesses in our patient group, it is likely that their acute symptoms were successfully mitigated with scheduled medication.

Our results revealed that 60% of PRN events occurred for physical reasons and we felt this was high because patient care included regular physical health assessments and treatment. However, it has been reported that people with severe mental illnesses have physical health problems more frequently than the general population (Byrne, 2018; Keinänen, 2018). Furthermore, some of the physical reasons for PRN, such as headaches, constipation, and extrapyramidal symptoms, may have been derived from scheduled medication and their side effects (Cuomo et al., 2019; Essali et al., 2019).

Most patients needed some medication for pain, which has been reported to be the most common physical reason for PRN (Goedhard et al., 2007). Some patients had received daily analgesics for a long time. This raises a question about the relationships and differences between PRN and scheduled medication. In some cases pain was not defined in the nursing notes or the patient had pain in several places. In our cohort, patients' pain could also have been due to a history of substance use, resulting in permanent tissue damage. Furthermore, patients can also become attached to pain medication.

A quarter of patients used PRNs daily or most days. Protracted PRN use may be caused by medically explained indications, but psychosomatic symptoms can also be an issue (Rief & Martin,

2014). We also wonder if some patients got into the habit of requesting PRNs or used them as a way of interacting with the staff. More research with different methods is needed to analyse possible reasons for the protracted use of PRN. Prolonged and repetitive use of PRNs raises doubts about the long-term outcomes of medication. If a patient needs PRN medication every day for the same reason, it would be better to consider more structured solutions. This would involve anticipating, and planning, non-pharmacological methods for each patients' usual and individual psychiatric and physical health problems. Solutions need to be based on evidence-based practice, including patients' preferences.

Patient characteristics linked to increased PRN use

A small subgroup of patients received a high amount of PRN, in line with earlier studies of acute units (Curtis et al., 2007; Martin et al., 2017; Stewart et al., 2012). There was a positive correlation between the number of PRN events for physical and psychiatric reasons. This suggests that medication played a more prominent role in some patients' care and they were keen to use PRNs for both physical and psychiatric health problems.

Female patients had more PRN events for both psychiatric reasons and insomnia. This finding agreed with another study conducted in a forensic hospital (Haw & Wolstencroft, 2014), but not with feedback from nurses from an acute psychiatric unit who indicated that PRN was more likely to be given to male patients (Usher et al., 2009). The reliability of our results was weakened by the male-dominated data, which reflected the patient demographics of the hospital. Gender-related differences in PRN use still need to be studied in the future. It could be that female patients experience anxiety and insomnia more often or that they are keener to use medication to alleviate these symptoms. Alternatively, female and male inpatients may be treated differently and have different opportunities to receive PRN.

Our results suggest that patients with more severe psychiatric symptoms and lower daily functioning needed PRN for psychiatric reasons and insomnia more frequently. It is notable that aggression is covered by the GAF evaluation and it can lower GAF values in this group. However, the number of PRN events was associated with GAF values, but not with violence screening values. This implies that the prevalence of PRN events could have been more affected by deficiencies in functioning than a propensity for violence. This result was unexpected, since earlier studies suggested that increased PRN use was connected to patients' aggression (Goedhard et al., 2007; Usher et al., 2009). Further research, using data of recorded incidents of violence, is required to provide evidence of the relation between PRN frequency and patients' actual violence.

Previous studies have shown that medication has been used to prevent violent behavior (Vaismoradi et al., 2018) and tranquillizers and sedation are used to manage acute aggression and agitation (NICE, 2015; Patel et al., 2019; Zaman et al., 2018). However, studies have reported that aggression has also been treated with psychosocial and cognitive behavioral methods (Lee & DiGiuseppe, 2018), which were also widely used in the study hospital (Aho-Mustonen, Tiihonen, Repo-Tiihonen, Ryynänen, Miettinen, & Räty, 2011; Kuivalainen, Vehviläinen-Julkunen, Louheranta, Putkonen, Repo-Tiihonen, & Tiihonen, 2017). These methods have also decreased coercive measures when caring for patients who engage in violent behavior (Putkonen et al., 2013). Based on our results, which were strengthened by earlier studies, we believe that non-pharmacological interventions are increasingly used to manage aggressive behavior. This also appeared to be successful, because aggressive incidents were rarely documented.

We did not find patient characteristics that would explain the frequency of PRN events for physical reasons and future research on this is needed due to the lack of existing studies.

Strengths and limitations

The strengths and limitations of this study related to the cohort, observation sheet, and data. At the time of the study, 224 adult patients had been treated by the hospital for more than a year. The hospital board stated that we needed informed consent to review the patients' documents. All the eligible patients had an equal chance to participate, but some were unwilling to take part or incapable of providing consent. This might have biased our sample, because PRN use in this group of patients may differ from our data. However, the sample reflected the hospital's patient demographics. The data were collected in one hospital, but the data were nationally representative as the hospital treats two-thirds of Finnish forensic patients. Our sample was not representative of all psychiatric settings, due to the psychiatric diagnoses, the prevalence of a history of substance use, and the high risk of violence of the cohort. Our study is the first of its kind in Finland. However, forensic care differs between countries, due to laws, procedures, and institutions (Nedopil, Taylor, & Gunn, 2015), and further studies are needed to confirm our results.

The observation sheet used to collect data was developed based on previous literature and the professional and academic expertise of the research group. The sheet was tested with two pilot rounds. A limitation was that it did not include information about the patients' physical illnesses and that could have indicated why they needed extra medication. A strength of the study was the length of the study period, as we retrieved a large number of events over the course of a year, unlike previous studies with shorter periods.

The retrospective data collection enabled us to represent the procedures for PRN medication during the study period. Patient documents have been produced for other reasons than research and this means that the data in this study were unaffected by the research process (Bowen, 2009). Our data relied on the documents and we acknowledge that poor PRN documentation has been noted in the literature (Martin et al., 2017). However, our data is strengthened by the systematic double checks required by the hospital and due to the fact that one nurse is responsible for the medication

and its punctual documentation in the unit during a shift. An exception could have been PRN medication given to patients in their room for self-administration. This was rarely documented and mainly concerned asthma medication. In addition, we acknowledge that a number of events were probably undocumented, namely when PRN medication was considered but not administered. When the reason for PRN was not documented, we categorized it based on the medication used. We acknowledge that PRNs can be administered for other than the prescribed indication (Baker et al., 2008a). However, the earlier literature has mostly concerned psychotropic medication (Vaismoradi et al., 2018). In our data, reason was most commonly undocumented when PRNs were used for physical reasons.

The suitability of the statistical tests used for the analysis was ensured by consulting a statistical specialist. Document analysis provided the results of the prevalence of, and the reasons for, PRN medication. However, triangulation of the research methods is needed to gain more comprehensive understanding of this issue.

Conclusions

PRN medication is one way to respond to patients' psychiatric and physical acute needs. Our study concluded that PRN events were common among long-term patients in a forensic hospital and further research is needed, especially on PRN for pain and other physical reasons. Our results showed that psychotropic PRN is not used for all inpatients with psychotic illnesses and a high risk of violence, but it is linked to more severe deficiencies of functioning. In some situations, PRN can be the only option available, but it may be replaced by psychosocial approaches as the patient's treatment proceeds.

~~In view of the frequency of PRN events highlighted by our study~~, Further research is needed to develop a more complete understanding of the relationship between PRN and scheduled medication. Studies should also focus on how to integrate PRN with regular treatment and non-

pharmacological methods and how PRN is related to violent incidents. It is important that healthcare professionals communicate openly with patients, so that they understand how to promote their health, perceive different symptoms, identify indications for PRN, and explore non-pharmacological coping strategies.

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Declaration of interest

None.

Table 1

Patient characteristics associated with the prevalence of PRN events. Statistically significant values ($p < .05$) in bold.

		All PRN events	PRN events for physical reasons	PRN events for psychiatric reasons	PRN events for insomnia
	Number (%)	*Mdn* (range)	*Mdn* (range)	*Mdn* (range)	*Mdn* (range)
All patients	67 (100.0)	51 (0-726)	34 (0-708)	1 (0-385)	0 (0-270)
Characteristic					
Gender[1]		Z = -1.922, p = .055	Z = -1.021, p = .307	**Z = -3.121, p = .002**	**Z = -2.521, p = .012**
Male	68 (86.6) 9	41.5 (0-714)	32 (0-708)	**0 (0-230)**	**0 (0-232)**
Female	(13.4)	223 (9-726)	47 (6-263)	**73 (0-385)**	**2 (0-270)**
Level of education[2]	4 (6.0)	x^2 = 1.00, p = .801	x^2 = 1.83, p = .609	x^2 = 3.48, p = .323	x^2 = 5.75, p = .124
Primary school not completed	36 (53.7)	74.5 (14-413)	47.5 (14-329)	4 (0-5)	21 (0-79)
Primary school	25 (37.3)	35 (1-726)	29 (1-375)	0 (0-385)	0 (0-270)
Secondary or higher education	2 (3.0)	55 (0-714)	32 (0-708)	3 (0-230)	1 (0-232)
Unknown		113 (41-185)	108 (40-175)	5.5 (1-10)	0 (0-0)
Status[1]		**Z = -2.379, p = .017**	Z = -1.569, p = .117	**Z = -2.973, p = .003**	**Z = -2.322, p = .020**
Forensic patient	42 (62.7)	**34 (0-650)**	32 (0-338)	**0 (0-230)**	**0 (0-232)**
Dangerous/difficult-to-treat	25 (37.3)	**91 (2-726)**	42 (1-708)	**5 (0-385)**	**2 (0-270)**
Primary diagnosis[2]	46 (68.7)	x^2 = .604, p = .739	x^2 = .096, p = .953	x^2 = 2.674, p = .263	x^2 = 1.644, p = .439
Schizophrenia	14 (20.9)	45 (0-726)	37 (0-708)	1 (0-385)	0 (0-270)
Schizoaffective disorder	7 (10.4)	59 (8-650)	29 (8-118)	7 (0-313)	0 (0-232)
Other		55 (5-76)	36 (5-55)	0 (0-14)	2 (0-44)
Substance use disorder[1]		Z = -0.617, p = .537	Z = -1.706, p = .088	Z = -1.235, p = .217	U = -1.508, p = .132
Yes	47 (70.1)	55 (0-714)	42 (0-708)	0 (0-230)	0 (0-232)
No	20 (29.9)	39 (1-726)	24 (1-329)	1 (0-385)	1 (0-270)
ECT or tDCS received*[1]		**Z = -2.472, p = .013**	Z = -1.144, p = .253	**Z = -2.411, p = .016**	**Z = -1.976, p = .048**
Yes	10 (14.9)	**324 (4-726)**	60 (4-188)	**130 (0-385)**	**3 (0-270)**
No	57 (85.1)	**41 (0-714)**	32 (0-708)	**1 (0-200)**	**0 (0-187)**
	Mdn (range)	Correlation	Correlation	Correlation	Correlation
Age in years[3]	45 (21-72)	r_s = .072, p = .562	r_s = .098, p = .430	r_s = -.099, p = .423	r_s = .020, p = .871
Length of stay in years[3]	5 (1-29)	r_s = -.149, p = .230	r_s = -.083, p = .505	r_s = -.229, p = .062	r_s = -.197, p = .109
GAF value[3]	16 (3-31)	r_s = -.218, p = .077	r_s = -.046, p = .712	**r_s = -.432, p < .001**	**r_s = -.350, p = .004**
V-RISK-10 value[3]	16 (7-20)	r_s = .086, p = .487	r_s = .133, p = .282	r_s = .004, p = .974	r_s = -.024, p = .845

[1]Mann-Whitney U test, [2]Kruskal-Wallis test, [3]Spearman's correlation
*ECT = Electroconvulsive therapy, tDCS = transcranial direct current stimulation

Table 2.

The reasons for the 8626 PRN events and their prevalence in the medical records of the 67 patients.

Reason for PRN event	Number of events (%)	Number of patients who had events (%)	Median and range among patients who had events
Physical reasons	**5145 (59.6)**	**66 (98.5)**	**35 (1-708)**
Pain	3701 (42.9)	64 (95.5)	20 (1-673)
back or neck pain	893	31	6 (1-528)
headache	772	50	6 (1-142)
toothache	684	45	4 (1-156)
limb pain	665	34	4 (1-165)
pain in several places	472	17	4 (1-252)
undefined pain	206	29	2 (1-54)
other pain	9	5	2 (1-3)
Flu or fever	540 (6.3)	49 (73.1)	7 (1-64)
Heartburn	280 (3.2)	17 (25.4)	4 (1-183)
Bowel disfunctions	275 (3.2)	26 (38.8)	2 (1-136)
Shortness of breath	116 (1.3)	10 (14.9)	12 (1-30)
Extrapyramidal symptoms	87 (1.0)	4 (6.0)	22 (2-41)
Skin disorders	30 (0.3)	8 (11.9)	1 (1-14)
Other	116 (1.3)	24 (35.8)	3 (1-23)
Psychiatric reasons or insomnia	**3481 (40.4)**	**40 (59.8)**	**23 (1-655)**
Psychiatric reasons	2245 (26.0)	36 (53.7)	14 (1-385)
anxiety	1474	30	10 (1-240)
psychotic symptoms	479	22	5 (1-142)
aggression	42	12	2 (1-14)
anxiety prevention	39	7	5 (1-13)
depressive mood	28	8	3 (1-7)
somatization	23	11	1 (1-6)
hypomanic symptoms	6	4	2 (1-2)
not specified	154	22	3 (1-22)
Insomnia	1236 (14.3)	25 (37.3)	8 (1-270)
Total	8626 (100.0)	66 (98.5)	52 (1-726)