



# HHS Public Access

Author manuscript

*J Am Pharm Assoc (2003)*. Author manuscript; available in PMC 2021 May 17.

Published in final edited form as:

*J Am Pharm Assoc (2003)*. 2019 ; 59(6): 836–841.e2. doi:10.1016/j.japh.2019.07.007.

## Implementation process for comprehensive medication review in the community pharmacy setting

**Chelsea Phillips Renfro, PharmD [Assistant Professor],**

Department Clinical Pharmacy and Translational Science, University of Tennessee Health Science Center College of Pharmacy, Memphis, TN

**Kea Turner, PhD, MPH, MA [Assistant Professor],**

Department of Health Services Research, Management, and Policy, University of Florida, Gainesville, FL

**Raj Desai, MS [PhD student and research assistant],**

Department of Health Services Research, Management, and Policy, University of Florida, Gainesville, FL

**Jacob Counts, BS [PharmD candidate],**

University of Tennessee Health Science Center College of Pharmacy, Memphis, TN

**Christopher M. Shea, PhD, MPA [Associate Professor],**

Department of Health Policy and Management, University of North Carolina, Chapel Hill, NC

**Stefanie P. Ferreri, PharmD, BCACP, FAPhA\* [Clinical Professor, Executive Vicechair and Codirector]**

PGY-1 Independent Pharmacy Ownership Residency Program, Division of Practice Advancement and Clinical Education, UNC Eshelman School of Pharmacy, University of North Carolina, Chapel Hill, NC

### Abstract

**Objectives:** To (1) describe the implementation process for comprehensive medication reviews (CMRs) among community pharmacies (e.g., processes for prioritizing patients, staffing, and information collection) and (2) examine factors associated with community pharmacies' CMR information collection process.

**Methods:** A survey was administered to the pharmacist responsible for implementation of CMRs (i.e., the lead pharmacist) in the community pharmacy (n = 87). The survey included questions about pharmacy characteristics, satisfaction with the NC community pharmacy enhanced services network (NC-CPESN) program, and implementation of CMRs. Frequencies and means were calculated to describe the sample characteristics and pharmacies' CMR implementation process. A

---

\*Correspondence: Stefanie P. Ferreri, PharmD, BCACP, FAPhA, UNC Eshelman School of Pharmacy, University of North Carolina, CB: 7574, Beard Hall 115B, Chapel Hill, NC 27599. stefanie\_ferreri@unc.edu (S.P. Ferreri).

Supplementary Data

Supplementary data related to this article can be found at <https://doi.org/10.1016/j.japh.2019.07.007>.

**Disclosure:** The authors declare no relevant conflicts of interest or financial relationships.

multiple linear regression was conducted to examine which characteristics were associated with the CMR information collection process.

**Results:** The majority of pharmacies in the sample were either independently owned single stores (46.5%) or multiple stores under the same independent ownership (41.6%). Most pharmacies used pharmacists (97.7%) or pharmacy technicians (65.5%) for patient outreach for CMRs. A small percentage of pharmacies used administrative staff to conduct patient outreach for CMRs (9.2%). Information for prescription medications (89.5%), indication (80%), and medication adherence (81.1%) was routinely collected. Information such as date of last dose for prescription medications (48.4%) and lifestyle factors, such as physical activity (21.1%), diet (29.5%), and alcohol (31.6%), was collected less routinely. Having a clinical pharmacist ( $P=0.025$ ) and pharmacist overlap hours ( $P=0.009$ ) significantly improved the CMR information collection process.

**Conclusion:** Although CMRs are important interventions for improving patient outcomes, more guidance is needed on how to effectively implement them. This would allow the process to be efficient and assure implementation with fidelity across all community pharmacies. In addition, staffing appears to influence the quality of CMR information collection. Future research is warranted on CMR implementation to develop efficient staffing models and standardize the process of information collection.

---

Medication therapy management (MTM) is a term that has been applied to various MTM services to improve patient outcomes.<sup>1</sup> MTM can be delivered by other health care providers (e.g., physicians, nurses); although evidence suggests that pharmacist-led MTM programs are highly effective.<sup>2-15</sup> For example, one meta-analysis found that such MTM services significantly improve medication adherence.<sup>1</sup> Additional studies have reported positive effects on patient outcomes, such as lowered blood pressure and cholesterol.<sup>2-7</sup> Despite the benefits, researchers have reported difficulty in summarizing the effects of MTM programs because of variability in implementation.<sup>1</sup>

A comprehensive medication review (CMR) is one of most common MTM services performed in a community pharmacy; however, the definition of a CMR is applied inconsistently among organizations.<sup>1</sup> The MTM Advisory Board defines a CMR as a systematic process of collecting patient-specific information, assessing medication therapies to identify medication-related problems, developing a prioritized list of medication-related problems, and creating a plan to resolve them with the patient, caregiver, and prescriber.<sup>16</sup> As CMRs are becoming a staple in community pharmacies, a standard CMR implementation process needs to be identified to provide consistent positive outcomes.

Although there are positive outcomes associated with CMRs, it is difficult to know what components of CMRs are associated with positive outcomes owing to the wide variability in defining and implementing CMRs. For example, CMRs have demonstrated a positive impact when implementation methods such as prioritizing CMRs and patient identification are used.<sup>17-19</sup> Pharmacies may encounter different sets of barriers and therefore use different implementation strategies to overcome those barriers. One study identified inadequate staffing and lack of training as significant barriers,<sup>20</sup> and another reported that inconsistency

of reimbursement and lack of pharmacist-physician relationships were major barriers to implementing CMRs.<sup>21</sup>

## Objectives

The aims of the present study were to (1) describe the implementation process for CMRs among community pharmacies (e.g., processes for prioritizing patients, staffing, information collection, and follow-up) and (2) examine factors associated with community pharmacies' CMR information collection process.

## Methods

### Study design

A descriptive cross-sectional study in 2016 was conducted. The unit of analysis was the pharmacy level.

### Intervention description

The NC Community Pharmacy Enhanced Services Network (NC-CPESN) was developed and implemented as part of a Center for Medicaid and Medicare Innovation project where pharmacies agreed to deliver a set of MTM services, including CMRs.<sup>20,22,23</sup> The NC-CPESN program was managed by Community Care of North Carolina (CCNC), the primary case management agency for Medicaid beneficiaries in NC.<sup>24</sup> The pharmacies were paid based on a per-member per-month payment model that was based on a patient's risk score and the pharmacy's performance score on medication adherence, total cost of care, hospital admission rate, and emergency department admission rates.<sup>25-27</sup> Patients were eligible for NC-CPESN if they had Medicaid, Medicare, dual eligibility, or NC Health Choice (Children's Health Insurance Program). Pharmacies received a patient attribution report each month that showed which patients were attributed to the pharmacy (based on a formula for how often patients filled prescriptions in that pharmacy) and which patients had a higher-than-average risk score and should be prioritized for CMRs and other MTM services.<sup>25,26</sup> CCNC is organized into regional networks, and pharmacies participating in NC-CPESN received technical assistance from network-level staff on NC-CPESN implementation and documentation. Participants were required to document CMR delivery in Pharmacehome, an MTM web application.<sup>28</sup> Documentation included a list of current medications, identified drug therapy problems, and a patient care plan. Pharmacehome includes information on patient health from prescription history, diagnosis data, Medicaid claims data, hospitalization data, and laboratory results.

### Study population

The study included community pharmacies that participated in either the first or the second year of the NC-CPESN program (September 2014 to August 2016). Pharmacies that joined NC-CPESN in the third year of the program were excluded because of insufficient experience with implementation at the time of survey administration.

## Data source

A survey was administered via Qualtrics (version 2015) to community pharmacies participating in NC-CPESN (Appendix 1, available online at [www.japha.org](http://www.japha.org)). All of the pharmacies participating in NC-CPESN were called to identify the pharmacist that was responsible for implementation (i.e., the lead pharmacist) and provide their e-mail address. A copy of the survey was e-mailed to each of the lead pharmacists and reminder e-mails were sent at about 2, 4, and 8 weeks after the survey was e-mailed. Each pharmacist received a \$50 gift card for participation. A team of community pharmacists and researchers (n = 25) reviewed the survey to assess the content, readability, and formatting. The survey included questions about pharmacy characteristics, satisfaction with the NC-CPESN program, and implementation of CMRs. This study was approved by the Institutional Review Board of the University of North Carolina at Chapel Hill (IRB # 17-1304).

## Measures

**Sample characteristics**—Data were collected on organizational-level factors that might be associated with the pharmacy's process for CMRs. Specifically, the following categorical variables were included: year the pharmacy enrolled in the CPESN program, pharmacy type (i.e., single or multiple independent, other), weekly prescription volume, years in operation, pharmacist nondispensing hours, whether the pharmacy has overlap hours, presence of a clinical pharmacist, participation in the Medicare Part D MTM program, and number of full-time pharmacists.

**CMR process**—Data were collected on the pharmacy's process for CMRs. Information on how the pharmacy prioritizes patients for CMRs (e.g., referrals from other providers), which staff conduct CMRs or assist with patient outreach for CMRs, and what information is collected during the CMR (e.g., prescription medication indication, patient goals) were collected. Data were collected on what information sources are consulted during a CMR (e.g., pharmacy management system, electronic health records) and whether pharmacies conduct a follow-up after the CMR and how often follow-up is conducted.

**CMR information collection score**—A variable was created that summed all of the information that a pharmacy collects during a CMR (e.g., prescription medication indication, patient goals, etc.) to create a CMR information collection score. The score was transformed into a z-score.

**Analytic strategy**—First, means and percentages were calculated to describe the sample characteristics. Second, a multiple linear regression model was conducted to examine which characteristics were associated with the CMR information collection score. All sample characteristics were included in the model except Medicare Part D MTM participation, because that variable had little variation (as described in the Results). Categorical variables (e.g., prescription volume) were transformed to binary variables for the model. There was 1 observation per pharmacy and the model did not need to account for clustering.

## Results

### Sample characteristics

Surveys were received from 101 out of 123 pharmacies, an 82.1% response rate. Several pharmacies (n = 14) had either missing responses or had selected the option “don’t know,” which was treated as missing. After removing those pharmacies from the sample, a total of 87 pharmacies were included in the analytic sample. The majority of pharmacies in the sample were either independently owned single stores (46.5%) or multiple stores under the same independent ownership (41.6%; Table 1). Most pharmacies had an average of 2.3 full-time pharmacists. About a third of pharmacies (31.1%) had a clinical pharmacist on staff. Nearly all pharmacies had participated in the Medicare Part D MTM program (95.1%).

### CMR implementation process

Pharmacies reported which factors they used to prioritize patients for CMRs. It was found that pharmacies most often used patient referrals from CCNC network staff (54.0%) or the CCNC patient attribution report (50.6%) to prioritize patients for CMRs (Appendix 2, available online at [www.japha.org](http://www.japha.org)). Factors such as CMS Star ratings and reimbursement from payers played less into decision making about which patients to prioritize for CMRs.

Pharmacies also varied in their staffing models for conducting patient outreach for CMRs and for conducting the CMRs. Most pharmacies used pharmacists (97.7%) or pharmacy technicians (65.5%) for patient outreach for CMRs. All pharmacies used pharmacists to conduct CMRs, and about a third also used pharmacy students (31.0%) and about a sixth pharmacy residents (16.1%) to conduct CMRs. A small percentage (9.2%) of pharmacies used pharmacy administrative staff to conduct patient outreach for CMRs.

There was also variability in the type of information that pharmacies collected during a CMR. Prescription medication information such as name, strength, dose, route, and frequency (89.5%) and indication (80%) were always collected during a CMR (Table 2). Pharmacists also reported frequently collecting information on medication adherence (81.1%), problems with medication (91.6%), or drug and food allergies (90.5%). Information such as date of last dose for prescription medication was collected less routinely (48.4%), as was information on lifestyle factors, such as physical activity (21.1%), diet (29.5%), and alcohol (31.6%). A small percentage of pharmacists routinely collected information on patient goals (34.7%).

Pharmacies used several sources of patient information to conduct CMRs. Most pharmacists reported using Pharmacehome (91.9%) and the pharmacy management system (86.2%). A majority of pharmacists also obtained information from patients directly (93.1%) but a smaller percentage obtained objective information from patients such as vital signs (69.0%). About half of the pharmacists (48.3%) reported using information from patients’ electronic health records to conduct a CMR.

Pharmacies varied in whether they conducted follow-up after a CMR and how frequently follow-up occurred. A majority of pharmacists (73.6%) reported that their pharmacy had

implemented a process for patient follow-up. Most pharmacies followed up on a monthly (48.5%) or quarterly basis (41.2%).

### Factors associated with CMR information collection

Holding all else constant, having a clinical pharmacist on staff was associated with a 0.62 increase in CMR information collection score ( $P = 0.025$ ). Similarly, having overlap hours within the pharmacy was associated with a 0.84 increase in CMR information collection score ( $P = 0.009$ ). Other characteristics were not significantly associated with the CMR information collection score (Appendix 3, available online at [www.japha.org](http://www.japha.org)).

## Discussion

This study described the CMR implementation process among community pharmacies (e.g., processes for prioritizing patients, staffing, information collection, and process for follow-up) and examined which factors were associated with CMR information collection. Most pharmacies (97.1%) used pharmacists to conduct patient outreach for CMRs and relied less on pharmacy technicians (65.5%) or administrative staff (9.2%). Pharmacies may increase efficiency by delegating the task of patient outreach to nonpharmacist staff. Nationally, there has been an evolution of the pharmacy technician role to include more clinical and nonclinical support duties.<sup>29-33</sup> Allowing pharmacy technicians to conduct patient outreach for CMRs would allow more time for the community pharmacist to focus on conducting the CMR. Future research is warranted that tests more efficient staffing models for CMR implementation that divides labor among staff members (i.e., pharmacy technicians and administrative staff) instead of relying solely on the pharmacist.

Some information is routinely collected during a CMR (e.g., prescription indication) whereas other information is not routinely collected and varies across pharmacies (e.g., lifestyle factors and affordability of medications). Community pharmacists are in an ideal position to use information gathered during a CMR, such as lifestyle factors, to provide programs that enhance patient-centered health care. Patients who are in greatest need of MTM services visit their community pharmacy 35 times per year, compared with visiting their primary care provider only 2 to 3 times per year.<sup>20</sup> Studies have found that combining counseling on lifestyle during existing MTM services, such as CMRs, may improve health outcomes.<sup>34</sup> The present findings suggest that having overlap hours within the pharmacy and having a clinical pharmacist on staff may improve information collection during a CMR. Future studies should examine in a larger sample how pharmacy staffing models affect CMR implementation quality, including information collection.

The Pharmacists' Patient Care Process (PPCP) emphasizes using a patient-centered care approach to optimize medication outcomes and patient health.<sup>35</sup> It states that when providing patient care, the pharmacist should collect health and functional goals that might affect care and access to medications. Once collected, patient goals should be used when assessing collected information, developing an individualized care plan, implementing the care plan and following up. Only 34.7% of community pharmacists surveyed in the present study routinely collected patient goals during a CMR. By implementing the routine collection of patient goals when conducting a CMR, pharmacists can engage in patient-

centered communication to encourage patient participation in their care.<sup>36</sup> Future research is needed to train community pharmacists in implementing patient-centered communication when conducting CMRs and to examine the impact on patient outcomes.

This study identified a wide array of strategies for prioritizing patients for CMRs. Pharmacies frequently used resources from CCNC to prioritize patients for CMRs, such as referrals from CCNC network staff (54.0%) and the patient attribution report (50.6%). Because not all community pharmacies have access to these resources, pharmacies may benefit from identifying a process to help prioritize patients for CMRs. Future studies are needed to develop information technology tools that implement prioritization systems for patients (e.g., functionalities in pharmacy management systems) to allow pharmacists to prioritize patients who are in greatest need of a CMR. Future studies could also determine the most effective way to prioritize patients for a CMR.

### Limitations

This study has several limitations. First, it was conducted with a small sample of community pharmacies from 1 state. Findings may not be generalizable to community pharmacies in other states. Second, this study was purely descriptive. Therefore, it is unknown which implementation components are correlated with improved performance. Future studies are needed to examine the CMR implementation process over time and compare it with performance. Finally, the majority of participants were independently owned pharmacies. Findings may not be generalizable to larger chain pharmacies.

### Conclusion

Although CMRs are important interventions for improving patient outcomes, more guidance is needed on how to effectively implement them. This would allow the process to be efficient and assure implementation with fidelity across all community pharmacies. Future research is warranted on CMR implementation to develop efficient staffing models and to standardize the process of information collection.

### Acknowledgments

**Funding:** Grants from the Community Pharmacy Foundation (71560) and the North Carolina Translational and Clinical Sciences Institute (UL1TR001111). In addition, the project described in this study was supported by funding opportunity number 1C12013003897 from the Centers for Medicare and Medicaid Services, U.S. Department of Health and Human Services (HHS). The contents provided are solely the responsibility of the authors and do not necessarily represent the official views of HHS or any of its agencies or other funders of this study.

### Appendix 1.: Lead Pharmacist Survey (Comprehensive Medication Review Section)

Please indicate how often you use each of the following to prioritize patients for comprehensive medication reviews

| Factor  | Always                | Often                 | Sometimes             | Rarely                | Never                 | Don't know            |
|---|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| Referrals from health care providers                      | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Referrals from other pharmacies                           | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Referrals from CCNC network staff                         | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| CCNC patient attribution report                           | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| CMS Star ratings  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Medication adherence scores from CCNC performance metrics | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Medication synchronization patients                       | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Reimbursement from payers                                 | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Other (please specify)                                    | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

1. Which staff members are responsible for outreach to the patient regarding the comprehensive medication reviews? (Select all that apply)
  - Pharmacist(s)
  - Pharmacy technician(s)
  - Pharmacy student(s)
  - Pharmacy resident(s)
  - Pharmacy administration personnel
  - Other (please specify role) \_\_\_\_\_
  
2. Which staff members are responsible for conducting the comprehensive medication reviews with patients? (Select all that apply)
  - Pharmacist(s)
  - Pharmacy technician(s)
  - Pharmacy student(s)
  - Pharmacy resident(s)
  - Other (please specify role) \_\_\_\_\_
  
3. For a comprehensive medication review, do you obtain patient information from any of the following sources? (Select all that apply)
  - Electronic health record
  - PHARMACeHOME
  - Pharmacy management system
  - Subjective information from the patient (e.g., ask the patient)
  - Objective information from the patient (e.g., check vital signs)
  - Other (please specify) \_\_\_\_\_



4. Do you currently have a process established to follow up with patients who have had a comprehensive medication review?
- Yes
  - No
5. As a general rule, when do you follow up with patients who have had a comprehensive medication review?
- Weekly
  - Monthly
  - Quarterly
  - Never
  - Other (Please specify) \_\_\_\_\_

Please indicate how often you collect the following types of medication information for a comprehensive medication review.

| Information  | Always                | Often                 | Sometimes             | Rarely                | Never                 | Don't know            |
|--|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| Prescription medication name, strength, dose, route, and frequency                     | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Indication for prescription medications  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Date of last dose taken for prescription medications                                   | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Nonprescription medication name, strength, dose, route, and frequency                  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Indication for nonprescription medications   | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Date of last dose taken for nonprescription medications                                | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Assess medication adherence (e.g., how often do you miss a dose in a week)             | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Ask how patient remembers to take medications at home                                  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Ask who manages patient's medications at home  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Determine patient's organizational system (e.g., pill box, colored bottles, etc.)      | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Ask questions to determine if medication is working (e.g., monitoring at home)         | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Ask whether patient has experienced any problems or has concerns with their medication | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Ask if patient has trouble affording their medication                                  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Physical activity  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Diet   | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Tobacco use  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Alcohol use  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Dietary and herbal supplement use  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

| Information                        | Always                | Often                 | Sometimes             | Rarely                | Never                 | Don't know            |
|------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| Drug or food allergies or allergen | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Adverse drug events                | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Patient goals                      | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Other (please specify)             | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

## Appendix 2: How pharmacies prioritize patients for comprehensive medication reviews (n = 87), %

| Category                            | Always | Often | Sometimes | Rarely | Never |
|-------------------------------------|--------|-------|-----------|--------|-------|
| Referrals from providers            | 47.1   | 16.1  | 14.9      | 13.8   | 8.1   |
| Referrals from other pharmacies     | 23.3   | 15.1  | 12.8      | 23.3   | 25.5  |
| Referrals from CCNC network staff   | 54.0   | 16.1  | 26.4      | 2.3    | 1.2   |
| CCNC patient attribution report     | 50.6   | 33.3  | 12.6      | 2.3    | 1.2   |
| CMS Star ratings                    | 5.7    | 48.3  | 27.6      | 10.3   | 8.1   |
| Medication adherence scores         | 17.3   | 33.3  | 26.4      | 8.1    | 14.9  |
| Medication synchronization patients | 31.0   | 36.8  | 17.3      | 2.3    | 12.6  |
| Reimbursement from payers           | 9.2    | 23.0  | 24.1      | 16.1   | 27.6  |

## Appendix 3: Multiple linear regression of comprehensive medication review information collection score (n = 84)

| Characteristic   | $\beta$ (SE)             |
|--|--------------------------|
| Year 1 of NC-CPESN program                               | -0.07 (0.26)             |
| Single independent pharmacy                              | 0.01 (0.26)              |
| Low prescription volume ( < 2000 prescriptions per week) | 0.35 (0.30)              |
| Established pharmacy (>20 years in operation)            | 0.31 (0.25)              |
| Low nondispensing clinical hours ( < 10 hours per week)  | 0.04 (0.29)              |
| Use of overlap hours                                     | 0.85 (0.32) <sup>a</sup> |
| Clinical pharmacist on staff                             | 0.62 (0.27) <sup>b</sup> |
| Number of full-time pharmacists on staff                 | 0.02 (0.12)              |
| Constant   | -1.36 (0.56)             |

Significance of multiple linear regression

<sup>a</sup> $P < 0.01$

<sup>b</sup> $P < 0.05$ .

## References

1. Viswanathan M, Kahwati LC, Golin CE, Blalock SJ, Coker-Schwimmer E, Posey R, Lohr KN. Medication therapy management interventions in outpatient settings: a systematic review and meta-analysis. *JAMA Intern Med.* 2015;175:76–87. [PubMed: 25401788]

2. Theising KM, Fritschle TL, Scholfield AM, Hicks EL, Schymik ML. Implementation and clinical outcomes of an employer-sponsored, pharmacist-provided medication therapy management program. *Pharmacotherapy*. 2015;35(11):e159–e163. [PubMed: 26598100]
3. Tsuyuki RT, Johnson JA, Teo KK, et al. A randomized trial of the effect of community pharmacist intervention on cholesterol risk management: the Study of Cardiovascular Risk Intervention by Pharmacists (SCRIP). *Arch Intern Med*. 2002;162(10):1149–1155. [PubMed: 12020186]
4. Carter BL, Barnette DJ, Chrischilles E, Mazzotti GJ, Asali ZJ. Evaluation of hypertensive patients after care provided by community pharmacists in a rural setting. *Pharmacotherapy*. 1997;17(6):1274–1285. [PubMed: 9399611]
5. Chabot I, Moisan J, Grégoire J-P, Milot A. Pharmacist intervention program for control of hypertension. *Ann Pharmacother*. 2003;37(9):1186–1193. [PubMed: 12921497]
6. Cheema E, Sutcliffe P, Singer DRJ. The impact of interventions by pharmacists in community pharmacies on control of hypertension: a systematic review and meta-analysis of randomized controlled trials. *Br J Clin Pharmacol*. 2014;78(6):1238–1247. [PubMed: 24966032]
7. Santschi V, Chioloro A, Colosimo AL, et al. Improving blood pressure control through pharmacist interventions: a meta-analysis of randomized controlled trials. *J Am Heart Ass*. 2014;3(2).
8. Nayarapally GA, Smith MA. Variability in state Medicaid medication management initiatives. *Res Social Adm Pharm*. 2017;13:214–223. [PubMed: 26972951]
9. Urick B, Brown P, Easter JC. Achieving better quality and lower costs in Medicaid through enhanced pharmacy services. *N C Med J*. 2017;78:188–189. [PubMed: 28576959]
10. Oliveira DRD, Brummel AR, Miller DB. Medication therapy management: 10 years of experience in a large integrated health care system. *J Manag Care Pharm*. 2010;16(3):185–195. [PubMed: 20331323]
11. Johnson M, Jastrzab R, Tate J, et al. Evaluation of an academic-community partnership to implement MTM services in rural communities to improve pharmaceutical care for patients with diabetes and/or hypertension. *J Manag Care Spec Pharm*. 2018;24(2):132–141. [PubMed: 29384026]
12. Caffiero N, Delate T, Ehizuelen MD, Vogel K. Effectiveness of a clinical pharmacist medication therapy management program in discontinuation of drugs to avoid in the elderly. *J Manag Care Spec Pharm*. 2017;23(5):525–531. [PubMed: 28448783]
13. Almodovar AS, Axon DR, Coleman AM, Warholak T, Nahata MC. The effect of plan type and comprehensive medication reviews on high-risk medication use. *J Manag Care Spec Pharm*. 2018;24(5):416–422. [PubMed: 29694292]
14. Mott DA, Martin B, Breslow R, et al. Impact of a medication therapy management intervention targeting medications associated with falling: results of a pilot study. *J Am Pharm Assoc*. 2016;56(1):22–28.
15. Bradley CL, Luder HR, Beck AF, et al. Pediatric asthma medication therapy management through community pharmacy and primary care collaboration. *J Am Pharm Assoc*. 2016;56(4):455–460.
16. Gamble KH. MTM Advisory Board updates definition of key pharmacist service. *Pharmacy Times*, 8 07, 2011. Available at: <https://www.pharmacytimes.com/news/mtm-advisory-board-updates-definition-of-key-pharmacist-service>. Accessed January 25, 2019.
17. Renfro C, Ferreri S, Barber T, Foley S. Development of a communication strategy to increase interprofessional collaboration in the outpatient setting. *Pharmacy*. 2018;6(1):4.
18. Pagano GM, Groves BK, Kuhn CH, Porter K, Mehta BH. A structured patient identification model for medication therapy management services in a community pharmacy. *J Am Pharm Assoc*. 2017;57(5):619–623.e1.
19. Turner K, Weinberger M, Renfro C, et al. The role of network ties to support implementation of a community pharmacy enhanced services network [e-pub before print]. *Res Social Adm Pharm* 10.1016/j.sapharm.2018.09.015.
20. Smith MG, Ferreri SP, Brown P, Wines K, Shea CM, Pfeiffenberger TM. Implementing an integrated care management program in community pharmacies: a focus on medication management services. *J Am Pharm Assoc*. 2017;57(2):229–235.e1.

21. Smith MA, Spiggle S, McConnell B. Strategies for community-based medication management services in value-based health plans. *Res Social Adm Pharm*. 2017;13(1):48–62. [PubMed: 26904962]
22. Collins S CMS-funded project to create community pharmacist network. *Pharm Today*. 2014;20(12):49.
23. Hemberg N, Huggins D, Michaels N, Moose J. Innovative community pharmacy practice models in North Carolina. *N C Med J*. 2017;78(8):198–201. [PubMed: 28576962]
24. Community Care of North Carolina. Available at: <https://www.communitycarenc.org/>. Accessed January 28, 2019.
25. Farley JF, Ferreri SP, Easter JC, McClurg MR. The North Carolina Experiment: active research in the development and assessment of new practice models. *N C Med J*. 2017;78(3):186–190. [PubMed: 28576958]
26. Urick BY, Ferreri SP, Shasky C, Pfeifferberger T, Trygstad T, Farley JF. Lessons learned from using global outcome measures to assess community pharmacy performance. *J Manag Care Spec Pharm*. 2018;24(12):1278–1283. [PubMed: 30479196]
27. Renfro CP, Urick BY, Mansour MA, Ferreri SP. Pharmacy characteristics correlating to performance in a community pharmacy network. *J Am Pharm Assoc*. 2019;59(2):275–279.
28. Community Care of North Carolina. PHARMACeHOME. 2017. Available at: <http://ccwnc.org/providers/information-systems>. Accessed January 28, 2019.
29. Mattingly AN, Mattingly TJ II. Advancing the role of the pharmacy technician: a systematic review. *J Am Pharm Assoc*. 2018;58(1):94–108.
30. Gernant SA, Nguyen MO, Siddiqui S, Schneller M. Use of pharmacy technicians in elements of medication therapy management delivery: a systematic review. *Res Social Adm Pharm*. 2018;14(10):883–890. [PubMed: 29221929]
31. Hohmeier KC, McDonough SL, Rein LJ, Gibson ML, Powers MF. Exploring the expanded role of the pharmacy technician in medication therapy management service implementation in the community pharmacy. *J Am Pharm Assoc (2003)*. 2019;59(2):187–194. [PubMed: 30679031]
32. Hohmeier KC, Desselle SP. Exploring the implementation of a novel optimizing care model in the community pharmacy setting. *J Am Pharm Assoc (2003)*. 2019;59(3):310–318. [PubMed: 30940516]
33. Frost TP, Adams AJ. Tech–check–tech in community pharmacy practice settings. *J Pharm Technol*. 2017;33(2):47–52.
34. Lenz TL, Monaghan MS. Implementing lifestyle medicine with medication therapy management services to improve patient-centered health care. *J Am Pharm Assoc*. 2011;51(2):184–188.
35. Joint Commission of Pharmacy Practitioners. Pharmacists’ Patient Care Process. 5 29, 2014. Available at: <https://jcphp.net/patient-care-process/>.
36. Naughton C Patient-centered communication. *Pharmacy*. 2018;6(1):18.

**Table 1**

Characteristics of participating pharmacies (n = 87)

| Characteristic   | %             |
|--|---------------|
| Year of NC-CPESN program                                       |               |
| Year 1   | 45.5          |
| Year 2   | 54.5          |
| Pharmacy type  |               |
| Single independent pharmacy                                    | 46.5          |
| Multiple independent pharmacy                                  | 41.6          |
| Other (outpatient pharmacy)                                    | 11.9          |
| Weekly prescription volume                                     |               |
| < 500  | 4.0           |
| 500-1000   | 26.2          |
| 1001-2000  | 36.4          |
| 2001-3000  | 23.2          |
| 3001-4000  | 6.1           |
| > 4000   | 4.0           |
| Years in operation   |               |
| 0-5  | 15.8          |
| 6-10   | 23.8          |
| 11-15  | 12.8          |
| 16-20  | 8.9           |
| > 20   | 38.6          |
| Pharmacist nondispensing hours                                 |               |
| 0  | 4.6           |
| 1-5  | 27.3          |
| 6-10   | 33.0          |
| 11-15  | 10.2          |
| 16-20  | 8.0           |
| > 20   | 17.1          |
| Use of overlap hours   | 74.4          |
| Clinical pharmacist on staff                                   | 31.1          |
| Participation in Medicare Part D Medication Therapy Management | 95.1          |
| Number of full-time pharmacists (mean $\pm$ SD)                | 2.3 $\pm$ 1.3 |

**Table 2**  
Patient information collected during a comprehensive medication review (n = 87), %

| Patient information   | Always | Often | Sometimes | Rarely | Never |
|---|--------|-------|-----------|--------|-------|
| Prescription medication name, strength, dose, route, and frequency    | 89.5   | 9.5   | 1.0       | 0.0    | 0.0   |
| Indication for prescription medication                                | 80.0   | 13.7  | 5.2       | 1.1    | 0.0   |
| Date of last dose taken for prescription medications                  | 48.4   | 24.2  | 15.8      | 9.5    | 2.1   |
| Nonprescription medication name, strength, dose, route, and frequency | 83.2   | 9.5   | 7.4       | 0.0    | 0.0   |
| Indication for nonprescription medication                             | 71.6   | 13.7  | 11.6      | 3.2    | 0.0   |
| Date of last dose taken for nonprescription medications               | 35.8   | 28.4  | 20.0      | 11.6   | 4.2   |
| Medication adherence  | 81.1   | 15.8  | 3.2       | 0.0    | 0.0   |
| Patient reminder systems for medication adherence (e.g., phone alarm) | 66.0   | 27.7  | 5.3       | 1.1    | 0.0   |
| Person responsible for managing patients' medications                 | 70.5   | 22.1  | 7.4       | 0.0    | 0.0   |
| Patient medication organization systems (e.g., pill box)              | 67.4   | 27.4  | 5.3       | 0.0    | 0.0   |
| Whether medication is effective                                       | 71.6   | 26.3  | 2.1       | 0.0    | 0.0   |
| Problems with medication  | 91.6   | 7.4   | 1.1       | 0.0    | 0.0   |
| Problems with affording medication                                    | 49.5   | 25.3  | 24.2      | 1.1    | 0.0   |
| Physical activity   | 21.1   | 34.7  | 39.0      | 5.3    | 0.0   |
| Diet  | 29.5   | 28.4  | 35.8      | 5.3    | 1.1   |
| Tobacco   | 39.0   | 27.4  | 25.3      | 6.3    | 2.1   |
| Alcohol   | 31.6   | 24.2  | 31.6      | 10.5   | 2.1   |
| Dietary and herbal supplements  | 59.0   | 31.6  | 8.4       | 1.1    | 0.0   |
| Drug or food allergies  | 90.5   | 7.4   | 2.1       | 0.0    | 0.0   |
| Adverse drug events   | 88.4   | 9.5   | 2.1       | 0.0    | 0.0   |
| Patient goals   | 34.7   | 33.7  | 23.2      | 7.4    | 1.1   |