Research in Social and Administrative Pharmacy 18 (2022) 2625–2633

Contents lists available at ScienceDirect

Research in Social and Administrative Pharmacy

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

A pharmacist's unique opportunity within a multidisciplinary team to reduce drug-related problems for older adults in an intermediate care setting

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ARTICLE INFO

Keywords:
Pharmacist
Medication
Older adults
Intermediate care
Drug-related problems

ABSTRACT

Background: There is a paucity of research describing the pharmacist's role in the multidisciplinary care of older adults in the intermediate care setting.
Objective: To determine the types of drug-related problems (DRPs) in older patients in this setting, to evaluate the implementation rate of pharmacist recommendations and the factors affecting implementation, and to assess the clinical significance of these recommendations.
Methods: Data were collected over a 12-week period on one pharmacist's recommendations to reduce clinically relevant DRPs identified during medication reconciliation and review for all patients ≥65 years admitted to an intermediate care unit. The clinical significance of the recommendations was judged by four independent assessors using a validated tool. Statistical significance was predetermined as $p < 0.05$.
Results: Of 494 clinically relevant DRPs identified in 91 patients (mean age: 82 years), 406 recommendations were communicated to the medical team, and 89.2% were implemented. Overall, 48.5% were communicated verbally, but no difference was found between the implementation rates of verbal and written recommendations (87.8% versus 90.4%; $p = 0.4$). Medication reconciliation recommendations were implemented more commonly than those regarding medication review (96.5% versus 79.5%; $p < 0.0001$). Recommendations judged to be of '*moderate significance*' (66.8% of total) were implemented more often than those of '*minor significance*' (93.2% versus 81.6%; $p < 0.001$). The consultant was provided with a significantly higher proportion of recommendations of '*moderate significance*' when compared to the junior doctor (79.6% versus 63.3%; $p = 0.02$), but implemented significantly fewer recommendations (69.4% versus 91.9%; $p < 0.0001$).
Conclusion: The high implementation rate in this study shows the importance of pharmacist involvement to reduce DRPs in the multidisciplinary care of older adults in an intermediate care unit. Future research should focus on investigating the impact of pharmacist interventions on older patient outcomes and the associated cost-effectiveness in this setting.

Introduction

It is well known that drug-related problems (DRPs) – events or circumstances involving drug therapy that actually or potentially interfere with desired health outcomes – are very common in older adults.[1] Potentially inappropriate prescribing (PIP) may be prevalent in up to 96% of older patients,[2] where the risk of using a medication may outweigh the perceived clinical benefit, or where a clinically indicated medication is omitted in the absence of a contraindication.[3,4] Prescribing in this patient group is a complex process due to increasing multimorbidity, polypharmacy, and age-related alterations in pharmacokinetics and pharmacodynamics.[5,6] Although often necessary for treatment, polypharmacy, in particular, is a key risk factor for DRPs, such as medication non-adherence, PIP, and adverse drug reactions (ADRs).[7–9]

DRPs and other medication safety issues in older adults often occur at point of care transfers.[10] Medication reconciliation is an important activity to minimise DRPs when patients are transferred across health services.[11] It is known that pharmacists are able to obtain the most accurate list of medications as part of medication reconciliation when

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https://doi.org/10.1016/j.sapharm.2021.05.003
Received 1 January 2021; Received in revised form 1 May 2021; Accepted 2 May 2021
Available online 6 May 2021

compared to other professions due to their specialised skill set, with pharmacist-led medication reconciliation being identified as a key cost-effective component in medication safety to reduce adverse drug events (ADEs) and improve patient outcomes.[11–14] The World Health Organisation (WHO) advises that patients should also receive a structured review of their medications on admission to healthcare settings. Pharmacists, as the experts in medicines, have a vital role in identifying DRPs and recommending medication changes; however, the degree of this service varies widely between organisations, often due to the lack of national standards.[11,15–17]

The acceptance rate of pharmacists' recommendations varies broadly from 11.4% to 94.2% across studies,[18–25] and may be influenced by a number of factors. Involvement of the pharmacist as part of a multidisciplinary team (MDT) appears to be an important factor as acceptance rates are generally higher when pharmacists are closely integrated within the team.[3,22] Although the role of the pharmacist has advanced over the past decade, it is still under-developed in much of Europe.[26] Internationally, pharmacists are widely incorporated into MDTs, particularly in the United Kingdom, United States of America, and Australia.[11,27] Studies have shown that integration of pharmacists within MDTs can result in a reduced prevalence of medication errors, reduced number of unscheduled hospital revisits and readmissions, and improved appropriateness and quality of prescribing for older adults.[10,13,28–31] However, most of these pharmacist intervention studies have addressed DRPs in acute hospital settings with limited evidence demonstrating such pharmacist interventions in intermediate care settings. Intermediate care has been broadly defined as a range of integrated services that promote faster recovery from illness, prevent unnecessary acute hospital admissions and premature admissions to long-term care, support timely discharge from hospital, and maximise independent living.[32] Pharmacists can play a vital role in medicines management in this care setting, but this has been underrepresented in the literature.[4] Therefore, with a clear need to provide greater evidence for pharmacist interventions in this setting, the objectives of this study were to:

- characterise the types and frequency of DRPs in older adults in an intermediate care setting identified by pharmacist-conducted medication reconciliation and medication review,
- to evaluate the medical team's implementation rate of the pharmacist's recommendations addressing the DRPs identified,
- to ascertain factors which may influence the implementation rate of the pharmacist's recommendations, and
- to assess the clinical significance of the pharmacist's interventions.

Methods

Study setting

At the time of the study, Our Lady's Hospice & Care Services (OLH&CS) was a 200-bed facility in Dublin, Republic of Ireland, encompassing a palliative care unit, a rheumatic and musculoskeletal diseases unit, an extended care facility, and the Community Reablement Unit (CRU). The CRU was a 24-bed ward with an average of seven admissions per week. This ward was a 2–4 week inpatient unit which facilitated the admission of frail older adults and involved a close-working MDT consisting of medical staff, a pharmacist, nursing staff, physiotherapists, occupational therapists, and healthcare assistants. Following a pre-assessment, patients deemed appropriate were admitted on a Monday or Tuesday morning and remained in the CRU until Friday for medication review, physiotherapy, and occupational therapy. Patients left the ward for the weekend and returned the following week to continue their programme until their discharge date was decided.

Medical care provided on the ward

A non-consultant hospital doctor (NCHD) of senior house officer (SHO) grade (a doctor with ≥1 year post-qualification experience) worked directly on the ward Monday to Friday from 9am to 5pm. Any relevant medication changes or medical issues for follow-up were also communicated to the GP through a discharge summary letter. A registrar (a doctor with ≥3 years post-qualification experience) from an acute hospital linked with the CRU also attended the ward weekly to review newly admitted patients. The medical team was led by a consultant geriatrician, who conducted a once-weekly ward round with the SHO and ward clinical nurse manager, and also led a once-weekly meeting with the wider MDT in the CRU held on a Monday afternoon to discuss patients admitted in the previous week.

Pharmaceutical care provided on the ward

At the time of the study, a full-time staff grade pharmacist with more than two years' post-registration experience worked between the CRU and other pharmacy services Monday to Thursday from 9am to 5pm and Friday from 9am to 4pm. The pharmacist had worked on the CRU for approximately two years prior to study initiation. The pharmacist in the CRU routinely conducted medication reconciliation and medication review for all patients, along with a weekly drug chart review and attendance at the once-weekly MDT meeting.

Medication reconciliation

It was policy at OLH&CS that medication reconciliation was carried out for all patients admitted to the CRU within 24–48 h of admission, which was conducted by the pharmacist using a three-step process of check, collect, and communicate.[33]

Medication review

The pharmacist conducted a full medication review for each patient during the first week of admission after medication reconciliation was complete, including a review of the patient's unified healthcare record (UHCR), laboratory results, blood pressure, heart rate, and any other relevant patient parameters. As part of this medication review, the pharmacist screened the patient information against the full set of STOPP/START criteria version 2.[34] The pharmacist was experienced in the use of this tool to identify potentially inappropriate medications (PIMs) and potential prescribing omissions (PPOs), but also applied their clinical knowledge to identify further DRPs – including renal dose adjustment of medications, drug-drug interactions, drug-disease interactions, ADRs, and other PIP issues not included in STOPP/START. After the initial comprehensive medication review, the pharmacist conducted a drug chart review on a weekly basis for all patients in the CRU.

Endorsement of the drug chart

The pharmacist routinely endorsed drug charts in the CRU, which did not require communication to the medical team. This included amendment of medication timing in the drug chart, endorsement of correct formulation, endorsement of strength if not specified and clearly determined through medication reconciliation, endorsement of drug strength if dose was prescribed in Roman numerals, and recording allergy status on the drug chart. Only endorsements which highlighted clinically relevant DRPs were included in this study.

Communication and implementation of the pharmacist's recommendations

Various methods were used by the pharmacist to communicate recommendations to the medical team to resolve clinically relevant DRPs. In terms of a clinically relevant intervention, we mean where the perceived benefits or where the effects are large enough to outweigh the associated costs, inconveniences, or possible harms.[35] Non-urgent medication reconciliation-related discrepancies identified were

verbally communicated if the NCHD was readily available; if the NCHD was preoccupied on the ward, the pharmacist left a handwritten note in a communication book checked regularly by the NCHD on the ward. This communication book was used instead of the medical notes, as these medical notes were not always accessible on the ward as they were routinely in use by multidisciplinary team members. If urgent discrepancies were identified, the NCHD was contacted by telephone or spoken to directly. For medication review-related DRPs, the pharmacist used their discretion to either communicate these *de novo* to the NCHD on the ward or to the consultant at the once-weekly MDT meeting. All the pharmacist's recommendations on DRPs were recorded as implemented when an amendment was made to the drug chart based on the pharmacist recommendation.

Study design

Approval for this study was granted by the Clinical Audit Committee at OLH&CS in February 2019 (reference: CA0219). This study describes interventions by a pharmacist to reduce DRPs in older adults (≥65 years) in the CRU, including i) an evaluation of the implementation rates of pharmacist recommendations by medical staff and ii) an assessment of the clinical significance of the pharmacist's interventions. The interventions in this study were representative of the routine service provided by the pharmacist on the ward prior to this study (i.e. standard care).

Data collection

Data collection was conducted over 12 weeks from 18th February to 10th May 2019 on all patients aged ≥65 years that were newly admitted to the CRU. Patients were excluded if they were immediately discharged prior to medication reconciliation. The type of data collected for each patient is outlined in the Supplementary Data.

Data analysis

Possible causes for DRPs were categorised according to the Pharmaceutical Care Network Europe (PCNE) classification for DRPs (version 9.00).[1]

Assessment of the clinical significance of the pharmacist's recommendations

After the data collection period, four independent assessors were recruited to evaluate the clinical significance of the pharmacist's interventions. Assessors consisted of two pharmacists (a hospital pharmacist with substantial experience in geriatric medicine and research, and a community pharmacist with a background in academic research) and two consultant geriatricians (one working between an acute teaching hospital and OLH&CS, but not directly involved in the CRU, and the other working in an acute teaching hospital in Dublin).

Anonymised data were sent to all assessors on a Microsoft® Excel spreadsheet by email, which contained an explanation of the assessment. Each assessor was asked to rate the clinical significance of all the pharmacist's interventions using a scale from 0 to 10, whereby 0 indicated no harm (the pharmacist's intervention was unlikely to have any impact) and 10 indicated death (the pharmacist's intervention was thought to have prevented potential death). This scale was based on that previously developed by Dean and Barber,[36] which has been shown to be a validated and reliable index for measuring the severity of errors and has been used in previous studies to measure the clinical significance of pharmacists' interventions.[10,37,38] All assessors were asked to return their scores by email. Mean assessor scores were categorised as minor (<3; very unlikely to have any adverse effects), moderate (3–7; likely to cause some adverse effects or interfere with therapeutic goals but very unlikely to result in death or lasting impairment) or severe (>7; likely to cause death or lasting impairment).[10,36,37]

Statistical analysis

Descriptive statistics – such as mean, range, and standard deviation – were calculated using Microsoft® Excel for patients' age, length of stay, number of medications, and number of DRPs. The % prescriber implementation rates were calculated by dividing the number of pharmacist recommendations implemented over the total number of recommendations made, and then multiplying this by 100.

The chi-squared test was used to inferentially determine the statistical significance between data subgroups. The level of statistical significance was predetermined as $p < 0.05$.

The clinical significance of interventions was calculated using the mean assessor score.[37] The percentage agreement between groups of two assessors was calculated by evaluating the proportion of times the assessors agreed on the same category of significance. The mean value across all groups of assessor data was then calculated to provide the overall percentage agreement between assessors.

Results

Patient characteristics

In total, 91 patients were included during the 12-week study period (58.2% female; 41.8% male). The mean age was 82 years (standard deviation [SD] 6.41; range 67–93 years). The mean length of stay in days excluding weekends was 13.2 (SD 3.7; range: 2–19 days). The mean number of regular medications on admission was 9.1 (SD 3.8; range 1–17), whereby 89% of patients had polypharmacy (≥5 regular medications) and 42.9% of patients had hyperpolypharmacy (≥10 regular medications).

Prevalence of DRPs

A total of 494 clinically relevant DRPs was identified in the included patients during admission (mean 5.4; SD 5; range 0–19). Fig. 1 details the numbers of clinically relevant DRPs identified in included patients. The majority of interventions addressing these DRPs were carried out on admission (66%) and during drug chart review (22%). The remainder were conducted at the MDT meeting or in the dispensary.

Pharmacist endorsement of the drug chart

Of the 494 clinically relevant DRPs identified, 83 did not require discussion with the medical team and were resolved through pharmacist endorsement of the drug chart (as detailed in Table 1).

Overall implementation rate and type of the pharmacist's recommendations

The pharmacist communicated 406 recommendations to the medical team, of which 362 were implemented (89.2%). Only recommendations made to the medical team were included in the calculation of the implementation rates; the 83 DRPs which were resolved through pharmacist endorsement and the five recommendations which were communicated to nursing staff were not included. Table 2 provides detail on the main characteristics of recommendations made and the implementation rates for each type of recommendation according to the PCNE classification system (version 9.00).[1] The most common types of recommendations communicated to the medical team were due to 'no or incomplete drug treatment in spite of existing indication' (29.3%) and 'no indication for drug' (26.7%). No statistically significant difference was found in implementation rates between individual types of either medication review or medication reconciliation recommendations.

PIP instances identified through the STOPP/START criteria accounted for 18.7% (76/406) of all DRPs (15.3% for STOPP and 3.4% for START), and represented 39.2% of all medication review-related recommendations. Overall, 79% of STOPP recommendations (49/62) and

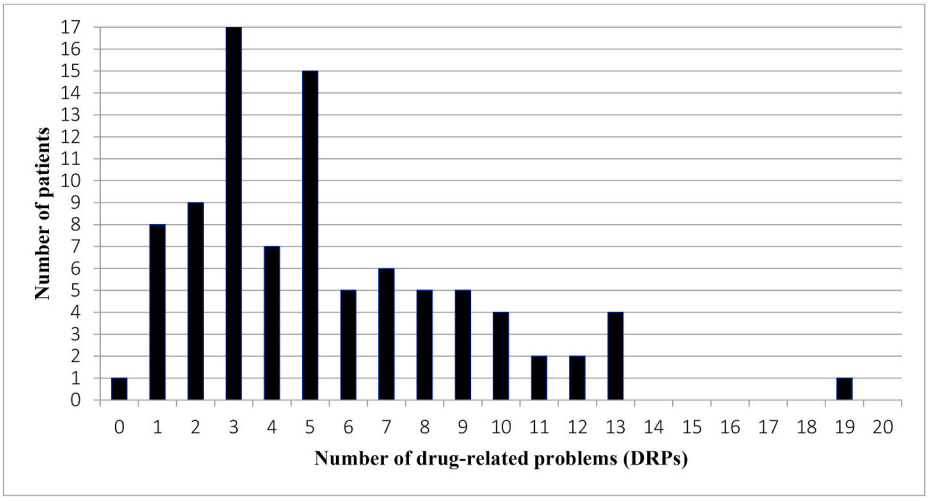

Figure 1. Number of patients according to the frequency of clinically relevant drug-related problems (DRPs).

Table 1
Drug-related problems (DRPs) resolved through pharmacist endorsement of the drug chart.

Drug-related problem (according to PCNE cause classification)	% of DRP resolved through drug chart endorsement
Dose timing instructions wrong, unclear, or missing (C3.5)	63% (46/73)
Necessary information not provided (C5.2)	51.2% (22/43)
Inappropriate drug form (for this patient) (C2.1)	50% (6/12)
Inappropriate duplication of therapeutic group or active ingredient (C1.5)	17.6% (3/17)
Dosage regimen not frequent enough (C3.3)	5.4% (2/37)
Dosage regimen too frequent (C3.4)	5.1% (2/39)
Drug dose too low (C3.1)	4.8% (1/21)
Drug over-administered (C6.3)	100% (1/1)

42.9% of START recommendations (6/14) were implemented.

Communication method and grade of staff contacted

Of the 406 recommendations made to the medical team, 357 (87.9%) were communicated to the NCHD through written or verbal communication. Of these, 91.9% were implemented (328/357). The remainder of the recommendations (n = 49; 12.1%) relating to medication review, were communicated face to face to the consultant at the MDT meeting. Of these, 34 were implemented (69.4%), representing a significant difference in the overall recommendation implementation rates between the NCHD and consultant (91.9% versus 69.4%; $p < 0.0001$). Similarly, significantly more verbally-communicated recommendations made to the NCHD were implemented compared to the consultant: 93.9% (139/148) versus 69.4% (34/49); $p < 0.0001$.

Table 3 provides a breakdown of the recommendations that were brought to the attention of the consultant and NCHD. Overall, 48.5% of recommendations were communicated verbally (197/406), but no statistically significant difference was found between the implementation rates of recommendations via verbal or written communication: 87.8% (173/197) versus 90.4% (189/209); $p = 0.4$. There was also no significant difference between the implementation rates of recommendations via verbal or written communication made to the NCHD: 93.9% (139/148) versus 90.4% (189/209); $p = 0.23$. Approximately five written recommendations (2.39%) that were accepted in the ward doctor's communication book (acknowledged with a tick) but not initially implemented were followed up verbally with the NCHD to facilitate implementation. However, even if these five written recommendations had not been implemented, there would still be no significant difference between the implementation rates of verbal recommendations and written recommendations: 87.8% (173/197) versus 88% (184/209); $p = 0.95$. Significantly more medication reconciliation-related recommendations were implemented compared to medication review-related recommendations (96.5% versus 79.5%; $p < 0.0001$). There was no significant difference found overall between implementation rates of medication review recommendations communicated verbally compared to those that were written ($p = 0.72$). However, significantly more medication review recommendations communicated to the NCHD were implemented compared to those communicated to the consultant: 83.5% (106/127) versus 69.4% (34/49); $p < 0.05$.

Table 2 shows that two of the most common types of DRPs brought to the attention of the consultant or the NCHD were due to 'no indication for drug' and 'no or incomplete drug treatment in spite of existing indication'. The issue of 'drug dose too high' was relatively much more common as a DRP communicated to the consultant. In contrast, the DRPs of 'dosage regimen too frequent' and 'dosage regimen not frequent enough' were some of the most common DRPs communicated to the NCHD, and these frequency issues were not addressed with the consultant at all.

Overall, 69.4% (43/62) of all STOPP-related DRPs and 57.1% (8/14) of all START-related DRPs were communicated to the NCHD, with the remainder communicated to the consultant. No statistically significant differences were found in the implementation rates between the NCHD and consultant for STOPP recommendations (83.7% versus 68.4%; $p = 0.17$) or START recommendations (62.5% versus 16.7%; $p = 0.086$).

Clinical significance of interventions

Overall mean assessor scores for significance of recommendations

Approximately one third of all pharmacist interventions (including recommendations and endorsements) were judged to be of minor significance (33.2%), with a mean score <3, whilst approximately two-thirds of recommendations were judged to be of moderate significance (66.8%), with a mean score of 3–7. No interventions had a mean overall score which fell into the category of severe significance (mean score >7).

Of interventions specifically communicated to the medical team, 65.3% were of moderate significance (265/406) and 34.7% of minor significance (141/406). The overall mean percentage agreement on the degree of clinical significance between assessors was 65.2%. The percentage agreement between pharmacists was significantly higher than between the geriatricians ($p < 0.05$).

Table 2
Classification of drug-related problems and the recommendation type, recipient, and implementation rates.

Drug-related problem (according to PCNE cause classification)	Number of recommendations (% of total)	Implementation rate	Recommendation type						Recipient of recommendation			
					Medication reconciliation		Medication review		NCHD		Consultant	
No or incomplete drug treatment in spite of existing indication (C1.6)	119	(29.3%)	89.9%	(107/119)	82	(35.7%)	37	(21%)	108	(30.3%)	11	(22.4%)
No indication for drug (C1.3)	47	(26.7%)	78.7%	(37/47)	20	(8.7%)	27	(15.3%)	35	(9.8%)	12	(24.5%)
Dosage regimen too frequent (C3.4)	37	(9.1%)	94.6%	(35/37)	34	(14.8%)	3	(1.7%)	37	(10.4%)	–	–
Dosage regimen not frequent enough (C3.3)	35	(8.6%)	97.1%	(34/35)	33	(14.3%)	2	(1.1%)	35	(9.8%)	–	–
Drug dose too high (C3.2)	32	(7.9%)	84.4%	(27/32)	8	(3.5%)	24	(13.6%)	19	(5.3%)	13	(26.5%)
Dose timing instructions wrong, unclear, or missing (C3.5)	27	(6.7%)	96.3%	(26/27)	8	(3.5%)	19	(10.8%)	27	(7.6%)	–	–
Necessary information not provided (C5.2)	21	(5.2%)	100%	(21/21)	21	(9.1%)	–	–	21	(5.9%)	–	–
Drug dose too low (C3.1)	20	(4.9%)	85%	(17/20)	14	(6.1%)	6	(3.4%)	20	(5.6%)	–	–
Inappropriate duplication of therapeutic group or active ingredient (C1.5)	14	(3.4%)	100%	(14/14)	5	(2.2%)	9	(5.1%)	13	(3.6%)	1	(2%)
Other cause (C9.2)	12	(3%)	75%	(9/12)	1	(0.4%)	11	(6.3%)	9	(2.5%)	3	(6.1%)
Duration of treatment too long (C4.2)	9	(2.2%)	77.8%	(7/9)	1	(0.4%)	8	(4.5%)	7	(2%)	2	(4.1%)
Inappropriate drug (within guidelines but otherwise contraindicated) (C1.2)	7	(1.7%)	71.4%	(5/7)	–	–	7	(4%)	5	(1.4%)	2	(4.1%)
Inappropriate drug form (for this patient) (C2.1)	6	(1.5%)	100%	(6/6)	1	(0.4%)	5	(2.8%)	6	(1.7%)	–	–
Inappropriate drug according to guidelines/formulary (C1.1)	6	(1.5%)	83.3%	(5/6)	–	–	6	(3.4%)	3	(0.8%)	3	(6.1%)
Patient unable to use drug/form as directed (C7.9)	5	(1.2%)	80%	(4/5)	2	(0.9%)	3	(1.7%)	5	(1.4%)	–	–
Too many drugs prescribed for indication (C1.7)	2	(0.5%)	100%	(2/2)	–	–	2	(1.1%)	2	(0.6%)	–	–
Prescribed drug not available (C5.1)	2	(0.5%)	100%	(2/2)	–	–	2	(1.1%)	2	(0.6%)	–	–
Patient uses/takes less drug than prescribed or does not take the drug at all (C7.1)	2	(0.5%)	100%	(2/2)	–	–	2	(1.1%)	1	(0.3%)	1	(2%)
Inappropriate combination of drugs, or drugs and herbal medications, or drugs and dietary supplements (C1.4)	1	(0.2%)	100%	(1/1)	–	–	1	(0.6%)	–	–	1	(2%)
Inappropriate timing of administration and/or dosing intervals (C6.1)	1	(0.2%)	100%	(1/1)	–	–	1	(0.6%)	1	(0.3%)	–	–
Duration of treatment too short (C4.1)	1	(0.2%)	0%	(0/1)	–	–	1	(0.6%)	1	(0.3%)	–	–
Number of recommendations/% total	**406**	**(100%)**	**89.2%**	**(362/406)**	**230**	**(56.7%)**	**176**	**(43.3%)**	**357**	**(87.9%)**	**49**	**(12.1%)**

PCNE: Pharmaceutical Care Network Europe Association NCHD: Non-consultant hospital doctor.

Clinical significance, method of communication, and implementation rates

There was a significantly higher proportion of recommendations of moderate significance implemented compared to those deemed to be of minor significance: 93.2% (247/265) versus 81.6% (115/141); $p < 0.001$. Of the recommendations judged to be of moderate significance, 53.6% (142/265) were communicated verbally. There was a significantly higher proportion of medication review recommendations judged to be of moderate significance (125/176; 71%) compared to medication reconciliation recommendations (140/230; 60.9%); $p < 0.05$.

Of the recommendations made to the NCHD, 63.3% were of moderate significance (226/357), encompassing 103 of the 148 verbal recommendations (69.6%) and 123 of the 209 written recommendations (58.9%) respectively. Of the 49 recommendations made to the consultant, 39 (79.6%) were of moderate significance. There was a significantly higher proportion of recommendations provided to the consultant that were of moderate significance compared to that provided to the NCHD (79.6% versus 63.3%; $p < 0.05$); however, significantly more of these were implemented by the NCHD (96% versus 76.9%; $p < 0.0001$).

Similarly, there was a higher proportion of medication review-related recommendations of moderate significance provided to the consultant compared to the NCHD (79.6% versus 67.7%; $p = 0.11$). However, when comparing just verbal medication review-related recommendations made to the NCHD and consultant, there was a significantly higher implementation rate for those brought to the attention of the NCHD (87% versus 69.4%; $p < 0.05$) despite a similar percentage of recommendations judged to be of moderate significance between the NCHD and consultant (77.8% versus 79.6%; $p = 0.82$).

Table 3
Implementation rates for medication reconciliation or medication review recommendations according to method of communication and grade of medical staff contacted.

Method of communication	Medication reconciliation implementation rates		Medication review implementation rates		*p*-value
Verbal	97.9%	(92/94)	78.6%	(81/103)	$p < 0.0001$
- Consultant	–	–	69.4%	(34/49)	–
- NCHD	97.9%	(92/94)	87%	(47/54)	$p < 0.05$
Written (to NCHD only)	95.6%	(130/136)	80.8%	(59/73)	$p < 0.001$
Total (verbal plus written)	96.5%	(222/230)	79.5%	(140/176)	$p < 0.0001$

NCHD: Non-consultant hospital doctor.

Reasons for non-implementation of the pharmacist's recommendations

Overall, 10.8% (44/406) of recommendations brought to the attention of the medical team were not implemented, of which reasons for non-implementation were available in 54.5% (24/44) of cases:

- Further follow-up necessary prior to review ($n = 7$; 15.9%).
- Inappropriate time to review ($n = 6$; 13.6%).
- Intentional change of medication dose or frequency on admission but not documented in the UHCR ($n = 3$; 6.8%).
- Unclear diagnosis from notes ($n = 3$; 6.8%).
- Patient discharged prior to review ($n = 2$; 4.5%).
- Recommendation to initiate medication unlikely to add benefit to the patient ($n = 1$; 2.3%).
- Patient under the care of another specialist ($n = 1$; 2.3%).
- Previous intervention unsuccessful ($n = 1$; 2.3%).

Discussion

With a paucity of research describing pharmacist interventions in intermediate care settings, the authors are not aware of any previous research like the present study – which has shown that the pharmacist, as part of the MDT, has a key role in identifying and reducing clinically significant DRPs in older adults in an intermediate care setting. DRPs were highly prevalent in this study with 99% of patients having at least one DRP, and 54% having at least five DRPs on admission. The prevalence of DRPs in our older patient cohort is higher than that reported in similar previous studies from hospital settings, which varies between 34.1% and 82%.[18,19,21,39] The higher detection rate of DRPs in this study may have resulted from increased pharmacist time and availability on the ward.[22,23,40] An observational study by Millar et al. from the intermediate care setting previously identified 3.27 instances of PIP in each older adult on average.[41] It is important to note that the work by Millar et al. only addressed 'potential' instances of inappropriate prescribing according to STOPP/START criteria version 2, whereas the present study is novel in that it involved a pharmacist identifying and intervening on 'actual' DRPs – of which approximately two-thirds of the DRPs were independently judged to be of '*moderate significance*'.

The implementation rate of pharmacist recommendations in our study was 89.2%, which is at the higher end of the range of acceptance rates reported in previous studies (11.4–94.2%).[18–25] In line with our findings, previous research would suggest that intervention studies where pharmacists are integrated well as part of the MDT result in higher acceptance rates compared to those without close integration.[3,18–25,42] The physical proximity of the pharmacist and the medical team has been described as a potential influencing factor in improving cooperation between these healthcare professionals in a previous study.[27] Furthermore, pharmacist recommendations communicated verbally are generally accepted significantly more often than written recommendations.[43] In studies which have reported acceptance rates and the method of communication, verbal communication is not the usual method of communication when pharmacists are not integrated as part of the MDT.[19,23] A previous Irish study by O'Sullivan et al. reported that only one third of their recommendations could be communicated verbally, with written communication more commonly reflecting normal practice in the Republic of Ireland.[19] The pharmacist in our study was closely integrated within the MDT, was on the ward regularly, and communicated almost half (48.5%) of recommendations verbally. Interestingly, there was no statistically significant difference between the implementation rate of recommendations via verbal or written communication ($p = 0.4$). Furthermore, when comparing the implementation rates of verbal and written recommendations made solely to the NCHD, there was also no statistically significant difference (93.9% versus 90.4%; $p = 0.23$). Therefore, a pharmacist working closely with other MDT members may be an important facilitator to the implementation of pharmacist recommendations, particularly written recommendations.

One of the aims of the study was to assess the clinical significance of pharmacist recommendations. The percentage agreement between assessors in this respect was 65.2%, which is higher than the agreement reported by the original study (58.7%),[36] but could be improved by assessors discussing the scale in advance before their independent evaluations.[23] The degree of clinical significance of recommendations may have influenced the method of communication and the implementation rate in this study. There was a significantly higher proportion of verbal recommendations to the NCHD judged to be of moderate significance compared to the proportion of written recommendations of moderate significance (69.6% versus 58.9%; $p < 0.05$), therefore vindicating the pharmacist's choice of communication for more complex DRPs. Furthermore, a significantly higher percentage of recommendations judged to be of moderate significance were implemented when compared to those of minor significance (93.2% versus 81.6%; $p < 0.001$). This is in line with previous research that has shown that the implementation rate significantly increases as the clinical relevance increases for recommendations targeting PIP in older adults.[44] In addition, Kimura et al. reported a higher acceptance rate when the pharmacist carried out a risk-benefit analysis and only communicated clinically relevant DRPs.[21] This may further support the importance of pharmacist assessment of the clinical relevance of recommendations before bringing them to the attention of the medical team.

A significantly higher implementation rate was evident when recommendations were brought to the NCHD compared to the consultant (91.9% versus 69.4%; $p < 0.0001$). The reduced implementation rate observed for recommendations made to the consultant overall may have been due to the fact that a significantly higher proportion of more complex recommendations, i.e. recommendations judged to be of moderate significance, were addressed with the consultant rather than the NCHD (79.6% versus 63.3%; $p < 0.05$). However, when comparing verbal medication review-related recommendations made to the NCHD and consultant, there was also a significantly higher implementation rate for those brought to the attention of the NCHD (87% versus 69.4%; $p < 0.05$) despite a similar percentage of recommendations judged to be of moderate significance between the NCHD and consultant (77.8% versus 79.6%; $p = 0.82$). Therefore, this reiterates that the grade of doctor can have a significant influence on the uptake of pharmacist recommendations.[45]

Medication reconciliation DRPs accounted for 56.7% of all DRPs communicated to the team, further emphasising the importance of medication reconciliation and that pharmacists are key healthcare professionals in ensuring the most accurate list of medications.[11,14] Although some medication reconciliation-related DRPs could be resolved through pharmacist endorsement of the drug chart or through communication with nursing staff, the majority required discussion with the medical team (82.2%). The high implementation rate of medication

reconciliation-related recommendations in this study (96.5%) highlights the importance of this process. It is known that more than 50% of medication discrepancies on discharge begin at hospital admission[19]; therefore, ensuring the most accurate and comprehensive list of medications is obtained at admission is essential as the most important step in pharmaceutical interventions prior to medication review. It is worth noting that the application of STOPP/START criteria accounted for 39.2% of medication review-related DRPs in these older adults. Therefore, this highlights that clinical expertise is also essential when reviewing the pharmacotherapy of older adults like this to ensure additional DRPs are identified which may not be covered by such explicit tools.

In this study, a significantly higher proportion of recommendations pertaining to medication reconciliation were implemented compared to medication review-related recommendations ($p < 0.0001$) irrespective of the method of communication. This may be explained by the fact that there were a significantly lower proportion of medication reconciliation-related recommendations judged to be of moderate significance when compared to medication review-related recommendations (60.9% versus 71%; $p < 0.05$), and therefore the medication reconciliation-related recommendations may have been more straightforward to amend. Furthermore, all these recommendations types were brought to the attention of the NCHD who implemented significantly more recommendations overall than the consultant. Our findings are in line with a previous Irish study where appropriateness issues detected during medication review had a significantly lower acceptance rate than those relating to medication reconciliation.[19] Previous studies have suggested that lower acceptance rates for medication review-related DRPs might relate to patients being treated for an acute illness during review or that recommendations were not clinically relevant at the particular time.[19,23,24] Despite the non-acute nature of this study setting, one of the main known reasons for non-implementation of recommendations was that it was an inappropriate time to review the DRP and that further follow-up was required. However, even with a significantly lower implementation of medication review-related recommendations, the implementation rate was 79.5%, which is much higher than that reported in a previous Irish study (38.5%),[19] but similar to that reported in other studies where the pharmacist worked closely within the MDT.[20,22,28] As the setting was non-acute and patients were medically well overall, they may have been deemed more suitable for medication review during their admission and this may have resulted in a higher implementation rate for these type of recommendations.

Notably, the implementation rate of recommendations to resolve PPOs (based on START criteria) was higher in this study (42.9%) than that in a previous Irish study (29.5%),[19] which again may relate to the non-acute nature of this setting. However, this implementation rate was a lot lower compared to other recommendation types. Given that polypharmacy was present in 89% of patients in this study and that there is an association between polypharmacy and underprescribing,[46] this may help to partially explain the low uptake of recommendations pertaining to PPOs as the medical team may have wanted to avoid adding further medication to patients with pre-existing polypharmacy.

Strengths and limitations

DRPs were classified according to the validated PCNE classification system[1]; however, challenges were identified as some DRP causes were deemed multifactorial, with an element of clinical judgement required to define which code was most applicable in classifying some DRPs.

One of the major strengths of this study was the close involvement of the pharmacist within the MDT, whereby the pharmacist was available on the ward regularly with good access to the medical team, which was likely a facilitator to the high recommendation implementation rates. However, given that the patients are typically not acutely unwell in this intermediate care setting, the results may not be as transferable to other settings. Furthermore, the generalisability of the study's findings may be limited by its single-centred nature involving one pharmacist and its sample size.

The consultant and NCHD remained largely unchanged for the duration of the study, which allowed an accurate reflection of the implementation rates based on an established working relationship between the pharmacist and medical team. The pharmacist's activity on the ward as part of this study did not change from usual practice; therefore, it is unlikely that the Hawthorne effect was present. Furthermore, this is supported by the fact that there was no unusual change in implementation rates before, during, or after the 12-week study.

It should be highlighted that this study importantly reports implementation rates rather than acceptance rates, which provides a true representation of the impact of the pharmacist on reducing DRPs on the ward. However, no clinical end-points were considered in this study, which would have been more valuable in demonstrating the clinical impact that the reduction of DRPs by pharmacist interventions can have on patient outcomes in the intermediate care setting.

Implications for future research

Although the pharmacist was involved at multiple stages of patient care during this study, there was no pharmacist involvement at discharge. One of the main known reasons for recommendation non-implementation here was that it was an inappropriate time to review or further follow-up was required – which emphasises the importance of discharge communication for future medication review. Pharmacist involvement at discharge would help to ensure an accurate medication list at this point of care transfer and may improve communication with the primary care team to sustain intentional medication changes. Therefore, future intervention studies like this should aim to investigate the impact that pharmacist-conducted medication reconciliation and review at discharge can have on patients in the intermediate care setting.

Given the high implementation rate in this study, as well as in other interventions where the pharmacist is well integrated into the MDT, studies should strongly consider having a pharmacist working closely with the medical team where possible. Additionally, future studies within the intermediate care setting should consider evaluating the impact of pharmacists' interventions on clinical outcomes for older adults. This study identified some factors that affected implementation of pharmacist recommendations; however, further research is required to investigate in greater depth the key factors affecting implementation of pharmacist recommendations in similar settings.

Conclusion

It is evident from this intervention that pharmacists have a key role in identifying and reducing DRPs in older adults in the intermediate care setting. This study demonstrated a high implementation rate of pharmacist recommendations where the pharmacist was closely aligned with the MDT, attended MDT meetings, and had a close working relationship with the medical team. This research has highlighted a number of factors which may have influenced implementation, including the grade of staff contacted, accessibility to the medical staff, the non-acute setting, the clinical significance of recommendations, and the type of recommendations made (e.g. medication reconciliation-related or medication review-related). Whilst researchers should consider using the information provided in this study to inform the design of future pharmacist interventions with high implementation rates, there should be a greater focus on investigating the impact of such interventions on patient outcomes and the associated cost-effectiveness in the intermediate care setting for older adults.

Declaration of competing interest

The authors declare no conflict of interest.

Acknowledgments

The authors would like to express sincere thanks to Dr. Róisín Purcell and all staff in the Community Reablement Unit at Our Lady's Hospice & Care Services. We would also like to thank the physicians (Joseph Browne and Rory Nee) and pharmacists (Amy Walsh and Ciara McGann) who very generously gave their time to assess the significance of the recommendations.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.sapharm.2021.05.003.

Funding

This research received no external funding.

Author contributions

Amy Byrne: Conceptualisation, Methodology, Writing – original draft, Writing – review & editing, Investigation, Data curation, Formal analysis, Visualisation, Sharon Byrne: Conceptualisation, Methodology, Writing – original draft, Writing – review & editing, Supervision, Kieran Dalton: Conceptualisation, Methodology, Writing – original draft, Writing – review & editing, Formal analysis, Visualisation, Supervision

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