

Using league tables to reduce missed dose medication errors on mental healthcare of older people wards

Alan Cottney
East London NHS Foundation Trust

Abstract

The unintentional omission of medication is one of the most commonly-reported administration errors on hospital wards throughout the world. The omission of a dose of medication can severely harm the patient affected, but to date there is limited evidence about cost-effective means for reducing the incidence of such errors. The current report describes a quality improvement project, conducted on the mental healthcare of older people (MHCOP) wards in East London NHS Foundation Trust, which led to a greater than 90% reduction in the rate of unintentionally omitted doses of medication. The project involved the publication of a fortnightly league table which ranked each of the wards by how many doses they had missed, with the ward missing the fewest doses receiving a prize. PDSA cycles were used to refine the concept, with the final incarnation of the fortnightly league table also incorporating the publication of a poster for each ward which showed how many weeks it had been since the ward missed a dose, and the ward's overall trend in missed doses. The project has resulted in the average missed dose rate on the MCHOP wards decreasing from 1.07% to 0.07%. In real terms, this represents a reduction from an estimated 2878 to 188 missed doses per year on the six MHCOP wards. By greatly reducing the risk of patients experiencing adverse drug events as a result of missed doses, this project has given rise to a potential cost-saving of around £34,000 per year across the wards studied. The use of league tables represents a simple, cost-effective means of tackling the problem of doses of medication being unintentionally omitted on hospital wards.

Problem

Medication administration errors are a common occurrence on inpatient hospital wards (1-3). A recent study conducted in East London NHS Foundation Trust (ELFT) found that the unintentional omission of a dose of medication is the most frequent administration error seen on the Trust's inpatient wards (3). This type of error accounted for 37% of all the errors observed during direct observation of medication rounds in ELFT.

The unintentional omission of a dose of medication is not an innocuous error- it can have a profoundly negative impact on patients. When the issue was investigated by the National Patient Safety Agency in 2010, they found that in England and Wales, in less than three years, 27 people had died and 68 were severely harmed after the omission of a medication (4).

There is a greater risk of omitting a dose of medication for a patient on wards specialising in the care of older people because, on average, older people will be prescribed more medication than their younger counterparts. Data from ELFT indicates that on the Trust's adult acute mental health wards, the average number of doses of medication prescribed per patient per day is 2.3, whereas it is 3.9 on the mental healthcare of older people (MHCOP) wards (3). When more doses are prescribed, there is a greater chance of omitting a medication- as there will be a proportionally higher opportunity for error. There is thus a demonstrable need to tackle the problem of missed doses of medication on MHCOP wards.

Background

The unintentional omission of medication is not a problem that is unique to ELFT. Two recent systematic reviews of medication administration error studies both reported omitted doses to be one of the most commonly observed problems on hospital wards throughout the world (1,2). To improve the standard of pharmaceutical care we provide to patients there is a clear need for the development of strategies to reduce the frequency with which unintentionally omitted doses of medication occur. However, there is limited current literature evidence about how missed dose rates can be reduced. Two studies have reported that the implementation of electronic prescribing systems has led to a significant reduction in unintentionally omitted doses (5,6). No such electronic systems are available at ELFT, and indeed, such systems can be costly and time consuming to implement. So whilst the implementation of electronic prescribing may represent a good strategy in the longer-term, there is still a need to develop interim approaches to reduce omitted doses - that can begin to have an immediate impact.

A group of Australian investigators report on the development and implementation of a training package to reduce harm from omission of medication (7). However, the investigators do not state whether this training package actually led to a reduction in the incidence of omitted doses in the hospitals in which it was implemented. Therefore, it is not clear whether implementation of such a package would be of benefit in ELFT. One further study reported a reduction in omitted doses of medication after the deployment of pharmacy assistants to support nursing medication rounds (8). This interesting finding may lead to the wider use of pharmacy support staff in such novel roles. However, the allocation of staff to such roles necessitates a commensurate reallocation of resources. It is not possible to adopt such an approach in the absence of additional financial outlay. There is a need to develop a novel, inexpensive

BMJ Quality Improvement Reports

approach to tackling the intractable problem of omitted doses of medication on inpatient wards. The goal of the current quality improvement project was to develop such an approach on the six MHCOP wards in East London NHS Foundation Trust.

Baseline measurement

The overall aim of the project was to reduce the number of unintentionally omitted doses of medication on the six mental healthcare of older people (MHCOP) wards. Therefore, the measure that was used to track the impact of the project was the rate of unintentional dose omission. This was defined as the number of unintentionally omitted doses per total number of doses due. Data was collected on a weekly basis by pharmacist review of all medication administration record (MAR) charts for all patients across the six wards. An unintentionally omitted dose was defined as any occasion on which the MAR chart record for a particular dose was not completed either with a nurse's signature indicating administration, or a specified code indicating that the dose had been intentionally omitted. This was in line with the methodology adopted in other studies of omitted doses (7-9). Chart review was conducted at least 24 hours after the last doses for that week should have been given.

Prior to the initiation of the project, weekly data about missed doses was collected from all six wards for six weeks. Over these six weeks, the average missed dose rate across the six wards was found to be 1.07%. That is, 1.07% of all doses of medication that were prescribed to be administered to patients were omitted unintentionally. Extrapolating the six weeks' worth of data to a year, it is estimated that an average of 268,926 doses will be given on the six MHCOP wards per annum. Therefore, if 1.07% of these doses are omitted, it would correspond to approximately 2878 doses of medication that patients are prescribed, but which they do not receive.

Design

It was felt that a vital component of the project would be to raise awareness of the problem of omitted doses of medication. Discussion with frontline nursing staff had revealed that not all staff members were aware of how many doses of medication were being omitted, nor the potential clinical consequences of dose omission. A search of 'BMJ Quality Improvement Reports' revealed a project in which the standard of antibiotic prescribing in a hospital had been improved through the use of a league table system (10). The league table helped to raise awareness of antibiotic prescribing standards and encouraged a competitive spirit that led to an overall improvement. It was felt that this league table concept was something that could be applied in ELFT with the aim of raising awareness of the problem of omitted doses of medication. Approval to test the league table concept was gained from the MHCOP directorate management team and relevant ward managers.

The weekly data about missed doses that was collected by pharmacists was provided to the Lead Pharmacist for MHCOP, who collated the information and used it to create a league table. The

league table was issued every fortnight, and was sent via e-mail to all ward managers. The ward managers were asked to forward the league table to each of the nurses working on their ward, and to print a copy to display on the ward's noticeboard. This was felt to be a sustainable model for the initiative because the potentially most time-consuming part - the collection of data about the missed dose rate - was something that in large part was already being done by pharmacists. On each of the wards, pharmacists regularly review the MAR chart for every patient, so asking them to record instances of missed doses did not add a large burden of extra work.

The data that was collected was also used to develop a control chart which showed how the omitted dose rate varied from week to week. This meant that the intervention's effect on the missed dose rate could be tracked in real-time.

Strategy

PDSA 1: A league table was created and issued to each of the wards as outlined in the 'Design' section above. The league table ranked the wards in terms of their average missed dose rate over the previous two weeks. Along with the missed dose rate, the league table showed how many doses of medication had been due on each ward in the past fortnight, and how many doses had been missed. The ward at the top of the league - that is, the one that missed the fewest doses - was then awarded a prize which consisted of some snacks for the ward staff. There was an immediate drop in the unintentionally omitted dose rate after the first league table was published.

PDSA 2: The league table continued to be issued on a fortnightly basis, and whichever ward was top of the league continued to receive a prize. After two issues of the initial design, the league table was adapted to include information about the change in missed dose rate from the previous issue. This meant that each ward could now see whether their missed dose rate had gone up or down over the previous fortnight.

PDSA 3: The issuing of the league tables was found to be effective in reducing the missed dose rate, and so the fortnightly distribution of the tables continued. A further change idea was tested when, along with the league tables, each ward was issued an individualised poster which very clearly stated how many doses had been missed on the ward in the past fortnight. If the ward had not missed any doses, the poster would then state how many weeks it had been since a dose had been missed. Each ward was issued its own poster and was asked to display this prominently, where it could be seen by patients and carers on the ward. The missed dose rate further reduced when these posters started being issued.

PDSA 4: The final refinement of the concept involved adapting the individualised ward posters to include a line graph which showed the weekly variation in missed rate for that ward since the project started. Each of the wards could now see whether the trend on their wards was towards a higher or lower rate of missed doses. It was hoped that this longer-term view of the missed dose rate would act as a further encouragement to the ward staff.

BMJ Quality Improvement Reports

Results

The control chart that was used to track the missed dose rate over the course of the project can be accessed under "Supplementary Material". From the control chart it can be seen that the missed dose rate has decreased sharply since the implementation of the project. There were two points of change that obeyed the statistical process control rules (11,12) for 'special cause variation'. No other changes that could have affected the missed dose rate have been identified, so it is very likely that this special cause variation can be attributed to the changes implemented through the current project.

As discussed above, the baseline missed dose rate in the six weeks before implementation of the first PDSA cycle was 1.07%; which would give an average of 2878 missed doses per year across the six MHCOP wards. In the last six weeks of the project, after the completion of four PDSA cycles, the missed dose rate was 0.07%. This would lead to an average of 188 missed doses per year across the six MHCOP wards. This means that the project has helped to ensure that, over the course of a year, the patients on the MHCOP wards should now receive 2690 doses of medication that they otherwise would have inappropriately gone without.

See supplementary file: ds5438.pptx - "Missed dose rate- control chart"

Lessons and limitations

An obvious lesson to take from the project is that healthy competition can help drive improvement. The wards all wanted to finish top of the league table, so they spurred one another on to make changes that would lead to them missing fewer doses of medication. This leads to a second learning point - that it can be effective to allow flexibility with regards the exact means of bringing about improvement. The league tables and posters gave the wards an indicator of how they were performing, but it was then up to them to enact the changes that would lead to improvement. This represents an organic way for improvement to develop within the framework of each particular context - and is in contrast to a more proscriptive, top-down approach to change.

An additional lesson from the project was that the visual display of information can be very effective at bringing about improvement. The league tables and posters that were published very clearly showed each ward how it was doing compared to other wards in terms of missed doses, and also whether the ward was improving or getting worse. Allowing the wards to keep track of their progress, and to benchmark their performance against that of other wards, encouraged them to keep trying to reduce their missed dose rate.

Another lesson was the fact that it is better to reward good practice than to punish bad. The nurses on the wards talked about the fact that they had previous experience of data being used in a punitive, negative way - to attach blame and criticise. The nurses were appreciative of the fact that the ward with the lowest missed dose rate would get a prize- rather than the ward with the highest rate being punished.

The intervention is cost-effective, as it involved very little financial outlay. The biggest potential source of cost would be the time taken for pharmacists to count missed doses. However, the pharmacists already review medication charts as part of their job role, so counting missed doses takes little extra time. On the other hand, there is potentially a large cost benefit associated with the project; an estimate of which can be obtained by the application of evidence from the academic literature. Each omitted dose represents a medication error, and Bates et al (1995) (13) have shown that for every 530 medication errors that are made in hospitals, there will be five actual 'adverse drug events' (ADEs). This means that the 2690 omitted doses that were avoided through the implementation of the current project would have been expected to give rise to around 25 actual ADEs in a year. Senst et al (2001) (14) conservatively estimate that the cost of one preventable ADE is \$2162, so the cost of 25 would be \$54,050 (£34,320 at the current exchange rate). Therefore, the current project has the potential to save more than £34,000 a year across the six MHCOP wards.

A limitation of the current project was that it was only implemented on the six mental healthcare of older people wards at ELFT. Therefore, at the minute, it is not clear whether the findings generated would be replicated if the change ideas were tested on other mental health wards, or wards in a general hospital. There are currently plans to test the intervention more widely within East London Foundation Trust, and if it generates similar results on other wards, the change ideas will be implemented throughout the Trust.

Conclusion

The unintentional omission of medication is amongst the most common medication administration errors that occur in the hospital setting. To date there is little evidence about cost effective means for reducing the incidence of unintentionally omitted doses. However, the introduction of a league table concept has led to a more than 90% reduction in the missed dose rate on the six mental healthcare of older people wards in East London NHS Foundation Trust. This has potentially led to a yearly cost-saving of around £34,000. The visual display of information about quality of care, the healthy competition that the league tables generated, and the rewarding of good practice, all played a part in the success of the project. The techniques employed will now be applied more widely throughout the Trust, and will be tested in a variety of clinical settings. If the results from the current study are replicated, the use of league tables will represent a simple, cost-effective means of reducing unintentionally omitted doses of medication on hospital wards.

References

1. Berdot S, Gillaizeau F, Caruba T, et al. Drug administration errors in hospital inpatients: a systematic review. *PLOS ONE* 2013;8(6):1-11.
2. Keers RN, Williams SD, Cooke J, et al. Prevalence and nature of medication administration errors in health care settings: a systematic review of direct observational evidence. *Ann Pharmacother* 2013;47:237-56.

BMJ Quality Improvement Reports

3. Cottney A and Innes J. Medication-administration errors in an urban mental health hospital: A direct observation study. *International Journal of Mental Health Nursing* 2015;24:65-75.
 4. National Patient Safety Agency. Rapid Response Report: Reducing harm from omitted and delayed medicines in hospital. NPSA/2010/RRR009. London: NPSA, 2010.
 5. Coleman JJ, Hodson J, Brooks HL and Rosser D. Missed medication doses in hospitalised patients: a descriptive account of quality improvement measures and time series analysis. *International Journal for Quality in Health Care* 2013;25(5):564-572.
 6. Warrick C, Naik H, Avis S et al. A clinical information system reduces medication errors in paediatric intensive care. *Intensive Care Medicine* 2011;37(4):691-694.
 7. Graudins LV, Ingram C, Smith BT et al. Multicentre study to develop a medication safety package for decreasing inpatient harm from omission of time-critical medications. *International Journal for Quality in Health Care* 2015;27(1):67-74.
 8. Baqir W, Jones K, Horsley W et al. Reducing unacceptable missed doses: pharmacy assistant-supported medicine administration. *International Journal of Pharmacy Practice* 2015 [online ahead of print].
 9. Wright J. Audit of missed or delayed antimicrobial drugs. *Nursing Times* 2013;109(42):11-14.
 10. Evans J, Saxby C and Armstrong A. The Champions League- Improving the quality of inpatient antibiotic prescription in Trauma and Orthopaedics. *BMJ Qual Improv Report* 2014;3.
 11. Benneyan JC. Use and interpretation of statistical quality control charts. *International Journal for Quality in Health Care* 1998;10(1):69-73.
 12. Benneyan JC, Lloyd RC and Plsek PE. Statistical process control as a tool for research and healthcare improvement. *Qual Saf Health Care* 2003;12(4):458-464.
 13. Bates DW, Boyle DL, Vander Vliet MB et al. Relationship between medication errors and adverse drug events. *J Gen Intern Med* 1995;10(4):199-205.
 14. Senst BL, Achusim LE, Genest RP et al. Practical approach to determining costs and frequency of adverse drug events in a health care network. *Am J Health Syst Pharm* 2001;58(12):1126-32.
- deemed an improvement study and not a study on human subjects.

Declaration of interests

Nothing to declare.

Acknowledgements

I am grateful for the assistance and encouragement provided by the East London NHS Foundation Trust Mental Healthcare of Older People directorate, Quality Improvement team and pharmacy team.

Ethical approval

This work was considered exempt from ethical approval as it was

QIR

Using league tables to reduce missed dose medication errors on mental healthcare of older people wards

Alan Cottney

BMJ Qual Improv Report 2015 4:
doi: 10.1136/bmjquality.u204237.w3567

Updated information and services can be found at:
<http://qir.bmj.com/content/4/1/u204237.w3567>

Open Access

These include:

This is an open-access article distributed under the terms of the Creative Commons Attribution Non-commercial License, which permits use, distribution, and reproduction in any medium, provided the original work is properly cited, the use is non commercial and is otherwise in compliance with the license. See: <http://creativecommons.org/licenses/by-nc/2.0/>
<http://creativecommons.org/licenses/by-nc/2.0/legalcode>

Email alerting service

Receive free email alerts when new articles cite this article. Sign up in the box at the top right corner of the online article.

Topic Collections

Articles on similar topics can be found in the following collections

[Patient safety](#) (37)

Notes

To request permissions go to:
<http://group.bmj.com/group/rights-licensing/permissions>

To order reprints go to:
<http://journals.bmj.com/cgi/reprintform>

To subscribe to BMJ go to:
<http://group.bmj.com/subscribe/>