The medication and prescribing errors health and social care essay

Patient safety has always been one of the most important healthcare priorities. It was suggested that the quality of patient safety in the future would depend on how the health care system investigate, manage and prevent medical errors (1). Although not all medical errors involve drugs and not all harm in healthcare arises due to errors, medical errors may still lead to adverse drug events (ADEs), which are defined as harmful events caused by medicines, and harm the patients (1, 2). In the past decades, the investigation and prevention of medical errors has become the backbone of improving patient safety. Diagnostic errors and medication errors are both classified as types of medical errors (3). Between these two categories, medication errors were the most common found errors (4). In order to find out the most effective intervention to reduce errors, an understanding of their prevalence, nature and causes is essential.

1. 2 Medication and Prescribing errors

Medication error was defined in previous study as " a failure in the treatment process that leads to, or has the potential to lead to, harm to the patient (5)." It could be divided into prescribing error, transcription error, administration error, dispensing and monitoring errors (4). Medication errors were found to be the second commonest cause of patient safety incidents, accounting for 11% of reported incidents (6), and prescribing errors were one of the most commonly found medication errors (identified in 974 out of 6605 medication orders, 14. 7% in an UK study)(7). Although higher frequency of administration errors was found when compared to prescribing errors(4), it is worth to be aware of that prescribing errors significantly increase the length of hospitalisation, economic burden, and almost double the risk of death(8).

Patients can experience serious injuries due to medication errors. Even if the errors do not cause any harm or are corrected before causing harm, it is still detrimental to the rapport between the health care professional and the patient, and can also increase unnecessary workloads(7). Based on a U. S. study, it was estimated that a 700-bed teaching hospital could cost up to $5. 6 million annually for all ADEs and $2. 8 million for preventable ADEs(9). According to National Patient Safety Agency in the UK, preventable ADEs cost an estimated £750 million nationally (10). Many studies have therefore been carried out to try to establish potential interventions to minimise these errors, as not only could they reduce the associated economic burden, but they could also improve the quality of healthcare delivery. For example, evidence shows that the implementation of electronic prescribing systems has been effective in reducing the incidence of prescribing errors. Some UK studies found that electronic prescriptions contained fewer anomalies (28 in 329 prescriptions, 8. 5%) than the written prescriptions (208 in 408 prescriptions, 51%) (11, 12). Extensive studies have been conducted to look at prescribing errors in general hospital settings (7, 13-20). (See table 2) However, comparatively less work has been done that focuses on prescribing errors that arise from mental health settings in the UK (21-25). (See table 1)

Table 1. Summary of some literatures focusing on prescribing errors in mental health settings

Study	Country	Study site (number= N)	Aims	Type of Approach	Type of Data collection	Method of error detection	Denominators used for error rate	Rate of errors
Haw, C. et al 2003 (24)	UK	Psychiatric hospital(N= 1)	To determine the prevalence, nature and severity of prescribing errors in one psychiatric hospital (24)	PProcess based	Pharmacists' routine pharmacy practice	Total number of prescriptionitems checked	2. 4% of prescription items
Stubbs, J. et al 2006 (23)	UK	Mentalhealthinstitutions(N= 16)	To examine the nature, prevalence and severity of prescribing errors in multiple mental health hospitals (23)	PProcess based	Pharmacy staffs' routine pharmacy practice	Total number of prescriptionitems checked	2. 2% of prescription items
Grasso, B. C. et al 2003 (25)	USA	Psychiatric hospital (N= 1)	To compare the effectiveness of using self-reporting and retrospective review method in error detection					

(25)RProcess basedRecord reviewPatient days165 Errors per1000 patientdaysPaton, C. et al 2003 (21)UKMental Health Trusts (N= 12)To describe prescribing errors in mental health settings by analysing pharmacists' interventions (21)PProcess basedPharmacy staffs' routine pharmacy practiceNo denominator was usedN/AKEYP = ProspectiveR = Retrospective

Table 2: Summary of some literatures focusing on prescribing errors in general hospitals

Study

Country

Study site (number= N)

Aims

Type of Approach

Type of Data collection

Method of error detection

Denominators used for error rate

Rate of errors

Dean-Franklin, B. et al 2002 (14)UKTeaching hospital(N= 1)To investigate the incidence of prescribing errors in a hospital. (14)PProcess basedPharmacists' routine pharmacy practiceTotal number of medication orders (estimated

denominator)1. 5% of medication ordersFranklin, B. D. et al 2011 (7)UKTeaching and Non-teaching Hospital (N= 3)To compare the causes and the rates of prescribing errors in newly written medication orders, and to find out how fast the errors were identified and corrected. (7)PProcess basedPharmacists' routine pharmacy practiceTotal number of newly written medication orders14. 7% of medication ordersSeden, K. et al 2013 (19)UKNHS hospitals in North West (N= 9)To evaluate the prevalence and nature of prescribing errors in different circumstances. (19)PProcess basedPharmacists' routine pharmacy practiceTotal number of prescription items checked10. 9% of prescription items

Study

Country

Study site (number= N)

Aims

Type of Approach

Type of Data collection

Method of error

detection

Denominators used for error rate

Rate of errors

Ghaleb, M. A. et al 2010 (20)UKTeaching and Non-Teaching Hospital(N= 5)To determine the frequency and nature of prescribing, medication and administration errors in paediatric patients. (20)PProcess basedDrug chart review and incident reportTotal number of medication orders13. 2% of

medication ordersDornan, T. AD. et al 2009(18)UKAcute Hospital trusts (N= 19)Measure the prevalence and nature of prescribing errors made by Foundation Year 1 doctors with different educational backgrounds. (18)PProcess basedPharmacists' routine pharmacy practiceTotal number of medication orders8. 9% of medicationordersKEYP = ProspectiveR = Retrospective

1. 3 Prescribing errors in mental health settings

Prescribing errors are a daily occurrence in Mental Health Trusts just like general hospitals (21). On average, it has been estimated that at least one potential serious error was likely to occur every week in mental health trusts(21). Interestingly, a recent issued data report has even illustrated that psychiatry was the second highest care setting associated with patient safety incidents among other care settings, accounting for 13% of the total reported patient safety incidents (6). Prescribing errors could be categorised into two sub-classes: prescription writing (clerical) or decision making (clinical) (4, 21, 24). Prescription writing errors in psychiatry were similar to types of prescribing errors found in general hospital such as illegibility, writing an incomplete prescription, missing the prescriber's signature, missing the frequency and dose of drug, major misspelling of a drug name and prescribing without strength for a drug (4). Decision making errors were basically the clinical mistakes made during prescribing, and the most common decision-making errors were prescribing a dose regimen which is not recommended, and prescribing a drug without the necessary Mental Health Act authorisation (4).

1. 4 Difference between psychiatry and general hospitals

In general terms, the commonest type of error found in earlier studies focusing on psychiatry was writing an incomplete prescription(27. 5%) (23), and in general hospitals, the commonest errors were wrong dosage (15). However, a published literature has shown that more than a half of errors (57. 7%) were rectified before any doses were administered, and on average less than one dose (0. 9 dose) of medication were administered to patients before the error was corrected (7). In other words, most errors were identified and amended by pharmacists before they caused harm(7). The most interesting point was that from previous studies, the prescribing error rate in mental health trusts was only found to be 2. 4% (23), while the prescribing error rate in general hospitals was found to be 7% (15). Serious errors in psychiatry (4. 3%)(23) were also reported to be lower than in general practices (19%)(7). In one study focused in psychiatry, psychotropic drugs were found to be involved in over 50% of all prescribing errors and antipsychotic drugs(17%) had the highest error rate (23). However, in another study focused in general hospital settings, antipsychotic drugs only accounted for 0. 9% error rate, and the drugs with the highest error rate were opioid and non-opioid analgesics drugs (9. 7%) (18). A few possible factors that contributed to the prescribing errors were suggested, such as lack of pharmacological knowledge on prescribed opioids, unfamiliar with patient’s medical history, similar drug name and confusion over various formulations (26).

1. 5 Possible factors contributed to different prescribing errors in mental health settings

The factors that make prescribing errors in mental health settings different from general hospitals are the use of different drugs, doses, route of administration and formulations in mental health settings (23). The majority of errors were reported as a consequence of prescribers' lack of pharmacological knowledge (23), whereas skills-based slips and memory lapses are also common factors causing errors (16). For example, errors from opioid and non-opioid analgesic drugs as mentioned above in section 1. 4. In addition, most psychiatric patients are elderly, who may suffer with co-morbid illnesses, and need to take multiple medicines (27). As a result, medication and prescribing errors may be more likely to arise due to case complexity (27). Apart from the complexity of the psychiatric patient, some particular situations in psychiatry such as forcible administration of medications and the requirement of Mental Health Act authorisation may cause different types of prescribing errors in psychiatry. Other specific situation like off-label prescribing is also common in psychiatry. The medication used by off-label prescribing frequently lacks the support of robust clinical trials, which means that problems could arise unexpectedly (28). Problems with look-alike and sound alike medication mix-ups have also been suggested such as confusion between Toprol, Topamax and Tegretol (4, 29), but product name confusion is also an issue in general hospital settings. In terms of the system within trusts, many UK mental health trusts are still using paper-based record systems instead of electronic systems (30), and electronic prescribing has been shown to significantly reduce

prescribing errors and improve the quality of prescriptions by eliminating common errors such as strength/dose missing and no signature (12, 31).

1. 6 Difficulties of measuring prevalence

Over the past few decades, interventions and changes have been implemented into the delivery of care, but there are still concerns with measuring the prevalence, understanding the causes and implementing potential solutions to the burden of prescribing errors in hospitals (17). One of the reasons that make it difficult to measure the prevalence is because of the variety of definitions used to define prescribing errors and medication errors. In recent studies (12), researchers even created and used their own definition instead of using more widely used definition such as the definition developed by Dean et al.(32). It has been suggested that the choice of definition has an impact on the rationale for conducting the research (33). Researchers should state the reasons why they have chosen a particular definition and provide a clear explanation in their studies. Otherwise, it is difficult to compare the data from different studies or use the data wisely as a component of clinical governance since the definitions might vary (32). Moreover, it was found that different methods of data collection can identify different errors types, and very few of those errors overlap (34). Therefore, in order to achieve a full picture of incidence of prescribing errors, a combination of methods should be used (34). Methods of detecting prescribing errors such as prospective detection, retrospective review and spontaneous reporting are commonly used. Studies may be classified according to whether they focus on outcome or process and whether study designs are retrospective or prospective. Process based method focuses on

the process of writing the order that include potential errors; outcome based method focuses more on errors that lead to adverse drug reactions (34).

1. 7 Limitations of prescribing error research from psychiatry settings

The previous UK studies focusing on prescribing errors in psychiatry were done by Haw, C and Stubbs, J in 2003 and 2006 (23, 24). One study(24) focused on only one psychiatric hospital and another(23) focused on 16 different psychiatry sites in England and Wales. In these two studies, they used the same denominator, which was the number of total checked prescription items, and same methodology to calculate the error detection rate. Their findings were also very similar. Stubbs, J. et al was strengthened in that it was conducted in multiple hospitals and collected a large amount of data; the definitions, severity scale and taxonomy of error types were validated. However, limitations could arise as it was suggested that denominators, methodological approaches, and definitions could influence the conclusions (35). The weakness of these two studies was that pharmacists did not know whether the errors had been recorded and some records might have been duplicated. Hence, the error rate could have been underestimated. In addition, both studies (23, 24) did not mention which age group of patient and which specific type of ward (e. g. elderly care) were at the highest risk of prescription errors. The prescribing stage that the errors occurred at were also not identified and recorded in these two studies. Although grades of prescribers who made the errors were reported, there were only three categories: Consultant psychiatrists, Non-consultant psychiatrists and unknown prescribers. They did not specify whether junior

doctors made more errors or senior psychiatrists made more errors within the category of non-consultant psychiatrists. A USA study, which used a retrospective data collection method, showed a different error rate to the UK studies. The rate of prescribing errors was found to be 165 errors per 1000 patient days, but since the denominator used was patient days rather than prescription items, the results could not be used to directly compare with the UK studies (25). Another UK study in 2003 (21) also focused on prescribing errors in psychiatry, but instead of prevalence it focused on the nature of these errors. The researchers did not use any denominator and therefore, there was no error rate to demonstrate the prevalence. Also, they did not provide a clear explanation of the definition used for prescribing errors, which could lead to difficulty in comparing data as mentioned above. Moreover, the common clerical errors could possibly be under-reported since a study found that pharmacists only recorded 31% of interventions that they made(36). In addition, this study did not show how prescribing errors were spread across the drug categories; it did not conclude severity scale of prescribing errors and it did not show which age group of patients were at risk of receiving an incorrect prescription. Furthermore, only a few studies had at least some data on psychiatric elderly patient and no studies have been conducted in child units (4, 27).

2. Aims and Objectives

The aims of this study were to measure the prevalence and nature of prescribing errors in a mental health Trust in the North West of England. It aimed to compare the prescribing error rates by different grades of prescribers and different prescribing stages. It also aimed to provide

recommendations for future study and improvement in clinical practice based on the data collected to improve patient safety. The objectives were to: Prepare a literature review to achieve better understanding on prescribing errors and determine the impact on patient safety by prescribing errors. Follow protocol used in EQUIP study(18) by checking all new prescription items or rewritten inpatient medication orders, and pilot in hospital before collecting data. Record and measure the prevalence, nature of errors in the mental health setting. Collate and analyse the data using Microsoft Excel in which error rate and frequency were calculated at the end of data entry. Report, discuss and compare the results with previous studies; provide recommendations on how to improve patient safety and how future research may help. Present the report to health care professionals and colleagues

3. Method

3. 1 Approach

This study was process-based rather than outcome-based as process-base study allowed all errors to be identified including potential error, whereas outcome-based study generally assessed more towards adverse drug events (34). Also, a prospective approach was used as it generated more comprehensive data. A retrospective study was useful in detecting errors that lead to serious outcome. However, a lot of errors were difficult to be identified using this approach owing to the lack of documentation and clinical information of the patient (34).

3. 2 Study sites

Three different mental health trusts in the North West of England were involved in data collection so that a set of more representative data was gathered. This study report focuses on the findings from one of the mental health trusts.

3. 3 Data collection process

The definition of prescribing error used in this study was that developed by Dean et al. " A clinically meaningful prescribing error occurs when, as a result of a prescribing decision or prescription writing process, there is an unintentional significant reduction in the probability of treatment being timely and effective, or an increase in the risk of harm when compared with generally accepted practice." (32)Situations relevant only to mental health settings were also included in the definition. " Prescribing a drug without first registering a patient with the appropriate company (e. g. clozapine and ZTAS/CPMS)"; " Prescribing a drug for mental health for a detained patient without the necessary authorisation from a Mental Health Act form (e. g. form T2 or T3, Advance Decision)" (23, 24). Unlike previous studies (23, 24), this study only focused on prescribing errors that identified in all new prescription items or rewritten inpatient medication orders as this minimises the chances of collecting duplicated data. The protocol of data collection and analysis followed a method used in an earlier study of prescribing error prevalence in general hospitals carried out by one of the current investigators (18, 37). The data collection forms were approved by the University ethics committee, and ethical approval at the hospital trust was also gained. It was piloted at three hospital sites in November and December

2012. The collection process took place only on the wards that pharmacists normally visit. There were two data collection forms. The first form was the denominator table shown in Appendix A. The second form was the error information form shown in Appendix B. The denominator table was used to record newly prescribed or omitted drugs checked by pharmacists on the data collection days. Errors occurred in all types of medication orders such as regular, when-required, once-only, intramuscular, leave and discharge medication, as well as errors in discharge items, leave items and transcribed items including those identified out-of-hours should be included. However, errors that made in outpatient prescriptions were excluded and not recorded. Items without errors were also recorded by putting a zero under the column of " no. of new drugs with Rx error". This table also recorded the stage that the patients stayed when the prescriptions were checked, the number of prescription items written or omitted by each grade of doctor and the number of errors detected. The definitions of each prescribing stage and further advice of filling in the table can be found in appendix C. In addition, the ward name, the hospital name and whether or not the item was prescribed electronically were all recorded. This table provided us a general view of prevalence of prescribing errors in the hospital and allowed comparison across various grades of prescriber. The error information form was completed only when an actual prescribing error was detected. A corresponding reference number from the denominator table was entered at the top of the error information form to allow cross referencing from the table. An error information form was filled in for each prescribing error identified, in other words, more than one error information form would have been completed if a prescription had more than one prescribing error. This

form contained details of the actual error such as details of drug involved, patient details (initials, sex and age), and description of error. Potential severity of identified errors was not assessed during this study.

3. 4 Responsible staff

Pharmacists were responsible for collecting the data since they had to clinically check all newly prescribed items as part of their routine pharmacy practice. Information Training Booklets with details were provided as guidance. Definition of prescribing errors described above was also given. Pharmacists were suggested to obtain a list of updated prescriber signatures and familiarise with the signatures so that the pharmacists were able to identify the grade of prescriber during collection process. The data collection process was taken place as part of the pharmacists' routine pharmacy practice.

3. 5 Data collection dates

Taking into account the rotations of junior doctors, 4 days' data collection covering Monday to Thursday was undertaken in separate weeks from January to February. The spacing could allow identification of a variety of errors from different doctors. Moreover, it could minimise collecting data from the same patient more than once. However, even if a patient was checked for the second time, he/she could have been in a different stage of hospital admission. It could also minimise the chance of any recent policy changes affecting the error rates. Prescriptions that were written at night (after 11pm) before the collection day was included as this could balance out the prescriptions missed on the night (after 11pm) of the collection day. Data collected on Monday included all newly written prescriptions over the

weekend, in other words, Friday evening onwards until Monday when the working day was complete. Data collection was undertaken in inpatient wards and the process was facilitated by the site specific study co-ordinator.

3. 6 Data analysis

Data was entered into Microsoft Excel Database and analysed under the guidance of the study investigators. The research team discussed and determined the type of error regarding the error type list (Appendix C) based on the description details of individual error. Each checked item was entered in a new row, and hence the total number of rows was the total items checked. All data including patient and medicine details were entered on the same spreadsheet to allow clear verification. Numbers 0 and 1 were used instead of " No" and " Yes" respectively to make number count easier. Unfilled boxes on the collection forms were left blank during the entry. The accuracy of data entry was checked by student colleagues. Error rates and frequencies in different areas (e. g. different prescribers and prescribing stages etc.) were calculated at the end of data entry. The numerator used in calculating the error rates was number of errors and the denominator used was the number of newly written prescription items. Comparisons of data between different areas were also made on separate spreadsheets. For instance, which grade of prescribers made most errors at each particular prescribing stage; which class of medicines were most strongly related to errors found in each age group of patients etc.

3. 7 Ethical issues

It was important to securely store all the data for this research. All data reported or published was anonymous. The error recording forms and paper

based data were kept in a secure, locked filing cabinet which was only accessed by those directly involved in this study. Electronic data was kept in password secured folders. All data would be securely stored for 10 years after completion and publication of the study findings.

5. Discussion

5. 1 Principal findings

In this study, the prevalence of prescribing errors was 4. 9%. 22 out of 466 prescription items were found to contain one or more than one error, which means that 95. 3% of newly written prescription items were without reported errors. On average, pharmacists detected one error for every 20 newly prescribed or omitted items checked. Error rates varied from grades of prescribers, prescribing stages, and days of the week (see above tables). GP/Psychiatry specialist registrar trainees made the majority of the errors (74. 0% of total errors), but their error rate (5. 1%) was not the highest among all prescribers. In fact, Staff Grade Psychiatrists had a higher rate than any other prescribers (13. 5%) (see table 3). The same error rate (7. 5%) was found in prescriptions at " during stay" and " TTA/Discharge Rx/TTO" stage whilst no errors were found in rewritten prescriptions (see table 3). The most common nature of errors was found to be " Incorrect formulation", accounting for 17. 4% of total errors, while " Omission on TTO (discharge prescription)" and " Omission on admission" only accounted for 8. 7% and 4. 3% respectively (see table 5). The most common drug associated with errors was Psychotropic drugs, accounting for almost half of the total errors (43. 5%) (see table 4). However, the drug that had the highest number of errors was inhaled corticosteroid used in respiratory disease.

5. 2 Interpretation and Relation to other studies

5. 2. 1 Prevalence of prescribing errors

The prescribing error rate in this study (4. 9%) was approximately two times higher than previous studies (2. 4% and 2. 2%) (23, 24) (see table 1). However, the total number of prescription items checked in these two studies (Haw. C et al: 2274, Stubbs. J et al: 22, 036) were a lot higher than in this study (466 items), and the difference in these values may have contributed to the difference in error rates. The value of denominators used could influence the outcome of the error rate as the higher the value of denominator, the smaller the error rate. One extra error in our study increased the error rate by 0. 2%; however, it needed extra 5 errors in Haw. C et al and extra 44 errors in Stubbs. J et al to increase the error rates by 0. 2%. Therefore, it would be unfair to compare these 3 studies by just looking at the error rates. Furthermore, these two previous studies focused on all prescription items which may have contributed to data duplications and led to underestimated error rates. When compared the error rate with general hospitals, the error rate in general hospital settings was higher. From a systematic review (15), the median prescribing error rate was 7%, which was 1. 4 times higher than the rate in this study. One of the main reasons may have been due to the use of different methods. Studies that used Incident report often produced a lower error rate because underreporting was very likely to happen (15). But interestingly, another study (18) focusing on general hospitals used the same method as our study observed the higher error rate (8. 9%) (see table 2) than the median error rate found the systematic review (7%) (15). This demonstrated that the method of checking

only newly prescribed items instead of all prescription items could eliminate the chance of generating underestimated error rates. The results also show that general hospitals appear to have a higher error rate than mental health settings. This may have been due to various reasons, for example, hospital policies, prescribers employed, different frequently used medicines etc. One possible reason may be related to the high number of errors made by Foundation Year 1 and Year 2 doctors (FY1 and FY2) in general hospitals. The EQUIP study demonstrated that the rate of prescribing error of FY1 was 8. 4%, FY2 was 10. 3% (18), but in this study FY1 and FY2 was 0% and 2. 4% respectively. In addition, very few FY1 and FY2 were employed in this psychiatric hospital, and since the grades of prescribers employed in this psychiatric hospital were different from general hospitals, it was difficult to interpret the difference of the error rates between mental and general hospital settings.

5. 2. 2 Prescribers

In this study, Staff Grade Psychiatrists had the highest error rate (13. 5%) (see table 3). It was surprising to see senior staff made more error than juniors, however, a previous study and review suggested that junior doctors actually had similar error rate to other prescribers regardless of the prescription numbers (16, 18). As explained earlier in this section, one single error could affect the error rate dramatically, especially when the value of the denominator (total number of items checked) used in calculating the error rate was small. In this study, the total number of items checked was small and therefore it may have influenced the confidence we placed in the findings between doctors. On the other hand, GP/ Psychiatry Specialist

Registrar Trainees (GP/PSRT) were responsible for 74% of total errors. This could be due to the lack of knowledge in psychiatric area. A systematic review conducted in 2009 showed that one of the most common causes of making error was lack of knowledge about specific medicines (16). Other factors such as lack of training and experience in specific area, which was psychiatry in this case, were also found to contribute to the generation of errors (16). Besides, physical and mental health of the prescribers such as fatigue, dehydrated, stress were also reported during the time errors happened (7, 13, 18). According to other studies (7, 13, 18), we can speculate that time pressures and workloads could possibly be the issues to affect the performance of GP/PSRT in this study since they were responsible for prescribing the majority of prescription items. In an interview carried out in 2011, two doctors said " Just pressure of time is the main one that just makes you potentially make mistakes..." and " Sometimes you just don't have enough time..." (7).

5. 2. 3 Prescribing stages

From this study, it was observed that most errors occurred at the stage of " during stay" and " TTA/Discharge Rx/TTO". It was different from EQUIP study which found " on admission" the highest (18). There was only 4. 4% error rate in admission prescriptions in our study but 13. 4% in EQUIP study. This may have been influenced by the higher number of admissions (35. 8% of total prescription items) in general hospital than in psychiatry (24% in this study). In addition, more errors were found in " during stay" because patients with mental health problems such as dementia needed to stay for a longer period in hospital than mentally well patients and as a result, errors were

more likely to occur (38). In two US studies (25, 39), number of errors per 1000 patient days were recorded. 165 errors were found in psychiatric hospital (25) and 115. 5 errors (39) were found in general hospitals per 1000 patient days. This illustrated that a higher number of errors were observed if patients spent the same period of time in psychiatry than in general hospital. The high error rate in discharge prescriptions (TTA/Discharge Rx/TTO) may have been related to the specific medicines used in psychiatry. 4 out of 10 errors found with psychotropic drugs were prescribed at the stage of " TTA/Discharge Rx/TTO". Many psychotropic drugs worked differently in individuals and required monitoring, the dose or frequency of these drugs could have changed upon discharge. Therefore, errors could arise during writing up the discharge prescriptions. Another possible factor contributed to errors on discharge prescriptions was that doctors rushed through the process of writing discharge prescriptions. Some doctors felt that this was a boring task and did not pay attention to it and consequently precipitate the production of errors (18). No error was found on rewritten drug charts, and may have been due to the fact that it is a comparatively more straightforward task which involves transcribing medicines from one chart to another. From previous study, error rate in this stage was also found to be the lowest (18).

5. 2. 4 Medicines

As mentioned in section 4. 4, psychotropic drugs accounted for 43. 5% of total error and antidepressants were the most strongly associated with errors, accounting for 13. 0% of total errors (see table 4). This was not consistent with previous psychiatry study (third highest, 7. 5%) (23),

however, a previous study (18) , which focused on general hospitals, found that anti-depressant was the drug with the highest error rate (3%) in the class of psychotropic drugs. Not only anti-depressants were found to be more likely associated with errors, but also caused adverse drug reaction and led to death as a result of overdose in other studies. Pirmohamed et al observed that antidepressants accounted for 7. 1% of adverse drug events in their study (40). A review also found that 11% of deaths were due to anti-depressants overdose (30). Other psychotropic drugs such as anti-psychotic (8. 7%) and depot anti-psychotic (8. 7%) were also associated with adverse drug reaction and death as they were commonly used in off-label prescribing (30).

5. 2. 5 Nature of errors

The most common nature of prescribing error found in this study was " incorrect formulation" (17. 4%) (see table 5). It was different from what EQUIP study found, which discovered that " omission on admission" was the most common nature in general hospitals (18). The reason why " incorrect formulation" occurred could possibly due to rule-based mistakes. Rule-based mistakes occur when someone applies a correct rule that learnt in the past inappropriately or applies an incorrect rule in a correct manner (18). One of the main causes of this mistake was the lack of expertise of trainees. Sometimes, junior doctors misjudged a clinical situation and applied an incorrect rule even though they actually knew the right option (18). Another reason was because doctors often failed to double check their prescriptions as they thought they were right (18). However, a simple check up with reference source or discussions with colleagues might be more than enough

to prevent the error. In the two previous studies focused on psychiatry, they both found that incomplete prescriptions were commonest (Haw. C et al: 43. 4%; Stubbs. J et al: 27. 5) (23, 24). However, this nature was differentiated into smaller categories in this study which made it non-comparable. Apart from this, from table 8 (see below), it was observed that the second or third most common nature found in our study were similar to the findings in Haw. C et al and Stubbs. J et al. Administration time/Frequency missing or incorrect and duplication was also found to be common in previous studies (18, 23, 24). These two could both be categorised into skill-based errors.

Table 8: Nature of error related to other studies

Study

Dose incorrect or missing

Administration time/Frequency missing or incorrect

Duplication

Duration of treatment

(too long or short)

Omission on admission

Under-dose

Dornan, T. AD. et al 2009

(18)20. 1%6. 1%5. 5%1%29. 8%11. 1%Stubbs, J. et al 2006 (23)N/A9. 8%1. 9%2. 7%N/AN/AHaw, C. et al 2003 (24)N/A3. 2%3. 9%N/AN/A1. 9%

Our study

13%13%8. 7%4. 3%4. 3%4. 3%The main contributing factors of this type of error could be rushing through prescribing process; unfamiliar with patient's drug history; assuming other staff, such as nurses or pharmacists, would raise the alarm when problem happened etc. Another main reason that had not yet been raised was the lack of standardisation in prescribing system, and format/design of drug charts (18, 30). It was also suggested that majority of prescribing systems in UK mental health settings were poorly developed. Doctors expressed that they found difficulty in prescribing medicines with unfamiliar systems (30), and also suggested that their previous working experience could affect their ability to complete a drug chart without missing anything owing to the different design of the charts (18). As a result, incomplete prescriptions became a common prescribing error as we could see from previous studies (Haw. C et al: 43. 4%; Stubbs. J et al: 27. 5%; Grasso. B. C et al: 51. 8%) (23-25). Even in this study, 30. 4% of errors (Administration times/frequencies incorrect/missing; Strength/dose missing; Start date incorrect/missing) were due to missing details on prescriptions.

5. 2. 6 Others

Interestingly, errors were only found in hand-written prescriptions but none in electronic prescriptions. This was consistent with the results found by studies focused on electronic prescribing and prescribing errors (12, 31, 41), in which all showed a significant lower error rate after the implementation of electronic prescribing system. Although there was a large difference in the total number of prescriptions between these two categories in this study, this

finding was still an interesting point to be explored. Another interesting point discovered in our study was that the vulnerable patient age group was not elderly (age > 60) but age 31-45. Generally, elderly is believed to be subject to experience prescribing errors as they are commonly suffering from co-morbidities (27). However, in this study, by just looking at the number of errors was not the best way to determine vulnerable group. The most appropriate way to look into this matter would be by calculating the error rate. However, patients' details were recorded only when errors occurred. The total number of patients (in different age groups) involved in the study was unknown, which disallowed us to calculate error rates in different age groups.

5. 3 Strengths and limitations

5. 3. 1 Strengths

Prevalence and nature of prescribing errors in psychiatry in the UK has not been studied and reviewed in the past few years. Only 2 UK studies (23, 24) were identified to focus mainly on this area. Therefore, our study can be added to strengthen this small evidence base. This study was well programmed as it can help people achieve a deeper understanding of prevalence and nature of prescribing errors by the combination of quantitative and qualitative approach (42). On one hand, it provided quantitative data to show the prevalence of prescribing errors. On the other hand, it recorded pharmacists' descriptions about the errors, which allowed researchers to characterise the nature of the errors. In addition, our study followed the well-developed method used in EQUIP study (18), which made the data comparable to other studies. Also, as mentioned above in section 3.

3, only prescribing errors arisen from newly written prescription items were recorded, and it consequently enhanced the validity of the results and avoided duplication of recorded errors. Moreover, this is the first UK study to have data showing the error rate of electronic prescribing in psychiatry, and allow comparison of prescribing error rate between the two systems (paper based and electronic based). This study also provides a view on vulnerable age group in mental health settings and the prescribing stage of the errors, which the previous two studies (23, 24) did not include.

5. 3. 2 Limitations

This was a relatively small study as it only focused on one mental health trust and size of data collected was comparatively small, which made the results not as representative as other bigger studies (18, 19, 23). For example, the number of prescription items prescribed by Foundation Year 1 and 2 doctors, non-medical prescribers (ie. Nurse and pharmacist prescribers) were low and non-comparable to GP/Psychiatric Specialist Registrar Trainee. Due to the small number of prescription items, one or two errors can affect the error rate heavily and produce results that may not reflect practice. The length of data collection period in this study was short as it only lasted for 4 days and did not covered all working days (only Monday to Thursday). Furthermore, severities of the errors were not included and analysed in this study, which created a non-completed picture of prescribing errors. Furthermore, the details of patients involved in the study were insufficient to calculate error rate. It disallowed us to identify vulnerable age group or which gender of patients was at higher risk of receiving an error in the way of calculating the error rates. Besides, the

description of the errors written by pharmacists was also a variable. The description and opinions were subjective and different pharmacists could have different judgement on the same error. Subsequently, the " subjective" descriptions could possibly affect the classification of the error types, though the classification was completed using a consensus approach which should have minimised this problem. In addition, a study found that pharmacists only recorded 31% of interventions that they made (36). As a result, the data collected in this study was possible to be under-reported since the data collection relied only on ward pharmacists(43).

5. 4 Recommendations

5. 4. 1Clinical Practice

Many FY1 trainees made mistakes owing to lack of knowledge, whereas dosage of medication was frequently reported (18). Therefore, undergraduate medical education programmes and foundation Year 1 education focusing on particular areas, e. g. prescribing of psychotropic drugs, should be provided so as to minimise prescribing errors. Additional education in clinical pharmacology and therapeutics for new graduates were also suggested (16). All these recommendations are aiming to target newly qualified and junior doctors as people believed they were more likely to make mistakes than other prescribers (19). However, from the results shown in our study, it illustrated that the error rates of GP/Psychiatric Registrar Trainees (5. 1%) and Staff grade Psychiatrists (13. 5%) were high enough to be concerned. Therefore, continuous training in prescribing should be provided for all grades of prescribers, for example, programmes or trainings which are similar to those provided for non-medical prescribers. Such kind of

programmes can further strengthen prescribers' prescribing skills in practice and their knowledge in pharmacotherapeutics prescribing, and also produce a more general reduction of error rates. Apart from the training, hospital guidelines on prescribing should be provided for all prescribers. Doctors were often not aware of making an error until they were called attention to it (13). Therefore, common prescribing errors, such as incomplete prescriptions, should be highlighted so that it alerts prescribers to the mistakes. Good standardisations in prescribing certain medicines and design/format of drug chart would also be helpful to prescribers as it can reduce the chance of writing an illegible prescription. Furthermore, hospital should implement and continually draw attention to policies for prescribers to notify pharmacy staffs of the use of off-labelled anti-psychotic drugs. If pharmacy staff is aware of this, close monitoring can be given to patients to prevent adverse drug events from happening. Members within the medical team including prescribers and pharmacists should also report prescribing errors and other medication errors to the National Reporting and Learning System (NRLS). NRLS is a comprehensive database holding information of patient safety such as patient safety incidents reported by healthcare professional (44). All those reported errors are essential for the process of indentifying trends and taking steps to prevent recurrence. Providing a comfortable environment is also essential for efficient teamwork. Previous UK studies showed that error-provoking conditions such as increasing workload, fatigue, stress and poor communications all facilitate prescribers to make errors (7, 13, 16). If hospitals can provide more breaks for prescribers; if consultants and senior doctors can give more advices to junior doctors, error-provoking conditions would ideally no longer exist. Hospital could also introduce a method named

" crew resource-management training". It is a training given in aviation to teach pilots how to recognise and avoid factors, for example tiredness and stress, which can affect their performance (45). A study in 2008 proved that this training effectively improved the inter-professional teamwork in an obstetrical setting (46). Therefore, an introduction of this may show improvement in preventing and managing prescribing errors. A UK study (31) showed that implementation of electronic prescribing system (EPS) helped reduced the error rate from 3. 8% to 2. 0%. Despite the complication and unexpected changes of using EPS (11), the implementation may still be an effective way to minimise errors. From this study, it was shown that approximately 30. 4% of total errors could actually be eliminated by the introduction of EPS; the frequency of errors such as strength/dose missing, no signature, start date incorrect/missing, administration times/frequencies incorrect/missing etc. would be reduced. However, EPS has limitations. New errors could still be found in electronic prescribing. For instance, select an incorrect product dose from menu, and incorrect use of default doses etc. (31). Therefore, further robust and systematic evaluation of EPS is essential for building a better patient safety net (11). For example, a more recent study (47) demonstrated that the use of an electronic system with integrated decision support, for example dosing and drug selection could effectively reduce prescribing errors and improve prescribing quality.

5. 4. 2 Future research

This study has illustrated the prevalence of prescribing errors in psychiatry, which is an important starting point when considering how to minimise these errors in future. Future work must use these findings to develop a better

understanding of the root cause of prescribing errors, which is equally important in developing solutions to address this problem. Since a systematic review (16) showed that none of the previous studies focused specifically on mental health setting, further qualitative research on underlying factors of errors in psychiatry should be conducted. For example, interviews with prescribers, pharmacists or other non-medical staffs would be useful. Based on the limitations of this study, some recommendations for future studies are also provided. As mentioned in section 1. 6, the outcome measurement is an extremely difficult task due to the wide range of methodologies and definitions. Therefore, further research should use the same standardised method to produce comparable data and improve the consistency(18). Details of all patients (with or without errors) should be recorded. It can aid the calculation of error rate and subsequently help the identification of vulnerable patients. Future study should also consider including the determination of error severities as this was not examined in this study. The results of error severities are vital for measuring how prescribing errors can impact on patient safety and suggest intervention accordingly. The data collection process should be taken place in multiple sites with a longer period of time. Not only can it generate more representative data and eliminate coincident result, which may lead to false percentage, but it can also provide a wider and clearer view of the prevalence and nature of prescribing errors in psychiatry. Thus, it can assist in evaluating interventions to improve clinical practice.

6. Conclusion

Prevalence of prescribing errors in mental health settings is not as high as general settings, but still affects one in 20 prescriptions written. Prescribing error rates do vary in different areas such as different grades of prescribers and different prescribing stages. The natures of the prescribing errors and medications involved were also found to be different. Numerous factors have been identified elsewhere that may affect the frequency and nature of errors, and may also contribute to the difference between psychiatry and general hospitals. However, the comparison of results with other previous studies is limited by variation in size and design of the study, use of methodology, amongst other factors. Nevertheless, some recommendations based on the findings are provided, and it is concluded that further research in the future and improvement of clinical practice such as implementation of electronic prescribing system are recommended for reducing the prescribing error rate and improving patient safety.