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An evaluation of the cost effectiveness of monitored dosage systems (MDS) as an aid to maintaining independence in taking medication

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An evaluation of the cost effectiveness of monitored dosage systems (MDS) as an aid to maintaining independence in taking medication.

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Summary

A monitored dosage system (MDS), usually in the form of a box or a blister pack divided into days of the week, is a medication storage device designed to simplify the administration of solid oral dose medication. MDS can potentially address the issues of difficulty accessing medication due to sight impairment or other disability and/or forgetfulness. There is currently heated debate about the usefulness of such devices. Liverpool Public Health Observatory (LPHO) was commissioned by the Merseyside Directors of Public Health, through the Cheshire & Merseyside Public Health Intelligence Network, to produce this rapid evidence review on the cost effectiveness of monitored dosage systems, involving a search of literature since 2004.

Potential benefits. Proponents of MDS argue that for those on multiple medications, MDS can enable them to be cared for at home, possibly avoiding the need for admission to hospital. An MDS lowers the risk of e.g. missed doses or medicine taken at the wrong time and has the potential to reduce waste (Chapman, 2011).

Possible disadvantages. Filling MDS is a time-consuming process. The 28 day packs may increase the likelihood of confusion and mistakes by patients when presented with four separate MDS packs at a time (Chapman, 2011). Any changes to the patient's prescription within the 28 days may result in substantial waste. There have been anecdotal reports that discharge from hospital has been delayed due to the administrative processes and extra time involved in preparing MDS. There is the possibility that increases in dispensing errors may result from the required repackaging of medicines (YHEC, 2010).

Evidence of cost effectiveness and related outcomes. It is estimated that 40%-50% of all prescribed medication is not used by patients as intended by the prescriber (Mahtani et al in 2011; and Zedler et al 2011). Non-adherence or medication errors can have serious health consequences, sometimes resulting in complications requiring hospital admission (Chapman, 2011, YHEC, 2010). Improving adherence to medication can reduce costs, as illustrated in modelled studies by Menini et al 2014 and Roebuck et al 2011.

MDS is a way of overcoming unintentional non-adherence to medication. However, a systematic review by Boeni et al in 2014 reported that economic outcomes were not reported in any study on MDS or other drug reminder packaging. There was one study by Alldred et al (2010) which noted that administrative costs can be significantly higher with MDS, although no figures were quoted.

Due to the lack of cost effectiveness evidence of the use of MDS in the literature, studies included in this review were those that would have *implications* for cost effectiveness. Four systematic reviews showed that drug reminder packaging had a positive effect on adherence and clinical outcomes (Boeni et al, 2014; Mahtani et al, 2011; Zedler et al, 2011; and Connor et al, 2004). However, each of the systematic reviews advised caution in interpretation of findings due to limitations in the quality of studies.

Targeting: Prime candidates for MDS are patients at risk of confusing their medication, including those whose ability to manage their medication is affected by disability or their

living arrangements or who have multiple medication (Chapman, 2011). If patients have significantly impaired mental self-care abilities, MDS dispensing is likely to be of little help to them (YHEC, 2010; Oboh, 2013).

Alternatives: Alternatives to MDS include patient counselling and education, alarms and telephone or text reminder systems (RPS, 2013; Oboh, 2013). There is a lack of good quality research on the effectiveness and cost effectiveness of these alternative interventions (George et al, 2008).

Recommendations:

- The use of original packs of medicines with appropriate support should be the preferred option of supplying medicines.
- MDS should only be used following assessments involving liaison between the patient, carers, pharmacist, GP and where appropriate, care home staff, nursing staff and hospital medical staff.
- Training is necessary for all those involved in the assessment process.
- The development of an evaluated national, multi-disciplinary assessment tool designed to identify, assess and resolve medicines issues is needed.
- Well conducted MDS prescribing and dispensing audits could help ensure productive use of such systems and so facilitate efficiency gains.
- NICE guidance in 2009 recommended that health professionals should routinely assess for non-adherence whenever medicines are prescribed, dispensed or reviewed.
- The Royal Pharmaceutical Society website can be used as a useful resource for links to the latest information and guidance on the use of MDS.
- Estimates from the literature can be applied to local population data to give an indication of the scale of the problem of drug related hospital admissions involving non-adherence issues.
- There is a need for more research on the effectiveness and cost effectiveness of MDS and its alternatives.

Introduction

Liverpool Public Health Observatory (LPHO) was commissioned by the Merseyside Directors of Public Health, through the Cheshire & Merseyside Public Health Intelligence Network, to produce this rapid evidence review on monitored dosage systems (MDS), with a three week timescale. It is the second in a series of reviews, the first one being on loneliness. This review presents the evidence on the cost effectiveness of monitored dosage systems as an aid to maintaining independence in taking medication.

MDS is defined in Box 1. It is also known as Multi Compartment Compliance Aid (MCA), Domiciliary Medication Dosage System (DMDS), Medication Compliance Device, or Unit Dosage System (in the US).

Methods

The review looked for evidence of the cost effectiveness of MDS relating to adults aged 18 plus, in papers published since 2004, up to 18/8/14. The different terms for MDS described in the previous paragraph were used as key search terms for the review, combined with 'cost' or 'cost effectiveness'. Databases searched included Medline, the NIHR Centre for Reviews and Dissemination database (CRD database, which includes Cochrane), NICE and the PSNC database (Pharmaceutical Services Negotiating Committee). A grey literature search was carried out using the FADE database and Google.

Box 1. Definition

A monitored dosage system (MDS) is a medication storage device designed to simplify the administration of solid oral dose medication, especially for those on multiple medication. It aims to address the issues of difficulty accessing medication due to sight impairment or other disability and/or forgetfulness.

MDSs are usually a variation on the design of a box or a blister pack, divided into days of the week with several compartments per day to allow for the different timing of doses such as breakfast, lunch, dinner and bedtime.

(Smith, 2010, Bhattacharya 2005)

The CRD database was the first to be searched, as this includes all the main systematic reviews relevant to the NHS, including Cochrane reviews. It features a separate sub-database for cost effectiveness reviews. Due to the short timescale of the project, the review focussed mainly on reviews of studies, rather than individual studies.

The text below summarises the background literature and evidence, with further details of the main individual journal articles provided in table 1 at the end of the review.

Background

MDS can potentially address the issues of difficulty accessing medication and following the regimen due to sight impairment or other disability and/or forgetfulness. However, the research evidence to support these proposed benefits is limited (Bhattacharya 2005, Smith 2010):

For some patients, provision of MDS or other medication adherence aids is mandatory, as pharmacists are required by the Equality Act 2010 to make reasonable and appropriate adjustments to services so as to ensure that a disabled person is not discriminated against. For pharmacists this will include making medication available with suitable instructions or in a suitable container. The pharmacy contract recognises the increased work and costs of meeting this legal obligation and there is an additional payment per prescription item to help with these costs. For patients not covered by the Equality Act, provision is discretionary and in some cases, the patient incurs the extra cost (Smith, 2010).

The decision on what adjustments are appropriate in each individual case is the responsibility of the community pharmacist. There are examples of assessment tools available from around the country, but these are generally out of date (Hampshire and Isle of Wight LPC, 2012; RPS: <http://www.rpharms.com/unsecure-support-resources/improving-patient-outcomes-through-the-better-use-of-mcas.asp>). Recent advice on MDS from Hampshire and the Isle of Wight is given in Box 5 below. In their guidance on the use of MDS, the Royal Pharmaceutical Society called for the development of an evaluated national, multi-disciplinary assessment tool designed to identify, assess and resolve medicines issues (RPS, 2013).

General Practitioners can come under significant pressure to prescribe MDS for patients in the community and in nursing and residential homes, from health and social care staff, nursing home owners and carers (Chapman, 2011; Athwal et al, 2011). Care homes have been encouraged by pharmacists and the CQC to use MDS (YHEC, 2010). In the UK, 86% of care homes use MDS (Alldred et al, 2011; YHEC, 2010). In guidance published by the Dispensing Doctors Association, Chapman (2011) presented a consideration of the drawbacks and benefits of MDS, as follows:

MDS benefits:

For those on multiple medications (polypharmacy), MDS can enable them to be cared for at home, possibly avoiding the need for admission to hospital. An MDS lowers the risk of unintentional non-compliance, especially for those with complex regimens (e.g. missed doses or medicine taken at the wrong time) (Chapman, 2011).

For carers, MDS allows them to more easily assess the patient's compliance, which can be important if the carer is involved in discussions with medical professionals. Chapman (2011) notes that this will help to avoid the scenario where the carer, the patient and the doctor are all unsure if the 'important' medication has been taken.

Chapman (2011) noted the potential for reduction of waste, although the 28 day MDS may on occasions lead to more waste (see next heading, and p.7).

MDS disadvantages:

Filling MDS is a time-consuming process. Twenty-eight day MDS prescriptions may be more convenient for dispensers and carers than 7-day packs. However, some possible drawbacks have been suggested:

- The 28 day packs may increase the likelihood of confusion and mistakes by patients when presented with four separate MDS packs at a time (Chapman, 2011 and Box 4 below).
- Any changes to the patient's prescription within the 28 days may result in substantial waste as all unused MDS will have to be destroyed, although there have been no studies to confirm this (Chapman, 2011; YHEC, 2010).
- Not all medication formulations can be dispensed into MDS (e.g. those that require refrigeration; liquids; soluble tablets; or those that are only stable for 7 days outside the original packaging). Consequently, the MDS will not provide a complete solution for a patient's medication problem (Smith, 2010; Chapman, 2011; RPS, 2013).
- There is a long ordering lead time often associated with the use of MDS (YHEC, 2010). There have been anecdotal reports that discharge from hospital has been delayed due to the administrative processes and extra time involved in preparing MDSs/MCAs (Box 2).
- The increase in dispensing errors that result from the required repackaging of medicines is unknown (YHEC, 2010).
- Using original patient packs supports the provision of information about the medicine to the patient through the manufacturer's patient information leaflet and reduces the time the pharmacist and their staff spend dispensing medicines (DH, 2008).

Further details on suggested advantages and disadvantages are listed on p.13-14 in Oboh, 2013.

MDS dispensing presently has strong proponents and strong detractors (YHEC, 2010). There have been heated discussions amongst pharmacists of the pros and cons, for example as featured in Chemist and Druggist (15/5/11), 'Outrage at monitored dosage systems' (see Appendix).

Box 2

Case study: Use of multi-compartment compliance aids (MCA) can cause delayed discharge

'Due to the amount of work involved, many hospitals do not dispense MCAs at short notice (less than 24-48hours), over weekends and bank holidays. This is because the hospital may have to request an SHO or consultant to issue a hospital FP10 so that it can be dispensed in the community consequently leading to delays in getting the medicines and discharge. Also, the pharmacist will have to find a community pharmacist to agree to continue dispensing the MCA for each patient (unless a relative or carer is willing to take on this responsibility). They then have to negotiate with each pharmacy; as the terms of service will vary for each community pharmacy e.g. notice period required to dispense MCA, whether they offer collection and delivery services etc. - this in itself is tedious, time consuming and not a good use of a busy hospital pharmacist's time or skills'.

(Oboh, 2013)

Evidence on the cost effectiveness and related outcomes of MDS

Non-adherence to medication

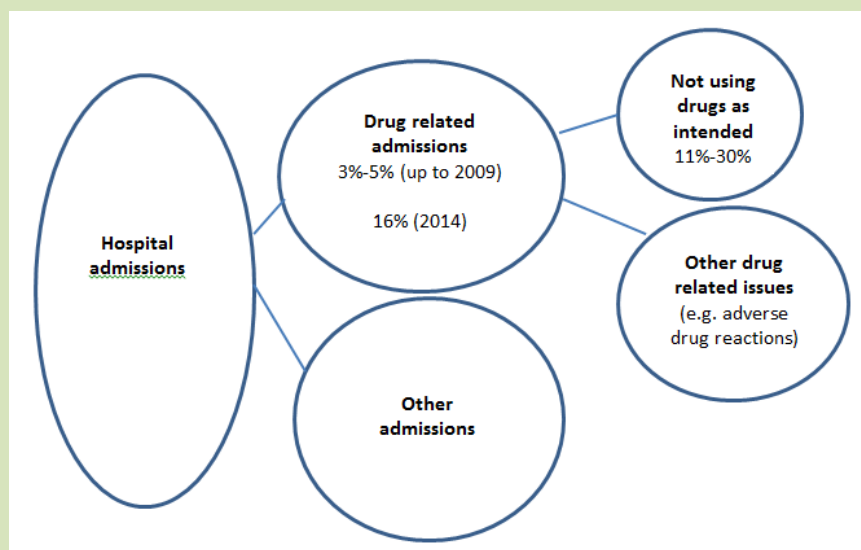
As detailed in Box 3 below, up to half of all prescribed medication is not used by patients as intended by the prescriber (Mahtani et al 2011; and Zedler et al 2011). Non-adherence or medication errors can have serious health consequences, sometimes resulting in complications requiring hospital admission (Chapman, 2011, YHEC, 2010) (Box 3).

Box 3

Patients not taking medication as prescribed: The scale of the problem

It is estimated that 40-50% of all prescribed medication is not used by patients as intended by the prescriber¹. Patient forgetfulness is a common factor (Zedler et al, 2011) This can make a significant contribution to health service costs and in extreme cases can lead to hospital admission. The frequency of drug related hospital admissions is reported to range from 2.9% to 5% (Bhattacharya 2005, quoting research from the 1970s; and Roughead and Semple 2009), rising to 10% amongst the elderly (Dilks 2008, quoting from a Pharmaceutical Services Negotiating Committee report in 2002).

A more recent Australian study noted that due to increases in the dispensing of prescriptions in more recent times, the likelihood of drug related hospital admissions will also have increased (Phillips et al, 2014). This was supported by their finding that 16% of admissions to an emergency department were due to adverse drug events, including adherence issues. Research summarised by Bhattacharya (2005) shows that between 11% and 30% of such hospital admissions are due to patients not using their medication as intended by the prescriber. This finding was supported in the study by Phillips et al (2014), where there were 15% such admissions. It would be possible to apply these estimates to the local Cheshire and Merseyside populations. The diagram below summarises these findings:



¹ noted in a systematic review by Mahtani et al in 2011; and Zedler et al 2011, quoting from a 2003 WHO book: 'Adherence to Long Term Therapies: Evidence for Action'.

Non-adherence to medication can be costly. Boeni et al (2014) noted that non-adherence is known to impair clinical, economic and humanistic outcomes (such as patient satisfaction, quality of life and safety issues). Boeni et al noted that the costs of non-adherence were outlined in a study by Hughes et al, although this was a relatively old study, carried out in 2001.¹

Improving adherence to medication can reduce costs. For example, in relation to antihypertensive treatment, a modelled study across five European countries found that increasing the percentage of patients adhering to treatment to 70% was estimated to lead to a reduction of cardiovascular related health-care costs by €332 million (Mennini et al, 2014). Improvements in adherence were achieved by modelling (i.e. simulation). In another modelled study, Roebuck et al (2011) found that although improved medication adherence increased pharmacy costs, it also produced substantial medical savings as a result of reductions in hospitalisation and emergency department use. Benefit-cost ratios ranged from 2:1 for adults under age sixty-five with dyslipidemia to more than 13:1 for older patients with hypertension. As these were both modelled studies, the methods for improving adherence (such as the use of MDS) were not a consideration.

MDS as a possible solution to non-adherence

MDS is way of overcoming unintentional non-adherence to medication. However, a systematic review by Boeni et al in 2014 reported that economic outcomes were not reported in any study on MDS or other drug reminder packaging. They did find two studies that considered costs, but these both dated back to 1993 and there was no cost effectiveness analysis. The authors suggested that this may be due to the fact that drug reminder packaging is generally supposed to be inexpensive, and thus presumed to be cost-effective. They concluded that compared to other adherence-enhancing programs, such as patient counselling, education or motivation, drug reminder packaging is a simple technical option and requires little resources on the patient's as well as on the provider's side (Boeni et al, 2014).

However, this conclusion would be disputed by some, for example Alldred et al (2011) noted that administrative costs can be higher, although no figures were quoted. Their observational study of drug rounds found that the repackaging of tablets and capsules involves pharmacy staff manually popping them out from the original packaging and placing them into MDS, thus increasing dispensing time and leading to significant costs associated with the equipment required.

Boeni et al (2014) noted the lack of studies considering humanistic outcomes of drug reminder packaging, such as patient satisfaction and quality of life and studies on safety issues (Boeni et al, 2014). Most studies considered clinical outcomes, such as improved blood pressure.

Due to the lack of cost effectiveness evidence of the use of MDS in the literature, studies included in this review were those that would have *implications* for cost effectiveness, for example those looking at outcomes including medication adherence leading to changes in waste levels or hospital admissions (Boeni et al, 2014).

¹ Hughes DA, Bagust A, Haycox A, Walley T: *The impact of non-compliance on the cost-effectiveness of pharmaceuticals: a review of the literature. Health Econ 2001, 10: 601 – 615*

A systematic review by Boeni et al (2014) found one study showing that drug reminder packaging significantly reduced the mean hospitalisation rate (a study carried out in 2000 – ref.44). Overall, the thirty studies reviewed by Boeni et al showed that drug reminder packaging had a positive effect on adherence and clinical outcomes. Similarly, these were the overall findings of systematic reviews by Mahtani et al (2011), Zedler et al (2011) and Connor et al (2004). Two reviews concluded that reminder packaging was especially effective in combination with other reminder strategies, such as education (Zedler et al, 2011 and George et al, 2008). However, each of the systematic reviews advised caution in interpretation of findings due to limitations in the quality of studies. (See Table 1 at the end for study details).

The York Health Economics Consortium evaluation (YHEC 2010) noted several studies showing that MDS and related devices may improve medicine taking². However, the YHECs own study involving interviews with relevant professionals and a survey of 90 care homes revealed concerns that if patients have significantly impaired mental self-care abilities, MDS dispensing is likely to be of little help to them. It could even be hazardous, in as much as it may give others a false confidence in their being able to care for themselves and/or their partners (YHEC, 2010). Giving a patient an MDS inappropriately could lead to overdose or treatment failure as well as increasing the risk of dispensing errors through secondary dispensing (Athwal et al, 2011).

In the YHEC (2011) evaluation, some professionals expressed concerns that MDS dispensing was being used as a solution to problems such as non-compliance or confusion in medicine taking (and so also to waste reduction) when in fact much deeper issues/needs remain to be addressed (see Box 4) (YHEC, 2010). Athwal et al (2011) raised similar concerns.

Targeting

As reasons for non-adherence to medication are highly individual and complex (Boeni et al, 2014), Mahtani et al (2011) concluded that further research is needed to improve the design and targeting of reminder packaging devices.

Guidance published by the Dispensing Doctors Association (Chapman, 2011) suggested that prime candidates for MDS are patients at risk of confusing their medication, including those whose ability to manage their medication is affected by disability or their living arrangements or who have multiple medication. This was supported in a summary of previous research by Boeni et al (2014), which suggested that drug reminder packaging is best suited to patients who are unintentionally non-adherent to medication, such as geriatric patients and patients with complex drug regimens.

² Kalichman S. C., D. Cain, et al. (2005). "Pillboxes and Antiretroviral Adherence: Prevalence of Use, Perceived Benefits, and Implications for Electronic Medication Monitoring Devices." *AIDS Patient Care and STDs* 19(12): 833-839

Ryan-Woolley B. M. and J. A. Rees (2005). "Initializing concordance in frail elderly patients via a medicines organizer." *Annals of Pharmacotherapy* 39(5): 834-9

Taylor A. J. and P. C. Block (2007). "Federal Study of Adherence to Medications (FAME): Impact of a medication adherence program on control of lipids and blood pressure." *ACC Cardiosource Review Journal* 16(4): 31-33

Certain patients would not be suitable for MDS, especially those with significant memory loss (Oboh, 2013). The YHEC evaluation found no evidence that dispensing complicated medication regimens in MDS devices such as Doseette boxes to, for example, mentally confused people living alone is a cost effective substitute for providing direct care and support in day to day medicine taking (e.g. see Box 4).

They noted that effects on other more able service users are also questionable (YHEC, 2010; quoting from Elliott and Ross-Degnan 2007). Such dispensing is relatively time consuming for pharmacists and so costly for funders (YHEC, 2010; Green and McCloskey, 2005). Although from the patient and carers' perspective, such devices can save time (Rivers et al, 2011). Employing MDS on a 'blanket' basis could in itself be regarded as a form of waste (YHEC, 2010).

For certain individuals, MDS may represent a simple method for improving adherence to medications. Their use should be targeted, with distribution following on from an assessment of individual patient needs, requests and abilities (Boeni, 2014; YHEC, 2010). The assessment should involve liaison between the patient, carers, pharmacist, GP and where appropriate, care home staff, nursing staff and hospital medical staff (Athwal et al, 2011; YHEC, 2010; RPS, 2013). The YHEC evaluation concluded that MDS could be cost effective if their use is targeted following good feedback and communication. There may be a need for appropriate training for staff in pharmacies, GP practices and care homes (YHEC, 2010).

Box 4
Quote from GP

"Often you go into the patient's house and they have started one Nomad (MDS tray), taken a few tablets from another, some from another. They get four from the pharmacy to last the month but open Tuesday in one in one room, move into the next room open another Tuesday and so on."

(YHEC, 2010)

Waste

As mentioned on p.iii and p.6, MDS has the potential to reduce waste, although the 28 day MDS may on occasions lead to more waste if there are changes to medication. The York Health Economics Consortium (YHEC) carried out an evaluation of the scale, causes and costs of waste medicines (YHEC, 2010). They included a summary of studies relating to MDS and other medicine taking aids, and identified that they contribute to the £150m of avoidable medicines related waste each year in the UK. Although in care homes, the wastage of medicines is relatively small, the literature to support the benefits of MDS in UK care homes and in the community is weak (YHEC, 2010).

NICE guidance

NICE guidance in 2009 recommended that health professionals should routinely assess for non-adherence whenever medicines are prescribed, dispensed or reviewed (NICE, 2009). With regard to the effectiveness of MDS to support adherence, NICE found the evidence inconclusive and did not recommend their widespread use. NICE and other publications (reported in Oboh, 2013) have found that MDS is overused in the community, initiated without proper assessments. For example many could have managed their medication in a standard container with a simple reminder system, not necessarily an MDA Oboh, 2013).

Electronic MDS

A number of electronic homecare devices are available to remind patients that it is time to take their medication. These include smart pill containers, special watches with alarms and

automated pill dispensers. One type of device is a blister pack that can report when each individual pill is removed. The blister pack is scanned by a reader and the data uploaded to a computer. Medication events monitoring systems (MEMs) include a 'smart pill' container with a cap linked to a microchip that sounds an alert when it is time to take the medication. However, these devices will only record that the cap was opened or the medicine removed and do not prove that the patient actually ingested the correct dose or the correct medication (Figge, 2010). These devices are widely used in the US, but they are expensive. A study in 2007 by Brunenberg et al found no clear evidence that MEMs are cost effective.

Audits

The YHEC evaluation also recommended that well conducted MDS prescribing and dispensing audits could help ensure productive use of such systems and so facilitate efficiency gains (YHEC, 2010).

Other advantages for care homes

A study of 90 care homes by the YHEC (2010) found that a move away from conventional dispensing to MDS had been encouraged and advised by pharmacists and/or the CQC in order to manage and help maintain the audit trail. However, they note that some PCT (now CCG) pharmacists were reported to discourage MDS use. YHEC did not say why this was - it could be related to any of the disadvantages mentioned on p.iii above. They reported that care home managers prefer MDS because they can easily audit the work of their staff to see if the day's doses have been given (YHEC, 2010).

Guidance from around the country

National guidance

The Royal Pharmaceutical Society have produced a document that aims to provide a better understanding of the selection of MCA (or MDS) as one adherence intervention amongst many: '*Improving patient outcomes: The better use of multi-compartment compliance aids*' (RPS, 2013). Their website provides links to the latest information and guidance (RPS online).

Local guidance

NHS East and South East England Specialist Pharmacy Services:

This pharmacy service produced a very detailed useful resource for consideration in supporting older people in the community to optimise their medicines including the use of multi compartment compliance aids (MCAs) (Oboh, 2013):

NHS Cambridgeshire 2011

Chapman (2011) issued guidance on the use of MDS and presented a joint statement agreed between NHS Cambridgeshire, the Local Pharmaceutical Committee (LPC) and the Local Medical Committee (LMC). This was also adopted in other areas, including Manchester in 2013:

Manchester Local Pharmaceutical Committee (LPC) 2013:
Manchester LPC guidance, published in 2013, was a direct copy of the Cambridgeshire guidance (Manchester LPC, 2013).

Hampshire and Isle of Wight LPC 2012
'LPC briefing: DDA & DMDS': This set of brief notes was produced by Hampshire and the Isle of Wight to clarify the situation for pharmacy contractors when dealing with requests for MDS from patients, carers and other professionals (Hampshire and Isle of Wight LPC, 2012). It suggests alternatives to MDS (see under 'alternatives' heading below). Box 5 outlines current guidance in Hampshire.

North West London Hospitals Trust 2011
The Trust has developed policy and guidance for hospitals, describing key factors that will indicate if a multi-compartment compliance aid (MCA – ie. MDS) is appropriate. For those in hospital, the policy mandates liaison between the patient, pharmacist, nursing staff and medical staff in hospital with agreement from the patient's GP and the community pharmacy to be obtained before supply of an MCA (Athwal et al, 2011).

NHS Northamptonshire 2010:
NHS Northamptonshire produced guidance on the use of monitored dosage systems (Smith 2010), noting that the evidence to support its use is limited.

NHS Herefordshire 2010:
In 2010, Herefordshire Council and NHS Hereford produced a set of notes on: '*Monitored dosage systems: Guidance for Health and Social Care Professionals in Herefordshire*' (Hereford Council 2010).

Box 5
Current MDS guidance :
Hampshire and Isle of Wight Pharmaceutical Committee

The decision to supply an MDS under the current contractual framework is one solely for the pharmacist. Under the Equality Act 2010, the provider of a service must consider whether the way that service is provided means a disabled person would not be able to access it and if necessary make a reasonable adjustment. Many groups such as carers/relatives, social care providers and health professionals may request MDS but the decision to provide MDS is the pharmacists and they must be satisfied that the MDS is

- the best adjustment for that particular patient
- suitable for the medicines the patient is taking and
- be the adjustment that the patient actually wants rather than one imposed upon them.

The pharmacist could be liable if the provision of an MDS (or other aid) was not the right adjustment and the patient came to harm.

(Billington, 2014)

Alternatives to MDS

MDS is one potential solution to unintentional non-adherence to medication. There are many alternative interventions which may be more appropriate to be used in preference to MDS in helping patients to take their medicines and to maintain their independence (RPS, 2013;

Oboh, 2013; Hampshire and Isle of Wight LPC 2012). Oboh (2013) pointed out that MDS is often inappropriate on the grounds of safety, efficacy or practicality, noting that the solution should be matched to the individual. Some alternative interventions support the use of original packs of medicines. The RPS recommends that the use of original packs of medicines with appropriate support should be the preferred option of supplying medicines.

Alternative interventions include:

- medication review to reduce inappropriate polypharmacy and simplifying regimen (which is particularly important as the number of prescribed medicines has been shown to be a powerful predictor of non-adherence, RPS, 2013);
- patient counselling to improve understanding of medicines-use;
- education or motivation training;
- training of social care assistants;
- the use of reminder charts (as a memory aid);
- the use of medicines administration record (MAR) charts;
- labels with pictograms;
- large print labels;
- information sheets;
- reminder alarms;
- IT solutions and new technology such as phone apps and telemedicine.

(RPS, 2013; YHEC, 2010; Boeni, 2014; Bhattacharya, 2005).

In some cases, alternatives can be more resource-intensive, both from the provider's and the patient's view (Boeni et al, 2014). The RPS note that all of these interventions have a place in ensuring patients take or receive the correct medicines at the right time. The use of an MDS is just one additional intervention in a range of intervention options. They note that in addition, patients themselves may have developed reminder systems to help them take their medicines correctly and care workers, family and friends may be in a position to provide support to patients. Patients should be encouraged and supported to retain autonomy over their own medicines administration for as long as they feel capable of doing this (RPS, 2013).

The systematic review by George et al (2008) considered a range of different interventions to improve medication taking, including regular scheduled patient follow-up, MDS, group education, individualised medication cards and medication review by pharmacists with a focus on regimen simplification. Due to inconsistent methodology, the authors were unable to draw firm conclusions in favour of any particular intervention. There is a need for good quality research on the effectiveness and cost effectiveness of these different interventions.

Conclusion and recommendations

There is a gap in research on the cost effectiveness of MDS. Boeni et al (2014) noted that economic outcomes were not reported in any study on drug reminder packaging. There is also a shortage of research on outcomes especially relevant to MDS, such as patient-relevant disease-unspecific long-term clinical outcomes, e.g., (re-) hospitalisation, or admission to a nursing home (Boeni et al 2014).

Boeni et al (2014) also noted the lack of studies considering humanistic outcomes of drug reminder packaging, such as patient satisfaction and quality of life and studies on safety issues (Boeni et al, 2014). Most studies considered clinical outcomes, such as improved blood pressure.

Studies with *implications* for cost effectiveness suggest that drug reminder packaging can have a positive effect on adherence and clinical outcomes (Boeni et al, 2014; Mahtani et al, 2011; Zedler et al, 2011; and Connor et al, 2004). However, each of these systematic reviews advised caution in interpretation of findings due to limitations in the quality of studies.

Reasons for non-adherence to medication are highly individual and complex (Boeni et al, 2014). MDS can aid medicines management for some patients because they act as a visual reminder prompting the taking of medicines. However, MDS is often perceived as a solution for all patients, including those who are either non-compliant or confused (Athwal et al, 2011).

The Royal Pharmaceutical Society (RPS) advises that the available evidence base indicates that MDS should not automatically be the intervention of choice for all patients (RPS, 2013; Athwal et al, 2011). Some alternative interventions support the use of original packs of medicines. The RPS recommends that the use of original packs of medicines with appropriate support should be the preferred option of supplying medicines (RPS, 2013).

Because of the many drawbacks to its use, MDS should be targeted, only being used where an assessment has shown that it is the best way to support the individual to manage their medicines independently (Oboh, 2013; Athwal et al, 2013; YHEC, 2010). The assessment should consider the individual patient's needs, requests and abilities (Boeni et al, 2014). Assessments should involve liaison between the patient, carers, pharmacist, GP and where appropriate, care home staff, nursing staff and hospital medical staff (Boeni et al, 2013; RPS, 2013). There may be a need for appropriate training for staff in pharmacies, GP practices and care homes in order for them to be able to contribute to the assessment process (YHEC, 2010).

Some areas have developed assessment tools, but these need evaluating and updating (e.g. Hampshire and Isle of Wight LPC, 2012). The development of an evaluated national, multi-disciplinary assessment tool designed to identify, assess and resolve medicines issues is needed (RPS, 2013).

Improved medication adherence can lead to reductions in hospitalisation and emergency department use (Roebuck et al, 2011) and the use of MDS is potentially one way of

achieving this, although there is no recent data (Boeni et al, 2013). Estimates from studies showing numbers of drug related hospital admissions involving non-adherence issues (Box 3 above) could be applied to local population data to give an idea of the scale of the problem in Cheshire and Merseyside.

Recommendations

- The use of original packs of medicines with appropriate support should be the preferred option of supplying medicines.
- MDS should only be used following assessments involving liaison between the patient, carers, pharmacist, GP and where appropriate, care home staff, nursing staff and hospital medical staff.
- Training is necessary for all those involved in the assessment process.
- The development of an evaluated national, multi-disciplinary assessment tool designed to identify, assess and resolve medicines issues is needed.
- Well conducted MDS prescribing and dispensing audits could help ensure productive use of such systems and so facilitate efficiency gains.
- NICE guidance in 2009 recommended that health professionals should routinely assess for non-adherence whenever medicines are prescribed, dispensed or reviewed.
- The Royal Pharmaceutical Society website can be used as a useful resource for links to the latest information and guidance on the use of MDS.
- Estimates from the literature can be applied to local population data to give an indication of the scale of the problem of drug related hospital admissions involving non-adherence issues.
- There is a need for more research on the effectiveness and cost effectiveness of MDS and its alternatives.

Table 1: Summary of main studies included in the review:

First author, date, country and study type	Title/study remit	Main findings Green = clear benefits Amber = possible benefits Purple = drawbacks
Cost effectiveness studies		
Brunenberg 2007. Netherlands, randomised controlled trial.	Cost effectiveness of an adherence-improving programme in hypertensive patients	Medication events monitoring systems (MEMs) include a 'smart pill' container with a cap linked to a microchip that sounds an alert when it is time to take the medication. However, such devices are expensive and the study found no clear evidence that MEMs are cost effective.
Studies with implications for cost effectiveness		
Boeni 2014. Swiss. Systematic review of 30 studies.	Effect of drug reminder packaging on medication adherence	<p>Overall, the studies showed a positive effect of drug reminder packaging on adherence and clinical outcomes. However, poor reporting and important gaps limit the drawing of firm conclusions (see critique below).</p> <p>Drug reminder packaging had a significant effect on adherence in a geriatric population [30], for chronic mental illness [31] and for cardiovascular disease [40].</p> <p>Drug reminder packaging offers a broad field of application and is mostly used for polypharmacy. As a consequence, disease-unspecific, generalisable clinical outcomes like morbidity or re-hospitalisation rates would provide viable and comparable results rather than measures of disease-specific clinical parameters. Only two trials investigated such outcomes [44,58], with one showing that drug reminder packaging significantly reduced the mean hospitalisation rate (a study carried out in 2000 – Boeni et al 2014, ref 44).</p> <p>Critique: CRD* and the authors note that the overall methodological quality of the studies included is poor and thus evidence for the effect of drug reminder packaging on adherence is low.</p>
Mahtani 2011. UK. Cochrane review of 12 studies.	Reminder packaging for improving adherence to self-administered long-term medications	<p>Reminder packaging increased the proportion of people taking their medications when measured by pill count; however, this effect was not large. Some evidence was found that reminder packaging may be beneficial in improving clinical outcomes such as blood pressure.</p> <p>The authors concluded that reminder packaging for certain individuals may represent a simple method for improving the adherence to medications; further research is needed to improve the design and targeting of these devices.</p>

First author, date, country and study type	Title/study remit	Main findings Green = clear benefits Amber = possible benefits Purple = drawbacks
Connor 2004. New Zealand. Systematic review of 15 randomised trials (12 of unit-of-use packaging).	Do fixed-dose combination pills or unit-of-use packaging improve adherence? A systematic review.	Unit-of-use packaging (MDS) is likely to improve adherence in a range of settings, but the limitations of the available evidence means that uncertainty remains about the size of these benefits.
Zedler, 2010. Systematic review of 10 randomised controlled trials.	Does packaging with a calendar feature improve adherence to self-administered medication for long-term use? A systematic review	Calendar packaging, especially in combination with education and other reminder strategies, may improve medication adherence. Critique: CRD* commented that the authors conclusions were 'suitably cautious', due to the methodological limitations.
George 2008. UK Systematic review.	A systematic review of interventions to improve medication taking in elderly patients prescribed multiple medications	Regular scheduled patient follow-up along with a multi-compartment dose administration aid was an effective strategy for maintaining adherence in one study, while group education combined with individualised medication cards was successful in another study. Medication review by pharmacists with a focus on regimen simplification was found to be effective in two studies. Critique: As a result of inconsistent methodology and findings across the eight studies, the authors state they were unable to draw firm conclusions in favour of any particular intervention.
Rivers 2011 UK. Qualitative study (11 interviews).	The perceived value and effectiveness of Monitored Dosage System (MDS) dispensed for domiciliary use by hospital and community pharmacies.	Pharmacy staff were not convinced that MDS was always of value and felt that the service increased pressure on other pharmaceutical care commitments. Service users and carers greatly valued MDS because it saved time and reduced the onus upon them to organise the safe administration of medicines. Formal assessment of adherence needs should be introduced in order to ensure that patients or carers are likely to benefit from MDS. Consider whether MDS should be funded through the NHS, rather than to assume that pharmacies will absorb the cost with or without the assistance of patients.
Allred 2010. UK Study (observation of drug rounds).	The influence of formulation and medicine delivery system on medication administration errors in care	Although there was some evidence that MDS reduced the odds of an administration error, the use of MDS impacts on other aspects of medicines management. The authors recommend a trial specifically designed to evaluate the overall impact of MDS on medicine management. The repackaging of tablets and capsules involves pharmacy staff

First author, date, country and study type	Title/study remit	Main findings Green = clear benefits Amber = possible benefits Purple = drawbacks
	homes for older people	manually popping them out from the original packaging and placing them into MDS; this increases dispensing time and leads to significant costs associated with the equipment required

*CRD = NIHR Centre for Reviews and Dissemination. CRD database

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NOTE: Publically available URLs have been given here. These links may therefore not always lead to the full article.

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Appendix

Extracts from Chemist and Druggist, 'Outrage at monitored dosage systems' 15/5/11:

AGAINST: *'The pharmacists day-to-day work is being swamped by the increase in numbers of MDS - they need to be filled weekly, which increases the time spent checking, and increases the risk of error, etc. '*

'Multiple dispensing is increasing by 25% to 30% a year and this is mainly due to the adoption of MDSs. Pharmaceutical Journal, in January, featured an article that stated. "A recent DoH report identified compliance aids (MDSs) as a contributor to the £150m of avoidable medicines related waste each year..... The usefulness of compliance aids has been questioned and the evidence to support their use is poor" (Pharm. J. 2011, Vol 286 p75).' [http://www.pharmaceutical-journal.com/career/career-feature/compliance-aids-an-
elephant-in-the-room/11063750.fullarticle](http://www.pharmaceutical-journal.com/career/career-feature/compliance-aids-an-
elephant-in-the-room/11063750.fullarticle)

*'Susan Patterson, a pharmacist who works with the Integrated Care Group at the Health and Social Care Board, agrees. She has undertaken work in this area and says there have been **a number of studies yet little evidence** that MDSs improve patient care or health outcomes. Certainly MDSs are no better in improving outcomes than the humbler medication card issued by our hospitals.'*

'In Northern Ireland, a Medicines Compliance/Concordance Support Service is being developed – will MDS feature in this?' One contributor hopes not, as 'the evidence-base for MDSs is just not there'.


'The drive to use MDS comes from care companies who employ staff who are incapable of administering more than a couple of separately dispensed items safely. Also, nurses and GPs see it as an easy way to boost compliance. It isn't a great earner when you factor in the staff time and consumables involved and with the contract payment going to all pharmacies whether they help their patients or not it means the ones who do are carrying the 'lazy' ones.'

FOR: Another pharmacist commented that *'on the plus side, with MDS there is virtually NO WASTE, which means BIG SAVINGS to the drug budget, which can only have a positive effect for community pharmacy. The increase in MDS is partly accounted for by the increase in the number of dependent patients most elderly and vulnerable'. Another stated 'I spend my time dispensing and talking to my patients, they are not numbers on a graph, they ALL tell me that MDS benefits compliance'.*

http://www.chemistanddruggist.co.uk/feature-content/-/article_display_list/11328191/outrage-at-monitored-dosage-systems :

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