

1 **Hospital Referral of Older Patients to Community Pharmacy: Outcome Measures in a**
2 **Feasibility Study**

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4 There has been increased recognition in recent years of the problems older people face on
5 discharge from hospital, including those related to medication (1). In 2011 post-discharge
6 Medicines Use Reviews (dMURs) were introduced into the English national community pharmacy
7 contract with the aim of improving medicine support to recently discharged patients who had
8 experienced changes to their medicines in hospital (2).

9 However, early reports showed minimal uptake of dMURs, even after signposting by hospitals (3).
10 Furthermore, there is little evidence of their impact on patient outcomes, with only one recent study
11 indicating that patients receiving a follow-up consultation with the community pharmacist may have
12 lower rates of readmission and shorter hospital stays if readmission did occur (4). The authors
13 stated that a randomised controlled trial (RCT) of the referral service would be required to fully
14 investigate the impact on patients but recommended that prior to this, a feasibility study should be
15 conducted to determine how best to design the trial and identify outcomes that would be feasible to
16 collect and allow assessment of effectiveness.

17 Prior to the publication of that research, we had already designed a randomised controlled feasibility
18 study to evaluate a referral process from hospital to community pharmacy, and have published data
19 relating to patient recruitment, community pharmacist perceptions of delivering the service, and the
20 potential clinical and economic impact of interventions made (5-7). This paper reports on potential
21 patient outcome measures, used during the feasibility study, that could be utilised in future
22 evaluations.

23 **Aim**

24 Identify potential outcome measures to investigate the impact of a hospital to community pharmacy
25 referral service for older patients that utilises the dMUR.

26 **Ethics Approval**

27 Ethics approval for this study was obtained from the Northwest Research Ethics Committee (Ref
28 13/NW/0779).

29 **Method**

30 Recruitment ran from April 2014 to January 2015. During this period all pharmacists working on
31 medical wards at Southport and Ormskirk Hospitals NHS Trust (SONT), England, identified in-patients
32 aged over 65 years who, in their professional opinion, could benefit from a dMUR. Inclusion and
33 exclusion criteria have previously been reported (5). It was intended to recruit between 60 and 100
34 patients to the feasibility study, in keeping with the usual sample size for pilot and feasibility trials
35 registered in the UK Clinical Research Network Database. Baseline demographic data were collected
36 and compared between participant groups using the chi-squared test for categorical data and an
37 unpaired t-test for continuous data (Table 1).

38 Informed consent was obtained from all individual participants included in the study. Participants
39 were randomised to receive either a dMUR or standard discharge care. For those to receive a dMUR,
40 a referral form and discharge prescription was faxed to their nominated community pharmacist to
41 allow completion within 28 days as per the national service specification.

42 All participants were followed up at four weeks and six months post-discharge by the lead researcher
43 (HR). At each follow-up point, any hospital admissions or accident and emergency (A&E) visits since
44 discharge were identified via the hospital's electronic patient administration system. If a re-admission
45 had occurred, a consultant geriatrician and HR reviewed the patient's notes to evaluate contributing
46 medication problems. Published criteria on evaluating medication related hospital admissions
47 (amended Hallas criteria for causality and Hepler criteria for preventability) were used during these
48 sessions (8).

49 All participants were sent a postal questionnaire at each follow-up. Questionnaires combined
50 questions relating to self-management of medicines and medication reviews participated in since
51 discharge, with scales measuring medication adherence and health-related quality of life (HR-QoL).

52 Medication adherence was measured using the validated 8-item Morisky Medication Adherence Scale
53 (MMAS) and HR-QoL, using the 12-Item Short-Form Health Survey, version 2 (SF-12v2) (9,10).

54 Additionally, a measurement of patient enablement following dMUR was derived for the intervention
55 group participants at the 4 week follow-up, using the Patient Enablement Index (PEI) (11).

56 Data on readmissions, A&E visits, adherence and HR-QoL for each participant were collated in an
57 Excel spreadsheet. It was acknowledged that the small number of participants to be recruited
58 during this feasibility study meant that it would be underpowered to detect statistically significant
59 differences in quantitative outcomes between groups. However, for methodological rigour, and in
60 preparation for any future RCT, various statistical tests were applied:

- 61 • The proportion of participants in each group having one or more readmission during the follow-
62 up period (dichotomous data) was compared using Chi-squared at both 4-week and 6-month
63 follow-up.
- 64 • The total number of readmissions in each group (ordered discrete data) was compared at both
65 follow-up points using the Mann-Whitney U-test.
- 66 • The mean length of readmission episodes in each group was compared using the Mann-
67 Whitney U Test.
- 68 • The proportion of participants in each group having one or more A&E visit (but being discharged
69 from here rather than admitted to a hospital ward) was compared using Chi-squared at both
70 follow-up points.
- 71 • The total number of A&E visits in each group was compared at both follow-up points using the
72 Mann-Whitney U-test.
- 73 • SF12-v2 and MMAS scores were treated as continuous numerical data and compared between
74 groups using an unpaired t-test at both follow-up points.
- 75 • Previous studies have reported the mean PEI with a 95% CI. Therefore the same practice was
76 employed here for intervention group participants who received a dMUR and returned a
77 scorable questionnaire.

78

79 **Results**

80 A total of 59 participants (30 intervention and 29 control) were recruited to the study. There were no
81 significant differences in baseline characteristics between study groups (Table 1). However, the
82 intervention group tended towards being more likely to live alone, and to have had a previous
83 admission within the last 30 days (not significant due to small participant numbers).

84 ***Insert new Table 1 here***

85 All participants were followed up with respect to readmissions and A&E visits at both time points.
86 Fifteen participants (6 intervention and 9 control) did not return the 4-week questionnaire and 23
87 participants (9 intervention and 14 control) did not return the 6-month questionnaire. In just under
88 half of cases the reasons for this are known, and included death (n=2), participant admitted to a
89 care home (n=3), participant no longer responsible for managing their own medication (n=4), and
90 participant in hospital at time of final follow-up (n=2). The number of usable questionnaires returned
91 represents a 61% return rate. Results of an intention to treat analysis including all randomised
92 participants showed no significant differences in any of the quantitative outcomes studied between
93 intervention and control groups at either four-week or six-month follow-up (Tables 1 and 2).

94 ***Insert new table 2 here***

95 The mean PEI for intervention group participants who received a dMUR and returned a scorable
96 questionnaire (n=16) was 3.69 (95% confidence interval (CI) 1.68-5.70).

97 Overall, 19% of the total study population (control and intervention) were readmitted at least once
98 within 4 weeks of their original discharge, rising to 53% by 6 months, representing 49 readmissions.
99 Case-notes for 48 readmissions were located and analysed. Twelve (25%) of these were possibly,
100 probably or definitely medication related according to the amended Hallas criteria (8). Seven
101 (58.3%) of the medication related readmissions were classed as at least possibly preventable using
102 the Hepler criteria (8). There were no preventable medication related readmissions involving
103 participants who had received a dMUR as part of the study.

104

105

106 **Discussion**

107 This study is the first to investigate ways of measuring the effect on patient outcomes of hospital
108 referrals to community pharmacies for dMUR in older patients. Importantly for a feasibility study, we
109 have demonstrated that recruitment of older patients to a randomised study of this nature is
110 possible. The fact that 41% (n=24) of participants completed this study as per protocol is in
111 keeping with research conducted by others indicating that studies involving older patients
112 experience high attrition rates (12). Death, or deterioration in health leading to participants being
113 readmitted, moving address to live in locations where their care needs can be better met, or simply
114 being no longer able to complete follow-up measures all contribute to this and were all observed
115 during this study.

116 In addition, difficulties with the delivery of the dMUR intervention to housebound patients by
117 community pharmacists in this study meant that only fourteen intervention group participants (47%)
118 received their dMUR as per study protocol and a further 6 received it after the 4-week time-point.
119 The format of the current nationally commissioned service appears to hinder accessibility to this
120 patient group, specifically via the facilitation of domiciliary visits, as discussed in our previous
121 publications (5-7).

122 Taking this factor into consideration, the outcome measures selected and the use of postal
123 questionnaire to collect data from participants appear appropriate to take forward to a future scaled
124 up evaluation.

125 The lack of significant differences in outcomes between control and intervention groups reported is
126 not unexpected, as the study was not designed or powered to detect such differences. However,
127 findings do indicate trends worthy of further investigation; in particular, the trend towards shorter
128 length of stay on readmission for the intervention group, which was also seen in Nazar et al's
129 evaluation (4). In the present study, one in seven readmissions occurring within the 6-month

130 follow-up period were judged as both medicines related and preventable, which is consistent with
131 previous reports and indicates that the criteria used were successful in identifying such
132 readmissions. The finding that no preventable medication related readmissions occurred among
133 patients who completed a dMUR suggests that they could be effective in preventing such
134 readmissions. Therefore, preventable medication related readmissions is an appropriate outcome
135 measure for any future large study.

136 The MMAS scores in both study groups indicated overall medium to high adherence at both follow-
137 up points, which may reflect over-reporting of adherence by participants or recruitment bias,
138 whereby adherent patients were more likely to agree to participate in the study. In a future larger
139 study it is recommended that, in addition to actual MMAS score, the proportion of patients falling
140 into the categories of low versus medium or high adherence should be analysed between groups.
141 This would allow comparison of results with those of the English community pharmacy New
142 Medicines Service evaluation, which also used the MMAS (13). Consideration should also be given
143 to using a second measure of adherence, such as pharmacy refill records, to provide an internal
144 check on validity.

145 In this study, mean physical HR-QoL score at six months was 5.39 points higher in the intervention
146 group than the control. Scale up of this study is needed to see if these findings can be reproduced
147 and represent real change in physical health-related quality of life following dMUR referral.

148 The mean enablement score following dMUR in this study, although similar to the scores of patients
149 aged ≥ 65 in Howie et al's original study of GP consultations, fell short of the score (≥ 6) deemed
150 necessary for clinically meaningful enablement (11). This could be due in part to the high levels of
151 adherence reported by participants, leaving little capacity for improvement or enablement.

152 This work is limited by the small-scale nature of the study, involving one hospital and the associated
153 community pharmacists. This means that the findings cannot be generalised to other settings.

154 However this was not the purpose of the study, which was designed to assess the feasibility of the

155 dMUR referral service and the chosen outcome measures in preparation for a future RCT, the
156 results of which would be generalisable.

157 Additionally, difficulties with delivery of the dMUR in the intervention group mean that confounding is
158 possible in that patients who were well enough to attend the pharmacy for a dMUR may have been
159 intrinsically less likely to be readmitted to hospital. It is not known whether a dMUR would have
160 prevented readmissions among intervention group participants who were unable to attend their
161 dMUR, had they completed the intervention as planned.

162 **Conclusion**

163 Recruitment and follow-up of older patients in a randomised study of referral from hospital to
164 community pharmacy, using the protocol described, is feasible. The outcome measures used to
165 analyse readmissions, medicines adherence, HR-QoL and patient enablement appear appropriate
166 for evaluation of the service.

167 This feasibility study should be scaled up to a full pilot study, followed by an adequately powered
168 RCT, in order to further investigate the effect on patient outcomes of dMUR referral.

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171 **Conflicts of Interest:** Helen Ramsbottom, Ray Fitzpatrick and Paul Rutter declare that they have
172 no conflict of interest.

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212 **Tables**

213

214 **Table 1: Participant Baseline Characteristics**

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Baseline characteristics	Overall (n=59)	Intervention (I) (n=30)	Control (C) (n=29)	P value (2-tailed) for I vs C	Test used
Female (%)	33 (56)	16 (53)	17 (59)	0.6826	Chi-squared
Mean Age in years (Range)	78 (65-92)	79 (68-92)	77 (6-89)	0.1142	T-test
Living alone (%)	19 (32)	13 (43)	6 (21)	0.0628	Chi-squared
Mean number meds (Range)	9 (2-19)	9 (3-16)	9 (2-19)	NA	NA
Mean MCI (Range)	20 (5 - 41.5)	21 (7.5–41.5)	19 (5-40.5)	0.3476	T-Test
Cognitive impairment (%)	11 (19)	7 (23)	4 (14)	0.3469	Chi-squared
Mean number co-morbidities (Range)	4 (2-8)	4 (2-8)	4 (2-8)	NA	NA
Admission in last 30 days (%)	11 (19)	8 (27)	3 (10)	0.108	Chi-squared
Admission in last 12 months (%)	29 (47)	15 (53)	13 (45)	0.6908	Chi-squared
Mean length baseline admission in days (Range)	7 (1-27)	6 (2-19)	7 (1-27)	0.7730	T-test

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219 **Table 2: Participant Outcomes**

Outcomes at 4-Week Follow-up	Intervention (I) (n=30)	Control (C) (n=29)	p-value (2 tailed) for I vs C	Test used
Patients having ≥ 1 non-elective readmission	6 (20%)	5 (17.2%)	0.7377	Chi-squared
Total number of non-elective readmissions	8	6	0.8026	Mann-Whitney
Mean Length of Readmissions (days)	4.38	7.00	0.1713	Mann-Whitney
Patients having ≥ 1 A&E attendance	7 (23.3%)	8(27.6%)	0.7643	Chi-squared
Total number of A&E attendances	9	9	1	NA
Outcomes Assessed Via Questionnaire	n=24	n=20		
Morisky Medication Adherence Score (MMAS)	7.20	7.54	0.3475	T-test
Health related Quality of Life (SF-12v2) Physical	34.77	34.50	0.9174	T-test
Health related Quality of Life (SF-12v2) Mental	44.41	42.68	0.6164	T-test
Outcomes at 6-Month Follow-up	Intervention (I) (n=30)	Control (C) (n=29)	p-value (2 tailed) for I vs C	Test used
Patients having ≥ 1 non-elective readmission	15 (50%)	16 (55.2%)	0.7924	Chi-squared
Total number of non-elective readmissions	26	23	0.9690	Mann-Whitney
Mean Length of Readmissions (days)	5.67	7.04	0.4487	T-test
Time to First Readmission (days)	72.87	57.81	0.4315	T-test
Patients having ≥ 1 A&E attendance	16 (53.3%)	17 (58.6%)	0.7909	Chi-squared
Total number of A&E attendances	36	32	0.9690	T-test
Outcomes Assessed Via Questionnaire	n=21	n=15		
Morisky Medication Adherence Score (MMAS)	7.40	7.22	0.5916	T-test
Health related Quality of Life (SF-12v2) Physical	40.80	35.41	0.0983	T-test
Health related Quality of Life (SF-12v2) Mental	43.42	45.34	0.5384	T-test

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