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A comparison of medication administration errors from original medication packaging and multi-compartment compliance aids in care homes: A prospective observational study

Julia Fiona-Maree Gilmartin-Thomas[*,a,b,1], Felicity Smith[b], Rory Wolfe[a], Yogini Jani[b,c]

[a] Department of Epidemiology and Preventive Medicine, School of Public Health and Preventive Medicine, Monash University, Melbourne, Australia
[b] Research Department of Practice and Policy, University College London School of Pharmacy, London, United Kingdom
[c] Pharmacy Department, University College London Hospitals NHS Foundation Trust, London, United Kingdom

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ABSTRACT

Background: No published study has been specifically designed to compare medication administration errors between original medication packaging and multi-compartment compliance aids in care homes, using direct observation.
Objectives: Compare the effect of original medication packaging and multi-compartment compliance aids on medication administration accuracy.
Design: Prospective observational.
Setting: Ten Greater London care homes.
Participants: Nurses and carers administering medications.
Methods: Between October 2014 and June 2015, a pharmacist researcher directly observed solid, orally administered medications in tablet or capsule form at ten purposively sampled care homes (five only used original medication packaging and five used both multi-compartment compliance aids and original medication packaging). The medication administration error rate was calculated as the number of observed doses administered (or omitted) in error according to medication administration records, compared to the opportunities for error (total number of observed doses plus omitted doses).
Results: Over 108.4 h, 41 different staff (35 nurses, 6 carers) were observed to administer medications to 823 residents during 90 medication administration rounds. A total of 2452 medication doses were observed (1385 from original medication packaging, 1067 from multi-compartment compliance aids). One hundred and seventy eight medication administration errors were identified from 2493 opportunities for error (7.1% overall medication administration error rate). A greater medication administration error rate was seen for original medication packaging than multi-compartment compliance aids (9.3% and 3.1% respectively, risk ratio (RR) = 3.9, 95% confidence interval (CI) 2.4 to 6.1, $p < 0.001$). Similar differences existed when comparing medication administration error rates between original medication packaging (from original medication packaging-only care homes) and multi-compartment compliance aids (RR = 2.3, 95%CI 1.1 to 4.9, $p = 0.03$), and between original medication packaging and multi-compartment compliance aids within care homes that used a combination of both medication administration systems (RR = 4.3, 95%CI 2.7 to 6.8, $p < 0.001$). A significant difference in error rate was not observed between use of a single or combination medication administration system ($p = 0.44$).
Conclusion: The significant difference in, and high overall, medication administration error rate between original medication packaging and multi-compartment compliance aids supports the use of the latter in care homes, as well as local investigation of tablet and capsule impact on medication administration errors and staff training to prevent errors occurring. As a significant difference in error rate was not observed between use of a single or combination medication administration system,

* Corresponding author.
E-mail address: julia.gilmartin-thomas@monash.edu (J.F.-M. Gilmartin-Thomas).
[1] Where research was completed: Research Department of Practice and Policy, University College London School of Pharmacy, London, United Kingdom.

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common practice of using both multi-compartment compliance aids (for most medications) and original packaging (for medications with stability issues) is supported.

What is known about this subject

- Systems that endeavour to improve medication supply to older populations, such as multi-compartment compliance aids (MCAs), via increased efficiency, ease of use, reduced costs and errors, require regular evaluation.
- Though MCA systems are commonly used by care homes for medication administration, they have not been regularly or extensively evaluated.

What this study adds

- The significant difference in, and high overall, medication administration error rate between original medication packaging and multi-compartment compliance aids supports the use of the latter in care homes, as well as local investigation of tablet and capsule impact on medication administration errors and staff training to prevent errors occurring.
- As a significant difference in error rate was not observed between use of a single or combination medication administration system, common practice of using both multi-compartment compliance aids (most medications) and original packaging (for medications with stability issues) is supported.

1. Introduction

Care home (CH) medication administration systems should be regularly evaluated to ensure a high standard of care and to minimise errors associated with their use (Alldred et al., 2009). A key variable in assessing health care facility medication systems is whether patients receive medications as prescribed (Barker et al., 2002). Despite the high reliability of observational methods to identify medication administration errors (MAEs) (Pierson et al., 2007; Flynn et al., 2002), few studies employing this ethnographic research approach have been published in the CH setting (Keers et al., 2013). In a 2013 systematic review of literature examining MAEs identified by observation, 89% (n = 81) of the studies were conducted in the hospital setting while 11% (n = 10) were conducted in long term care facilities (including nursing/care/assisted living homes) (Keers et al., 2013). Of the 10 studies, only one was conducted in the UK (USA n = 6, Netherlands n = 2, Belgium n = 1), the majority (n = 7) included 12 or less CHs in their sample, and the majority (n = 6) either did not specify the duration of observation or observed medication administration for approximately 25 days or less (Keers et al., 2013). No study was specifically designed to observe only tablet or capsule oral administration (all 10 studies observed all routes of administration) and two studies used disguised observation while the remaining eight did not specify the type of observation (Keers et al., 2013). It is a limitation that only two studies used the medication expertise of pharmacist observers (although the majority used observers with a pharmacy background n = 5), while remaining studies used nurses (n = 3) or observers from the Department of Health (n = 1) or a Consulting Agency (n = 1) (Keers et al., 2013). Nurses or nursing staff were observed in six studies and the remaining studies observed other staff at the CH (Keers et al., 2013). It is a strength that a uniform method for calculating and reporting MAE rates was used in all studies, where the numerator related to the number of doses with one or more medication errors and the denominator corresponded to the total opportunities for error (Keers et al., 2013).

It is difficult to apply findings arising from hospital-based research to CHs due to significant differences in support structures within the respective work environments, facilities available and the level of education and training of staff. When conducting research in CHs, unique complexities arise from the interaction between the residential and medical aspects of the CH environment (Gilmartin, 2015). Care homes are a complex healthcare setting, where a home-like environment is created, while also incorporating processes and protocols to facilitate efficient and effective healthcare delivery by onsite staff and visiting healthcare professionals. Compared to a hospital environment, CH residents may be cared for by staff who have varying levels of education and skills related to healthcare provision, and varying access to prompt, specialist healthcare support and advice.

The Care Home Use of Medicines Study (CHUMS) established the prevalence, types and underlying causes of medication errors in CHs in England (Alldred et al., 2009; Barber et al., 2009). Of the 256 residents from 55 CHs involved in CHUMS, 69.5% had at least one medication error (Alldred et al., 2009). The prevalence of MAEs by opportunity for error was 8.4% (involving all administered medication formulations including solid oral, liquid, topical medications) and 22.3% of residents were observed to be exposed to a MAE (Alldred et al., 2009). Alldred et al. also identified in adjusted analyses of CHUMS data that there was a statistically significant doubling of the odds of a MAE for tablets and capsules administered from original packaging (OP) compared to multi-compartment compliance aid (MCA) medication administration systems (odds ratio = 2.14, 95% confidence interval (CI) = 1.02–4.51) (Alldred et al., 2011). However, CHUMS was not specifically designed to compare the accuracy of medication administration between these two medication administration systems (Alldred et al., 2011). CHUMS recommended that research should be conducted into the effectiveness of MCAs (Barber et al., 2009). This limitation has been addressed in the current study.

In UK CHs, MCAs are commonly prepared by pharmacy staff at pharmacies and delivered to CHs. They assist CH staff with managing large volumes of medications (Gordon et al., 2014) by organising medications according to the day of the week and time of the day in which they must be administered. Different types of MCAs exist worldwide, however, UK CHs commonly use MCAs that may be referred to as unit-dose, bubble pocket blister packs. The 28 clear plastic bubble pockets on a single MCA each contain the same medication to be administered at a specific dosing interval (e.g. breakfast, lunch, dinner or bedtime) for every day of the week, for 28 days. The plastic bubble is pushed to force medications through the paper backing of the MCA and into an administration device. A resident's entire medication regimen may be contained within multiple MCAs, which correspond to different medications, and which are to be given at different dosing intervals.

Limitations associated with the use of MCAs have been identified by pharmacists, including reduced staff alertness during medication administration, restricted ability to identify medications and medication wastage (Gilmartin et al., 2015a). Pharmacists predict continued use of MCAs in the future due to their perceived benefits of improved safety and efficiency (Gilmartin et al., 2015a). This is despite the Royal Pharmaceutical Societies of England and Scotland cautioning against the routine use of MCAs, calling for a need to review the value of their continued use (Royal Pharmaceutical Society Scotland, 2012), taking into account the evidence-base for their effectiveness as one medication adherence