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The missing piece: Clinical pharmacists enhancing the interprofessional nephrology clinic model

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Abstract

Objectives: To embed pharmacy residents in an interprofessional nephrology clinic to conduct medication reconciliation in targeted high-risk patients with nondialysis kidney disease.

Setting: This pilot was a prospective quality improvement initiative conducted in an interprofessional outpatient nephrology clinic.

Practice description: The nephrology clinic team includes nephrology providers, a social worker, and a geriatrician. The team is responsible for the management of conditions such as nondialysis kidney disease, resistant hypertension, acute kidney injury, proteinuria, and nephropathy.

Evaluation: Primary outcomes included the number and type of medication discrepancies and drug therapy problems identified. Secondary outcomes included the changes in care process directly resulting from the pharmacy residents' recommendations. The perceived value of the pharmacy residents to the interprofessional team was assessed through postintervention anonymous surveys and semistructured interviews.

Results: The pharmacy residents conducted 118 visits for 87 unique patients (mean age 73 years, 97% male) with nondialysis kidney disease (89% stages III–V), polypharmacy (87% of patients

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taking > 10 medications), and a heavy comorbidity burden (85% hypertension, 80% dyslipidemia, 59% diabetes mellitus type II) from January to October 2017. Pharmacists identified 344 medication discrepancies and 301 drug therapy problems, resulting in 398 changes in care process. The most frequently identified discrepancies and drug therapy problems were the omission of an active medication from the medication list (86 of 344 discrepancies, 25%) and potentially inappropriate medications (106 of 301 drug therapy problems, 35%). Pharmacists recommended 228 medication changes, provided 76 adherence devices, facilitated 24 consults or referrals, and communicated with the primary care team on 70 occasions. The interprofessional team members all strongly agreed that patients and the team benefited from the pharmacists' involvement.

Conclusion: Pharmacy resident–led medication reconciliation resulted in the identification and resolution of medication discrepancies and drug therapy problems, leading to changes in the care process.

In a recent population-based retrospective cohort study of 2 million adults, patients seen by a nephrologist had the highest number of comorbidities, mean number of prescribed medications, highest rate of death, and highest rate of placement in a long-term care facility.[1] Indeed, the majority of patients seen by outpatient nephrology providers in the United States are adults with chronic kidney disease (CKD) and complex medical conditions,[1–3] who are at increased risk of cognitive decline,[4] frailty,[5] and difficulty completing activities of daily living as they age.[6,7] Owing to a high comorbidity burden and diminishing kidney function, older adults with CKD also have an elevated risk for polypharmacy, with potentially inappropriate medications or inappropriately dosed medications based on the level of kidney impairment, all of which may lead to adverse outcomes.[1,8,9] Adults with kidney disease are subject to many medication-related problems, including adverse drug reactions, drug–drug interactions, and inappropriate renal dosing. These types of medication-related problems contribute to 1 in 6 hospitalizations and an estimated annual United States health care cost of $175 billion.[10]

As kidney disease progresses toward end-stage renal disease (ESRD), medication burden grows: in a cohort study of dialysis-dependent adults in the United States, one-fourth were taking 25 or more daily medications, which was significantly associated with reduced medication adherence, decreased physical function, and lower health-related quality of life.[11] The associated annual cost of medication nonadherence in the United States has been estimated to be $300 billion, with an estimated annual cost of prescription drug–related morbidity and mortality of more than $528 billion.[12,13]

Medication reconciliation may provide a solution for the detection and resolution of medication-related problems, polypharmacy, and medication nonadherence in patients with kidney disease. Using a structured process to compare patients' medication lists, prescription and nonprescription medication bottles, medication management behaviors, and adherence is critical for patients with kidney disease, who take a high number of medications with frequent dose adjustments.[10,13–16] Medication reconciliation is paramount after any transition of care, including a hospitalization, and should be conducted at routine intervals to account for frequent medication changes or adverse effects in patients with kidney disease.[13]

Pharmacists are proficient in medication reconciliation and management, and intervention supports improved clinical outcomes and medication adherence, as well as reduced hospitalization and health care costs for older high-risk patients.[13,17,18] Because medication management is critical to preventing the progression of kidney disease to ESRD, pharmacists' use of a proactive approach to medication optimization and deprescribing is key.[14] The 2012 Kidney Disease Improving Global Outcomes "Clinical Practice Guidelines for the Evaluation and Management of Chronic Kidney Disease" support involving pharmacists in the medication management and review of patients with kidney disease.[19]

Although much has been published regarding the role of pharmacists in reducing medication burden and associated costs in dialysis[16,20–27] and transplant[28–33] patients, evidence for pharmacist intervention for patients with nondialysis kidney disease in the outpatient setting is sparse and hetero-geneous.[34] Several models have used pharmacist expertise effectively in the management of anemia in patients with nondialysis kidney disease; however, they did not use medication reconciliation to target the issues of medication-related problems, polypharmacy, and nonadherence.[35–37] In 2 French outpatient clinics, inclusion of a pharmacist consultation service for patients with CKD led to the detection of significantly more drug-related problems compared with usual renal care, with more drug-related problems associated with older age and higher number of daily medications.[38,39] Similarly, pharmacists within a quality improvement initiative in a community health center detected an average of 3.2 drug-related problems per CKD patient, but fewer than half of the pharmacist recommendations were accepted and implemented by physicians.[40] That study showed a significant correlation between a greater number of drug-related problems and more advanced kidney disease.[14,34,40] Although those studies highlighted the importance of pharmacist medication review and reconciliation in identifying drug therapy problems, there was minimal description of the pharmacist's role in resolving medication discrepancies, communicating with non-nephrology providers, assessing adherence, and triggering consultations or referrals to needed services. In addition, the clinical models had the pharmacist and nephrology providers working separately rather than collaborating in person.

Four published interprofessional care models report on patient outcomes for those with a pharmacist on their care team compared with usual care.[41–44] Collectively, these models demonstrated a slower rate of estimated glomerular filtration rate decline,[41] improved parathyroid hormone monitoring and adherence to guideline-recommended antihypertensive medications,[42] and improved proteinuria screening; however, there was no significant impact on mortality or acute care utilization in those with a pharmacist on their team versus usual care.[44] These studies did not report on the specific pharmacist workflow or changes in care process resulting from pharmacist assessment. Therefore, it was difficult to determine how or if the pharmacist contributed to improved clinical care in the outpatient CKD population.

Objectives

To our knowledge, our model is the first to describe embedding pharmacy residents in an outpatient clinic to conduct medication reconciliation for patients with nondialysis kidney disease, working with nephrology providers in person and in real time. We applaud efforts to use medication reconciliation in the dialysis and transplant settings, and we build on

previously published models within the nondialysis population to target the issues of medication-related problems, polypharmacy, and nonadherence. In this quality improvement initiative, we assess the impact of pharmacy residents within an interprofessional nephrology clinic conducting medication reconciliation on targeted high-risk patients with kidney disease. We describe the technical aspects of the pharmacist workflow to allow for replication in other nephrology and potentially other subspecialty clinic settings. We also detail the pharmacist's role in the detection and resolution of medication discrepancies and drug therapy problems, with a focus on specific changes in care process that resulted from pharmacist assessment.

Setting

This pilot was a prospective quality improvement initiative conducted in a Veterans Affairs (VA) interprofessional outpatient nephrology clinic from January to October 2017. The nephrology clinic receives requests for formal consultation from other providers for the management of conditions such as nondialysis CKD, resistant hypertension, acute kidney injury, proteinuria, and nephropathy. Consultation requests may be placed by primary care providers or medical specialists within the VA Boston Healthcare System. Patients are followed in a different clinic if they proceed dialysis; thus the present study population includes only those with nondialysis kidney disease.

Practice description

The nephrology clinic team includes nephrology providers, a social worker, and a geriatrician. Figure 1 details the roles and responsibilities of each team member in the pilot. Within the outpatient nephrology clinic, Veterans are seen for an initial in-clinic visit after the placement of a consultation. Follow-up visits may take place as needed: as frequently as every 2 weeks for acute issues, and as infrequently as yearly for those with stable kidney disease. The nephrology providers are responsible for the evaluation of renal disease. Nephrology providers are the sole parties responsible for associated billing for the visits. Nephrology providers frequently order laboratory monitoring and counsel on diet and self-care. Patients see the social worker and geriatrician on an as-needed basis in clinic. Although these providers document their encounters with the patients, they do not bill for the visits. Their workload is documented through the encounter and the billing for all encounters with the interprofessional team is completed by the nephrology provider at the end of that day's visit. At times, providers may follow-up with patients via telephone; providers document and bill for these encounters accordingly. The purpose of the pilot was to embed 2 pharmacy residents into the clinic model to conduct in-person medication reconciliation to improve medication management for high-risk patients with nondialysis kidney disease. The pilot was approved by the facility's internal Research and Development Committee as a quality improvement initiative and was exempt from further Institutional Review Board oversight.

Evaluation

Primary outcomes included the number and type of medication discrepancies and drug therapy problems identified. Secondary outcomes included the changes in care process directly resulting from the pharmacy residents' assessment. The perceived value of the pharmacy residents to the interprofessional team was assessed. Data collection on patient

baseline characteristics, medication reconciliation data, and changes in care process[45] occurred via retrospective chart review of encounter notes, medication lists, medication refills, and consultations or referrals up to 1 year after the end of the pilot period. Descriptive statistics are summarized. This pilot did not include a control or comparator group, so no statistical analysis was completed.

The value of pharmacy residents' inclusion in the interprofessional team model was evaluated through anonymous surveys and semistructured interviews derived from previously published assessments of interprofessional teams[46–48] and were completed by all team members (n = 6) after pilot completion. Team members were given a paper survey with questions addressing the perceived benefit of pharmacists (e.g., I am satisfied by the care provided by the pharmacists in clinic; My patients benefit from pharmacist-led medication reconciliation; Findings or recommendations by the pharmacist influence my care plan). Team members indicated their level of agreement for each question on a 5-point Likert scale. After the anonymous survey, a clinical pharmacist who was previously involved in the pilot as a pharmacy resident used the above questions to facilitate a semistructured interview with the team member. The pharmacist asked team members to provide any additional comment for each of the 9 questions as the team members saw fit. Surveys were scored, and interview data were compiled and analyzed for common themes.

Practice innovation

During the pilot period, 2 pharmacy residents were embedded in the clinic to conduct medication reconciliation for targeted high-risk patients: 1 postgraduate year (PGY) 2 resident specializing in geriatric pharmacy and 1 PGY-1 resident. Both residents had experience in geriatrics and medication reconciliation through outpatient residency rotations but had not received prior formal training in nephrology. Pharmacy residents were precepted by the attending nephrologist in the clinic and conducted patient visits separately. Although clinical pharmacy specialists may work under a scope of practice with a collaborating physician, allowing the pharmacist to prescribe medications and order necessary laboratory tests within that scope of practice, in the present model the nephrology providers were responsible for the prescription of medications and ordering of necessary laboratory tests.

Each week, the pharmacy residents reviewed the charts of scheduled nephrology clinic patients in the electronic medical record (EMR) to identify targeted patients for medication reconciliation who had any of the criteria in Figure 2. Before or after their visits with the nephrology provider, these targeted patients were offered a visit with a pharmacy resident to review their medications. Patients who may not have been targeted in the screening process may have been referred to the pharmacy resident in real time if a nephrology provider identified the need for pharmacist assessment during their clinic visit that day. If a patient was seen by a pharmacy resident at his or her previous renal visit, he or she was not excluded from an additional medication reconciliation at subsequent visits. Patients seen by a pharmacy resident were not required to have a diagnosis of CKD and may have been seen in the nephrology clinic for other reasons.

A pharmacy resident completed an in-person comprehensive medication review in a designated examination room within the clinic space, using best practices for medication

reconciliation.[49–51] The medication review was conducted before the nephrology clinic visit. During this time, patients would normally have been seated in the reception area waiting to be roomed. Instead, the pharmacy resident escorted patients to the examination room, completed the medication review, and communicated with the nephrology provider before the nephrology provider met with the patient. This did not extend the clinic visit and allowed the nephrology provider to obtain vital information before their nephrology assessment.

The pharmacy resident reconciled the clinical indication, dose, route, frequency, and timing of medication administration with the prescription orders in the system-wide medical record. Alternate sources for medication reconciliation were used when applicable or available (e.g., information from home nurse or caregiver, contacting non-VA pharmacies via telephone, patients' own medication bottles or pillboxes). Discrepancies and drug therapy problems were identified using open-ended motivational interviewing, refill records, and pill count when available.[49–51]

Medication nonadherence was defined as a patient report of missing > 80% of medication doses in an average week. This was extrapolated from the Pharmacy Quality Alliance which recommends a proportion of days covered threshold of 80% to classify medication nonadherence.[52] Because the pharmacy resident targeted many older adults with kidney dysfunction for assessment, the pharmacy resident assessed medication appropriateness according to patient age and renal function and completed an in-person side-effects screening related to the patient's current medications.[9,53–55] All data from the pharmacy residents' assessment were recorded in a templated encounter note in the EMR. In addition to medication reconciliation, the pharmacy resident provided in-person patient education about medication instructions, indication, adverse effects, interactions between medications, and appropriate dosing with the use of IBM Micromedex during the visits as needed. Patients had the opportunity to ask questions during the visit.

After all members of the interprofessional team completed their patient encounter, the team gathered for an in-person huddle. During this discussion, findings and recommendations from all members of the team, including the pharmacy resident, were integrated to yield awritten comprehensive treatment plan which was discussed with the patient. The pharmacy residents provided the patient with adherence devices such as medication calendars (a tabular medication list organized by administration time of day, designed to make filling a pillbox easier), pillboxes, tablet splitters, and tablet crushers as needed. The pharmacy resident completed any necessary medication refills or renewals through the facility's outpatient pharmacy. After the care plan was completed, the pharmacy resident ensured that the medication list in the EMR was reconciled to reflect the patient's current medication regimen, including any changes made that day, and documented all pharmacist actions in their encounter note in the EMR (Figure 1).

In response to the pharmacy resident's medication reconciliation, changes to any medications managed by the nephrology providers were made in real time. The pharmacy resident contacted primary care providers and other specialists through secure e-mail regarding any recommendations or notable findings from the medication reconciliation performed during the encounter. The pharmacy resident assisted providers in facilitating

medication changes or referrals. At times, the pharmacy resident subsequently performed follow-up telephone calls to patients to assess changes, such as tapering of proton pump inhibitors, liberalizing diabetes or hypertensive regimens, titration of new medications, and monitoring of medication adverse effects, and documented these follow-up encounters in the EMR.

Results

During the pilot period, the pharmacy residents completed a total of 118 medication reconciliation visits for 87 unique patients. Seventeen patients were seen 2 to 4 times by the pharmacy residents, and 1 patient was seen 6 times (discussed below).

Patients seen by the pharmacy residents were most often white non-Latino (78%) men (97%) with a mean age of 73 years. The majority of these patients had advanced CKD, with 29% having CKD stage III, 48% stage IV, and 12% stage V. Patients seen by the pharmacy residents had a heavy comorbidity burden, including hypertension (85%), dyslipidemia (80%), diabetes mellitus type II (59%), and a history of clinical atherosclerotic cardiovascular disease[56] (51%). Fourteen patients (16%) had a diagnosis of cognitive impairment, and 6 of those were newly diagnosed as a direct result of the interprofessional nephrology clinic visit. All but 1 of the 87 patients met the definition for polypharmacy (more than 5 active medications),[57] and 87% of the patients had more than 10 medications at the time of the visit. On average, patients received outpatient prescriptions from 11 ± 6 unique prescribers over the past year, including postdischarge prescriptions from inpatient prescribers (Table 1).

Pharmacy residents identified 344 medication discrepancies and 301 drug therapy problems. The most common discrepancies were classified as an omitted drug from the medication list (n = 86; 25%; e.g., over-the-counter medication omitted from medication list), continuation of a previously discontinued medication (n = 65; 19%; e.g., diuretic discontinued after previous hospitalization but patient continued taking it), and taking a medication differently from prescribed (n = 55; 16%; e.g., self-adjusting basal insulin doses based on blood glucose readings). The majority of the identified drug therapy problems stemmed from potentially inappropriate prescribing[53–55] (n = 106; 35%; most often American Geriatrics Society Beers Criteria medications) leading to a potential or actual adverse drug reaction (n = 81; 27%). On average, the pharmacists identified 2.9 medication discrepancies and 2.6 drug therapy problems per visit (Table 2).

The pharmacy residents retrospectively identified 398 changes in the care process that resulted directly from their own interventions. The pharmacy residents collectively made 228 recommendations to optimize medication management, including evidence-based strategies for deprescribing.[9,58] The nephrology providers implemented 135 medication changes (59% of recommendations) and primary care providers implemented 46 changes (20% of recommendations); 47 recommendations (21%) were not implemented, 25 of which were refused by the patient and 22 not implemented for unknown reasons. Pharmacy residents identified medication nonadherence in 42 (36%) of the visits and provided 76 medication adherence devices (56 pill calendars, 13 pillboxes, 6 tablet splitters, and 1 tablet

crusher). The pharmacy residents facilitated 24 consultations or referrals, most frequently consultations for further geriatric or cognitive evaluation (n = 8) or home-based primary care (n = 9). Pharmacy residents communicated directly with the patient's primary care team on 70 occasions (Figure 1).

For the particular patient who was seen 6 times by the pharmacy resident, multiple visits with all members of the interprofessional team led directly to a comprehensive geriatric assessment and cognitive evaluation by the embedded geriatrician, which yielded a dementia diagnosis, triggering the nephrology and primary care teams to provide the patient and caregiver with increased support through home-based primary care services, social work services, and pharmacy resident assistance at all nephrology visits.

In postintervention surveys and interviews, all members of the interprofessional team strongly agreed that patients and staff benefited from the pharmacy resident-provided care and medication reconciliation within the nephrology clinic. Quotes from the semistructured interviews highlighted the added value of the pharmacists:

> "The patients love it. They come out of other doctors' visits and complain that they are in and out in 15 minutes. I have had families and patients tell me that they really feel taken care of … they value the service and the extra time."
>
> — Nephrology provider

> "The pharmacists are collaborative and make for an improved interdisciplinary team. Our patients are complex. Medication management is one of the main things that keeps our patients from heading toward dialysis, so having a pharmacist is really important."
>
> — Social worker

> "[Patient name] was especially someone that I needed help with— he had so many medication changes, wasn't able to do his meds on his own, and it was just impossible to keep track of everything. For these complicated patients, which unfortunately is a lot of our patients, having more heads looking [at them] is much better than just me, the doctor."
>
> — Nephrology trainee

Discussion

We have described the first model of embedding pharmacy residents in an outpatient clinic to conduct medication reconciliation for patients with nondialysis kidney disease. Targeted patients for pharmacy resident intervention in our pilot were older with advanced kidney disease and a high medication and comorbidity burden, highlighting the importance of vigilant medication review in this vulnerable population. Our findings also demonstrate the value of adding the pharmacist to an interprofessional nephrology team, contributing 398 changes in care process over a 9-month pilot period. Anonymous survey evaluation and semistructured interviews noted the value of the pharmacy resident and the interprofessional team to patients and providers.

In line with previous literature,[1,8–11,13–16] all but 1 of the 87 patients exhibited polypharmacy and multiple prescribers.[57,59,60] Our results were similar to a population-based cohort study that noted that the patients seen by a nephrologist had a high mean number of comorbidities (4.2, 95% CI 4.2–4.3) and a high mean number of prescribed medications (14.2, 95% CI 14.2–14.3).[1] This further underscores the need for proactive pharmacist-led medication reconciliation in patients with nondialysis kidney disease at regular intervals to prevent adverse outcomes.[10,13–16,19] We gave priority to older patients with a recent hospitalization, because patients seen by a nephrologist have significantly higher rates of death (6.6%, 95% CI 6.3%–6.9%) and placement in a long-term care facility (2.0%, 95% CI 1.8%–2.2%) compared with adults not seen by a nephrologist.[1] We found that 38% of patients were non-adherent to their complex medication regimens, possibly related to difficulties managing complex medical conditions,[2,3] cognitive decline,[4] frailty,[5] and functional decline.[6,7] We did not assess if pharmacy resident intervention resulted in improved medication adherence, mortality, or affected nursing home placement. This is a target for future study.[38–43]

Pharmacist interventions led to similar to discrepancy detection rates in other studies; however, those studies lacked description of pharmacist interventions related to managing polypharmacy and deprescribing in the population of the present model.[38–40] When inappropriate medications were identified, pharmacy residents used CKD-specific deprescribing techniques,[8,9,58] although further research is needed to help reduce the medication burden in older patients with nondialysis kidney disease. Pharmacy resident intervention resulted in 328 changes in care process; although published literature describes the high detection rate of drug-related problems in this population, they fail to describe the pharmacist's role in the resolution of these problems, especially related to communication and coordination of care.[38–40] Future directions for this model may include targeted pharmacist medication reconciliation after discharge for enrollees in the outpatient nephrology clinic.[61,62]

There are potential limitations to our model, which was conducted in a VA facility, an integrated health care system with a unique funding structure and shared medical record. The use of pharmacy residents eliminated the need for assessment of the number of full-time-equivalent pharmacists needed per panel of kidney disease patients, which has not yet been defined.[10] Nonresident clinical pharmacists did not provide direct patient care in this model. This was intentional, because the pilot model described here could lead to the justification for funds to hire a full-time nonresident clinical pharmacist to conduct medication reconciliation, deprescribing, and associated follow-up. A cost-benefit analysis is underway to translate pharmacy resident interventions to cost-avoidance and cost savings; this analysis will provide the basis for advocating for funds to compensate 1 clinical pharmacist for the 4 hours/week clinic time slot. Future directions will include scalability of that clinical pharmacist to all 4 weekly clinic sessions depending on cost-benefit analysis. An alternate approach may be the use of specially trained pharmacy technicians for medication review under the supervision of 1 pharmacist. In the private sector, pharmacists collect reimbursement for medication reconciliation and medication therapy management services in the ambulatory care setting for patients with high drug costs and chronic conditions such as CKD.[10,63–66] However, changes to the Medicare Part D system may

preclude dialysis patients from qualifying for medication therapy management services in the future based on cost of medications alone.[10]

The pharmacy residents also targeted older high-risk patients with kidney disease, which may have led to more discrepant medication reviews and medication management challenges. This pilot study lacked a control group; although members of the interprofessional team valued the pharmacist-led medication reconciliation in semistructured interviews, it is possible that members of the nephrology team may have identified these medication errors during their own respective visits. We did not report on patient-centered outcomes, such as health-related quality of life, that have been negatively associated with medication burden.[11,14] Retrospective review for changes in care process was completed through chart review, which may not have shown unsuccessful attempts to taper or change medications. Although pharmacy residents communicated with providers frequently, they did not contact providers to understand why pharmacy resident recommendations were not implemented.

Conclusion

The addition of pharmacy residents to an interprofessional nephrology clinic model led to the detection and resolution of hundreds of medication-related problems. The collaboration of the interprofessional team yielded changes in the care process and is a valuable model for caring for older adults with nondialysis kidney disease. Pending cost-benefit analysis, resources may be allocated to allow for clinical pharmacists to be embedded within interprofessional care teams to further improve how we care for older adults in subspecialty settings and to allow for further study of outcomes related to the financial and clinical value of pharmacists in these settings.

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Key Points

Background:

- Pharmacy residents were embedded in an interprofessional nephrology clinic to conduct medication reconciliation for targeted older high-risk patients with nondialysis kidney disease and complex medical conditions.

Findings:

- Through 118 medication reconciliation visits with 87 unique patients, pharmacy residents identified 344 medication discrepancies and 301 drug therapy problems (~4 per patient), resulting in 398 changes in care process.
- All members of the interprofessional team strongly agreed that patients and staff benefited from the pharmacy resident involvement within the nephrology clinic.

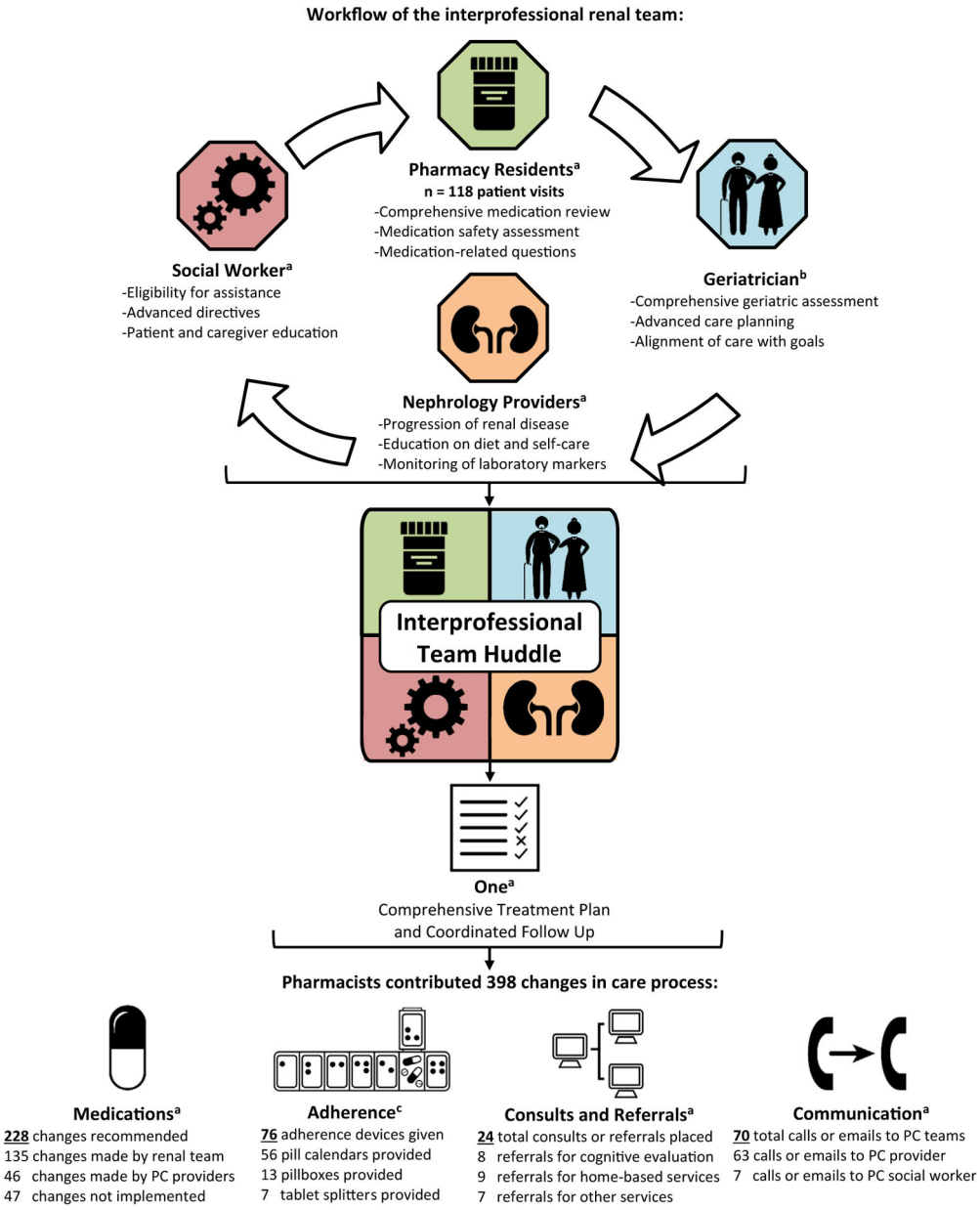

Figure 1.

A schematic illustration of the interprofessional clinic process, team member roles, and resulting changes in the care process due to the pharmacy residents' interventions. The interprofessional team consisted of a geriatrician, 2 pharmacy residents, a social worker, and nephrology providers. The pharmacy residents completed 118 medication reconciliation visits for targeted patients. Patients had the option to meet with the geriatrician and social worker as needed. After all individual visits were completed, the interprofessional team huddled to create a comprehensive treatment plan and coordinate follow-up. After retrospective review, the pharmacy residents contributed 398 changes in care process: 228 medication-related recommendations, 76 adherence devices, 24 consultations or referrals, and 70 telephone calls or e-mails to primary care (PC) teams. [a] Images by Bakunetsu Kaito

from the Noun Project. [b] Image by Marie van den Broeck from the Noun Project. [c] Image by Michael Thompson from the Noun Project.

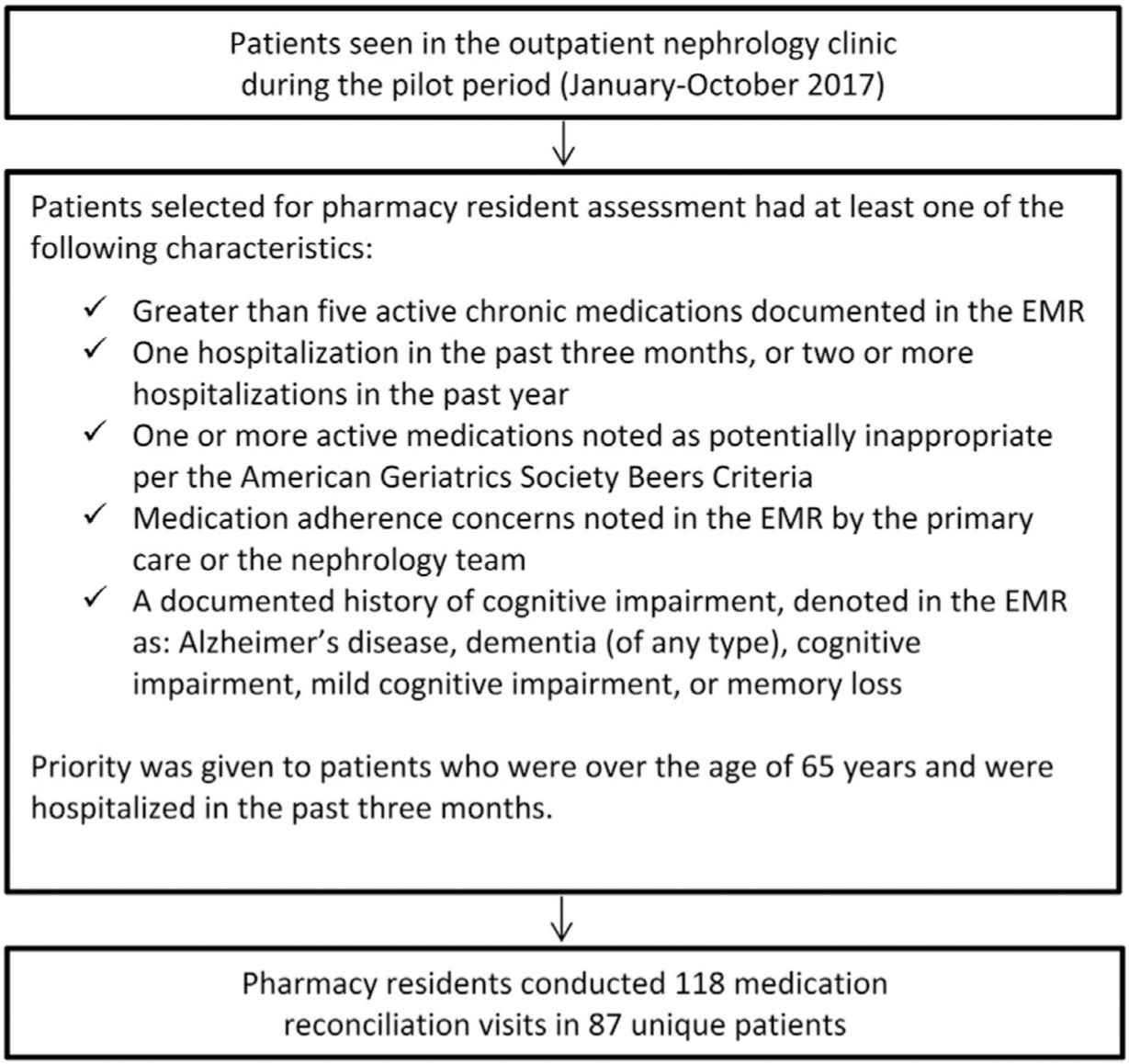

Figure 2.

A diagram of the pharmacy resident's method for identifying clinic patients for medication reconciliation. Each week, the pharmacy residents reviewed the charts of scheduled patients with the use of the electronic medical record (EMR), targeting patients with the characteristics described within the figure. Patients were also referred to the pharmacy residents by the interprofessional team as needed. Before or after their visit with the nephrology provider, targeted patients were offered a visit with a pharmacy resident to review their medications.

Table 1

Characteristics of patients seen by pharmacists (n = 87)

Characteristic	n (%)
Age, y, mean ± SD	73 ± 10
Male	84 (97)
Race	
White, non-Latino	68 (78)
Black, non-Latino	15 (17)
Other or not specified	4 (5)
CKD stage by eGFR (mL/min/1.73m^3)	
I, eGFR > 90	1 (1)
III, eGFR ≥30–59	25 (29)
IV, eGFR ≥15–29	42 (48)
Nondialysis V, eGFR < 15	10 (12)
Seen for non-CKD-related renal condition[a]	9 (10)
Comorbid conditions[b]	
Hypertension	74 (85)
Dyslipidemia	70 (80)
Diabetes mellitus type II	51 (59)
Clinical ASCVD[c]	44 (51)
Obesity	32 (37)
Depression	21 (24)
Heart failure	19 (22)
Atrial fibrillation	16 (18)
Posttraumatic stress disorder	15 (17)
Asthma or COPD	15 (17)
Cognitive impairment[d]	14 (16)
Existing diagnosis, n	8
New diagnosis resulting from nephrology visit, n	6
Number of medications	
4–10	12 (13)
11–15	41 (47)
16–20	17 (20)
> 20	17 (20)
Patients with medication adherence issues	33 (38)
Number of prescribers in 1 year, mean ± SD	11 ± 6

Abbreviations: ASCVD, atherosclerotic cardiovascular disease; CKD, chronic kidney disease; COPD, chronic obstructive pulmonary disease; eGFR, estimate glomerular filtration rate.

[a] Included idiopathic membranous nephropathy (2), partial nephrogenic diabetes insipidus (1), poorly controlled hypertension (2), acute kidney injury (2), and proteinuria (2).

[b] Identified with the use of patient “problem list” in the electronic medical record.

[c] As defined in the 2018 AHA/ACC guideline.[55]

[d] Consisted of mild cognitive impairment (n = 6), vascular dementia (3), dementia (2), memory loss (2), and cognitive impairment (1).

Table 2

Pharmacist findings on medication reconciliation

Characteristic	n (%)
Medication discrepancies	344
Omitted drug	86 (25%)
Previously stopped medication	65 (19%)
Patient not taking as prescribed	55 (16%)
Incorrect or missing dose	46 (13%)
Incorrect frequency	38 (11%)
Additional drug	34 (10%)
Duplicate therapy	17 (5%)
Incorrect drug	3 (1%)
Mean: 2.9 discrepancies per visit	
Drug therapy problems	301
Potentially inappropriate medication	106 (35%)
Potential of actual adverse drug reaction	81 (27%)
Adherence issue	42 (14%)
Unnecessary drug therapy	27 (9%)
Dose too high	15 (5%)
Needs drug therapy	12 (4%)
Dose too low	9 (3%)
Needs different drug product	9 (3%)
Mean: 2.6 drug therapy problems per visit	
Anticholinergic medications[a] identified	46
Inappropriately dosed medications[b]	4
Gabapentin	2
Allopurinol	1
Metformin	1
AGS Beers criteria[c] medications identified	99
Long-term use of PPIs in low-risk patients[d]	33 (34%)
Benzodiazepines	12 (12%)
Opioids for chronic noncancer pain	11 (11%)
Nonbenzodiazepine sedative hypnotics	9 (9%)
Alpha-blockers for BP management	8 (8%)
Diphenhydramine	5 (5%)
Use of scheduled oral NSAIDs	5 (5%)
Oxybutynin	4 (4%)
Tricyclic antidepressants	4 (4%)
Skeletal muscle relaxants	3 (3%)
Non-DHP CCBs for BP management in HFrEF	2 (2%)
Doxepin > 6 mg/d	1 (1%)

Characteristic	n (%)
Hydroxyzine	1 (1%)
Paroxetine	1 (1%)

Abbreviations: AGS, American Geriatrics Society; BP, blood pressure; HFrEF, heart failure with a reduced ejection fraction; CCBs, calcium channel blockers; DHP, dihydropyridine; NSAIDs, nonsteroidal antiinflammatory drugs; PPIs, proton pump inhibitors.

[a] Based on the Anticholinergic Risk Scale.[53]

[b] Medications were inappropriately dosed based on package insert and patient's renal function.

[c] American Geriatrics Society 2015 Beers Criteria Update Expert Panel.[54]

[d] Per the AGS Beers criteria, long-term use of PPIs is considered to be appropriate in certain high-risk patients. Patients noted here did not meet the criteria for high-risk patients and therefore, per the Beers criteria, their use of long-term PPIs was inappropriate.[54]