

New barcode checks help reduce drug round errors in care homes

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**Title: The responses of nurses and social care staff towards
a pharmacy-led barcode medication administration
system**

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Abstract

The present study (January 2008 - December 2010) conducted by researchers at the University of the West of England, Bristol and Warwick Medical School, evaluated the impact upon medication administration of a pharmacy-led barcode medication management system (PBMS) in care homes (with or without on-site registered nursing staff). Using a pre and post design with repeated mixed methods, findings showed that the PBMS: raised awareness of 'near miss' errors (particularly in nurses); reduced stress and the pressure of medication rounds, and had a beneficial impact upon interruptions and distractions. Care staff in nursing homes in particular, could administer selected medications using this system but attention to developing a wider professional framework is recommended.

Introduction

The PBMS generates automatic real-time alerts for the user to draw attention to inappropriate or unsafe medication administrations. The administrator uses a hand-held device to scan each resident's barcode identifier to access the correct file. The system provides visual confirmation of the resident (photograph) followed by a number of checks. If the proposed medication administration is incorrect, the system alerts the administrator immediately. A weekly report is sent to the care home manager (CHM) with details of mistakes and the staff involved. If a medication within the correct time frame is entirely missed, the system enters this as a 'missing record'.

Literature Review

With the number of people aged 75 and over projected to nearly double in England by 2033, increasing from 4.8 to 8.7 million (Office of National Statistics 2009), patient safety for older people and the management of medication in care homes will increasingly be important. In a recent UK study in 55 care homes, 70% of residents experienced one or more medication errors (Barber *et al* 2009). Despite improvement, 28% of all care homes in England have been described as failing to meet required standards in medication systems (Care Quality Commission 2011).

A systematic review has found evidence that computerised support systems can produce improvements in prescribing and dispensing practices, although there was little evidence on the administration of medications (Kaur *et al* 2009).

Aim of the study

The study evaluated the impact of the PBMS upon medication administration in nursing homes (NH) with registered nurses (RN) and residential homes (RH) with social care staff. Pre- and post-PBMS introduction, differences between the type of home and type of staff were recorded in terms of staff awareness of medication administration errors and reasons for them.

Methodology

Design

A pre and post intervention design was used in 9 RHs and 4 NHs. Study sites included small and large independent care providers from both commercial and 'not for profit' sectors, representing a geographical spread covering the South West, Midlands and North West of England. The Care Quality Commission rated the care homes as being either a 'good' or a higher standard. All care

homes selected used a paper-based Medication Administration Record (P-MAR) system prior to the introduction of the PBMS. Ethical approval for the study was obtained from the lead University's Research Ethics Committee.

Materials and methods

All staff administering medication received training before PBMS introduction. Prior to training, a convenience sample of care home staff (home managers, social carers and RNs) completed questionnaires and interviews to explore the awareness of errors when using the current P-MAR system. A second questionnaire was completed and interviews undertaken 12 weeks post training, once staff had used the new system. In this, staff compared the PBMS with their previous P-MAR system in terms of benefits and limitations. In total 43 interviews and 5 focus groups were completed.

Study participants

A total of 49 staff from the 13 homes (NH: 14 RNs and RH: 35 social carers), responsible for management and/or administration of medications, completed the pre-PBMS survey questionnaire. Post introduction of PBMS, a total of 39 staff (12 NH RNs and 27 RH social carers) with a similar responsibility completed the second questionnaire from 11 of the care homes (1 NH's staff withdrew and 1 RH's staff failed to comply).

Analysis

The pre- and post-PBMS questionnaire data were entered into SPSS 17. Two researchers analysed the qualitative interview data using content analysis. Each acted independently in the first instance then they jointly agreed the transcripts' themes and sub themes from a review of all comments.

Descriptions of errors

The study adhered to Williams (2007) description of medication errors given as arising '*when a discrepancy occurs between the drug received by the patient and the drug therapy intended by the prescriber.*'

A further distinction was made between errors that actually occurred ('administering' and 'documenting') with 'near misses', i.e. those where a mistake was being made but was stopped either by the person administering (or another), or averted by a technological system.

Results

Response rates

Thirty-five care staff in RHs and 14 RNs in NHs completed the pre-PBMS questionnaire. Following introduction of the new system, a total of 27 care staff in RHs and 12 RNs in NHs completed the post-PBMS questionnaire.

Awareness of 'near misses'

Table 1 shows staff awareness of the occurrence of 'near misses' by type of home. Pre-PBMS, 40% of staff in RHs confirmed awareness of 'near misses' but none of the RNs in NHs reported this. The difference between staff groups and types of home pre-PBMS was significant (Mann-Whitney: $Z = -2.74$; $p < 0.05$).

Table 1. Pre and post-PBMS staff awareness of occurrence of 'near misses' by type of home

| Awareness of 'near misses' | RH PRE-PBMS (Carer = 35) N % | RH POST-PBMS (Carer=27) N % | NH PRE-PBMS (RNs = 14) N % | NH POST-PBMS (RNs=12) N % |
|----------------------------|------------------------------------|-----------------------------------|----------------------------------|---------------------------------|
| Yes | 14 (40) | 20 (74) | 0 | 10 (83) |
| No | 18 (51) | 6 (22) | 12 (86) | 2 (17) |
| Missing | 3 (9) | 1 (4) | 2 (14) | 0 |
| TOTAL | 35 (100) | 27 (100) | 14 (100) | 12 (100) |

Box 1 – Awareness of the occurrence of ‘near miss’ errors

CHM (RN) – NH: I think the signing or not signing because that is such a big issue and actually putting the reasons in why the drug hasn't been given because that's again something that we are picked up on...'

CHM (RN) – NH: 'Drug errors, we don't have any major things really but it's just things like omitting to sign...sometimes drug are missed ... silly things really.'

CHM (RN) – NH: ' When I'm saying to the RNs *'we've got picked up from CSCI because there's x amounts of gaps on the MAR sheet'*, you get the tuts and the *'oh you know we ran out of time ... CSCI being picky'* and *'it's just a bit of a nuisance'* ... but until they're in a position where they've made a mistake I don't think it actually hits home....'

RN – NH: 'I think if I was going to give Paracetamol and it was telling me I was a minute too soon, I would still be inclined to give it but I don't think I would give it until about ten fifteen minutes before it's due. That's not professionally wrong if I know that it's within a couple of minutes. Probably by the time I've actually potted it all, got it down to the resident, it's going to be time to give it anyway.'

CHM-RN - NH: 'I think you were oblivious (of) near miss because you'd pick up a bottle and then think wrong bottle and put it down but this [PBMS] highlights the number of times you're actually doing it.'

Deputy CHM-RH: 'We are finding gaps appear which the computerised system is going to completely wipe out ...things written on MAR sheets incorrectly ... staff not writing out the instructions properly and nobody checking at all until myself.'

Post-PBMS, more staff were aware of the occurrence of 'near miss' errors than when using the P-MAR system. This suggests that the PBMS had a beneficial effect in raising staff awareness of 'near misses'. No significant difference was found between staff groups.

Related comments in Box 1 reflect staff views on pre-PBMS 'near miss' errors. Contrary to Table 1 responses, in RNs' comments there was a recognition that 'near misses' had occurred. Some RNs justified these as legitimate deviation from prescribed instructions following the exercising of professional judgement. Other RNs seemed not to register them as errors, until attention was drawn to them by the PBMS.

Reasons for medication errors pre- and post-PBMS

Table 2 presents staff's selection of one or more reasons for errors pre- and post-PBMS by type of home. At both time points, 'interruptions to the round' was most likely to be reported by both staff groups but more so by care staff. However, markedly fewer staff in both types of home subscribed to this item post-PBMS in comparison with pre-PBMS.

Of the other items, pre-PBMS, RNs were more likely to select 'under pressure' of time than 'stressed'. However, this was the opposite for care staff, who also showed higher levels of agreement with both items than RNs. Post-PBMS *stress* and *pressure* were less likely to be selected by both care staff and RNs.

Subscription to 'shortage of qualified staff' and 'staff overworked' showed different patterns for the two staff groups. RH care staff had higher percentages for both items pre-PBMS than post-PBMS, whereas for NH RNs, it was the opposite. Pre-PBMS none of the RNs and only a small percentage of care staff subscribed to 'lack of training', or to their old system being 'confusing and open to error'. However, post-PBMS, none of the care staff subscribed to either item and only a few RNs found the new system 'confusing and open to error'.

Table 2. Staff reasons for medication errors pre and post-PBMS by type of home

| REASONS | RH PRE-PBMS (Carers = 35) N (%) | RH POST-PBMS (Carers = 27) N (%) | NH PRE-PBMS (RNs = 14) N (%) | NH POST-PBMS (RNs = 12) N (%) |
|--|---------------------------------------|--|------------------------------------|-------------------------------------|
| Interruptions to the round from other staff and residents | 35 (100) | 21 (79) | 12 (86) | 5 (42) |
| Staff are under stress | 23 (66) | 8 (30) | 3 (21) | 1 (8) |
| Under pressure of time to complete drug round | 14 (40) | 5 (19) | 9 (64) | 1 (8) |
| Staff are overworked | 13 (37) | 4 (11) | 2 (14) | 2 (17) |
| Shortage of suitably qualified staff | 7 (20) | 0 | 1 (7) | 3 (25) |
| Current system of drug administration is confusing and open to error | 6 (17) | 0 | 0 | 3 (25) |
| Poor/insufficient knowledge of medications | 4 (11) | 0 | 0 | 0 |
| Lack of training | 2 (6) | 2 (7) | 0 | 4 (33) |

Comments in Box 2 describe RNs' and care staff's views on the reasons for errors pre-PBMS. RNs had a tendency towards being complacent with the familiarity of the round, exercising reliance upon memory, and rushing through the process. When using the P-MAR, RNs indicated that they were able to make clinical judgements for medication administration. However, when using the PBMS, if they attempted to override it, this deviation was recorded. In contrast, care staff focussed upon following pre-PBMS hand written or post-PBMS computer-generated instructions. Pre-PBMS, care staff reported that errors could occur when badly written changes had been made on P-MAR sheets.

Box 2 – Reasons for medication errors

CHM (RN)-NH: 'It's very difficult...the drug round in the morning here is quite big and it is a busy time because people are getting up. Carers are coming to the nurse saying can you come and have a look at this, ...and it's constant distractions. So they're being pulled away all the time.'

CHM (RN) – NH: 'I think once you get complacency, that's when you start getting the missed signatures and those kinds of little things start creeping in. It's not big issues but it's little issues. The Nurse who does it five mornings a week, by day five knows exactly what everybody's having and she can do it with her eyes closed.... then if something has been added in or changed, you miss it.'

CHM (RN) - NH: 'We're beating the machine now [PBMS]...we're not really beating it we're just using our commonsense ... occasionally I've done it and I think 'oh it's going to come up as a near miss on the weekly report', and as soon as you do it you think I shouldn't have done that but it's not done intentionally.'

CHM-RH: 'I think sometimes when GPs have written on our MAR charts their terminology can be difficult for us to understand because we're not nurses.'

CHM-RH: 'They do it for speed and probably one of the biggest problems in here is distraction. Staff go and ask them a question and that's when the mistakes happen, it goes to the wrong person because they've forgotten where they are.'

CHM-RH: 'We're not prescribing ... we're not nurses. So unless it says the right thing on the box compared to the MAR sheet we can't give it. It's more about labelling for us than it is anything else, making sure the prescribed dose is correct on the box and the MAR sheet and if it's not then we can't give it. So it's quite straight forward really'

Other pre-PBMS comments given in Box 3 relate to 'stress' and the 'pressure' associated with medication rounds. For RNs in particular, key stressors were the time taken to complete the round, multitasking during the round, and trying to finish the round in reasonable time as a marker of being perceived by others as organised and efficient. In contrast, care staff related their sense of stress/pressure to staff shortages exacerbating workload. Importantly, the physical presence of the new system appeared to reduce pressure by raising the profile of the administrator role and increasing awareness of the importance of the task in the eyes of other carers.

Box 3. Stress and the pressure of Medication Rounds

RN-NH: 'it's not only the medication ...we have to do things like dressings; catheterisation; bladder wash-out and those are things that you have to put in between...and you may have an accident during that shift and recording is important. So it's a timing thing - you have to be controlling the things.'

RN-NH: 'I think it's always a worry in the back of my mind *oh gosh this is going to look really bad and somebody has missed a dose* because of the time it took me to do the round and it's there in the back of your mind as a worry.'

Carer - RH: 'If we're short, I just think oh and I feel pressured then. If I know that there's some kind of short staffing...I'm thinking 'God will I get it done so I can help''.

Deputy CHM-RH: 'Since I've been using the system staff have become aware of the difference in roles...there's less pressure being put on. Whereas before it was very much, oh you don't do anything but the drug round...now they're realising that actually that is the most important thing that you've got to do. They can actually see you physically and hear it as you scan and because they hear that they realise that you're actually doing something.'

Issues arising from the use of PBMS

Staff were asked if some medications could be given by care staff in NHs using the PBMS. As shown in Box 4, RNs held mixed views towards this innovation. Issues raised included the legality of RNs' delegation to non-nurses, and

differences between RNs' with carers' levels of knowledge and professional judgement. RH care staff were more positive, providing a boundary could be drawn between medications appropriate for administration by care staff and those requiring the RN's skill. In other comments, it was suggested that since RNs did not have routine medication competency updating acquisition of new knowledge was the responsibility of the individual RN as a professional. In contrast, care staff responded that they were formally checked and required to be up to date more so than RNs.

Box 4. Issues raised from consideration of NH care staff administering medications

RN-NH 'if legislation becomes such that we can do that, I think I would be quite happy about it to be honest.'

CHM (RN) - NH: 'It's quite a progressive thought. Some of my [care] staff really have got brains ... I wouldn't want every Tom, Dick and Harry doing it only those with specific training for it'.

RN-NH: 'At least I know what I'm giving and when I last gave it. To use the same machine and go and do it they couldn't ... it would have to be all separated.'

RN-NH: 'Okay, they've [care staff] had a little bit of training but some of them wouldn't even think...you just don't give the medicines you have to think what the reaction is with another medicine. Your knowledge kicks in doesn't it?'

CHM (RN) – NH: 'We don't actually do competency updates ... I think it would be a good idea.'

CHM (RN)-NH: We do annual Medication Training, with Pharmacy Plus. ..we don't actually go into this drug is for this and this drug is for that. That's very much a case of our own professional accountability as Registered Nurses to do that'.

CHM – RH: 'There's medications that care staff can't give...injections and things like that... apart from that, I think it's better because the care staff have to have so much more updating and checking than Nursing'

Limitations

The study's main limitations included: the small overall number of care homes, the convenience sampling of participant staff, and disparity between the number of RNs with that for care staff. However, the use of different sources and methods employed in the pre and post comparative design are believed to have provided reliable findings from those involved.

Discussion

The present analysis has shown disparity of approach towards medication administration between different types of care homes and their staff groups. Similar to other research, in which RNs tended only to report errors that actually occurred (National Patient Safety Agency 2009), this study's RNs (unlike care staff) claimed to be unaware of the occurrence of 'near misses' pre-PBMS. As 'near misses' only seemed to register with RNs when the new system's recorded alerts heightened their awareness of them, perhaps they were oblivious to their perpetration pre-PBMS. Alternatively, some RNs could have dismissed 'near misses' as non-events because they deemed them to be clinically insignificant.

Some pre-PBMS RNs' comments acknowledged that complacency and reliance upon memory during medication rounds contributed to errors, as reported by another author (Preston 2004). Similar to the findings of Westbrook *et al* (2010), both staff groups gave 'interruptions by staff and residents' as the main cause of errors. Care staff and RNs both described the nature of these interruptions as related to work demands not associated with the medication administration round, as a review by Biron *et al* (2009) reported. The pressure that the intrusion of these secondary demands creates upon RN's time appeared to be compounded by the additional threat of being seen as inefficient if taking too long. In contrast, care staff described stress arising when medication rounds were undertaken in circumstances where staff shortages placed pressure on workload (Whitman *et al* 2004).

Both groups of staff reported lower percentages of interruptions post-PBMS than when using the P-MAR. For care staff, the visibility of the PBMS helped increase respect from other staff for the role and task of the medication administrator. In contrast, some RNs appeared professionally disempowered by the inflexibility and precision of the PBMS, perceived as limiting their professional judgement and opportunities to deviate from prescribed instructions. As only one RN evidenced attempts to over-ride the PBMS, it is probable that the system's recording of such incidents with identification of the perpetrator in weekly feedback to the CHM could have been a deterrent.

RN's gave mixed responses towards delegation of medication administration to care staff in NHs. Negativity rested mainly on their perceptions of care staff as having a lower level of medication knowledge than RNs. However, care staff did not perceive that their medication training or knowledge were deficient post-PBMS. Medication checks and updates for RHs and staff were said to be in excess of those undertaken by NHs and RNs. In contrast, RNs appeared to lack update for competency in medications and other related training appeared to be *ad hoc*. This could suggest an over-reliance by managers upon placing the onus on individual RNs as professionals to initiate keeping up to date. Both staff groups recognised operationally that care staff in NHs using the PBMS could require a separation of medications according to the level of skill needed for its delivery. Finally, some RNs raised the issue of RNs delegation of medication administration to non-nurses. Nelson *et al* 2010 have suggested that upskilling the carer workforce into nursing roles requires a comparable professional accountability framework to protect the public and carers.

Conclusions and Recommendations

The findings demonstrate that when NH RNs and RH care staff were using the PBMS, there was less reported stress and pressure, increased awareness of errors, and fewer interruptions than with the former P-MAR system. It can be argued, that care staff in nursing homes could be just as effective as their counterparts in RHs in giving basic medications using the PBMS. This would leave RNs with more time to focus on complex medications and free up valuable

RN time for other tasks. However, within this context, further research into the differences between RNs and care staff's respective approaches towards medication administration is required. In particular, there is a need to understand the differences in approach, behaviour, nature of interruptions, and nature of clinical judgement leading to attempt to bypass the PBMS. It is recommended that urgent action is taken to develop a professional accountability framework akin to nursing to support care home carers undertaking medication administration.

Conflict of Interest

The study was funded by Pharmacy Plus, Bristol (the provider). The study's design, methods and materials were prepared by an independent academic team (the authors) with their IPR retained by the lead University.

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