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Assessing Medication Self-Management Challenges and Self-efficacy During Emergency Department Medication Reconciliation: An Evidence-based Quality Improvement Project

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ABSTRACT

Introduction	Older adult patients (≥65) accessing emergency departments (ED) represent a significant demographic. Recidivism secondary to adverse drug events (ADE) ranges between 6-24% and levels of prescribed medication non-adherence is common among older adults. The ED pharmacist medication reconciliation workflow may mitigate self-management challenges in real time and reduce medication-related harm while potentially impacting recidivism, medication adherence, and patient self-efficacy. The purposes of this evidence-based project were to (1) evaluate the impact of a modified Medication Management for Deficiencies in the Elderly (MedMalDE) intervention on Self-Efficacy for Appropriate Medication Use (SEAMS) and 30-day return to care and (2) identify factors associated with medication self-management challenges (MedMalDE) in the participating institution.
Methods	As part of an evidence-based quality improvement (QI) effort to build an accredited geriatric emergency department (GED) and meet State legislated acute care medication history requirements, a new medication reconciliation workflow was deployed. To assess the intervention's impact on self-efficacy in a pre/post design, 21 older adult patient's underwent SEAMS assessment at two time points: the intervention and 7-14 days post-discharge from the emergency department. Baseline data and medication self-management challenges for an ED convenience sample of 167 older adult patients completed the MedMalDE. Descriptive statistics and a logistic regression model were used to evaluate the impact of the intervention and factors associated with medication management deficiencies. Wilcoxon Signed Rank was used for pre/post SEAMS score change.
Results	The self-efficacy (SEAMS) scores of 21-patients participating in the intervention were significantly improved from 19.88 to 21 (p=0.0077, p10%, included lack of knowledge regarding medication names, ease of opening or manipulating medications, ease of swallowing medications, and affordability. MedMalDE total scores were significantly associated with female gender (OR=2.0, 95%CI=1.14-3.51, p=0.016), and the functional (ability) subscale was associated with female gender (OR=1.88, 95%CI=1.03-3.41, p=0.011) and patient as the informant (OR=0.49, 95%CI=0.27-0.89, p=0.019).
Conclusion	Integrating a modified MedMalDE into medication reconciliation can identify common patient medication self-management challenges in real-time, guiding pharmacist's interventions and potentially reducing medication-related harm. Individualized assessment improves self-efficacy while ensuring the health system has a reliable and accurate medication history at times of transition.

IMPACT STATEMENT

Ensuring assessment of medication self-management challenges, during ED medication reconciliation, can impact medication understanding, adherence, and self-efficacy.

ED older adult medication self-management challenges	**Adherence gaps**: a significant percentage of older ED adults report gaps in adherence	**Medication dispensing**: pharmacies have not adapted to changes in older adult functional status	**ED older adult resources**: lacks attention to medication regimen complexity with aging
Key QI takeaways	**Tangible medication list**: Patients and caregivers value updated, understandable, and printed medication lists	**ED pharmacy**: their role is essential and has raised their awareness of medication self-management challenges	**Medication list accuracy:** while important for self-efficacy it is only part of medication reconciliation

INTRODUCTION

Approximately 20% of U.S. emergency department (ED) visits involved adults age 60 or older and the patient percentage increases with advancing age.[1, 2, 3] With advancing age, there is a greater incidence of chronic disease and prescribing of pharmaceuticals, which create an opportunity for adverse drug events.[4,5,6] Advanced age is also associated with an increased need for medication reconciliation.[6] Older adult patients can exhibit greater vulnerability secondary to evolving cognitive and functional age-related changes, complex medication regimens, greater co-morbidity, and increased life expectancy.[7,8] Assessing patient medication self-management is a process requiring multiple participants including caregivers, patients, and health professionals.

The incidences of medication-related injury requiring medical intervention are not uncommon.[9] It is estimated 6-11% of recidivism is related to adverse drug events (ADE) in all age groups, with 22% of older adults experiencing a return to ED care within 30-days post-ED discharge.[10,11] The greater percentage of ADE etiologies include medication communication deficiencies in transitions of care.[9,12] It is estimated that 46% of errors were related to transitions of care.[13] Medication reconciliation and counseling by pharmacists and other health professionals have shown a reduction in harm events and adverse drug events following this intervention.[14,15]

National research and improvement organizations, such as Institute for Healthcare Improvement, American Geriatrics Society, Agency for Health Research and Quality, and Joint Commission support the incorporation of workflows addressing medication literacy through education and reconciliation, especially in transitions of care.[16,17,18,19,20] The assessment of a patient's medication self-management does not typically occur with medication reconciliation. Evaluating this through a self-management assessment tool to aid health professionals in clinical settings can be challenging.[17,21]

Combining medication self-management assessment with a reconciled mediation list may improve outcome metrics further.[22,23] Different methods of research (qualitative, observational, and RCT) and meta-analyses have demonstrated the benefits of reconciliation and counseling provided by pharmacists in different clinical settings, but ADE and hospital resource utilization mitigation remain elusive.[9,19,24] Introducing the Medication Management for Deficiencies in the Elderly (MedMalDE), as an intervention instrument, into medication reconciliation has been shown to identify self-management challenges ("with permission").[5]

Iuga & McGuire, (2014), Lam & Fresco, (2015), Badawoud et al., (2020) and Ziaeian et al. (2012) provide evidence on the impact of medication reconciliation and self-efficacy improvement on adherence outcomes among older adults. There is currently no benchmark for measuring or predicting medication adherence, and the issues are multi-factorial.[12,26] A QI workflow to improve the medication reconciliation process by incorporating a self-management assessment tool is imperative to patient health outcomes.[7] This QI project aimed to standardize the ED medication reconciliation process for older ED adults focusing on self-management challenges and measuring self-efficacy change. The project addresses the 2018 California legislation (Senate Bill 1254) referring to the medication reconciliation gap in acute care settings requiring hospitals to obtain an accurate list of medications for all health-system defined high-risk patients upon admission.[27]

METHODS

A pre-and post-design was utilized to assess the impact of the QI intervention and cross-section design was used to identify factors associated with medication self-management deficiencies in the older adult. The project institution is a tertiary and quaternary care academic medical center located in San Francisco. The Emergency Department (ED) has thirty-four main ED and ten clinical decision unit (CDU) beds. The age-friendly emergency department project was coordinated between the Division of Geriatrics and the Department of Emergency Medicine, involving a multi-disciplinary team of health professionals. It included pharmacy, social worker, ED nurse champions, physicians, and nurse practitioners (NPs). The pharmacy technicians and a pharmacist added a modified MedMalDE assessment intervention into a structured ED medication reconciliation workflow as part of a broader modified comprehensive geriatric consult.

A 167-patient convenience sample underwent medication reconciliation with MedMalDE assessment to identify self-management challenges. A 21-patient subset underwent a pre-MedMalDE measurement of medication self-efficacy using Self-Efficacy for Appropriate Medication Use (SEAMS) followed by post-MedMalDE pharmacist interventions based on the MedMalDE identified challenges. Only a 21-patient subset underwent the pre/post SEAMS subsequent to inclusion criteria and frequent unavailability of the pharmacist/principal investigator (PI) dyad during institutional COVID limitations and failed three attempts at patient follow-up.

MedMalDE: Medication Management for Deficiencies in the Elderly ("with permission")	13 question instrument, modified to 10, identifying medication self-management challenges divided into questions in three domains of knowledge, ability, and access barriers. (Appendix A)
SEAMS: Self-Efficacy for Appropriate Medication Use. ("with permission")	13 question instrument, modified to 10, measuring medication management self-efficacy on a Likert scale for each question. (Appendix B)

Older adults in the ED were considered high-risk based on the unspecified definition in SB1254 legislation. All patients meeting the GED pathway criteria of age ≥ 65 and emergency severity index of 2-5 were eligible to undergo medication reconciliation with both assessments. Data collection occurred over a four-week period in January to February 2022.

MedMaDE data collection occurred as a dyad of the GED pharmacist and/or pharmacy technician coordinated with the PI Monday through Friday from 10AM to 6PM. Pharmacy technicians identified older adult ED patients living in a non-institutional setting and alerted the PI. The PI verified the patient's primary medication self-management responsibilities and completed the pre-SEAMS. The pharmacy tech would follow and complete the MedMalDE assessment during their multi-source verification of the prescribed and over-the-counter medication history. The MedMalDE was scanned into the electronic medical record (EHR) and a hard copy was retained by the PI for validation, fidelity, and accuracy review. The fidelity of MedMalDE instrument utilization, during data collection, was accomplished by the PI and pharmacist through two processes. Two newly hired pharmacy technicians were orientated to the modified MedMalDE and the clinical pharmacist and PI directly observed the pharmacy technicians utilizing the assessment instrument following the initial training session and at periodic observations.

The MedMalDE findings guided a clinical pharmacist's interventions based on the identified challenges. The pharmacist's medication reconciliation workflow assessed age and clinically associated medication appropriateness as well as the MedMalDE findings. The pharmacist's consult recommendations were communicated to the primary care provider and inpatient teams via internal and external messaging. Prior to discharge, or transition of care, the PI attempted to provide a reconciled and laminated version of the medication list to each patient and/or caregiver. The SEAMS assessment was repeated, via telephone follow-up, after 7-14 days if the patient had returned to a non-institutional setting with continued primary medication self-management. An intentional but informal discussion opportunity was scheduled with the pharmacy technicians and pharmacist at the conclusion of data collection. This was meant to be a qualitative discussion for

experiential perspectives. It revealed both reflections of the professionals but also persistent workflow challenges.

Measures

Demographic information for the 167 patients was collected and additional details regarding evidence of 30-day return to ED care for the 21-patient subset were collected through medical records. Data included gender, age, informant, and number of medications but additional details for the 21-patient subset included reason for index visit, date of service, highest level of education, caregiver relationship to the patient (if present), assigned bed in the emergency department, and ethnicity if identified.

The MedMalDE and SEAMS instruments were piloted concurrently with a 12-patient convenience sample over a two-week period in December 2021 and then modified and deployed. The published MedMalDE and SEAMS instruments were validated in home settings where older adult population characteristics were perceived to differ from the acute ED setting. A pilot was necessary to ensure all questions were considered relevant and concordant between the intervention instrument (MedMalDE) and the outcome instrument (SEAMS).

The three domains of the previously published MedMalDE assessed knowledge, adherence, and functional (ability) challenges. The published instrument was evaluated on older adults in a home outpatient setting. The validity was measured against pill count revealing a sensitivity of 80% when the patient was compliant >80% of the time or 68% if compliant <80% of the time. The specificity of the instrument was 44.4% for patient compliance >80% of the time and 83.3% for <80% compliance. The instrument demonstrated acceptable inter-rater reliability (0.74), test-retest (0.93), and internal consistency (0.71).[5.]

The collected responses during the two-week pilot of the 13-item MedMalDE, by the GED clinical pharmacist and principal investigator, reduced MedMalDE from thirteen to ten questions. (The modified tool is available from the corresponding author upon request. The original tool can be found at: https://doi.org/10.1093/geront/46.5.661.) The eliminated questions included knowledge of the medication dose and dose timing and the patient's ability to fill a glass of water as no patients identified these as barriers. Other modifications combined questions such as the ability to sip enough water and swallow medications which was changed to difficulty swallowing medications. The ability to complete a medication refill question replaced the question regarding knowledge of a refill's existence. The question regarding who to contact to obtain a refill was changed to address financial challenges with medications refills. The pilot added an adherence question regarding the past seven days to align with geriatrician and pharmacy technician recommendations. A "No" response was coded as one and "Yes" zero for each question suggesting a greater numerical total equated to increased medication self-management barriers. Patients were permitted to utilize different options to identify the names or indication for their medications from any available or accessible source (memory, printed list, cell phone image) in the knowledge domain.

The originally published questions of the13-item SEAMS assessed medication self-efficacy used a three-point Likert scale of confidence under difficult medication management circumstances and the patient's continuation when related to uncertain circumstances. The Self-Efficacy for Appropriate Medication Use Scale (SEAMS) scored highest in validity, internal consistency, inter-rater reliability, and test/retest reliability.[28] The SEAMS demonstrated adequate validity with minimal scale variance. The test-retest reliability was deemed reasonable and ranged from 0.8 to 0.71 with a Spearman's correlation of 0.62, $p = 0.0001$. The scale performed similarly across multiple literacy levels ("with permission").[29] The scale conclusions made it an excellent choice for this quality improvement assessment.

The piloted SEAMS modifications were based on two concerns: alignment of the SEAMS questions to the MedMalDE and the second was the natural fluidity of the SEAMS' questions. The pilot resulted in rewriting some SEAMS questions via a daily Plan-Do-Study-Act (PDSA) process involving issues of wording congruence with the MedMalDE questions. The final SEAMS version involved removing questions two and eleven and combining questions twelve and thirteen, reducing it to ten questions (The modified tool is available from the corresponding author upon request. The original can be found at https://doi.org/10.1891/106137407783095757.) As a follow-up to the system-wide Department of Pharmacy implementation of the modified MedMalDE, an EHR report was built to monitor pharmacy technician utilization. The sole purpose was to identify utilization in the

new standardized medication history workflow in the ED. The report looked for the coded EHR smart text including the modified MedMalDE questions.

Statistical analysis

The first aim (primary) analysis for the QI project's impact was to measure any significant change in self-efficacy. Wilcoxon Signed Rank Test was used to determine significance in patient SEAMS score change pre/post intervention.[30] The second aim's statistical analysis evaluated associations with MedMalDE total scores and sub-scores (knowledge, functional/ability, and access subscales), as well as adherence. Logistic regression (for dichotomous outcomes) and ordinal logistic regression (for ordinal outcomes) used the R v4.1.0 package MASS v7.3.54.[31] For ordinal logistic regression, the proportional odds assumption was tested using the Brant test in the R package Brant v0.3.0.[32] All Brant test results failed to show any deviation ($p>0.05$) and conclusions did not change under a multinomial logistic regression model using the package nnet v7.3.16.[33] A MedMalDE score ≥3 was combined into a single category (outcome >4 was extremely rare); for the subscales, medication functional/ability scores ≥2 were combined, medication knowledge scores dichotomized at ≥1, and medication access scores dichotomized at ≥1. Four covariates were tested: age, number of medications (cube root transformed to a more normal distribution), gender, and whether the informant was the patient or another person. Covariates were first modeled univariately, and a multivariable model when appropriate (if more than one covariate with $p<0.2$, followed by backward stepwise selection with $p<0.05$ for retention). This was considered an exploratory analysis, and we report associations with $p<0.05$ as significant; none of the tests would meet a Bonferroni correction for significance. The UCSF Institutional Review Board (IRB) provided a verbal review given the medication reconciliation requirement was State mandated and the QI implementation was part of an enhanced workflow. Therefore, IRB approval was not required per institution policy.

RESULTS

A 167-patient convenience sample participated in medication reconciliation with MedMalDE assessment (QI intervention) including 21-patients completing pre and post SEAMS. Demographic data revealed a greater female than male patient distribution and a mean age of 79 which mirrored the aggregate ED older adult visit history (**Table 1**). The most common informant in the 167 patients was a family member when collecting a medication history. The MedMalDE instrument guided pharmacist insights and interventions regarding the most common medication self-management challenges and identified 50% of patients' reporting non-adherence to their prescribed regimen over the past seven days. The mean medication burden in the 21-patient SEAMS assessed patients returning to ED care within 30 days versus not were 12.3 and 10.3, respectively.

Table 1. Demographic Characteristics of MedMalDE Participants n=167 (Age (>/=65 years)

		n	M	S.D.	Range	Percent
	All patients	167	79	9.5	65-104	
	SEAMS subset	21	81	9.7	65-102	
Gender	Female	94				57
	Female Aggregate ED*	1146/2269				51
	Female SEAMS subset	10				48
	Male	71				43
	Male Aggregate ED*	1121/2269				49
	Male SEAMS subset	11				52
Informant	Patient	79				48
	Spouse	19				11

	Family	61				37
	Caregiver (not family)	6				4
Number of medications			12.5	7.2	1-46	
*Emergency department patients >/= 65 years old registered for care (gender total/total visits)						

A comparison of pre/post SEAMS scores for the subset of 21 intervention patients reached statistical significance using the Wilcoxon Signed Rank Test (Z=-2.70, p=0.0077). A medical record review, examining 30-day return to care of the pre/post subset, revealed two patients returned to the same or different ED for a similar chief complaint and two for a new acute reason. This represents a 9.5% recidivism rate while the aggregate ED older adults (≥65) rate for the same period was 12.3%. Comparing 30-day return to care rates to the SEAMS pre/post mean scores, using Mann-Whitney U Test but did not reach significance (U=14.5, two-tailed p=0.62).

The QI project's secondary aim was to identify medication self-management challenges utilizing the MedMalDE instrument total and domain scores. There were four questions in the MedMalDE knowledge domain which was identified as the greatest barrier for 43% of the 167 sample patients. The ability challenges included opening medication packaging, ease of manipulating a medication delivery system (inhaler or eye drops) and swallowing medications. The access domain included affordability of medication co-pays. Self-management challenges were identified in the three questions of both ability and access domains in 33% and 19% of patients, respectively.

An exploratory analysis was conducted for associations among covariate data elements and MedMalDE total scores and total scores of each of the three domains (ability, knowledge, and access) and adherence. Logistic regression was used to compare scores and adherence with age, patient gender, medication burden, and the identified informant. The findings revealed the MedMalDE total score was significantly associated with female gender (OR=2.00, 95% CI=1.14-3.51, P=0.016). Female patients scoring 0, 1, 2, or ≥3 challenges accounted for 23%, 35%, 23%, and 18% of the female total. The male patients with total challenge scores of 0, 1, 2, and ≥3 accounted for 38%, 36%, 15%, and 11% of the male total respectively (**Table 2**). 41% of females identified two or greater challenges versus 26% of males. No other variables showed any association (p<0.05).

Table 2. MedMalDE and adherence associations.

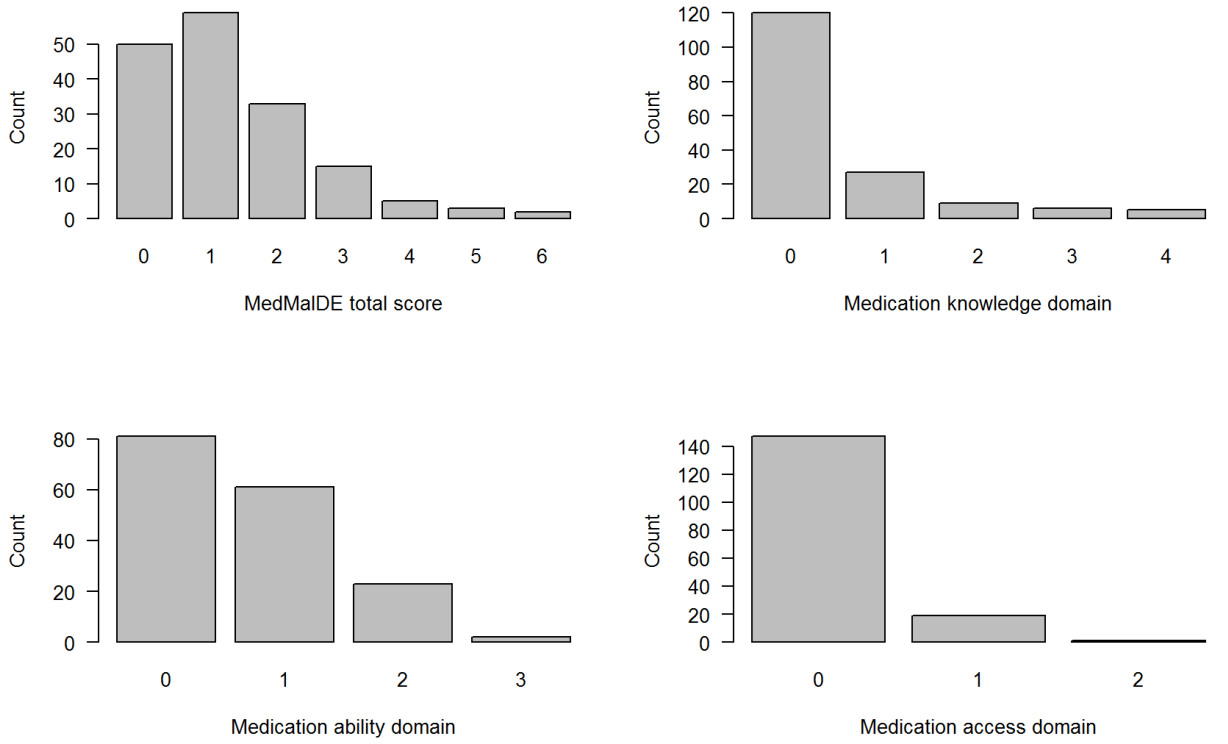
		Age		Medications (cube root)		Female		Patient informant	
Outcome	**N**	**OR**	**P**	**OR**	**P**	**OR**	**P**	**OR**	**P**
MedMalDE total score[1]	167	1.00 (0.97, 1.03)	0.95	1.46 (0.79, 2.70)	0.23	2.00 (1.14, 3.51)	0.016	0.82 (0.47, 1.42)	0.48
MedMalDE: ability[1]	167	1.01 (0.98, 1.04)	0.61	1.29 (0.69, 2.44)	0.43	2.00 (1.11, 3.60)	0.022	0.47 (0.26, 0.84)	0.011
MedMalDE: ability (multi-variable model)[1]	167	—	—	—	—	1.88 (1.03, 3.41)	0.038	0.49 (0.27, 0.89)	0.019
MedMalDE: knowledge[2]	167	1.00 (0.96, 1.04)	0.96	0.94 (0.44, 1.97)	0.86	1.07 (0.54, 2.11)	0.85	1.86 (0.94, 3.70)	0.075
MedMalDE: access[2]	167	0.98 (0.93, 1.03)	0.38	1.42 (0.50, 4.05)	0.51	0.94 (0.37, 2.41)	0.9	1.07 (0.42, 2.72)	0.89
Adherence[2]	112	0.99 (0.94, 1.04)	0.71	1.10 (0.40, 2.97)	0.86	1.45 (0.61, 3.45)	0.4	0.60 (0.25, 1.40)	0.24

[1]Ordinal logistic regression; [2]logistic regression

(Each domain score and total score were analyzed for odds ratio/significance to age, number of medications, gender, and informant. Only those findings of significance or relevance are shared. For example: age and number of medications had no significant relationship to any MedMalDE challenge domain or adherence. Patient informant had a significant relationship to the MedMalDE ability domain and MedMalDE total score to gender for female patients only.)

Of the MedMalDE domain totals, the ability domain showed an association with females (OR=2.00, 95% CI=1.11-3.60, p=0.022); females, 43%, 36%, and 21% had scores of 0, 1, and ≥2, respectively; males, 56%, 37%,

and 7%. In addition, the ability domain showed an association whether the informant were a patient (OR=0.49, 95% CI=0.27-0.89, P=0.011); if the medication history informant were a patient, 50%, 51%, and 20% had scores of 0, 1, and 2+; if not, 58%, 32%, and 10% (**Figure 1**). The effect sizes were similar in the multivariable model, which included both gender and informant, indicating these effects were relatively independent as to the outcome. No other MedMaIDE subscale or adherence associations were observed ($p<0.05$).



(1) MedMalDE total score = x	Number of patients identifying 1-6 challenges across all 3 domains = y
(2) Knowledge, ability, and access domain scores = x	Number of patients identifying 1-4 challenges across each of 3 domains = y

Figure 1. MedMaIDE total and subscales (n=167)

As part of monitoring the post-implementation of medication self-management challenge questions to pharmacy technician workflow (MedMalDE) EHR aggregate ED data was searched for a ten-month period (June 2022 to April 2023). The pharmacy technician completion for MedMalDE ranged 13-18% for all eligible older adult ED patients (**Figure 2).** The QI project qualitative data collected included a summary of reflective comments from the professionals directly involved. The pharmacy technicians and geriatric-boarded pharmacist shared their thoughts on the implementation and experience when assessing medication history and reconciliation involving older adults in the emergency department. Qualitative perspectives of the geriatrics-trained pharmacists and pharmacy technicians describe their involvement as transformative secondary to their discovery of previously unknown patient and caregiver medication management challenges. The comments are summarized in **Appendix A**.

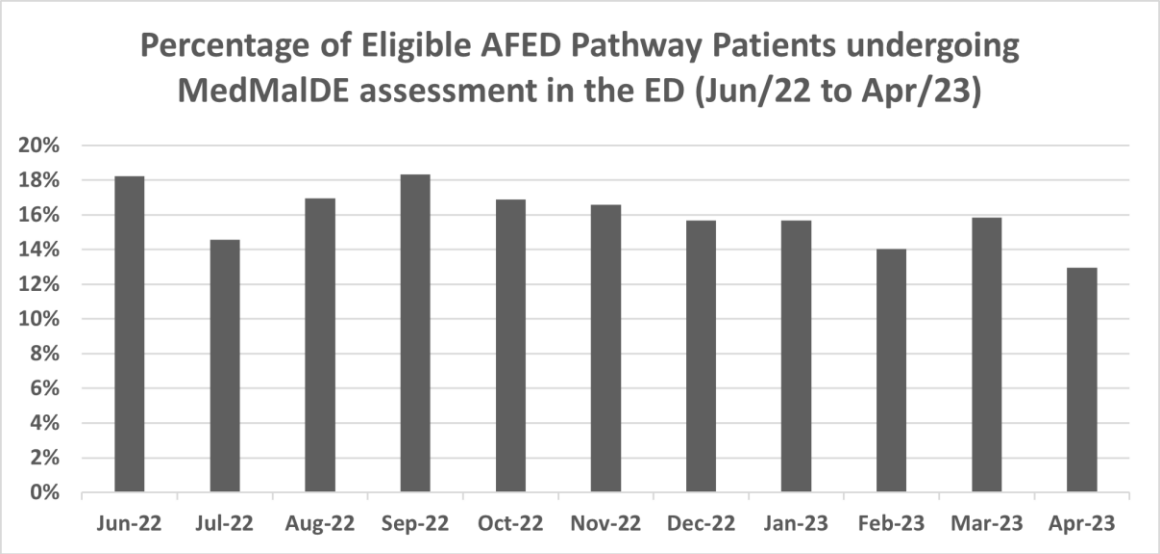


Figure 2. Pharmacy technician utilization of MedMalDE in the ED post-implementation.

DISCUSSION

This quality improvement project was initiated in response to the absence of a standardized approach to medication reconciliation in the ED. The GED's mandate was to optimize older adult care. Assuming self-efficacy and its relationship to medication adherence is a provider concern, assessing and addressing a patient's understanding, ability to use and access medications could be indispensable. However, the non-adherence finding was similar to research findings of Jin et al., (2016) at 52.5%. The primary aim of this medication reconciliation QI project was to investigate the impact of MedMalDE and factors associated with medication self-management deficiencies in older adults on self-efficacy. Our findings support using the MedMalDE to identify challenges and intervene improving self-efficacy in medication self-management.

The exploratory analysis of MedMalDE results suggest that women are more challenged by medication self-management and specifically in the domain of functional capacity. A higher MedMalDE score was associated with patients as the sole informant suggesting there is a need to focus support on patients living alone. The reconciled and laminated medication list received a positive response from patients and caregivers as a tangible reference for future interactions with a health care provider. Although not significant there were differences in pre/post patient recidivism and medication burdens.

Integrating quality improvement findings into a health system can be challenging. The Department of Pharmacy's review of the medication self-management challenges and self-efficacy findings were compelling enough to support the introduction of MedMalDE elements into pharmacy technicians' workflow for all inpatient medication histories. **Appendix B** provides an EHR screenshot of the system wide implemented MedMalDE. Identifying barriers in real time created greater assessment equity. The pharmacy technician capacity to incorporate self-management questions was limited by resources and suggests there are more improvement opportunities. More importantly, ensuring the assessment was prioritized for patients discharged directly from the ED versus those patients admitted where other reconciliation opportunities for assessment can occur.

Although this QI project found a positive impact, the work was limited to an academic health system and may not equate to other settings. The resources available to this project may not be available in all emergency departments, even those with ACEP GED accreditation. Patient acuity and assessment in an emergency department differs significantly from other clinical settings creating potential selection bias. Comprehensive chart review, to determine if a return to care was ADE related, was challenged by variable provider documentation. After the pilot phase and subsequent modifications to the MedMalDE and SEAMS a repeated validation was not addressed and was limited to individual patient responses only. The sample size of the SEAMS assessed subset limits broad applicability. Future research and quality improvement should focus on modifiable factors, during emergency department medication reconciliation and transitions of care, to identify

patient characteristics which lead to medication-related risk. Interventions facilitating a patient's medication self-efficacy and ability to reach their optimal health management goals supports an age friendly model of care.

KEYWORDS

Medication reconciliation, emergency department, self-management, geriatrics

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CONFLICTS OF INTEREST

No author indicates a conflict of interest related to the data collection, design, or content of this manuscript.

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