Bridging the continuity: Practice-enhancing publications about the ambulatory care medication-use process in 2024

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Purpose: This article identifies, summarizes, and prioritizes published literature on the ambulatory care medication-use process (ACMUP) from 2024 that can describe ambulatory pharmacy practice. The MUP is the foundational system that provides the framework for safe medication utilization within the healthcare environment. The ACMUP is defined in this article as having the following components: transitions of care, prescribing, access, dispensing, adherence, and evaluating. Articles evaluating at least one step of the ACMUP were assessed for their usefulness toward practice improvement.

Summary: A PubMed search was conducted in January 2025 for the publication year 2024 using targeted Medical Subject Headings (MeSH) keywords and the table of contents of selected pharmacy journals, providing a total of 3,427 articles. A thorough review identified 34 potentially practice-enhancing articles: 4 for transitions of care, 10 for prescribing, 5 for access, 2 for dispensing, 4 for adherence, and 9 articles for evaluating. Trends identified in the impactful articles are discussed and compared to trends identified in previous articles in this series highlighting articles published from 2020 through 2023.

Conclusion: It is important to routinely review the published literature and to incorporate significant findings into daily practice. This article continues a series of articles defining and evaluating the currently published literature around the ACMUP. As healthcare continues to advance and care shifts to ambulatory settings, the ACMUP will continue to be a crucial process to evaluate.

Keywords: adherence, accessing care, ambulatory care, collaborative practice, community pharmacy, medication use process, monitoring, quality, specialty pharmacy, transitions of care

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The medication-use process (MUP) provides the framework for safe medication utilization within health systems.[1-14] The United States Pharmacopeia (USP) describes 8 major steps of the MUP: procurement, prescribing, transcribing, order entry, preparation, dispensing, administration, and monitoring of medications.[1] An ongoing series of annual articles highlighting research and innovations in the MUP has been published in the *American Journal of Health-System Pharmacy* (*AJHP*).[2-14] In the articles published, the literature showed an increasing trend of MUP publications that were focused on transitions of care and ambulatory care pharmacy practice. These could not be easily classified into the major steps described above, and the authors identified an emerging need to define and evaluate the MUP literature in the ambulatory care setting.[2-14] The authors pursued a separate ambulatory care–focused article, by Gazda et al,[6] highlighting articles from the 2020 publication year, and other articles in that series

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reviewed articles published in 2021, 2022, and 2023.[10,11,14]

Pharmacy continues to play an evolving and crucial role in the ambulatory phase of care.[15-17] Both pharmacists and pharmacy technicians have assumed advanced roles in the ambulatory setting that aim to encourage the safe and effective use of medications. These expanding roles of the ambulatory care pharmacist and technician are also endorsed by national pharmacy organizations.[18-24] The high-value pharmacy enterprise (HVPE) framework highlighted the importance of pharmacy involvement in the MUP for various ambulatory care domains, including clinics, retail, and specialty pharmacy.[18] The value and impact of the ACMUP has been further described and defined.[12]

This article defines the ACMUP as having the following 6 components: transitions of care, prescribing, access, dispensing, adherence, and evaluating. These unique distinctions differ from those used in previous ACMUP publications and have been refined through trend evaluation, literature review, and feedback from industry experts.[12,16-24] Other disciplines (ie, critical care, infectious diseases) have published "significant article" series; however, there has been very little in the literature on the importance and impact of innovations and technology on the ACMUP.[15,16,25-30]

KEY POINTS

- The medication-use process (MUP) is the foundational system that provides the framework for safe medication utilization within the healthcare environment, ensuring medications are utilized and secured in the most appropriate manner and across all settings.
- This article summarizes practice-enhancing publications about the MUP in ambulatory care.
- More research and publications are needed to better refine and describe the steps of the MUP in the ambulatory care setting.

Methods

The methods of this study are similar to those used in previously published studies.[2-14] A PubMed search was conducted in January 2025 for the 2024 publication year using the following Medical Subject Headings (MeSH) keywords: medication systems, pharmacy administration, pharmacists, community pharmacy service, ambulatory care information systems, outpatient clinics, hospital, care transitions, and medication adherence. The table of contents of journals listed in the American Association of Colleges of Pharmacy's "Core List of Journals for Pharmacy Education" (*Journal of Pharmacy Practice, American Journal of Health-System Pharmacy, Journal of the American Pharmacists Association, Pharmacotherapy, The Annals of Pharmacotherapy, The Senior Care Pharmacist, The International Journal of Pharmacy Practice, Journal of Managed Care and Specialty Pharmacy, Research in Social and Administrative Pharmacy, and Journal of the American College of Clinical Pharmacy)* were included into the search strategy and total number of articles to review.[31] The authors elected to use a table of contents search due to the delay in indexing articles for MeSH keywords and non-MeSH keywords.[32] The authors have incorporated guidelines from the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guideline where appropriate.[33]

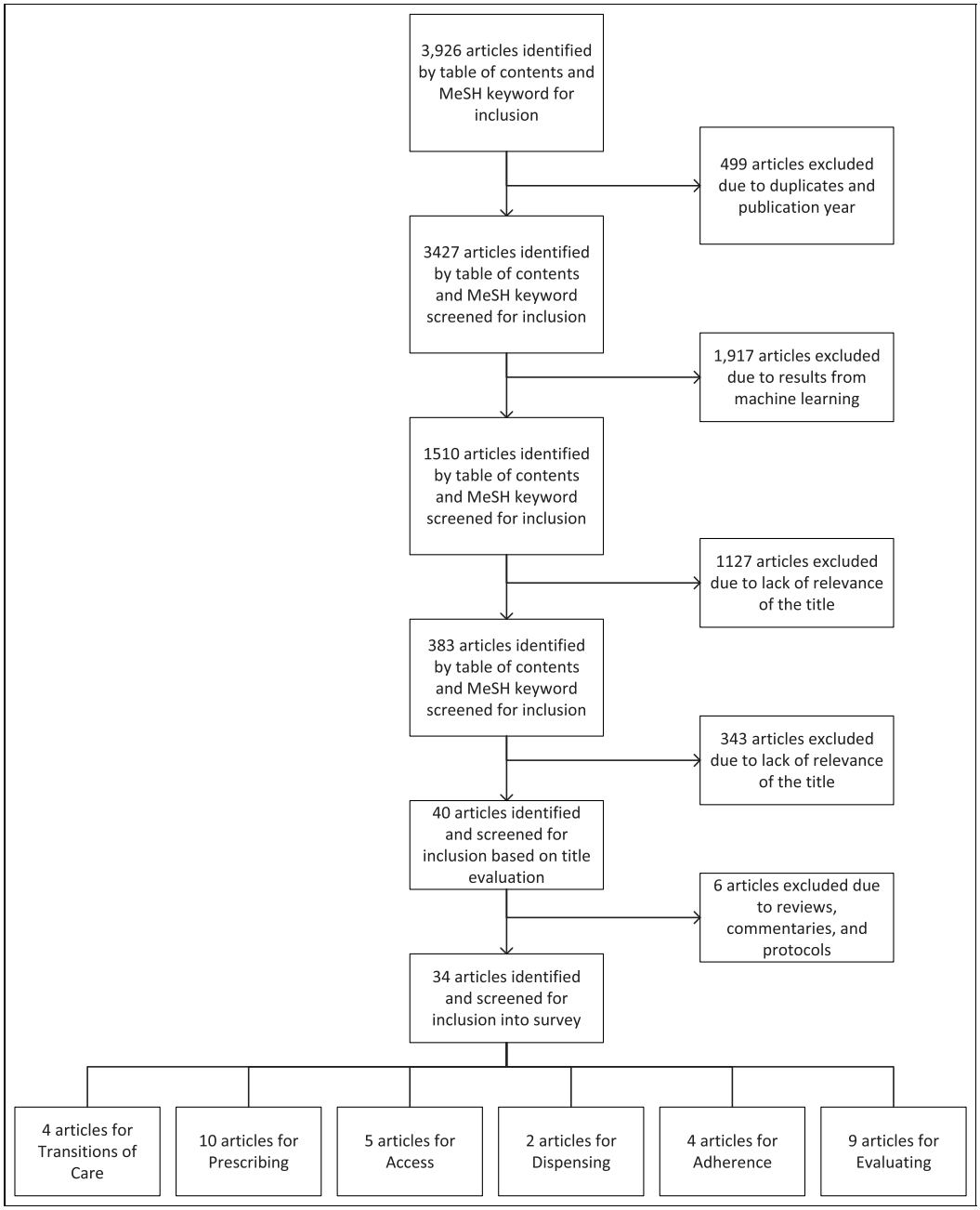
The search resulted in 3,427 articles (3,926 prior to duplicates being removed). At this point, the authors used a machine learning algorithm that has previously been published[34] to narrow the number of articles needing to be manually screened. Remaining were 1,510 articles, and the authors selected the ones deemed to potentially be the most impactful on the MUP by title alone. If any author thought the title of one of the algorithm-produced articles was significant, the article moved on for additional screening. After the initial screening, 384 articles remained for further review. If 4 or 5 authors thought the title of one of the 384 remaining articles was significant, the article continued in review. After the second screening, 40 articles remained. These selections were then analyzed against the following criteria: interventions were feasible and reproducible, the type of study supported an objective evaluation of the intervention (pre-post study, retrospective or prospective randomized control trial, evaluation, implementation, systematic review, or meta-analysis), authors unanimously agreed the results warranted discussion within the pharmacy community, and authors unanimously agreed the paper should be included. Articles not meeting all 4 criteria were excluded from additional consideration. Articles meeting all 4 criteria were subsequently categorized by the authors into one of the 6 ACMUP steps. It was recognized that some articles might span more than one area. If this occurred, the authors evaluated the largest area of impact in the study and classified it based on this area.

After the final screen, a total of 34 articles were selected and identified for inclusion in the review (4 articles for transitions of care, 10 for prescribing, 5 for access, 2 for dispensing, 4 for adherence, and 9 for evaluating). The study's full process for inclusion and exclusion of articles is illustrated in Figure 1. The 34 articles are summarized by each step of the ACMUP in Tables 1 through 7. The authors have summarized important trends identified across all articles in each section and provided findings below.

Transitions of care[35-38]

It is well established that programs addressing gaps in transitions of care (TOC) are necessary to alleviate excessive costs and financial penalties associated with hospital readmissions and to improve overall patient care. In 2024, there were 4 articles (Table 2) meeting the inclusion criteria, a decrease from prior years. Each was

Figure 1. Process for inclusion and exclusion of articles. MeSH indicates Medical Subject Headings.



unique in focus and program development, with themes consistent with those identified in articles published in 2022 and 2023.[2-14]

First, and consistent with prior studies, was recognition that pharmacists as medication experts are well positioned to lead the medication management elements of a targeted or comprehensive TOC program. In these articles, pharmacist interventions included medication reconciliation, medication education, medication initiation or cessation, navigating medication access challenges and changes in medication choice, dose, or duration of therapy.

Second, there continues to be a consistent focus on the emergency department or hospital readmissions rate as a success measure.[14] All 4 of the studies published in 2024 demonstrated a move away from success measures focused on specific interventions, such as programs focused on diabetes or primary care, which was common in 2023 articles, and instead described pharmacist-led TOC program interventions aimed at reducing emergency department or hospital readmission rates. This trend suggests a maturing of study design and a realization that TOC programs, especially ones requiring a heavy resource load, must have a

Table 1. Summary of All Articles Identified for 2024 Publication Year

Authors	Article title
Transitions of care	
Axtell S, Nixon B	Implementing transitions of care services in a primary care clinic: role of the pharmacist
Benny T, Jain K, Marie Hale G, et al	Impact of pharmacist transitions of care on 30-day readmissions within a primary care-based accountable care organization
Dalton H, Hinely MT, Kostelic EM	Evaluation of the impact of a pharmacy transitions of care program
McCormick C, Bhatnagar M, Arnold RM, et al	Description and outcomes of a palliative care pharmacist-led transitions of care program
Prescribing	
Brown KF, Curtis KA, Kline MM, et al	Implementation of depression management by ambulatory care pharmacists in the primary care setting
Green AR, Quiles R, Daddato AE, et al	Pharmacist-led telehealth deprescribing for people living with dementia and polypharmacy in primary care: a pilot study
Hayes M, Gregory P, Smith B, et al	Assessment of embedded versus remote pharmacist versus remote student pharmacist outreach on statin prescribing
Rea E, Portman D, Ioannou K, et al	Pharmacist-driven deprescribing initiative in primary care
Shin Y, Shin S, Ryu H, et al	Impact of oncology pharmacy services on the management of chemotherapy-induced nausea and vomiting: a systematic review and meta-analysis
Thomas A, Forsyth P, Griffiths C, et al	Implementation and evaluation of pharmacist-led heart failure diagnostic and guideline directed medication therapies clinic
Trueman C, Langenhan E, Dunn L, et al	Implementation of a pharmacist-developed, indication-based order panel for outpatient prescribing of direct-acting oral anticoagulants
Varghese CJ, Grunske M, Nagy MW	Implementation of a pharmacist-driven aspirin deprescribing protocol among older veterans in a primary care setting
Yates M, Supple M, Maccia M	Impact of a pharmacist-led weight management service in a cardiology clinic
Yates NY, Hale SA, Clark NP	The impact of clinical pharmacy services on direct oral anticoagulant medication selection and dosing in the ambulatory care setting
Access	
Dohrn A, Hoskins R, Collier L, et al	Evaluation of a telehealth-based pharmacist led chronic care management program
Faulkner W, DiScala SL, Quellhorst JA, et al	Implementation of a pilot PharmD medication optimization telehealth clinic within a Veterans Affairs system
Harsh A, Gabbert J, Peek G	Evaluation of the impact of a clinic infusion pharmacist on the retention of infusion therapy
Marte F, Bianco J, Martinez A, et al	Impact of a pharmacist-managed telemedicine pharmacotherapy clinic in the era of COVID-19
Schermerhorn S, Aurora J, McElligott M, et al	Implementation of a pharmacist-led weight loss service to improve medication access and weight loss
Dispensing	
Eagon ML, Thomas KC, Micic C, et al	Conversion of an outpatient pharmacy to a mail-order pharmacy within a health system
Jairoun AA, Al-Hemyari SS, Shahwan M, et al	Community pharmacist-led point-of-care colorectal cancer screening program: early detection of colorectal cancer in high-risk patients

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Table 1. Summary of All Articles Identified for 2024 Publication Year

Authors	Article title
Adherence	
Ahn H, Byun BK, Lee TH, et al	Effects of pharmacist-led home visit services and factors influencing medication adherence improvement
Bandiera C, Cardoso E, Locatelli I, et al	A pharmacist-led interprofessional medication adherence program improved adherence to oral anticancer therapies: the OpTAT randomized controlled trial
Christopher CM, Blebil AQ, Bhuvan KC, et al	Assessing feasibility of conducting medication review with follow-up among older adults at community pharmacy: a pilot randomised controlled trial
Davis DD, Hale G, Moreau C, et al	Evaluating pharmacist-driven interventions in a primary care setting to improve proportion of days covered and medication adherence
Evaluating	
Albabtain B, Bawazeer G, Paudyal V, et al	Impact of a community pharmacy-based medication therapy management program on clinical and humanistic outcomes in patients with uncontrolled diabetes: a randomized controlled trial
Beldon C, Rogers K, Johnson A, et al	Assessment of a community pharmacist remote monitoring service in patients using continuous glucose monitors
Glover LH, Skelley JW, Cimino LH, et al	Impact of a pharmacist-driven COPD clinic on outcomes related to COPD in a federally qualified health center
Haddon AM, Gross KR, Mozes CJ	Impact of clinical pharmacist practitioner management of chronic obstructive pulmonary disease in the ambulatory care setting
Handshaw JV, Celauro L, Francoforte K	Impact of a pharmacist-led telemedicine visit in a geriatric primary care clinic
Mack K	Financial reimbursement of a pharmacist-led chronic care management program utilizing pharmacist extenders within a privately owned family medicine clinic
Miller L, Woodyear J, Marciniak MW, Rhodes LA	Evaluation of a community-based pharmacy resident-led continuous glucose monitoring program within a family medicine clinic
Pasour T, Sheehan L, Troyer M, et al	Evaluation of a pharmacist-led personal continuous glucose monitor workflow to improve glycemic management in an internal medicine clinic
Wells C, Warren AC, Scott MA	Development and implementation of ambulatory care pharmacy services at an internal medicine clinic

return on investment with an offsetting impact on high-priority organizational quality, clinical, and financial measures.

Prescribing[39-48]

Whether they describe pharmacists' direct involvement through collaborative practice agreements (CPAs) or indirect involvement through an increased ambulatory clinic presence in providing medication management support, the identified 10 articles (Table 3) highlight the opportunities that exist for pharmacists, as the medication management experts, to influence prescribing.

A growing theme in 2024 was the role pharmacists can play in medication deprescribing as a component of medication optimization. One article described a pilot study of pharmacist-led medication deprescribing for people living with dementia. Another focused-on polypharmacy reduction with medication deprescribing in primary care, and a third on pharmacist-led, guideline-supported aspirin deprescribing in a veteran population.

The 2022 and 2023 articles had a heavy focus on pharmacists' influencing prescribing as part of ambulatory antimicrobial stewardship programs and the ongoing value of pharmacists in clinics with a high rate of specialty drug prescribing.[11,14] In 2024, these focus areas were less present in the literature. Instead, there was a noticeable return to primary care, with studies focused on pharmacists supporting depression management, advancing appropriate statin use in large population health initiatives, speeding time to achieving guideline-directed medication

Table 2. Summary of 2024 Articles on Transitions of Care Step of Ambulatory Care Medication-Use Process[35-38]

Authors	Article title	Study type, population, and intervention/objective	Results/conclusions
Axtell S, Nixon B	Implementing transitions of care services in a primary care clinic: role of the pharmacist	Single-center, pre-post, quality assessment review of pharmacist TOC services on change in acute healthcare encounters (hospital readmissions and/or ED visits) in the 6-month periods before and after pharmacist intervention	• The total number of combined acute healthcare encounters in 6 months decreased by 15%, from 280 at baseline to 238 post intervention ($P = 0.087$). • Pharmacist transitions of care services to identify and resolve drug-related problems contribute to a trend in decreasing acute healthcare utilization.
Benny T, Jain K, Marie Hale G, et al	Impact of pharmacist transitions of care on 30-day readmissions within a primary care-based accountable care organization	Retrospective chart review assessing the impact of pharmacist-led telephonic TOC encounters on all-cause 30-day readmission rate within 3 ACO practices	• There was no statistically significant difference in 30-day readmission rates between those who received a telephonic TOC encounter and those who did not (15.7% vs 28.2%; $P = 0.059$). • The results of this study suggest that performing a pharmacist telephonic TOC encounter in a primary care–based ACO setting has the potential to reduce 30-day readmission rates and that further research appears to be warranted in this important area of practice.
Dalton H, Hinely MT, Kostelic EM	Evaluation of the impact of a pharmacy transitions of care program	Retrospective observational cohort study assessing impact of a pharmacist-led TOC program on number of hospitalizations in high-risk patients in the 30-day periods before and after pharmacist intervention	• There were 62 prior hospitalizations within 30 days before intervention and 31 hospitalizations within 30 days post intervention, equating to a 50% relative reduction ($P < 0.001$). • There was a non–statistically significant decrease in secondary outcomes: 90-day hospitalization ($P = 0.0275$), ED visits at 60 days ($P = 0.0063$), and ED visits at 90 days ($P = 0.024$).
McCormick C, Bhatnagar M, Arnold RM, et al	Description and outcomes of a palliative care pharmacist-led transitions of care program	Descriptive report and retrospective chart review of a single-site pilot study assessing impact of a pharmacist-led telephonic TOC program on 7- and 30-day readmissions, 7- and 30- day ED visits, and time from index discharge date to readmission within a high-risk palliative care population; provider satisfaction, medication discrepancies, and drug therapy problems identified and addressed were also assessed	• Pilot data revealed a reduction in 7-day readmissions ($P = 0.011$) in the intervention group but no difference in 30-day readmissions ($P = 0.378$) or ED visits ($P = 0.12$). • Among the 42 patients in the TOC program, an average of 14.9 medication discrepancies per patient were identified and resolved, highlighting the medication complexities and potential opportunities for pharmacist integration in the care team supporting this patient population.

Abbreviations: ACO, accountable care organization; ED, emergency department; TOC, transitions of care.

therapy following a heart failure diagnosis, and optimizing direct oral anticoagulant prescribing.

An area where future studies are expected, given the exponential rise in glucagon-like peptide 1 receptor agonist (GLP-1 RA) medications, was a study demonstrating the value of pharmacist-led weight management services.

Access[49-53]

Access covers different aspects of procurement in the ambulatory care arena that are not present in the acute setting and include various elements such as navigating financial workflows, patient and provider enrollments, scheduling, and utilization of convenient care delivery mechanisms.[12] The access step continues to be a

Table 3. Summary of 2024 Articles on Prescribing Step of Ambulatory Care Medication-Use Process[39-48]

Authors	Article title	Study type, population, and intervention/ objective	Results/conclusions
Brown KF, Curtis KA, Kline MM, et al	Implementation of depression management by ambulatory care pharmacists in the primary care setting	Single-center, retrospective study characterizing interventions for treatment of depression by ambulatory care pharmacists working under collaborative practice agreements within a health system	• Among the 27 patients, 38 interventions were made, with 32% being initiation of a new medication. • Pharmacists in the primary care setting working in a collaborative model within a primary care clinic are well positioned to support depression management.
Green AR, Quiles R, Daddato AE, et al	Pharmacist-led telehealth deprescribing for people living with dementia and polypharmacy in primary care: A pilot study	Multisite pilot study assessing feasibility and pilot implementation of a pharmacist-led telehealth deprescribing intervention for people living with dementia and their care partners in primary care	• At 3 months, 22 patients (81%) in the intervention group and 14 (50%) in the control group had ≥1 medication discontinued, resulting in a non–clinically meaningful 1.0-point reduction in the mean medication regimen complexity indicator (MRCI) score in the intervention patients. • Study results suggest that pharmacists are well positioned to support goal-concordant care, which may involve deprescribing. • The study also recognized that multiple steps are needed before deprescribing in this patient population, a role pharmacists can play to alleviate PCP time pressure.
Hayes M, Gregory P, Smith B, et al	Assessment of embedded versus remote pharmacist versus remote student pharmacist outreach on statin prescribing	Single-center, retrospective chart review of patients at risk for failing statin quality measures, comparing initiation rates for recommended statin prescriptions between embedded pharmacist, remote pharmacist, and remote student pharmacist outreach groups	• The initiation rates for recommended statin prescriptions between the embedded pharmacist, remote pharmacist, and remote student pharmacist outreach groups were numerically different (36.7%, 28.2%, and 36.7%, respectively) though not statistically different ($P = 0.61$). • The study contributes to the body of literature suggesting that remote student pharmacists can be leveraged for population health initiatives, including support of the Status Use in Persons with Diabetes (SUPD) quality measure.
Rea E, Portman D, Loannou K, et al	Pharmacist-driven deprescribing initiative in primary care	Single-site quality improvement project assessing impact of a pharmacist-led, system-wide deprescribing initiative in the primary care setting	• Among the 63 enrolled patients, an average of 5.6 medications per patient were deprescribed, with a potential annualized cost avoidance of $184,221. Sixteen patients (25.4%) were referred to a pharmacist-led clinic for follow-up. • The authors concluded that embedding deprescribing into a standard clinic pharmacist workflow supports poly-pharmacy reduction and the expansion of pharmacy-led services.
Shin Y, Shin S, Ryu H, et al	Impact of oncology pharmacy services on the management of chemotherapy-induced nausea and vomiting: A systematic review and meta-analysis	Systematic review of 12 studies and meta-analysis of 8 studies assessing impact of pharmacist-led services on reducing CINV and improving overall treatment experience	• In the meta-analysis, pharmacists' interventions were clinically impactful in reducing the incidence of nausea ($P = 0.003$) and vomiting ($P = 0.014$), as compared with the incidence in the control groups, particularly during the delayed phase of CINV. • The authors concluded that while the analysis of clinical pharmacy services demonstrated improvements in CINV, further studies with standardized pharmacist-led services and outcomes measures are needed.

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Table 3. Summary of 2024 Articles on Prescribing Step of Ambulatory Care Medication-Use Process[39-48]

Authors	Article title	Study type, population, and intervention/ objective	Results/conclusions
Thomas A, Forsyth P, Griffiths C, et al	Implementation and evaluation of pharmacist-led heart failure diagnostic and guideline directed medication therapies clinic	Single-site, pre-post, qualitative study assessing impact of a pharmacist-led diagnostic heart failure clinic on time to diagnosis, time to first specialist review, and proportion of patients achieving optimization of guideline-directed medication therapy	• In the pharmacist intervention cohort, statistical significance was achieved in median time to first appointment following diagnosis (a decrease from 54 to 14 days) and proportion of patients achieving guideline-directed medication therapy at 180 days following diagnosis (an increase from 24% to 86%). • The authors concluded that a pharmacist-led heart failure diagnosis and medication optimization clinic enhanced healthcare delivery, with the potential to improve patient clinical outcomes.
Trueman C, Langenhan E, Dunn L, et al	Implementation of a pharmacist-developed, indication-based order panel for outpatient prescribing of direct-acting oral anticoagulants	Descriptive report and retrospective chart review in a single health system of pharmacist impact on appropriate DOAC prescribing, through the development of an indication-based order panel	• Following order panel development and implementation, initial data from a small patient sample (n = 22) supported a favorable impact on the rate of inappropriate prescriptions (a decrease from 31.5% to 13.6%); however, additional study is needed. • The authors concluded that there is an opportunity to improve DOAC prescribing when combining clinical and informatics expertise to develop innovative decision support tools within the electronic health record.
Varghese CJ, Grunske M, Nagy MW	Implementation of a pharmacist-driven aspirin deprescribing protocol among older veterans in a primary care setting	Single-site, prospective, cohort study assessing the impact of the addition of a pharmacist-driven aspirin deprescribing protocol compared with primary care provider education only in a primary care setting	• The pharmacist-led active deprescribing group had a higher rate of aspirin deprescription than the education-only group (54% vs 18%, $P = 0.0001$). • Pharmacist-led aspirin deprescribing for primary prevention in combination with provider-patient education can reduce polypharmacy, align clinical practice with recent guideline changes, and may ultimately improve long-term patient outcomes.
Yates M, Supple M, Maccia M	Impact of a pharmacist-led weight management service in a cardiology clinic	Single-site, prospective, pre-post analysis of a pharmacist-led weight management clinic on achieving ≥5% weight loss at 6 months following interventions of lifestyle counseling and initiation and titration of GLP-1 RAs	• All patients (n = 204) referred to the pharmacist-led weight management service who completed the 6-month study achieved the primary outcome of at least 5% weight loss (mean, 12.6%). • Functioning under a collaborative practice agreement, there is clinically meaningful value in expanding cardiology clinic pharmacist services to include weight management.
Yates NY, Hale SA, Clark NP	The impact of clinical pharmacy services on direct oral anticoagulant medication selection and dosing in the ambulatory care setting	Single-site, retrospective chart review assessing impact of a centralized, clinical pharmacist intervention on DOAC prescribing following a dispense report–driven pharmacist review	• During the study period, 147 recommendations, primarily related to dose and cost, were proposed, with 84% accepted by the prescribing provider. • The authors concluded that a centralized pharmacist-led service can support optimized DOAC selection and dosing across a wide population, but further study is needed to determine the impact on clinical outcomes.

Abbreviations: CINV, chemotherapy-induced nausea and vomiting; DOAC, direct-acting oral anticoagulant; GLP-1 RA, glucagon-like peptide 1 receptor agonist; PCP, primary care provider.

more novel concept and approach, as compared to the acute care MUP, and leans into the need to help patients successfully navigate operational and financial barriers to access medication therapy. The previous editions of this series have also discussed and commented on access as part of the ACMUP.[2-14]

For the 2024 publication year, 5 articles were identified (Table 4) and many trends were observed. These trends focused on telehealth programs, pharmacists as part of infusion practices within clinics, and pharmacist-managed weight loss programs. These trends were slightly different in previous renditions of the article series, where trends were more focused on pharmacist participation in consults and patient assistance programs and various clinical and financial impacts of pharmacy services.[2-14,49-53] It would be reasonable to expect future literature to not only focus on previous trends, especially financially, but also to focus on infusion practices and weight loss management. With the introduction and refinement of the role of the profession of pharmacy in revenue integrity, the pharmacy workforce is a key aspect of not only providing effective care but also securing and ensuring financial approval and reimbursement for therapy.

As mentioned above, the access step varies with differences and complexities in the ambulatory care setting versus the acute care setting. This variation can be driven by patient-specific factors and payment models. The cost, complexity, and procurement nuances in practice provide an opportunity for the pharmacy workforce to ensure patients receive the medications they need and receive care in this setting. The access step in the ACMUP will likely only increase in complexity and financial pressures, and health systems will need to continue to innovate to have workflows and team members to navigate care in this setting. The profession of pharmacy will likely continue to evolve and aid health systems in this setting.

Dispensing[54,55]

While dispensing is a critical step in the MUP, there continue to be few articles published in this area. There were only 2 articles identified (Table 5) through our analysis, both from pharmacy-focused journals. This number was down from 6 identified articles in 2023 (4 were from pharmacy journals) and the same as in 2022, when there were 2 articles (both from pharmacy journals). The article in this series that focused on the 2022 publication year was the first in which dispensing was categorized as a distinct step of the ACMUP.[2-14]

One of the articles published in 2024 described a retail pharmacy conversion to a mail-order pharmacy in a health system, and the other reported on pharmacist activities in a community pharmacy located in the Middle East. Although the reasons for the scarcity of high-quality published articles assessing dispensing in the ACMUP are unclear, this gap highlights an opportunity for pharmacy research, with many questions still awaiting investigation. This really needs to be a focus, as this sector and step of the MUP is under significant transformation. The more and better the evaluation on the best way to perform dispensing in the community pharmacy setting, the better it will be for the profession and the patients served.

While it is essential for pharmacists to ensure that a patient's medication regimen is suitable and free from adverse effects or drug interactions, it is also important to evaluate the efficiency and cost-effectiveness of medication dispensing. This is the reason high-quality research on the dispensing step is needed.

Adherence[56-59]

The adherence stage in the ACMUP continues to be an active research focus for pharmacists. Since patients often forget to take their routine medications and pharmacists work closely with patients to make best use of their medications, they can positively impact adherence and improve patient quality of life. Nonadherence has been shown to increase hospitalization rates and overall medical costs. As most medications are dispensed in community settings, pharmacists in these environments are ideally suited to explore methods to improve adherence. Ensuring patients are on the correct medications for their conditions and helping them take these medications consistently can lead to better health outcomes and reduced healthcare costs.

There were 4 articles in 2024 that were dedicated toward research on medication adherence (Table 6), with 2 of them appearing in a pharmacy journal. In 2023 there were 8 articles (7 of which were in pharmacy journals), and in 2022 there were 6 articles.[11,14] There were fewer articles to review for the 2024 publication year compared to past years.

Pharmacists have an excellent opportunity to tailor patient counseling to educate patients about their medications, understand barriers to adherence, and implement strategies to improve adherence. In the 4 2024 articles reviewed, there was variability in the interventions evaluated; some were done in person, whereas another one was completed through a phone call. One of the studies involved the pharmacist going to the patient's home, whereas others occurred within the pharmacy. This demonstrates that there are methods to assess ways to improve adherence in various ambulatory care settings.

Although pharmacist interventions focused on adherence are often associated with independent pharmacy settings, health-system pharmacists can also effectively impact patients through their retail and specialty pharmacy strategies. While there are trends suggesting this, additional research needs to occur to better understand the impact of the different settings on adherence and the impact of patient-related barriers on improving overall medication utilization.

Evaluating[60-68]

The evaluating step of the ACMUP is defined as the cognitive activities

Table 4. Summary of Articles on Access Step of Ambulatory Care Medication-Use Process[49-53]

Authors	Article title	Study type, population, and intervention/objective	Results/conclusions
Dohrn A, Hoskins R, Collier L, et al	Evaluation of a telehealth-based pharmacist led chronic care management program	Mixed methods evaluation using the Reach, Effectiveness, Adoption, Implementation, Maintenance (RE-AIM) framework to assess pharmacist-led CCM for patient outcomes and sustainability	• Implementation facilitators included patient medication cost concerns, disease burden, provider revenue generation, CCM-dedicated software, streamlined call process, and remote EMR access. • Implementation barriers included provider discomfort marketing the program, potential patient costs, "unclear need from patient," pharmacists not being considered providers, pharmacist cost, multiplatform software, reprioritized stakeholder support, and lack of partner site diversification. • Program maintenance showed revenue generation and profitability.
Faulkner W, DiScala SL, Quellhorst JA, et al	Implementation of a pilot PharmD medication optimization telehealth clinic within a Veterans Affairs system	Pilot implementation of board-certified clinical pharmacist practitioners utilizing the VIONE model within a patient-aligned care team	• Project period potential cost avoidance over 1 year was $17,716. • Usage of VIONE methodology ensures medication optimization provides cost savings.
Harsh A, Gabbert J, Peek G	Evaluation of the impact of a clinic infusion pharmacist on the retention of infusion therapy	Single-center, pre-post, retrospective and prospective cohort study at a large quaternary care academic medical center to evaluate the impact of an embedded clinic infusion pharmacist on the retention of outpatient infusion therapy	• Statistically significant increase in overall administration of high-impact medications (from 5,683 infusions before implementation to 6,574 infusions after implementation; $P < 0.001$). • ROI for an embedded clinic infusion pharmacist's services was greater than 2,500%. • Health systems can utilize this model to improve patient access to infusion and injection therapies.
Marte F, Bianco J, Martinez A, et al	Impact of a pharmacist-managed telemedicine pharmacotherapy clinic in the era of COVID-19	Single-center, retrospective, quasi-experimental study to evaluate the impact of expanding telemedicine services on adult patients with chronic diseases	• The mean (SE) change in no-show rate in the hospital-based clinic was –12.09% (4.862%; $P = 0.014$), compared to 2.88% (3.656%; $P = 0.431$) in the physician-based clinic. • The mean (SE) change change in HbA_{1c} in the hospital-based clinic was 0.00% (0.338%; $P = 0.992$), compared to 0.01% (0.239%; $P = 0.945$) in the physician-based clinic. • The mean (SE) reimbursement in the hospital-based clinic was $1.93 ($4.209; $P = 0.647$), compared to $20.46 ($3.210; $P < 0.0001$) in the physician-based clinic. • Expansion of pharmacy telemedicine services provided evidence for improved appointment adherence and increased reimbursement.

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Table 4. Summary of Articles on Access Step of Ambulatory Care Medication-Use Process[49-53]

Authors	Article title	Study type, population, and intervention/objective	Results/conclusions
Schermerhorn S, Aurora J, McElligott M, et al	Implementation of a pharmacist-led weight loss service to improve medication access and weight loss	Single-center, retrospective, and quality improvement study within 3 outpatient clinics to improve weight loss outcomes and assess the utilization of services provided by clinical pharmacists for collaborative weight loss management	• The median baseline weight was 105.5 kg (IQR, 93.1-120.5 kg), and median BMI was 38.1 kg/m^2 (IQR, 33.9-43.5 kg/m^2). • The median weight loss from baseline through end of study duration was 8.0% (IQR, 3.1-12.1%) • Pharmacists assisted in medication access, providing education on devices and lifestyle management, and engaging in frequent follow-up.

Abbreviations: BMI, body mass index; CCM, chronic care management; EMR, electronic medical record; HbA_{1c}, glycated hemoglobin; IQR, interquartile range; ROI, return on investment.

Table 5. Summary of 2024 Articles on Dispensing Step of Ambulatory Care Medication-Use Process[54,55]

Authors	Article title	Study type, population, and intervention/objective	Results/conclusions
Eagon ML, Thomas KC, Micic C, et al	Conversion of an outpatient pharmacy to a mail-order pharmacy within a health system	Description of process used to convert an established outpatient pharmacy to a closed-door mail-order pharmacy	• Pharmacy observed a 20% increase in prescription volume. • Increases were also observed in prescriptions processed, prescriptions verified, packages delivered, and monthly revenue. • Engagement surveys demonstrated an increase in job satisfaction but a decrease in the percentage of staff who indicated they would likely be working at the pharmacy in a year.
Jairoun AA, Al-Hemyari SS, Shahwan M, et al	Community pharmacist-led point-of-care colorectal cancer screening program: Early detection of colorectal cancer in high-risk patients	Prospective point-of-care interventional study to evaluate the ability of community pharmacists to conduct a colorectal cancer screening program	• 36.4% of screened patients (146 of 401) had undiagnosed colorectal cancer. • Patients with an increased prevalence of cancer were older, had a history of type 2 diabetes mellitus, and/or had a history of inflammatory bowel disease. • Aspirin use was a negative predictor of undiagnosed colorectal cancer.

the pharmacy workforce completes to care for the patient. There were 9 articles (Table 7) published and identified in this step. Activities that are most often associated with the evaluating step may include annual wellness visits, motivational interviewing, pretreatment assessment, scheduled patient appointments, or monitoring of laboratory values.[12]

"Evaluating" was first introduced as a component of the ACMUP in the 2022 edition of this publication series, highlighting an area of research that has grown significantly and currently represents the second most-researched step of the process.[11,14] In addition to overall growth of research in this area, the focus of research has also shifted. Primary care and community-based pharmacy interventions remain a key

Table 6. Summary of 2024 Articles on Adherence Step of Ambulatory Care Medication-Use Process[56-59]

Authors	Article title	Study type, population, and intervention/objective	Results/conclusions
Ahn H, Byun BK, Lee TH, et al	Effects of pharmacist-led home visit services and factors influencing medication adherence improvement	Evaluation of pharmacist-led home visits on medication adherence	• Adherence rates were better at the final visit vs the first visit, as measured by scores for both motivation and knowledge. • Patients <70 years of age, those with poor or neutral health literacy, and those with 5 or more diseases had better improvement in adherence.
Bandiera C, Cardoso E, Locatelli I, et al	A pharmacist-led interprofessional medication adherence program improved adherence to oral anticancer therapies: The OpTAT randomized controlled trial	Randomized control trial to assess an interprofessional medication adherence program led by pharmacists targeting patients taking protein kinase inhibitors	• The adherence rate was higher at 6 months for those in the implementation arm vs the control arm. • Similar numbers of patients in the 2 groups dropped out due to adverse events. • 58.6% of patients in the intervention group had an interruption of therapy (a median of 2 days in a row), a lower percentage than in the control group.
Christopher CM, Blebil AQ, Bhuvan KC, et al	Assessing feasibility of conducting medication review with follow-up among older adults at community pharmacy: a pilot randomised controlled trial	Randomized, controlled pilot trial to evaluate conducting medication reviews in a community pharmacy	• 11 of 30 recommendations were focused on the prescribed medication, and 6 counseling sessions occurred. • At 6 months, there were statistically significantly more drug-related problems in the control group vs the intervention group (baseline numbers of drug-related problems in the 2 groups were similar). • Use of the Medication Use Questionnaire (MedUseQ) contributed to improved adherence.
Davis DD, Hale G, Moreau C, et al	Evaluating pharmacist-driven interventions in a primary care setting to improve proportion of days covered and medication adherence	Observational study to assess PDC changes following pharmacist phone calls regarding adherence	• There was a statistically significant ($P < 0.05$) increase in PDC scores for ACE inhibitors/ARBs and statins but not for noninsulin antidiabetic medications. • 208 interventions occurred, with patient education/counseling being the most frequent.

Abbreviations: ACE, angiotensin-converting enzyme; ARB, angiotensin receptor blocker; PDC, proportion of days covered.

area of focus; however, pharmacist-led programs involving continuous glucose monitoring (CGM) devices represented a significant theme of research in the current publication.[61,66,67] Additionally, recent literature recognizes the importance of justification of resources and the ability to generate revenue in the ambulatory care environment. Pharmacists continue to find ways to enhance patient care while also supporting the financial goals of their entities.[61,62,66,67]

A community pharmacy–based medication therapy management program resulted in improved diabetes care through statistically significant

Table 7. Summary of 2024 Articles on Evaluating Step of Ambulatory Care Medication-Use Process[60-68]

Authors	Article title	Study type, population, and intervention/objective	Results/conclusions
Albabtain B, Bawazeer G, Paudyal V, et al	Impact of a community pharmacy-based medication therapy management program on clinical and humanistic outcomes in patients with uncontrolled diabetes: a randomized controlled trial	Randomized controlled trial with qualitative interviews, 6 months in duration, designed with 2 arms (open-label, parallel-group)	• A community pharmacy–based MTM program resulted in a non–statistically significant decrease in HbA_{1c} and statistically significant improvement in BP control. • No participants in the intervention group reported hospitalization or ER visits during the study, compared to 14 in the control group. • Patient satisfaction, drug-related problems, and adherence were also positively impacted.
Beldon C, Rogers K, Johnson A, et al	Assessment of a community pharmacist remote monitoring service in patients using continuous glucose monitors	Prospective feasibility study evaluating the clinical impact of a community pharmacist–provided remote patient monitoring service on patients' glycemic control	• 3 of 8 glycemic metrics (very high TAR, TIR, and average glucose) significantly improved. • Other measures improved, but improvements were not statistically significant. • The study findings support community pharmacist involvement with remote CGM monitoring.
Glover LH, Skelley JW, Cimino LH, et al	Impact of a pharmacist-driven COPD clinic on outcomes related to COPD in a federally qualified health center	Quality improvement cohort study performed at a federally qualified health center	• All patients required medication adjustments to align with appropriate GOLD guideline-directed therapy. • Improvements in dyspnea scale scores and satisfaction with UDS quality measures occurred. • The study findings support the utilization of a pharmacist-driven service focused on COPD in the primary care setting and further evaluation of the impact of this model.
Haddon AM, Gross KR, Mozes CJ	Impact of clinical pharmacist practitioner management of chronic obstructive pulmonary disease in the ambulatory care setting	Prospective quality assurance project performed at multiple community-based outpatient clinics	• Clinical pharmacy practitioner management of COPD led to improved care. • This study supports expansion of pharmacist management of COPD in the ambulatory care setting.
Handshaw JV, Celauro L, Francoforte K	Impact of a pharmacist-led telemedicine visit in a geriatric primary care clinic	Retrospective chart review for patients who received primary care in any of 5 participating offices in a geriatric primary care setting	• A total of 259 patients were included in the final analysis, and 230 completed an appointment with the pharmacist. • Two-thirds of patients had at least 1 unidentified medication discrepancy, and more than 90% were identified as having suboptimal regimens.

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Table 7. Summary of 2024 Articles on Evaluating Step of Ambulatory Care Medication-Use Process[60-68]

Authors	Article title	Study type, population, and intervention/objective	Results/conclusions
			• This study highlights the impact of a remote ambulatory care pharmacist on patient care and supports consideration of applying this model to other primary care settings.
Mack K	Financial reimbursement of a pharmacist-led chronic care management program utilizing pharmacist extenders within a privately owned family medicine clinic	Retrospective study evaluating financial reimbursement of a CCM program led by a pharmacist, with the support of pharmacy residents and students, in a single privately owned family medicine practice	• The CCM program evaluated generated $55,104.64 in gross revenue and a 481.1% ROI. • The positive financial impact shown by this study could assist with justification of pharmacist-led CCM services with extenders in other settings.
Miller L, Woodyear J, Marciniak MW, Rhodes LA	Evaluation of a community-based pharmacy resident-led continuous glucose monitoring program within a family medicine clinic	Retrospective evaluation of the impact of a PGY1 community-based pharmacy resident–driven CGM program on clinical, financial, and patient satisfaction measures	• 18 patients were included in the study, and a mean HbA_{1c} reduction of 1.2% was realized. • Billing of CPT codes generated $3,761.40 in revenue. Additionally, patients were overall satisfied and willing to continue the CGM service. • This study supports the ability of community-based pharmacists to improve diabetes management through CGM while decreasing primary care provider burden.
Pasour T, Sheehan L, Troyer M, et al	Evaluation of a pharmacist-led personal continuous glucose monitor workflow to improve glycemic management in an internal medicine clinic	Prospective, investigator-initiated pilot study at an internal medicine clinic to create and evaluate a pharmacist-led CGM workflow in adult patients with diabetes	• Patients experienced statistically significant improvements in HbA_{1c}, and the clinic realized additional billed CGM services and provider RVUs. • This study further indicates that pharmacist-led CGM workflows within an internal medicine clinic can be integral to maximizing diabetes management.
Wells C, Warren AC, Scott MA	Development and implementation of ambulatory care pharmacy services at an internal medicine clinic	Observational descriptive report reviewing the step-by-step implementation of ambulatory care pharmacy services at an internal medicine clinic transitioning to a federally qualified health center look-alike entity	• Within approximately 1 year, the impact and growth of services supported the addition of a second pharmacist to the clinic team. • Following a step-by-step guide when evaluating ambulatory care pharmacy growth opportunities can support successful service planning, creation, and sustainability.

Abbreviations: CCM, chronic care management; CGM, continuous glucose monitoring; COPD, chronic obstructive pulmonary disease; CPT, Current Procedural Terminology; GOLD, Global Initiative for Chronic Obstructive Pulmonary Disease; PGY1, postgraduate year 1; HbA_{1c}, glycated hemoglobin; RVU, relative value unit; UDS, Uniform Data System.

improvement in BP control but with non–statistically significant decreases in glycated hemoglobin (HbA_{1c}) levels.[60] Participants also experienced fewer hospitalizations or emergency department visits when compared to the study's control group. A community pharmacist remote monitoring service for patients with CGM devices led to improvements in average blood glucose, time in the target glucose range, and very high time above range.[61] A 3-month pilot CGM program conducted by community-based pharmacy residents within a family medicine clinic found a mean HbA_{1c} reduction of 1.2%. Patients were overall satisfied and willing to continue the service.[66] Multiple studies found opportunities to increase revenue through billing of Current Procedural Terminology codes corresponding with services provided.[61,62,66,67]

Additional evidence supports pharmacists' ability to improve patient care through chronic disease state management within the primary care setting.[64] A pharmacist-led chronic obstructive pulmonary disease (COPD) initiative including in-person and telehealth follow-up led to guideline-directed medication adjustments for all included patients, a decrease in COPD symptoms, and improvements in addressing quality measures.[62] Clinical pharmacy practitioners within the Veterans Affairs system improved use of guideline-directed therapy by ensuring appropriate use of inhaled corticosteroids in addition to making positive impacts on receipt of vaccinations and smoking cessation attempts.[63]

Pharmacists can leverage available resources to support growth in ambulatory services focused on the evaluating step of the ACMUP. A federally qualified health center "look-alike" provided a descriptive report reviewing a step-by-step implementation of ambulatory care pharmacy services.[68] Return on investment (ROI) was evaluated and supported the addition of a second pharmacist to the clinic within approximately 1 year. Additional studies highlight the ROI potential of chronic care management programs, including a project within a privately owned family medicine clinic whereby $55,104.64 in gross revenue was generated at an ROI of 481.1%.[65]

Overall, literature regarding the evaluating step of the ACMUP supports pharmacist-led interventions, especially within primary care. New technologies, including CGM devices, have created opportunities for pharmacists to explore novel methods for chronic care management in clinic and community-based settings. Finally, the ability to financially justify resources is critical and has become a significant area of focus in the ACMUP literature.

Discussion

With this being the fifth article in the ACMUP series, the authors were able to evaluate trends in the 2024 publication year compared to the previous 4 years. These trends are described above. Holistically, the authors continue to see the evolution of technology and its importance in ensuring safety and efficiency. The authors have also seen a trending decrease in the number of articles identified as impactful through this publication series (18 less in 2024 vs 2023). The authors encourage continued publication of innovative programs intersecting with the ACMUP.

Limitations of this article include a lack of previously published literature clearly defining the ACMUP, which was partially addressed by the first publication of this series in 2020 and an *AJHP* commentary published in 2024.[6,12] Efforts to refine the naming convention of each step of the ACMUP should continue to ensure it most appropriately captures pharmacy practice in this novel model.

Since the literature search was completed in January, it is likely that articles were missed for inclusion; however, the authors believe that the table of contents search mediated this limitation by including articles based on a review of the article table of contents, which allows for full identification at the beginning of January. As the authors use the AACP "Core List of Journals for Pharmacy Education," this inherently imposes a limitation on the study, as some journals are missed, but provides us a list to start from that is generally accepted amongst pharmacy educators.[30] The addition of the machine learning methodology has helped mitigate many of these limitations.

Conclusion

There were numerous ambulatory care–focused, practice-enhancing articles published in 2024 that highlight the unique steps of the ACMUP. Ambulatory care and pharmacy management practitioners should benefit from having a systematic review of currently published literature that prioritizes emerging studies on improving pharmacy and medication services.

Pharmacists have a duty to review and incorporate best practices into their organizations in order to improve the efficiency and cost of care, optimally utilize the technology that is in use, and reduce the potential for medication errors.[1] There will be a continued need to research and publish on innovation in ambulatory care, as healthcare continues to shift away from acute care environments.

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Data availability

The data underlying this article are available in the article.

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