

Prescription legibility: bigger might actually be better

Rebecca Fallaize,¹ Gemma Dovey,² Sarah Woolf³

¹Department of General Surgery, University Hospitals Bristol NHS Foundation Trust, Bristol, UK
²Faculty of Medical Leadership and Management, London, UK
³Department of Paediatrics, University Hospitals Bristol NHS Foundation Trust, Bristol, UK

Correspondence to

Dr Rebecca Fallaize, General Surgery, University Hospitals Bristol NHS Foundation Trust, Bristol BS2 8AE, UK; rcullwick@gmail.com

Received 17 July 2018
 Revised 12 October 2018
 Accepted 16 October 2018

ABSTRACT

Introduction Drug errors are common and can be detrimental to patients, even resulting in death. Junior doctors write most prescriptions and are therefore responsible for most errors. There is little literature about the effect of legibility of the prescriber's handwriting on the rate of drug errors. Folklore would deem doctors' handwriting to be poorer than average; however, studies have shown this to be incorrect. In fact, handwriting in general has been shown to be poor.

Methods A random sample of prescriptions from inpatient drug charts were chosen to provide a wide spread of legibility, with an even spread of the use of upper-case and lower-case lettering. Two cohorts of 13 junior doctors and 13 non-medical controls were recruited and asked to transcribe each of the prescriptions. Results were analysed for evidence of a statistical difference in correct transcription rate between lower-case or upper-case letters. **Results** Non-medical participants correctly transcribed only 45% of prescriptions written in lower case. This rose to 66.5% for those written in upper case. This showed strong statistical significance, $p < 0.005$. A statistical difference was also shown for differences in transcription by junior doctors (92.3% vs 97.8%, $p = 0.016$).

Conclusion Doctors must take responsibility for the quality of the prescriptions they write, to prevent avoidable drug errors. Legibility is improved by the use of capital letters. Therefore, we recommend that the use of upper cases should become routine practice when writing drug prescriptions.

INTRODUCTION

Drug errors are common and can have deleterious outcomes for the patient, even resulting in death. A recent meta-analysis study by Elliott *et al* explored the prevalence and burden of medication errors in the UK.¹ They estimated that there are 47 million drug errors in secondary care in the UK each year, of which 4 million (8.5%) are due to prescribing errors. Of these, 293 338 errors had potential to cause serious harm or death. It is well grounded in public folklore that doctors' handwriting is worse than average.² However, more recent studies have shown that this is not the case; more accurately, average handwriting is itself very poor.³

Although prescription errors have been investigated previously, few have looked at prescription legibility as a causative factor. Studies considering legibility have deemed up to 25% of prescriptions as illegible.⁴⁻⁹ As legibility is a recognised cause of drug errors, improving it should result in improved patient safety.

METHODS

The authors chose a random sample of 28 drug prescriptions from drug charts on medical and

surgical wards within a district general hospital. In total, 14 were written in lower-case letters and 14 in upper case. The authors chose a broad spread of prescriptions from what they deemed to be legible or illegible within each set. A cohort of 13 junior doctors from the same hospital and 13 non-medical controls were recruited. No junior doctor whose prescription was sampled was included in this cohort. The participants were asked to transcribe the drug names, as written, not correcting any spelling mistakes. These results were analysed for evidence of a statistical difference in correct transcription rate between lower-case or upper-case letters. A Pearson χ^2 test was performed using a p value of 0.05 for statistical significance. Correctness of drug name spelling was also assessed.

RESULTS

All participants transcribed all 28 drug names. Of the 28 randomly chosen prescriptions, 5 were incorrectly spelled (16.7%).

Non-medical participants correctly transcribed the drug names in only 45% of those written in lower case. This percentage was improved to 66.5% with use of upper-case letters. There was also a difference in transcription accuracy in the junior doctor group who identified 92.3% of lower case and 97.8% of upper case drug names. A Pearson χ^2 test found these differences to be statistically significant in both participant groups (table 1).

Four of the five misspelled drug names were a single letter change and none of these changes altered the name to spell as an alternative drug. The fifth error was metronidazole which was written metronidale. Although this spelling error was greater, it still did not alter the drug name to spell as another recognised drug.

DISCUSSION

Dean *et al*, in 2005, undertook a Delphi consensus to define a 'prescribing error'. Illegibility scored 8 out of 9 (strongly agree) in both rounds.¹⁰ The majority of prescription errors in hospitals are made by junior doctors,¹¹ mainly because they are the most frequent prescribers. In the PROTECT programme, Ross *et al* investigated perceived causes of prescribing errors by junior doctors. Individual and environmental factors were cited including fatigue, workload and looking after other teams' patients. They also recognised that there was an assumption that the ward pharmacist would identify and correct any errors.¹² Transcription errors were highlighted as this task is often rushed and thought to be of low-level priority. However, drug errors can have deleterious effects on the patient.

Serious consequences have resulted in prescription illegibility. In 1989 an asthmatic patient was



© Author(s) (or their employer(s)) 2019. No commercial re-use. See rights and permissions. Published by BMJ.

To cite: Fallaize R, Dovey G, Woolf S. *Postgrad Med J* 2018;**94**:617–620.

Table 1 Results for transcription rates between junior doctors and non-medical participants.

	Transcribed correctly	Transcribed incorrectly	Total	Pearson X ²	P values
Non-medical participants					
Lower case	82 (45.1%)	100 (54.9%)	182	16.94	<0.005
Upper case	121 (66.5%)	61 (37.5%)	182		
Junior doctors					
Lower case	168 (92.3%)	14 (7.7%)	182	5.84	0.016
Upper case	178 (97.8%)	4 (2.2%)	182		

prescribed Amoxil for a chest infection but Daonil, an oral hypoglycaemic, was dispensed instead. The patient developed a hypoglycaemic coma and subsequent brain injury. Both the doctor and the pharmacist were found guilty of negligence, and the patient was rewarded damages.¹³ In 1999, a patient died after being given Isordil rather than Plendil, an error which was ruled to be a direct result of the physician's poor handwriting.¹⁴ Many medical negligence lawyers in the UK advertise on their websites that prescription errors due to illegibility are a reason to seek recompense and, in the age of increasing litigation in the UK, this is surely something prescribers should wish to avoid through simple attention to detail in their handwriting.

Prescription errors due to illegibility also impact on the pharmacist or nurse dispensing the medication. It is generally accepted that the person dispensing the medication is the final check in the process that the prescription has appropriate drug dose and frequency for the drug stated, but this cannot be relied on. In the two cases of negligence quoted above, the pharmacist was also found guilty as they had not recognised the error. Moran and Duncan, in 2004, wrote in the *Journal of Nursing Care Quality* that doctor prescription illegibility was the number one cause of drug errors as recognised by the 983 registered nurses taking part in their study. However, respondents also reported that less than half of medication errors were reported.¹⁵ The potential ripple effect of a drug error is wide, affecting not just the patient and their family but also the pharmacist or nurse dispensing the drugs who could stand to lose their careers and be open to criminal charges of negligence or harm. The authors would propose that not only do doctors have a duty of care to their patients but that they also have a professional duty to their multidisciplinary colleagues in ensuring they can carry out their duties without risking their own professional standing. If nothing else, poor legibility opens the prescribing doctor up to potential legal recourse should a drug error be resultant risking their own professional registration and possible criminal charges.

In our prescription sample there were five misspelled drugs. None of these errors resulted in the drug appearing to be a different one but the misspelling of metronidazole as metronidale does require the dispensing nurse to make an assumption that the correct drug is actually metronidazole. To the authors' knowledge, there were no drug-dispensing errors due to poor handwriting or spelling errors in the prescription samples obtained during this project. Solanki *et al* performed a root-cause analysis of drug errors over three wards at their hospital. They found 117 prescription errors in 300 patients over 10 months. Root-cause analysis was undertaken and a prescription documentation cause was demonstrated in 62/117 (53%). On further analysis, illegible prescriptions were found to be accountable in 21 (34%) of these errors. Therefore, of 117 errors, 21 were due to illegible prescriptions (18%). When considered another way, 7% of patients included in the study were adversely affected by illegible writing on their prescription charts.¹⁶

Historically, doctors have been considered to have poor levels of handwriting. Berwick *et al* investigated this folklore in 1996. They compared the legibility of handwriting across 209 health professionals. They found no significant difference in legibility of handwriting between doctors and non-doctors. However, high-level managers (chief executives and chief operating officers), male subjects and those who were older had significantly less legible handwriting than their counterparts. More worryingly, however, was that legibility across all subjects was felt to be only fair to good on a four-point scale (poor, fair, good, very good).³ Schneider *et al* compared handwriting between different occupations.¹⁷ They corroborated Berwick's findings with regard to gender but found no other significant differences.

Doctors are bound by the standards laid out by the General Medical Council. With regards to prescriptions it states that 'documents you make to formally record your work must be clear, accurate and legible'.¹⁸ The prescription chart is as important a part of the patient documentation as the patient notes. When there are cases of litigation against doctors, the quality of the medical notes is often cited as a reason for why cases settle out of court. If the clinical notes are poorly written, it can be fairly assumed that prescriptions could be equally poor. The Prescribing Competency Framework as published by the National Institute for Health and Care Excellence and the Royal College of Pharmacists outlines the competencies required to be met by all health professionals who prescribe drugs. It states that prescribers 'write legible, unambiguous and complete prescriptions which meet legal guidelines'.¹⁹ Doctors must therefore ensure that they are compliant with these standards and that their prescriptions are legible. The question remains, what do we deem as 'legible'?

The definition of the word 'legible' is 'clear enough to read'.²⁰ However, there is no statement in prescribing guidelines as to how prescriptions should be written to make them compliant with this.²¹ The authors suggest that all prescriptions should be easily and accurately understood by anyone, not just people familiar with the prescriber's handwriting. This is especially true in the present day when the doctor writing the prescription is unlikely to be looking after that patient for the rest of their stay and when nurses handover frequently. The risk is increased by the frequent movement of patients between wards and the number of different members of staff interacting with a patient's drug chart. Each new interaction with the drug chart is an opportunity for misreading of the prescription and a potential drug error.

There are no studies written with regards to the legibility of lower-case versus upper-case letters although it is generally accepted that full paragraphs of upper-case text are more difficult to read due to lack of variability in letter height and shape. However, a study which looked at how best to improve legibility of text for people with reduced visual acuity showed that the use of upper-case text improved legibility and reading speed for

participants with both normal and reduced visual acuity.²² We must not assume that all members of staff reading a patient's drug chart have perfect visual acuity; even more reason to ensure perfect legibility of prescriptions. Another study, considering the legibility of typed prescription labels, showed a preference by participants for the use of upper-case letters.²³ In America, the use of 'tall man', that is, capital letters, is recommended to reduce errors between similarly named drugs. Although these studies are with relation to printed prescriptions, it is conceivable that their findings could be extrapolated to written text.

Studies have considered the use of pharmacists in reducing errors in the prescribing process. Isles *et al* compared the prescriptions of junior doctors compared with that of transcription-trained pharmacists. Also, 20% of doctor prescriptions were considered illegible compared with 0% of the pharmacists.⁴ The reasons behind this are likely to be plentiful. Junior doctors are busier than ever before with a faster turn over of increasingly elderly patients who are generally more comorbid. This results in more drugs being required, therefore leading to more prescriptions being written. It is possible that the writing of drug charts is considered a chore by already very busy junior doctors. Trying to complete this task quickly may result in poorer handwriting. Prescribing pharmacists, on the other hand, are a self-selected group of professionals who have chosen to undertake additional training to become transcribers. It may therefore be that they see this task as less of a chore, and spend more time doing it. Noble *et al* have recently shown coworking between junior doctors and pharmacists as a way to positively contribute to junior doctors prescribing skills. Transcribing pharmacists are becoming more widespread across our hospitals and 'up skilling' junior doctors alongside them may be a way to reduce prescription errors.²⁴

Medical schools place emphasis on teaching medical students how to prescribe the appropriate drug at the appropriate dose while avoiding potential interactions. Less time is taken educating medical students in how to physically produce a good quality written prescription either on a hospital drug chart, outpatient prescription or FP10. However, a recent meta-analysis has shown that students still start professional life with a general lack of preparedness, self-confidence, knowledge and skills regarding general prescribing.²⁵ This lack of preparedness is likely to also extrapolate to physical prescription writing confidence and abilities. It appears that medical schools need to address competency of students with regards to prescribing skills and the technicalities of the actual written prescription should be an integral part of that. Good habits start early and, if the use of capital letters were introduced from the beginning, then the chances are their usage would persist. That being said, responsibility cannot be placed purely on the medical schools and the UK Foundation Programme Office should routinely incorporate ongoing education in prescribing skills for its F1 and F2 doctors, ensuring it maintains high-quality prescriptions from its trainees.

Many methods to reduce drug errors and improve prescription quality have been introduced to National Health Service (NHS) hospitals. Preprinted drug charts for certain medications, for example, venous thromboprophylaxis, are standard across many trusts and preprinted stickers which can be placed in drug charts are becoming more widespread. These methods act to prevent incorrect dosing in a 'normal' patient but they run the risk of possible adverse consequences in the non-standard patient, for example, at the extremes of weight or with poor renal function. Senior doctors should be encouraged to allow adequate time for juniors to prescribe when on a ward round to reduce the risk of error and to allow legible writing. NHS governance encompasses the use of incident reporting to allow

further education and change in processes to ensure patient safety. Dispensing staff, both pharmacists and nurses, should be encouraged and supported to report all drug errors that they see and not to dispense the drug in question if they have any doubt about the legibility of the prescription.

Use of electronic prescribing is widespread across primary care and is becoming more common across NHS hospitals. Studies have shown that these systems not only reduce drug errors, including those of illegibility and other factors related to human factors, but also reduce the number of interventions required by pharmacists to make a prescription correct and safe.^{26–28} Electronic prescribing does, however, introduce other potentials for errors. Like preprinted prescriptions, it potentially allows doctors to prescribe on 'auto-pilot' without carefully considering dosing. Training is required to enable use of the electronic system, which are not standard across all NHS Trusts. Therefore, this is an additional resource that junior doctors will need to spend time learning each time they move Trust. Like all electronic systems, electronic prescribing systems can 'crash', information may not be correctly saved or equally not deleted, meaning a drug may not be started or stopped when it should be. For these reasons, electronic prescribing should not be viewed as a panacea, but should be viewed as supplementary to other work which is presently ongoing in the NHS patient safety arena. As the NHS becomes more adept at using technology to manage health records, it should be expected that electronic prescribing systems will guard against prescription of known allergens, recognised drug interactions and over or underdosing due to weight or renal function.

CONCLUSION

There are a number of factors which contribute to prescription errors but handwriting illegibility should not be one of them. Doctors and other prescribing practitioners must take responsibility for the legibility of every prescription they write, knowing that prescription errors can result in patient morbidity and mortality. We have shown that the use of upper-case letters can improve legibility. The introduction of electronic prescribing will ultimately remove the need for legible writing on drug charts

Main messages

- ▶ Poor legibility is a recognised cause of drug errors and can result in serious morbidity and potential mortality for the patient.
- ▶ Use of capital letters increases legibility and therefore has the potential to reduce drug errors as a result.
- ▶ Doctors have a duty of care to their patient and a professional duty to their dispensing colleagues to ensure drugs prescriptions are readily identifiable.

Current research questions

- ▶ Will widespread use of electronic prescribing reduce drug errors or simply alter the profile of the errors?
- ▶ Will the use of electronic prescribing reduce doctors' ability to recall drug interactions, indications and contraindications without an electronic prompt?
- ▶ What would be the single best intervention to improve prescription legibility, and resultant drug error rate, among the junior doctor population?

What is already known on the subject

- ▶ Prescribing errors account for 4 million drug errors in secondary care each year.
- ▶ Folklore suggests that doctors have poorer handwriting than the general public.
- ▶ Doctors are bound by the General Medical Council standards, stating that all recorded documents of care should be "clear, accurate and legible".
- ▶ Electronic prescribing is becoming more common in secondary care.

but in the meantime it remains vital for us to focus on reducing avoidable prescription errors. The fundamental way in which we would suggest achieving this would be encouraging the use of capital letters in paper prescribing in conjunction with ongoing junior doctor education and ensuring that the working environment is conducive to attention to detail in this task.

Contributors RF and SW planned the study. SW and GD collected the data. RF wrote the article with edits by SW and GD. RF submitted the study. RF is responsible as overall guarantor.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient consent Not required.

Provenance and peer review Not commissioned; externally peer reviewed.

REFERENCES

- 1 Elliott RA, Camacho E, Cambell F. Prevalence and economic burden of medication errors in the NHS in England. Available from: <http://www.eepru.org.uk/wp-content/uploads/2018/02/eepru-report-medication-error-feb-2018.pdf> [Accessed Jul 2018].
- 2 Goldsmith H. The facts on the legibility of doctors' handwriting. *Med J Aust* 1976;2:462–3.
- 3 Berwick DM, Winickoff DE. The truth about doctors' handwriting: a prospective study. *BMJ* 1996;313:1657–8.
- 4 McFadzean E, Isles C, Moffat J. Is there a role of a prescribing pharmacist in preventing prescribing errors in a medical admissions unit? *Pharm J* 2003;270:896–9.
- 5 Albarak AI, Al Rashidi EA, Fatani RK, et al. Assessment of legibility and completeness of handwritten and electronic prescriptions. *Saudi Pharm J* 2014;22:522–7.
- 6 Murray S, Boylan G, O'Flynn S, et al. Can you read this? Legibility and hospital records: a multi-stakeholder analysis. *Clin Risk* 2012;18:95–8.
- 7 Mendonça JM, Lyra DP, Rabelo JS, et al. Analysis and detection of dental prescribing errors at primary health care units in Brazil. *Pharm World Sci* 2010;32:30–5.
- 8 Calligaris L, Panzera A, Arnoldo L, et al. Errors and omissions in hospital prescriptions: a survey of prescription writing in a hospital. *BMC Clin Pharmacol* 2009;9:9.
- 9 Meyer TA. Improving the quality of the order-writing process for inpatient orders and outpatient prescriptions. *Am J Health Syst Pharm* 2000;57 Suppl 4:P18.
- 10 Dean B, Barber N, Schachter M. What is a prescribing error? *Qual Health Care* 2000;9:232–7.
- 11 Dornan T, Ashcroft D, Heathfield H. An in depth investigation into causes of prescribing errors by foundation trainees in relation to their medical education. EQUIP Study. Available from: https://www.gmc-uk.org/media/documents/FINAL_Report_prevalence_and_causes_of_prescribing_errors.pdf_28935150.pdf [Accessed Mar 2018].
- 12 Ross S, Ryan C, Duncan EM, et al. Perceived causes of prescribing errors by junior doctors in hospital inpatients: a study from the PROTECT programme. *BMJ Qual Saf* 2013;22:97–102.
- 13 Mullan K. Importance of legible prescriptions. *J R Coll Gen Pract* 1989;39:347–8.
- 14 Charatan F. Family compensated for death after illegible prescription. *BMJ* 1999;319:1456.
- 15 Mayo AM, Duncan D. Nurse perceptions of medication errors: what we need to know for patient safety. *J Nurs Care Qual* 2004;19:209–17.
- 16 Solanki N, Shah C. Root cause analysis of medication errors at a multi-specialty hospital in Western India. *Int J Basic Clin Pharmacol* 2013;2:819–23.
- 17 Schneider KA, Murray CW, Shaddock RD, et al. Legibility of doctors' handwriting is as good (or bad) as everyone else's. *Qual Saf Health Care* 2006;15:445.
- 18 General Medical Council. Good practice in prescribing and managing medicines and devices. 2013. Available from: https://www.gmc-uk.org/-/media/documents/Prescribing_guidance.pdf_59055247.pdf [Accessed Mar 2018].
- 19 A competency framework for all prescribers. Available: <https://www.rpharms.com/Portals/0/RPS%20document%20library/Open%20access/Professional%20standards/Prescribing%20competency%20framework/prescribing-competency-framework.pdf> [Accessed Apr 2018].
- 20 legible | definition of legible in english by Oxford dictionaries. Available from: <https://en.oxforddictionaries.com/definition/legible> [Accessed Apr 2018].
- 21 NICE. BNF: British National Formulary. Available from: <https://bnf.nice.org.uk/guidance/prescription-writing.html> [Accessed Apr 2018].
- 22 Arditi A, Cho J. Letter case and text legibility in normal and low vision. *Vision Res* 2007;47:2499–505.
- 23 Leat SJ, Krishnamoorthy A, Carbonara A, et al. Improving the legibility of prescription medication labels for older adults and adults with visual impairment. *Can Pharm J* 2016;149:174–84.
- 24 Noble C, Billett S. Learning to prescribe through co-working: junior doctors, pharmacists and consultants. *Med Educ* 2017;51:442–51.
- 25 Brinkman DJ, Tichelaar J, Graaf S, et al. Do final-year medical students have sufficient prescribing competencies? A systematic literature review. *Br J Clin Pharmacol* 2018;84:615–35.
- 26 Donyai P, O'Grady K, Jacklin A, et al. The effects of electronic prescribing on the quality of prescribing. *Br J Clin Pharmacol* 2008;65:230–7.
- 27 Dainty KN, Adhikari NK, Kiss A, et al. Electronic prescribing in an ambulatory care setting: a cluster randomized trial. *J Eval Clin Pract* 2012;18:761–7.
- 28 Bizovi KE, Beckley BE, McDade MC, et al. The effect of computer-assisted prescription writing on emergency department prescription errors. *Acad Emerg Med* 2002;9:1168–75.