International Journal of Pharmaceutics 510 (2016) 386–393

Contents lists available at ScienceDirect

International Journal of Pharmaceutics

journal homepage: www.elsevier.com/locate/ijpharm

Personalised Medicine

# Modification of oral dosage forms for the older adult: An Irish prevalence study

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ARTICLE INFO

*Article history:*
Received 3 May 2016
Received in revised form 9 June 2016
Accepted 22 June 2016
Available online 23 June 2016

*Keywords:*
Oral dosage form modification
Older patients
Fractional dosing
Medication administration
Dysphagia

ABSTRACT

Age-related pharmacological changes complicate oral dosage form (ODF) suitability for older adults. The aim of this study was to investigate the appropriateness of ODF for older adults by determining the prevalence of ODF modifications in an aged care facility in Ireland. Drug charts for eligible patients were obtained. Details of all medications administered were recorded. ODF modifications were examined to determine if they were evidence-based: defined as complying with the product license or best practice guidelines (BPG).

In total, of 111 patients, 35.1% received at least one modified medicine. Medicines were most commonly modified to facilitate fractional dosing (82.0%). Of the 68 instances of medicine modification, 35.3% complied with the product license. Of the 44 unlicensed modifications, 14 complied with BPG. Therefore, 44.1% of modifications were not evidence-based. This study highlights that clinicians have to routinely tailor commercial ODF to meet older patients' needs despite the lack of an evidence-base for almost half of these modifications. The main factor contributing to these modifications is the lack of appropriate, licensed dosage forms. However, reimbursement policies also play a role. Research is needed to optimise medicine administration and to provide clinicians with much needed evidence to support their daily practice.



## 1. Introduction

Despite accounting for between 12 and 18% of the population of developed countries, people aged 60 years and over consume approximately 50% of all prescribed medicines and are responsible for 60% of medication-related costs (Sabate, 2003). Given the projected growth in the older population (United Nations Department of Economic and Social Affairs Population Division, 2013), healthcare systems are tasked with optimising medication use in an environment of increasing demand and expense. Provision of optimum medical care to older patients involves the consideration of a number of specific age-related challenges including; pharmacokinetic and pharmacodynamic changes and increased susceptibility to adverse effects (Stegemann et al., 2010; Turnheim, 2004). Pharmacists' involvement in strategies to increase the appropriateness of medicine use for older patients have shown favourable results (Gillespie et al., 2009; Lee et al., 2013), but as the healthcare system moves towards a more multidisciplinary approach, pharmacists need to continue to add value to multi-disciplinary teams (MDT). Pharmacists are recognised experts in medicine and have a unique understanding of all aspects of medication use from formulation to use in a clinical setting. One area where pharmacists' specialised knowledge could be used is in the optimisation of medication administration by aiding the selection of appropriate dosage forms for the individualised needs of patients.

The oral route of drug administration is preferred as it is the simplest, most convenient and safest route of administration (Aulton and Wells, 2002). Oral dosage forms (ODF) are favoured as they facilitate accurate drug dosing, in a manner that ensures the chemical and physical stability of the drug (Aulton and Wells,

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http://dx.doi.org/10.1016/j.ijpharm.2016.06.056
0378-5173/

2002). However, for certain patients with individualised needs, ODF may prove problematic (Quinn et al., 2016). Solid ODF (e.g. tablets and capsules) may need to be modified for fractional dosing (administration of part of an ODF to allow administration of a lower dose) or to overcome actual or perceived swallowing difficulties. These modifications may include splitting or crushing tablets, opening capsules or mixing the medication with food or liquid. ODF modification appears to be quite prevalent in the community setting with between 59% (Schiele et al., 2013) and 68% (Strachan and Greener, 2005) of patients with difficulty swallowing medication modifying the ODF to facilitate administration. Tablet splitting is also common, with just under one in four tablets prescribed in a German study being split prior to administration (Quinzler et al., 2006). Specific studies investigating medicine modification for older adults are limited (Mc Gillicuddy et al., 2015). Given that the prevalence of dysphagia increases with increasing age (Ney et al., 2009) and is higher in nursing home residents (Stegemann et al., 2012), difficulty swallowing oral medicines is likely to complicate ODF administration in older adults. Older patients represent a heterogeneous cohort with a diverse range of pharmacokinetic and pharmacodynamic changes that may further complicate dosing. Therefore, ODF modifications may be required to meet the individual needs of older patients: to facilitate fractional dosing and/or to overcome difficulty swallowing medication.

ODF are becoming increasingly complex as dosage forms now control factors including the (i) rate, (ii) extent (iii) site of drug release and (iv) drug stability both in the dosage form and the gastrointestinal tract (Aulton and Wells, 2002). If these ODF are modified to facilitate fractional dosing, the administered dose may not be accurate (Zhao et al., 2010) and the method of modification may affect dosing accuracy (van Riet-Nales et al., 2014). Modifications for fractional dosing or swallowing difficulties may affect the physical and chemical stability of the drug or the clinical performance of the drug through an increase or decrease in bioavailability, which may lead to adverse effects or toxicity or decreased efficacy (Cattaneo et al., 2012; Moore et al., 2014; Schier et al., 2003; Zafar et al., 2009). These changes could potentially affect clinical outcomes for patients. In addition, the taste of the modified medicine may be an issue, which could impact on patient acceptability and adherence (Barnes et al., 2006; Kelly et al., 2009; Kelly et al., 2010).

There is a growing acceptance that the needs of the older patient must be considered in the design, formulation and evaluation of medicines (European Medicines Agency, 2011). The European Medicines Agency (EMA) have highlighted the importance of investigating if the specific needs of the older patient are being met and to identify issues that should be addressed to ensure that medicines that are developed are suitable for older patients (European Medicines Agency, 2013a). By investigating the use of oral medicines in routine clinical practice, the needs of the older adult can be elucidated and drug development adapted to meet these needs.

## 2. Aim of the study

The overall goal of this study is to investigate if practice-based evidence shows that there is a deficit of patient appropriate and patient-centered drug formulations for older patients. To achieve this goal, the primary objective of this study was to determine the prevalence of ODF modifications, for older patients in an aged-care facility (ACF), by pharmacist-led drug chart review. The secondary objectives were to identify the most commonly modified medicines, along with the accompanying rationale and the presence or absence of an evidence-base for these modifications.

## 3. Method

### 3.1. Ethical approval

Ethical approval for the study was obtained from the Clinical Research Ethics Committee of the Cork Teaching Hospitals, Cork, Ireland.

### 3.2. Study design and setting

This retrospective, descriptive study was undertaken in an ACF in the Munster region of Ireland between April and August 2015. The ACF comprises a 63-bed unit with two distinct patient cohorts: Continuing Care (CC) patients, and Respite Care (RC) patients. CC patients are long-term residents and generally have high dependence levels. RC patients are admitted for one or two weeks respite care and are generally reflective of a less dependent, community-dwelling population. A research pharmacist (AMG), not employed at the ACF, was responsible for data collection.

### 3.3. Inclusion criteria

Patients were eligible for inclusion if they met the following criteria:

- Age $\geq$ 65 years
- Resident in a CC bed on the 31st of December 2014 or
- Admitted to a RC bed in the last quarter of 2014 (October to December 2014).

### 3.4. Data collection

For all eligible patients, drug charts and medical notes were obtained. Using a standardised data collection form, the researcher recorded demographic details for each patient (age, gender, category of admission and details of previous swallowing assessments).

Details of all drugs administered during 2014 (for CC patients) and in the last quarter of 2014 (for RC patients) were recorded. Medicines charted for when required (*prn*) use were only included if the medication was administered. The following medication details were recorded: (i) name, (ii) dose, (iii) formulation, (iv) strength, (v) route of administration, (vi) instructions for ODF modifications on the drug chart and (vii) initiation and discontinuation dates. In addition, AMG used her professional judgement to decide whether a modification would have been necessary, based on the dose prescribed, e.g. 12.5 mg quetiapine necessitates halving of a 25 mg tablet. A second pharmacist (MK), experienced in working in a medication dispensing role in Ireland, analysed 20% of patient records to make an independent judgement as to whether a modification would have taken place, and to allow determination of the inter-rater agreement. Any discrepancies were discussed and a consensus was reached about the likelihood of ODF modification.

Medications were categorized using the Anatomical Therapeutic Chemical (ATC) classification system. Analysis included recording the number of medications administered to patients. For changes in strength or brand of a medication, the medication was counted once only. If the formulation changed e.g. from immediate release to sustained release, this was recorded as two different medications. For non-chronic medications e.g. antibiotics, each non-consecutive administration was counted separately.

The evidence-base for the modification was assessed by determining whether the modification complied with the terms of the product license, using the Summary of Product