Factors associated with non evidence-based prescribing of antipsychotics

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Abstract

Objectives: Non evidence-based prescribing of antipsychotics is common in the UK and internationally with high doses and polypharmacy the norm. These practices often remain even after systematic attempts are made to change. We aimed to establish which factors are linked to antipsychotic prescribing quality so we can identify and target patients for interventions to improve quality and allow us to understand further the drivers of non evidence-based prescribing.

Method: A cross-sectional survey with a collection of factors potentially affecting antipsychotic prescribing quality outcomes was carried out in eight secondary care units in England. Participants were inpatients prescribed regular antipsychotics on the day of the survey. Antipsychotic dose, polypharmacy, type and route were the main outcome measures.

Results: Data were collected for 1198 patients. Higher total dose was associated with greater weight, higher number of previous admissions, longer length of admission, noncompliance with medication and use of an atypical antipsychotic. A lower total dose was associated with clozapine use. Polypharmacy was associated with not being a patient at the South London and Maudsley NHS Trust centre, the subject having a forensic history, a greater number of previous admissions and higher total dose. Younger age, not being detained under a Mental Health Act section, atypical antipsychotic use and oral route were predictors of antipsychotic monotherapy. Atypical antipsychotic use was associated with oral route, higher total dose, being administered only one antipsychotic, having had fewer previous antipsychotics and no anticholinergic use. Use of the oral route was associated with not being sectioned under the Mental Health Act, atypical antipsychotic use, younger age, non-schizophrenia diagnosis, fewer previous admissions and a lower total dose.

Conclusion: In patients with chronic illness who are detained, heavier, noncompliant, not taking clozapine and on a depot antipsychotic, prescribers use larger doses and antipsychotic polypharmacy. We found that use of percentage of licensed maximum doses favours typical antipsychotics arbitrarily, and that high doses and polypharmacy are inextricably linked.

Keywords: antipsychotic agents, ethnology, drug administration routes, clozapine, polypharmacy, inappropriate prescribing

Introduction

Non evidence-based prescribing of antipsychotics is common in the UK and internationally (Barnes and Paton, 2011]. Most studies examining outcomes such as dose, type, route and antipsychotic combination report a situation where high doses and polypharmacy are the norm [Harrington *et al.* 2002; Taylor *et al.* 2002]. These practices often remain even after systematic and vigorous attempts are made to change [Paton *et al.* 2008]. Although individual organisations can make dramatic improvements in prescribing quality through multidisciplinary quality improvement programmes [Mace and Taylor, 2014], such successes are rare.

Antipsychotic polypharmacy should be avoided for several reasons. Firstly it is illogical. Combining medicines with different mechanisms of action has understandable theory for the treatment of conditions such as hypertension [NICE, 2011]. However, antipsychotics have broadly similar

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mechanisms of action [Kapur and Seeman, 2001] and clinically meaningful differences between them (with the exception of clozapine) are small [Leucht *et al.* 2013]. In addition, using depot and oral medication together negates the very reason for prescribing a long-acting formulation. Secondly combining antipsychotics is harmful. We know movement, metabolic, cardiac and neurocognitive adverse effects are more likely with combinations [Waddington *et al.* 1998; Carnahan *et al.* 2006; Correll *et al.* 2007; Elie *et al.* 2010] as is increased mortality [Joukamaa *et al.* 2006]. Thirdly polypharmacy is financially costly. Prescribing more than one antipsychotic obviously costs more, particularly for atypical combinations, and increases risk of nonadherence [Fenton *et al.* 1997]. Furthermore polypharmacy is a major risk factor for high dose prescribing which compounds all of these harms.

What makes these prescribing practices so obdurate despite robust evidence to suggest they are both harmful and illogical? Most of the studies in this area reveal a lack of response to a single antipsychotic agent as the main reason for prescribing combinations. Other reasons include the use of 'when required' antipsychotics, attempting to treat persistent aggression and trying to avoid high dose monotherapy (that is, prescribing two drugs within their licensed dose range is seen as better than one drug at supramaximal dose). However, polypharmacy and high doses of antipsychotics are prescribing practices that are inextricably linked as one commonly leads to the other. Changing these practices is difficult with multifaceted interventions often providing only modest improvements [Thompson *et al.* 2008; Constantine *et al.* 2010].

Of course there are some instances when combined antipsychotic prescribing is evidence-based. These include cross titration of antipsychotics during switching [Taylor, 1997], clozapine augmentation to improve efficacy [Taylor and Smith, 2009], managing side effects (e.g. adding aripiprazole to combat raised prolactin or metabolic symptoms [Shim *et al.* 2007; Henderson *et al.* 2009]) and rapid tranquillisation [Taylor *et al.* 2012].

We previously examined antipsychotic prescribing quality [Connolly *et al.* 2010] in black and white patients in hospitals serving the largest proportions of minority ethnic groups in the UK. Initially we adjusted prescribing outcomes for multiple confounding factors to determine if prescribing differed by ethnicity. In the current investigation we aimed to establish which factors are linked to antipsychotic prescribing quality. This will help us to identify which patients may be at risk of non evidence-based prescribing, enable us to target them for interventions to improve quality, and allow us to understand further the drivers of such prescribing.

Method

This study was conducted in eight mental health trusts in London, Nottingham and Manchester and is a new analysis of a previously reported investigation. The details of the method of this study are described extensively elsewhere [Connolly *et al.* 2010].

Briefly data were collected for all adult inpatients on acute psychiatric wards in the trusts taking part in the study. Subjects were of all ethnicities, i.e. Black, White, Asian, Mixed or Other (as categorised by the most recent UK Office for National Statistics Census 2001 at the time of data collection), and were prescribed and taking one or more regular antipsychotics. Outcomes in our initial study were total dose, type of antipsychotic, polypharmacy (both prescribed and administered), high dose [that is, more than 100% of British National formulary (BNF) dose] and cost. This analysis examines predictors of the first three outcomes listed in addition to route of administration and clozapine use. These new outcomes were derived from the current dataset and have previously been reported to be influenced by ethnicity [Lloyd and Moodley, 1992; Kuno and Rothbard, 2002; Whiskey *et al.* 2011].

Data were collected by medical and pharmacy staff at each trust and numerous confounding factors were collected from case notes: age; legal status; substance misuse; diagnosis; duration of illness; education; employment status; forensic history; gender; compliance history; language; length of current admission; number of previous admissions; patient ethnicity; previous antipsychotic treatments; previous treatment with current antipsychotic; race of patients consultant; smoking status; and weight. Other factors were collected from prescription charts including anticholinergic prescribed, clozapine use, dose, length of treatment with current antipsychotic, polypharmacy prescribed, polypharmacy administered, type of antipsychotic and route of administration.

Statistical analysis

The relationship between patient and clinical variables listed earlier and each of our five outcomes was assessed using multivariate linear regression for the continuous outcome of total dose and multivariate binary logistic regression for the remaining categorical outcomes. Initially, previous research studies examining associations between antipsychotic prescribing and race were evaluated to determine which variables were important to include in our model, i.e. which variables predicted or adjusted outcomes. In addition each variable was entered into a simple univariate regression model to determine the strength of the relationship between predictor and outcome. All variables with a significance of $p < 0.05$ were then included in a multivariate regression model using a backward method [likelihood ratio (LR) for logistic method, entry $p < 0.05$, removal $p < 0.1$] with a complete cases dataset. Where patient ethnicity was not significantly associated with outcome it was included in the model as it is the predictor of interest in our study. Finally significant variables from this method were included in each model using the enter method. Non-significant variables were removed singly in order of least significance until a final parsimonious model was determined.

Data were checked for outliers using descriptive statistics and graphical boxplot representation. Two-way interactions between variables included in the model were tested for association. No interactions were significantly associated with our outcomes and did not improve model fit. Full diagnostics were performed including testing assumptions of linear and logistic regression, model fit and residuals. Log transformation of continuous predictor total dose ensured assumption of linearity between continuous variables and total dose. Effects of missing data on model fit were performed. All analyses were conducted using IBM SPSS statistics version 21.

Results

Study population

Demographic and patient variable details for the total sample are listed in Tables 1 and 2. Data were collected for a total of 1198 patients. Around a quarter of patients had at least one unrecorded demographic detail. Effects of missing data for each outcome showed no significant effects on model fit.

Causes of associations with log total dose

Log transformation of total dose ensured residuals homoscedasticity and normality. Associations with higher log total dose (Table 3) were greater weight, higher number of previous admissions, longer length of admission, noncompliance with medication and use of an atypical antipsychotic. The taking of clozapine was associated with a lower log total dose.

Causes of associations with clozapine use

No significant predictors of taking clozapine were identified from analysis of this dataset.

Causes of associations with polypharmacy prescribed

Associations with being prescribed more than one antipsychotic (Table 4) were; not being a patient of the South London and Maudsley (SLaM) NHS Trust centre, the subject having a forensic history and a higher total dose. Younger age, not being detained under a mental health act section and oral route were predictors of prescribed antipsychotic monotherapy.

Causes of associations with polypharmacy administered

The effects of overdispersion in the model were reduced by using the dispersion parameter to rescale standard errors and confidence intervals. Associations with being administered more than one antipsychotic (Table 5) were greater number of previous admissions and higher total dose. Atypical antipsychotic use predicted being administered monotherapy.

Causes of associations with type of antipsychotic

Associations with atypical antipsychotic use (Table 6) were; oral route, higher total dose, being administered only one antipsychotic, having had fewer previous antipsychotics and no anticholinergic use.

Causes of associations with route of administration

Associations with oral route (Table 7) were not being Sectioned under the Mental Health Act, atypical antipsychotic use, younger age, non-schizophrenia diagnosis, fewer previous admissions and a lower total dose.

Table 1. Demographic and clinical variables.

Variable		*n* (%)	Missing (%)
Missing data (all variables)	Complete cases	866 (72.3)	332 (27.7)
Centre	SLaM	228 (19)	0 (0)
	Not SLaM	970 (81)	
Gender	Female	427 (35.6)	0 (0)
	Male	771 (64.4)	
Patient ethnicity	White	562 (46.9)	17 (1.4)
	Black	410 (34.2)	
	Other	209 (17.4)	
Employment	Not employed	1127 (94.1)	22 (1.8)
	Employed	49 (4.1)	
Education	Secondary	618 (51.6)	105 (8.8)
	Other	475 (39.6)	
Language	Not English	168 (14)	34 (2.8)
	English	996 (83.1)	
Smoking status	Nonsmoker	325 (27.1)	55 (4.6)
	Smoker	818 (68.3)	
Substance misuse	No	628 (52.4)	57 (4.8)
	Yes	513 (42.8)	
Diagnosis	Not schizophrenia	329 (27.5)	76 (6.3)
	Schizophrenia	793 (66.2)	
Forensic history	No	636 (53.1)	87 (7.3)
	Yes	475 (39.6)	
Race of consultant	White	768 (64.1)	45 (3.8)
	Not white	385 (32.1)	
Section status	Sectioned	824 (68.8)	6 (0.5)
	Informal	368 (30.7)	
Previous admissions	0 or 1	254 (21.2)	83 (6.9)
	2 or more	861 (71.9)	
Noncompliant history	No	227 (18.9)	77 (6.4)
	Yes	894 (74.6)	
Clozapine use	No	1074 (89.6)	0 (0)
	Yes	124 (10.4)	
Route of administration	Intramuscular	280 (23.4)	0 (0)
	Oral	918 (76.6)	
Type of antipsychotic	Typical	284 (23.7)	0 (0)
	Atypical	914 (76.3)	
Polypharmacy prescribed	No	640 (53.4)	1 (0.1)
	Yes	557 (46.5)	
Polypharmacy administered	No	911 (76)	29 (2.4)
	Yes	258 (21.5)	
Anticholinergic use	No	963 (80.4)	41 (3.4)
	Yes	194 (16.2)	
Previous treatment with current antipsychotic	No	382 (31.9)	138 (11.5)
	Yes	678 (56.6)	
Previous number of antipsychotic treatments	0 or 1	468 (39.1)	178 (14.9)
	2 or more	552 (46.1)	

SLaM, South London and Maudsley NHS Trust.

Discussion

Main findings

What factors affect our prescribing? The associations of our outcomes reveal important insights into antipsychotic prescribing quality. As we found in our previous publications, race was not a predictor of any outcome [Connolly *et al.* 2010].

Higher doses were prescribed to patients of greater weight, those not compliant with medication, those on atypical antipsychotics, with

Table 2. Continuous demographic and clinical variables.

Variable	Median	Missing (%)
Median age (years; range)	38 (18–76)	2 (0.2)
Median weight (kg; range)	77.8 (33–175.7)	156 (13)
Median length of admission (days; range)	56 (1–4210)	31 (2.6)
Median duration of illness (days; range)	3285 (1–18250)	131 (10.9)
Median total dose (% maxima; range)	55.5 (2.5–272.5)	41 (3.4)

Table 3. Multivariate linear regression model for log total dose outcome.

Variables	Coefficient B	Standard error	*p*-value	95% CI for B	
				Lower bound	Upper bound
Constant	0.95	0.41	0.021	0.15	1.76
Weight (log)	0.45	0.09	0.001	0.26	0.63
Previous admissions	0.30	0.06	0.001	0.19	0.42
Length of admission (log)	0.10	0.02	0.001	0.06	0.13
Compliance history	0.19	0.06	0.001	0.08	0.30
Clozapine use	–0.35	0.08	0.001	-0.50	-0.20
Type of antipsychotic	0.44	0.05	0.001	0.34	0.55

n = 978.
R^2 = 0.153.
Reference categories: previous admissions = ≤1; compliant = yes; clozapine use = no; type of antipsychotic = typical.
CI, confidence interval.

Table 4. Multivariate logistic regression model for polypharmacy prescribed.

Variables	Coefficient B	Standard error	*p*-value	Odds ratio	95% CI for odds ratio	
					Lower	Upper
Constant	–0.87	0.33	0.008	0.42	N/A	N/A
Centre	0.80	0.17	0.001	2.23	1.60	3.11
Age	–0.02	0.01	0.001	0.98	0.97	0.99
Forensic history	0.34	0.14	0.015	1.40	1.07	1.84
Section status	–0.42	0.15	0.005	0.66	0.49	0.88
Route of administration	–0.40	0.16	0.012	0.67	0.49	0.92
Total dose	0.02	0.002	0.001	1.02	1.01	1.02

n = 1071.
-2 Log likelihood = 1306.144.
Reference categories for predictors; centre = SLaM; forensic history = no; section status = sectioned; route of administration = intramuscular.
CI, confidence interval; N/A, not applicable.

a longer length of admission and a greater number of previous admissions. Weight and dose were probably associated both because antipsychotics cause weight gain [Rummel-Kluge *et al.* 2010] and perhaps because prescribers use higher doses for bigger people. Those non-compliant with medication were also prescribed higher doses probably because dose is often increased when effect is lost through covert noncompliance. In addition noncompliance increases the likelihood of relapse and relapse is associated with overall dose increases [Wyatt, 1991; Harrington *et al.* 2002].

Table 5. Multivariate logistic regression model for polypharmacy administered.

Variable	Coefficient B	Standard error	*p*-value	Odds ratio	95% CI of odds ratio	
					Lower	Upper
Constant	−3.68	0.32	0.001	0.03	N/A	N/A
Previous admissions	0.59	0.78	0.02	1.78	0.39	8.27
Type of antipsychotic	−1.07	0.62	0.001	0.34	0.10	1.15
Total dose	0.04	0.01	0.001	1.03	1.02	1.05

n = 1081.
-2 Log likelihood = 833.632.
Reference categories for predictors; previous admission = ≤1; type of antipsychotic = typical.
CI, confidence interval; N/A, not applicable.

Table 6. Multivariate logistic regression model for atypical type of antipsychotic.

Variables	Coefficient B	Standard error	*p*-value	Odds ratio	95% CI for odds ratio	
					Lower	Upper
Constant	−1.27	0.26	0.001	0.28	N/A	N/A
Route	2.64	0.20	0.001	14.08	9.51	20.83
Polypharmacy administered	−0.89	0.24	0.001	0.41	0.26	0.66
Previous number of antipsychotics	−0.55	0.18	0.003	0.58	0.40	0.83
Anticholinergic use	−1.42	0.23	0.001	0.24	0.16	0.38
Total dose	0.02	0.003	0.001	1.02	1.02	1.03

n= 996.
-2 Log likelihood = 798.936.
Reference categories predictors; route = intramuscular; polypharmacy administered = no; previous number of antipsychotics = ≤1; anticholinergic use = no.
CI, confidence interval; N/A, not applicable.

Table 7. Multivariate logistic regression model for oral route of administration.

Variables	Coefficient B	Standard error	*p*-value	Odds ratio	95% CI for odds ratio	
					Lower	Upper
Constant	1.80	0.41	0.001	6.06	N/A	N/A
Age	−0.02	0.01	0.022	0.98	0.97	0.99
Diagnosis	−0.99	0.22	0.001	0.37	0.24	0.57
Section status	0.64	0.21	0.002	1.90	1.26	2.86
Previous admissions	−0.75	0.26	0.004	0.47	0.28	0.79
Type of antipsychotic	2.57	0.19	0.001	13.09	9.08	18.86
Total dose	−0.007	0.002	0.001	0.99	0.98	0.99

n= 1070.
-2 Log likelihood = 862.526.
Reference categories for predictors; diagnosis = not schizophrenia; section status = sectioned; previous admission = ≤1; type of antipsychotics = typical.
CI, confidence interval; N/A, not applicable.

The association of atypical antipsychotic use with higher doses was unexpected. However, recommended doses of typical antipsychotics are usually a much lower proportion of their maximum dose than atypicals. This is because efficacious dopamine blockade occurs at much lower doses of typical antipsychotics than was previously understood [Kapur *et al.* 2000]. For example,

haloperidol 6 mg/day gives near maximal dopamine receptor blockade for antipsychotic effect but the UK maximum dose at the time of the study was 30 mg/day (and was previously 200 mg/day). The effective dose of olanzapine is probably around 13 mg/day [Bishara *et al.* 2013]. Thus an effective dose of haloperidol is 20% of the licensed maximum but for olanzapine it is 65%. Longer length of admission and a greater number of previous admissions are proxy measures of severity and chronicity of illness, and so their association with higher doses is understandable. These associations demonstrate the practice of increasing the dose at relapse and admission. Interestingly, clozapine use predicted a lower total dose perhaps reflecting a lower risk of polypharmacy because of the greater efficacy with this unique antipsychotic [Kane *et al.* 1988]. It was not possible to fit a model for clozapine use to determine this assumption.

Antipsychotic polypharmacy was associated with higher total doses, greater number of previous admissions, having a forensic history and not being a patient at the SLaM centre. Monotherapy was predicted by younger age, not being detained under a Mental Health Act Section, oral route of administration and use of an atypical antipsychotic. Antipsychotic polypharmacy and higher doses are inextricably linked [Harrington *et al.* 2002] and their association in our data reflects current UK prescribing practice [Paton *et al.* 2008]. Once again a chronic illness course indicated by a greater number of previous admissions was associated with non evidence-based prescribing, this time with polypharmacy. As with high dose, polypharmacy is more likely in those with many previous episodes as their illness is likely to be more severe and intractable. Patients with a forensic history have often been prescribed high doses and more than one antipsychotic [Lelliott *et al.* 2002], particularly depot plus oral combinations [Barnes *et al.* 2009]. Reasons for this are unclear but prescribers suggest lack of efficacy of monotherapy as a key factor [Haw and Stubbs, 2003; Grech and Taylor, 2012]. The influence of centre on polypharmacy was robust. The NHS trusts other than SLaM had a greater preponderance for prescribing of more than one antipsychotic. Whilst changing polypharmacy prescribing practice is difficult, the SLaM centre has individually reported marked improvements in combination and high-dose prescribing through the use of a quality improvement programme, thus explaining this association [Mace and Taylor, 2014]. Previous studies of antipsychotic prescribing have found that polypharmacy does differ by centre [Connolly and Taylor, 2008] indicating perhaps that the culture of an organisation has a powerful effect on prescribing patterns [Barnes and Paton, 2011].

Younger age is associated with fewer previous episodes of illness and a greater sensitivity to some adverse effects of antipsychotics. This is reflected in the association of youth with antipsychotic monotherapy. Similarly not being detained suggests a less severe illness presentation and a lower risk of polypharmacy. Overall we can see that high doses and polypharmacy are more common in severe and chronic subjects. This probably reflects a need by prescribers to 'do something' rather than adherence to any evidence base. Encouragingly, atypical use was also associated with antipsychotic monotherapy, perhaps finally reflecting changes in recommended prescribing practice for the newer antipsychotics [Paton *et al.* 2008].

Atypical antipsychotic use was associated with patients on oral medication, antipsychotic monotherapy, having had fewer previous antipsychotics and not taking anticholinergic medication. Higher doses were also associated with atypical antipsychotic use (as they were when dose was our outcome) possibly because, as discussed earlier, atypicals have much narrower ranges of licensed doses than typicals, we used percentage maximum to measure dose and older antipsychotics can be difficult to tolerate at high doses. For example, the maximum licensed dose of flupentixol decanoate is 32 times greater than the minimum dose whilst for risperidone injection it is only twice as high. Both atypical antipsychotic use and oral route were associated with each other when used as outcome and predictor and to a similar large magnitude. This provides reassurance of our methodological processes. Atypical antipsychotics are, when used at recommended doses, less likely to cause movement side effects than older agents and so would not require anticholinergic medication to treat extrapyramidal effects. Given that atypical antipsychotics are predominantly available as only oral formulations, the robust association of these two factors is clearly explained.

Use of the oral route was associated with younger age, not having a diagnosis of schizophrenia, informal Section status, fewer previous admissions, atypical antipsychotic use and a lower dose.

Again younger age, informal Section status and fewer previous admissions suggest a less severe and earlier stage of illness and a reduced use of depot antipsychotics. As discussed earlier, atypical antipsychotics were mostly only available as oral formulations and so accounts for this association. The association between oral route and low dose may be due to doses of depots. This is because the maximum doses of depots have not reduced in line with recommended doses (e.g. flupentixol depot UK maximum dose of 400 mg/week; usual recommended dose 30 mg/week). Diagnosis was associated with oral doses being used in patients without schizophrenia. Antipsychotics used for other conditions, for example bipolar disorder, are often only available as oral formulations and may not be prescribed long term as depot antipsychotics commonly are in schizophrenia [Barnes *et al.* 2009].

Comparison with previous studies

Previous analysis of our dataset used multiple imputations for missing data, black and white patients data only, did not include our outcomes as covariates, and used total dose outcome complete cases only (the primary outcome in our initial study).

Predictors of antipsychotic polypharmacy include anticholinergic use, male gender, poor symptom control and longer lengths of admission to hospital [Barnes and Paton, 2011]. Again these may be markers of a chronic illness course.

Can our study be generalised to a larger population? Other larger studies [Paton *et al.* 2008; Barnes *et al.* 2009] examining combination antipsychotic prescribing found similar results in patients with broadly comparable demographic data. For example, diagnosis of schizophrenia was 61% in one of these studies [Paton *et al.* 2008] and 66.2% in our sample. Within sample centre diagnoses were also largely similar.

What can we do about non evidence-based prescribing? Intensive quality improvement programmes can help and for some individual units progress may be dramatic. For the most part, however, these interventions result in, at best, modest change. Prescribers do not want to prescribe in a non evidence-based manner; they are audited, compared with their peers and NHS trusts take these data seriously, particularly when ranked against other trusts. The main reason prescribers state for polypharmacy and high dose prescribing is poor response to current treatment. This is because of the limited range of effective drugs for treating schizophrenia. Clozapine is well known to be the most efficacious antipsychotic; however, it is often underused because of side effects and patient reluctance to receive the blood testing monitoring requirements [Gee *et al.* 2013]. We know that there are long delays from when patients should start clozapine (after lack of response or tolerability to two antipsychotic trials) to when they actually do [Howes *et al.* 2012] and we know prescribers would prefer to use combinations rather than prescribe clozapine [Neilsen *et al.* 2010]. Methods to encourage use of clozapine for patents whose symptoms are refractory to treatment are effective [Gee *et al.* 2013]. We need to educate prescribers and encourage patients to use clozapine, otherwise the inefficacy and adverse effects of non evidence-based prescribing are likely to remain.

Limitations

The predictive power of our linear and logistic regression models was poor and the magnitude of effects was small overall. This is despite (or possibly because of) the collection of a large number of variables that could affect prescribing of antipsychotics which adds to our model's statistical complexity. Unfortunately we did not collect data on patients' mental state (a predictor in other studies of antipsychotic use and race [Van Dorn *et al.* 2005; Shi *et al.* 2007] nor the reasons why clinicians prescribed on a non evidenced-based manner, so making it difficult to judge the appropriateness of any individual prescription. The low predictive ability of our models suggests that other factors as yet unknown are also major predictors of our prescribing quality. In addition using complete cases may have affected our results, although previous analyses of this data including missing data [Connolly *et al.* 2010] produced models with similar predictive power.

Conclusion

In patients with chronic illness who are detained, heavier, noncompliant, not taking clozapine and on a depot antipsychotic, prescribers use larger doses and antipsychotic polypharmacy. We found that use of percentage maximum doses favours typical antipsychotics arbitrarily and that high doses and polypharmacy are inextricably linked. In addition poor compliance may lead to

erroneous dose increases. Newer agents were used for patients who had been treated with fewer previous antipsychotics and not taking anticholinergic medicines. Oral medicines were used for patients who were younger, not detained, did not have schizophrenia, had had fewer previous admissions, on atypical antipsychotics and taking a lower dose. Race did not play a part in prescribing quality decisions.

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Conflict of interest statement

The authors declare no conflicts of interest in preparing this article.

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