Patient Partnerships to Improve Safety in the Clinic Setting:

Creating an accurate medication list through a patient-centered approach

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ABSTRACT

***Purpose**: To evaluate the efficacy of patient-centered strategies implemented in a community-based setting to improve the accuracy of the medication list in the outpatient setting.*

***Scope:** Creating an accurate medication list is the first requirement in medication reconciliation, requiring both patient and provider participation. Inaccurate medication lists in the outpatient setting can lead to significant adverse outcomes.*

***Methods:** A quasi-experimental trial using two waves of cross-sectional data from patients aged 55 years or older conducted in five Aurora healthcare clinics in Walworth County, Wisconsin. Interventions included education, personal medication lists, and medication bags. The primary outcome measure was the rate of accurate medication lists in the intervention clinics with a comparison group of 68 clinics.*

***Results**: After disseminating over 16,600 medication lists and 7,800 medication bags at over 80 educational programs, the rate of accurate medication lists increased from 55% to 72% ($p < .001$). This was significantly better than the comparison group ($p < .001$). The patient-level difference was confirmed by a more conservative mixed-model hierarchical analysis ($p < .034$). A community-based initiative providing tools and resources for patient engagement can improve the accuracy of the outpatient medication list.*

***Key words:** patient-centered care; medication reconciliation; accurate medication list*

PURPOSE

The purpose of this study was to evaluate the efficacy of patient-centered strategies implemented in a community-based setting to improve the accuracy of the medication list in the outpatient setting. Specific project objectives included:

- Creation of a patient safety partnership council for five outpatient clinics in Walworth County, Wisconsin
- Develop strategies created by the council for patients and providers aimed at improving medication list accuracy in the clinic medical record
- Implement and disseminate the strategies and tools among patients and providers
- Assess the accuracy of the medication lists
- Measure the impact of the project on patients, providers, council members, and the community
- Disseminate the lessons learned from the project, including tools and interventions that were effective in improving the accuracy of the medication list

SCOPE

Medication safety is a major concern to both patients and providers as the rate of drug use continues to grow among Americans. Over 60% of US adults aged 65 or older in the ambulatory setting take at least five different medications per week, with 15% taking at least 10.[1] Though medication regimens requiring multiple drugs may be clinically appropriate, proper medication management by providers and patients is essential to prevent errors and adverse drug events (ADEs). The reported rate of medication errors and ADEs varies widely, depending on the care setting and the methods used to measure them, with growing evidence that errors and ADEs are common on the ambulatory setting.[2,3] The older adult population is at high risk; individuals 65 years and older were 2.4 times more likely to sustain an ADE and seven times more likely to be hospitalized than younger patients were.[4]

Improving the safety of medications requires participation of and interventions for both providers and patients. A key strategy recommended by national and international patient safety experts is to engage patients in the medication process through a collaborative relationship with their provider.[5, 6,7] Providers can promote this by providing patient-centered care that includes maintaining effective communication; providing accurate, accessible information and education; and promoting patient self-care strategies. Research shows that patient-centered care can enhance outcomes of care, patient adherence to medication regimens, chronic disease outcomes, and patient satisfaction.[6, 8, 9, 10] Engaged, active patients who are provided tools and support for self-management of their medications are linked to better health outcomes.[6]

The process recommended for providers to utilize as a mean of preventing medication errors is called medication reconciliation.[6] The first step in medication reconciliation is verification: obtaining a complete, accurate list of the medications that a patient is taking and comparing this to the list documented in the medical record.[6] The few studies conducted in the outpatient setting have identified that significant discrepancies exist in the medication list (defined as inconsistency or lack of agreement between the provider medication list and what the patient is taking, based on comparison between the medical record and the patient's medication list and/or

medication bottles).[11, 12, 13] An inaccurate medication list can lead to significant adverse events.[13]

Though both patient-centered care and medication reconciliation are strongly recommended, few studies have described how to implement these in the outpatient setting and what the impact is on creating an accurate medication list. The goal of this project was to develop and implement patient-centered strategies to improve the accuracy of the medication list. To assist in identifying relevant strategies for patients, a community-based advisory council was established. Through a collaborative process involving patients, providers, and community members, medication safety tools were created and disseminated through out the community. The primary interventions focused on patient medication self-management tools; secondary interventions addressed the redesign of the medication process for providers in the outpatient setting. This study evaluated the effectiveness of these interventions by measuring the rate of accuracy in the medication lists over a 2-year period and compared to a control group of clinics. Additional qualitative measures included patient, provider, and community surveys.

METHODS

STUDY SETTING, PATIENT POPULATION

This project was conducted from July 2005 through June 2007 in five Aurora Health Care outpatient clinics Walworth County, Wisconsin. Aurora Health Care is a large, integrated health system, including 13 hospitals, over 75 clinics, 120 retail pharmacies, and a visiting nurse program. The physician staff includes approximately 650 employed and over 3,000 affiliated physicians. At the five intervention clinics in Walworth County, the targeted patients were those aged 55 years and older, seen by any of the 23 Aurora primary care providers (two Internal Medicine, 18 Family Practice and three Obstetrics/Gynecology). Efforts to engage older adults throughout Walworth County were part of the community-wide campaign. The comparison group was 68 other Aurora Health Care clinics located through out southeastern Wisconsin. At the comparison clinics, data were collected from patients seen by one of 363 primary care providers, which included 136 internal medicine, 171 family practice, and 56 obstetrics/gynecology physicians.

Support for the project was received from two partners – Consumers Advancing Patient Safety (CAPS) and Midwest Airlines.[14,15] CAPS assisted in the development and facilitation of the council, and Midwest Airlines provided expertise in consumer-engagement and marketing.

This project was reviewed and approved by the Research Subject Protection Program, the Institutional Review Board affiliated with Aurora Health Care.

DEFINITIONS

An “accurate clinic medication list” was defined as when the clinic chart medication list contained the same list of prescription medications as the patient’s list (or bag of prescription medications); that is, there were none missing on the clinic list, nor were there medications

listed that the patient was not taking. For this study, the outcome measure was having the same medications documented on both the clinic and the patient list. Dose, frequency, and route of medication were not evaluated in the measurement. The definition and measurement used in this study were based on a previously reported methodology.[16]

INTERVENTIONS

The interventions consisted of multiple components intended to encourage and facilitate patients and providers to collaborate in the medication reconciliation process. First, the project team established a patient advisory council as a structure through which providers could 'partner' with their patients and the community. The Walworth County Patient Safety Council was established in November 2005. (The methods used to establish the patient advisory council and develop the interventions have been described previously).[17] To identify specific intervention strategies, the council and project team conducted patient and provider focus groups, surveys, and interviews. This formative research identified the need for patient education and tools that would facilitate communication between the patient and their provider and foster patient self-management of their medications. For providers, interventions were directed at the assessment and redesign of the clinic workflow during the medication reconciliation process.

The patient-directed interventions developed by the council included a personal medication list (paper-based) and an insulated bag for transporting medications to their provider visits. In addition, the medication lists and bags were distributed to patients and community members through a variety of venues: clinics, retail pharmacies, hospitals, health fairs, and community organizations. Education and training on medication safety, the importance of communication with providers, and instructions on how to complete the medication list and utilize the bags were provided at various settings by council members and the project team.

The provider interventions included education on medication reconciliation and patient-engagement; an analysis of clinic workflow during the medication reconciliation process; and identification of 'best practice processes' that were most efficient and effective toward achieving an accurate medication list.

DATA COLLECTION METHOD

The outcome measure used to evaluate the impact of the interventions was the rate of accurate medication lists in the five intervention clinics. Accuracy of the chart medication list was measured during two data collection periods, baseline and post-intervention. Targeted patients included all those 55 years old and older scheduled for a visit with a primary care provider during the data collection periods. Patients were contacted prior to their appointment by a clinic staff person, who asked them to bring a list of their prescription medications (or the medications themselves) with them to their appointment. At the appointment time, the nurse (or medical assistant) interviewed the patient and compared the personal medication list (or the actual medications) that the patient brought with them to what was documented in the clinic chart medication list. (The medication lists in all of the five intervention clinics were paper based; these clinics did not have an electronic medical record at the time of the study. In the comparison group of clinics, the medication list was either paper based or electronic, depending on whether they had an electronic medical record.)

If the patient forgot to bring their medication list or their medications with them to their appointment, the patient was asked to recall the prescription medications they were taking. The staff completed a data collection tool, which included patient age; gender; whether they were taking prescription medications or not; whether the patient brought into the clinic a medication list and/or their actual medications or neither; and whether the patient used supplements, herbals, and/or over-the-counter medications. Though the procedure of reviewing medications at the time of a visit with their primary care provider was routine in Aurora clinics, the documentation of noting discrepancies between the patient list and the clinic chart medication list was only done during this measurement period. The data were scanned into a centralized database.

The qualitative data included patient focus groups, patient interviews and surveys, provider interviews and survey, and a community telephone survey. During the initial formative research, two patient focus groups of randomly selected Aurora Health Care patients from the five intervention clinics as well as from individual patient and provider interviews that were conducted between August 2005 and June 2006.[17] Post-intervention data included a survey of all patients aged 55 and older from the five intervention clinics. A provider survey was sent to physicians, nurses, medical assistants, and retail pharmacists from the five intervention clinics and the four Aurora retail pharmacies in Walworth County. In addition, a community telephone survey was used to measure the penetration of this project beyond the intended target group of Aurora patients. The sampling frame of this survey included adults aged 55 years or older, residents of Walworth County, who were not an Aurora patient within the previous year. All surveys and focus groups were developed and conducted by the project team, assisted by Aurora staff and external agencies with expertise in qualitative research.

The study was designed as a quasi-experimental, prospective, longitudinal trial using cross-sectional data for each measurement point. Individual patients were not linked across waves of data collection. Because a limited set of clinics in a specific county were targeted, a larger number of comparison sites were used to establish reliable rates for comparison.

Data were collected during two 4-week periods: pre-intervention (baseline) in September 2005 and post-intervention in March 2007. Eligible patients included those aged 55 years or older taking prescription medications and scheduled for a visit with a primary care provider during one of the data collection period. Patients were sampled within ambulatory care clinics when being seen by primary care providers. Sampling from among eligible patients was at random in order to reduce staff and respondent burden. Clinic staff (nurses and medical assistants) who reviewed the patient's personal medication list and their clinic medical record invited every other eligible patient to participate. In the intervention clinics, the clinic staff reviewed approximately 60 charts per primary care provider. In comparison clinics, sampling continued until 10 charts for each primary care provider were reviewed.

Results reported include both a descriptive analysis based on the patient as the unit of analysis and a final outcome analysis using a hierarchical model in which patients were clustered within clinics, with the clinic serving as the primary unit of analysis. These models take into account the similarities of people within clinic—the intra-class correlation. In these models, covariates

measured on the patient level (age, sex, and physician specialty) were incorporated as adjustment variables. Condition—intervention site or comparison group—was assigned and measured on the clinic level. Although individual physicians may have highly variable practice styles within a specific clinic, the physician was not the unit of analysis, as the number of charts reviewed per physician was too low for reliable statistical modeling, and participation in the intervention was based on the clinic, not on the individual physician.

Data were scanned to an ACCESS data set. Patients were excluded if they were not taking prescription medications by self-report (even if medications were listed on the clinic record) or if no medication record was found in the patient's chart. Cases with missing data on the primary outcome measures were also excluded. As indicated in Table 1, 382 (12.6%) of the 3,029 post-intervention (2007) records examined were excluded from the analysis. All statistical analyses were conducted using the Statistical Package for the Social Sciences (SPSS, version 15.01). For statistical tests, a two-tailed test was used with the rejection region set to $p = .05$.

LIMITATIONS

Several limitations were recognized in this project. Our definition of accurate medication list only required that the name of the medication was on both the clinic chart and patient medication lists. Incorrect route, dose or frequency---critical details for an accurate medication lists---were not evaluated. In addition, the measurement did not include a comparison of documented over-the-counter, herbal, or supplemental products. More than 65% of the Aurora patients surveyed self-reported use of over-the-counter drugs (2007 data not shown), so nonprescription drugs present a significant risk for problems such as drug interactions. This study did not evaluate the relationship between an accurate medication list and outcomes such as errors, adverse drug events, or medication adherence. Despite this limited definition and analysis, our results are consistent with findings previously reported, which reveal significant discrepancies between patient and provider knowledge of the medication list.[3, 11, 12, 13]

The data collection process and analysis had the potential for bias and error. Data was obtained by a variety of staff at each clinic; therefore, variability and inconsistency in the process may have occurred. Relying on patient's memory to confirm or deny their current medications may have biased the results. However, this method of measuring the accuracy of the medication lists had been conducted annually since 2004, so the clinic staff had up to 4 years of experience with this process. Data analysis at the clinic level did not account for individual physician practices. The clinic data was linked over time, but patients were not matched over time. To adjust for this, a sequential cross-sectional design was used to study outcomes within the same set of clinics.

The relationship between the interventions and the measured outcomes was not defined. Though the project provided extensive education as well as self-management tools to the target population, a direct causal effect on the improved accuracy of the medication lists could not be confirmed. Confounding variables may have influenced the results. Information directed at consumers has become readily available from other sources on medication safety.[25] Changing behaviors and practices takes time; measured results may improve as more patients adopt the use of personal medication lists. Some of the patients who received a medication list or bag may not have been seen in the clinic during the data collection period, so the findings may be more

conservative than if measured over a longer period of time. Though this study suggests that patient self-management tools are important, broader evaluation is necessary to determine which specific interventions are most effective at improving the accuracy of the medication list.

The interventions identified for the providers may not be relevant in other outpatient settings. At the time of the study, the intervention clinics used paper-based charting, not electronic medical records. The medication reconciliation processes may differ depending on differences in system issues, such as staffing patterns and technology. However, during replication efforts at some of the comparison clinics, the project team identified similar process issues regardless of level of staff or electronic charting. Though technology such as electronic medical records has great potential to reduce the risk of errors in the medication process, process issues such as medication reconciliation still need to be addressed.[26,27] As with patients, provider behavior may take time to change, and results may improve as processes change. Providers may have been influenced by other interventions than those identified by the project, including recent emphasis and education by professional organizations.[6,7] Though multiple interventions were implemented, this study did not assess the affects of each one separately; therefore, the results may not be attributed to a single intervention.

RESULTS

The Walworth County Patient Safety Council was established in November 2005. The council consisted of 11 patients (55 years and older) and 12 healthcare providers (n=4 physicians, 3 clinic nurses, 1 parish nurse, 1 retail pharmacist, and 3 community health services professionals). The council met on a monthly basis from November 2005 through June 2007 for a total of 17 meetings (excepting 3 months due to holiday and summer schedules). The mean attendance was 85%, and evaluations completed by all members after each meeting showed an approval rating of 4.5 on a 5-point scale (5 being excellent).

Formative research conducted early in the project identified barriers and opportunities for improving the medication management process, for both patients and providers. Two patient focus groups (with 22 participants), 21 individual patient interviews, and 21 provider interviews were completed. As previously reported,[17] patients identified the challenge of effective communication with their healthcare providers as a barrier, evidenced by comments such as, “I am timid about asking questions of my doctor” and “We are speaking different languages.” Some patients were not using any medication self-management tools, rationalized by one interviewee, who stated, “I don’t keep a medication list; my doctor knows what I take.” In the healthcare provider interviews, their limited time was consistently identified as a major barrier to conducting a complete medication review during an office visit. In addition, providers often complained that patients did not maintain a medication list.

Two tools were created by the Patient Safety Council to improve communication between patients and their provider regarding medications---a personal medication list and a medication bag (Figure 1). The logo ‘Partners in Safety’ was created and selected by the council with community input and was printed on both the tools for easy identification. The Partners in Safety medication list was sent by US mail to every patient aged 55 years or older, seen in any of the

five Aurora clinics in Walworth County within the year prior to August 2006. The Partners in Safety lists and bags were distributed to patients by staff (physicians, nurses, medical assistants, pharmacists) at the five clinics and through the four Aurora retail pharmacies. Formal presentations on medication safety and instructions on use of the lists and/or bags were given at over 80 community education programs with over 2,300 participants. Based on the council's recommendation, broader dissemination of the medication lists was initiated after the first 3 months of distribution. The council members, through their links with community-based organizations and social groups, provided access to the community through organizations such as Kiwanis, Rotary and Lions clubs, senior centers, health fairs, churches, and personal social gatherings. Using the PPECA model,[18] two educational programs were provided at a Walworth County public library. Every member of the council played an active role in the dissemination and education, with the top three distributors of the tools being the project coordinator (PP), one of the patient representatives on the council, and a parish nurse. Between August 2006 and June 2007, more than 16,600 Partners in Safety medication lists and 7,800 Partners in Safety medication bags were disseminated to patients and the community in Walworth County.

To address the provider issues in the clinics, a workgroup was created with representatives from each of the five clinics. Patient representatives from the council participated at the eight meetings held between April 2006 through June 2007. At these meetings, the project team leaders provided education on medication safety, medication reconciliation, and patient-centered care. Barriers and opportunities for improving the medication review process were addressed. Weekly communication between the project coordinator (PP) and staff at the individual clinics provided assistance and support. Physician education and engagement was promoted by the physician project leader (KL) through a variety of means: presentations at physician leadership and management meetings; individual physician discussions; and workshops led by content experts. Additional Aurora staff, trained in conducting work flow analysis, were brought into each of the clinics to evaluate the processes used during medication reconciliation that were most efficient and effective for obtaining an accurate medication list. Best practices identified by the evaluators included reminding patients (via reminder letters or telephone calls) in advance of their appointment to bring in their medication list or bag. This encouraged and enforced the message of patient ownership of their medication list. Those physicians who had their assisting staff (nurse or medical assistant) verify the patient's medication list prior to the actual physician encounter had more accurate lists. This allowed time for physicians to perform the reconciliation of the medication list. Physician documentation in the chart of these reconciled medications in real time (i.e., immediately after the patient encounter) was a critical step for maintaining accuracy beyond that visit. These findings were shared with staff and physicians, with strong recommendations to incorporate them into their practices.

To evaluate the impact of these interventions, the rate of accurate medication lists in the five intervention sites was measured and compared to the 68 other Aurora clinics. Of the total 6,242 charts reviewed at all Aurora clinics in both the baseline and post-intervention periods, 845 were ineligible based on the exclusion criteria. Table 1 summarizes the characteristics of the eligible patients interviewed in the intervention and comparison groups for both baseline and post-intervention periods. There were statistically significant differences between the intervention and the control group on age and physician specialty. The intervention sites served an older population and had a higher percent of visits with family practice physicians than did the

comparison sites. These variables were subsequently used as adjustment variables in the hierarchical models.

The priority patient populations addressed in this project included the elderly and women. All patients who were interviewed, participated in focus groups, and/or had their medication lists evaluated were age 55 years or older. As noted in Table 1, the mean age of the patient populations studied during the accurate medication list measurement ranged from 69 to 73 years. Women made up 59% to 65% of the patient population measured during the data collection. Ethnicity and race information was not collected; however, the community estimates of ethnic breakdown remained the same in Walworth County. Based on these demographics, it is estimated that, of the total 1,190 patients interviewed in Walworth County over the course of the 2-year project,77 Latinos and 12 African Americans participated.

Table 2 summarizes the rate of accurate medication lists measured in the intervention and comparison clinics at baseline and post-intervention times. The aggregate rate of accurate medication lists in the five intervention clinics at baseline was 55 % (328/596). The baseline rate of accurate medication lists in the comparison group was 63% (1,366/2,154), statistically higher than in the five intervention sites ($p < .001$, Fisher's exact test). The post-intervention rate of accurate medication lists was 72% (429/594) in the intervention sites, a 17-percentage-point improvement from the baseline rate. In the comparison group, the rate of accurate medication lists was 56% (1,142/2,053) post intervention. This was statistically lower than their baseline rate and was significantly lower than the rate at intervention sites ($p < .001$). Thus, the two groups started with a significantly lower medication list accuracy rate in the intervention sites; by post-intervention time, the intervention clinics had improved and surpassed the rate of the comparison clinics, which decreased their accuracy rate.

The results of the more conservative mixed model hierarchical linear analysis are summarized in Table 3. In this analysis, both the patient-level and the clinic-level data are used to adjust for between-group differences and to account for the intra-class correlation of individuals within clinics. Because the same individuals at both points in time were not measured, this model used only the data collected in 2007. The baseline accuracy rate was statistically less for the intervention clinics than in the comparison clinics. The mixed model results show a 15-percentage-point difference in accuracy between the intervention and comparison sites, after adjusting for the covariates in the model. The higher rate of medication list accuracy for those patients seen in the intervention sites relative to the comparison sites was significant at $p = .034$.

The rate of utilization of personal medication lists and bags by patients, measured in both the intervention and comparison sites, is described in Table 4. The use of any personal medication list increased significantly in the intervention sites, from 51% at baseline to 61% ($p < .001$). Those bringing in their medicines (i.e., use of a medication bag) decreased in the interventions clinics from a baseline rate of 41% to a post-intervention rate of 25% ($p < .001$). In the comparison group, there was no significant change in the rate of utilizing personal medication lists (49% at both data collection periods), but the rate of medications brought into the clinics did increase (from 28% to 35%, $p < .001$). Comparing the intervention sites to the comparison group, there was a greater rate of personal medication lists in the post-intervention period (61% in the intervention sites, 49% in the comparison group, $p < .001$). There was no difference in the

post-intervention measures of who brought in neither a medication list nor their actual medications (23% vs. 24%).

Use of the project-specific Partners in Safety medication list, measured only in the intervention clinics during the post-intervention period, was 31% (see Table 4). At the intervention clinics, 13% of the patients brought in the Partners in Safety medication bag, and 7% brought in both their medication list and a medication bag. Thus, about half the patients at the intervention clinics who brought in a medication list or bag of medications used the project-specific materials.

The post-intervention surveys conducted among patients, providers, and the community supported the quantitative results. Of the 7,724 surveys mailed in May 2007 to Aurora patients aged 55 years and older 6 months after they were sent the medication list, 1,577 completed and returned the forms (response rate 20.4%); 76% of the respondents had documented their medications on the list, and 73% has brought this list to their physician appointment. Also, 69% felt the personal medication list made it easier to talk with their provider about their medications. Only 23% used the medication bag to transport medicines to their clinic visits. Comments from surveyed patients included “The list is a very good idea. Although I had prepared a list for my 91-year-old mother, I had not thought of doing one for myself.” “Having the list of medicines helps me remember to take information to my doctor's appointment….so I can discuss it with my doctor. Being visually impaired, the bag helps me keep my medications in one place and allows me to take it easily when I go visit my family.”

The provider survey was sent in April 2007 through the Aurora email system to 92 providers in Walworth County, including physicians, nurses, and retail pharmacy staff; 52 completed the survey, for a response rate of 57%. Of those responding, 85% (44/52) agreed or strongly agreed that there was a more accurate medication list on file because of the personal medication list, whereas only 54% (28/52) felt the medication bag improved the accuracy. Though 96% (50/52) of the respondents agreed or strongly agreed that the list facilitated communication, 12% felt the bag did not improve communication. Comments from the providers regarding the project included the following: I think patients are more aware of how this is a partnership tool for their health. It has increased awareness with the patients of the importance of sharing all their meds with all their physicians and pharmacists. This project caused patients and healthcare providers to examine medication administration and its effects on patient health and safety. [This was] a collaborative effort that empowers patients to inspire providers to achieve best practice standards.

Sixty Walworth County residents participated in the telephone survey in April 2007 to measure the penetration of the project into the community beyond those members who were patients in the Aurora system. Of these 60 community members, 13.3% (8/60) had received a Partners in Safety medication list, and 5% (3/60) had been given a medication bag. After applying the response rate of 13% to the approximately 10,000 Walworth County residents aged 55 years or older who were not Aurora patients,[19] up to 2,600 community members may have been affected by this project.

DISCUSSION

Through a collaborative process involving patients and providers, interventions were developed and implemented at the community level to engage patients in the medication process and foster patient-centered care among ambulatory care providers. By using tools to facilitate patient medication self-management, which included personal medication lists, bags, and education, the rate of accurate medication lists improved by 17% in five outpatient clinics. The personal medication list was the preferred self-management tool by both patients and providers, as evidenced by the rate of patient use of a medication list and by providers' perception of what improves the accuracy of their chart list. In contrast to the comparison group, the higher rate of accuracy in the intervention clinics suggests that the various interventions contributed to the observed improvement.

This project identified the need to address both patient and provider issues and the importance of community involvement, which is consistent with national and international recommendations.[6,7] Patients need to understand the inherent risks due to the complexity of the medication process, but they also need tools to facilitate greater self-management. Education and training need to be provided and available in easily accessible formats. Trained community leaders can bring the message and education about medication self-management to older adults in a familiar setting using community-based organizations and social networks. The Walworth County Patient Safety Council did not pursue technologic interventions, in part due to costs but also recognizing that many older adults are not comfortable with computer-based resources. Although the personal medication lists were utilized at a greater rate and preferred more than the medication bags, a variety of self- management tools are necessary to meet the individual needs of patients (i.e., visual impairment). Our findings are consistent with previous research, which found that the more effective interventions for improving medication adherence include a variety of components.[20]

Just as patients need education and raised awareness of their role in medication reconciliation, providers need to understand the complexity of this process from all perspectives. Creating an accurate medication list through a collaborative, patient-centered process requires participation by patients that is reinforced and encouraged by their providers. This should not be interpreted as merely shifting the responsibility onto patients to manage their medications.[21] The provider role in patient-centered care includes identifying appropriate tools for patients to utilize and offering effective education and resources.[6] The primary focus of this study was on creating patient self-management tools, but, without the positive reinforcement from providers, patients feel that their participation is neither necessary nor valued. One patient representative on the council expressed frustration after he brought all his medications to three clinic visits and the staff never asked to check them. In order for clinic staff to adopt new approaches to the medication reconciliation process, their system-based issues---clinic workflow, time availability, staff roles---must be addressed. The 'best practices' identified in this study for improving the medication reconciliation process are being evaluated for replication through out all Aurora clinics.

The most significant lesson from this project was the important role of community-based and nontraditional partners in creating a collaborative relationship between patients and providers. This study expanded the concept of patient partnering to a broader scale in both the structure and the process used. The Walworth County Patient Safety Council exemplified the type of partnership relationship between patients and providers that defines patient-centered care but on a community scale. Including healthcare providers such as retail pharmacists or parish nursing and social service groups as additional partners facilitated the dissemination of a consistent message heard by a wide audience of patients. Partnerships with CAPS and Midwest Airlines provided the expertise and guidance for engaging consumers in the development of both the message and the tools. The process used---establishing a collaborative structure between the research team and the community, including representatives affected by and concerned with medication safety issues, and involving them in all aspects of the research process with the goal of improving the health of the community---were consistent with the principles of community-based participatory research.[22,23] As others have suggested,[24] applying public health concepts, theories, and interventional methods such as CBPR and social marketing may be more effective than the traditional medical model for addressing the challenge of medication safety. By creating the educational message and tools for medication self-management in a culturally acceptable format and then disseminating them through community-based organizations, the community itself became empowered to address the public health burden of medication safety that affects everyone, directly or indirectly. This community engagement, led by formal and informal leaders, was evidenced by the measure of penetration of the project beyond just Aurora patients. Furthermore, in February 2007, the Walworth County Board presented a Certificate of Accomplishment to the Patient Safety Council "in recognition of their efforts to improve medication safety through the unique model of a partnership between medical providers and their patients." The measured success of the Walworth County project suggests that community engagement may be a significant component of the patient-provider partnership for medication safety.[6]

CONCLUSIONS

Patient-centered care strategies, applied at the community level, are associated with significant improvement in the accuracy of the medication list in the outpatient setting. Both patient and provider interventions are necessary to facilitate a collaborative approach to medication management. The methods and tools used in Walworth County are available in two toolkits, accessible through the CAPS website at www.patientsafety.org. Though a perfect accurate medication list cannot be attributed to a single intervention or tool, addressing medication safety as a public health problem may be an effective approach. As Americans continue to consume medications with a voracious appetite, humans (both patients and providers) will continue to err. Using a collaborative approach involving education, accountability, and technology, consumers and providers together can tackle the public health challenge of medication safety.

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Table 1: Patient Characteristics for Intervention Clinics versus Comparison Clinics, Baseline and Post-Intervention Periods

	Intervention Clinics			Comparison Clinics			P value*
Characteristics	Baseline (n = 596)	Post (n = 594)	P (within group change)	Baseline (n = 2,154)	Post (n = 2,053)	P (within group change)	P (Baseline & Post)
Number of clinics	5	5	na	67	68	na	na
Mean number of patient participants per clinic	119	119	na	32	29	na	na
Age, mean (std. dev.) y	73.1 (9.8)	72.0 (10.5)	.07	70.6 (9.9)	69.5 (10.0)	<.001	<.001 <.001
Percent female	65%	59%	.074	64%	63%	.412	.801 .139
Percent of patients seen by family practice physician	74%	80%	.022	46%	47%	.453	<.001 <.001

*P value: intervention clinics versus comparison clinics, difference at baseline and post-intervention periods

Table 2: Rate of Accurate Medication Lists at Baseline and Post-Intervention Periods, with Patient as Unit of Analysis

Sites	Baseline	Post Intervention	P (within group change)
Intervention Clinics, No./Total (%)	328/596 (55%)	429/594 (72%)	<.001
Comparison Clinics No./Total (%)	1366/2154 (63%)	1142/2053 (56%)	<.001
P (between group difference)	< .001	<.001	

Table 3: Estimated Marginal Means for Rate of Accurate Medication List (Post-Intervention Results), based on Mixed-Model (Hierarchical) Regression*

	Estimated Mean (%)	Standard Error
Intervention Clinics	69.9	6.5
Comparison Clinics	54.9	**2.2**

*Marginal means estimated for clinic as unit of analysis with patient nested within, adjusting for individual patient level age, sex, and family medicine specialist as provider.

The difference between conditions significant at p = .034

Table 4: Rate of Patient Utilization of Personal Medication Lists and Medication Bags at Baseline and Post-Intervention Periods

	Intervention Clinics (n=586)		Comparison Clinics (n=2,040)	
	Pre	Post	Pre	Post
Brought Personal Medication List	51%	61%	49%	49%
Brought Medications	41%	25%	28%	35%
Brought Neither	18%	24%	28%	23%
Brought Both*	10%	10%	4%	7%
INTERVENTION CLINICS ONLY				
Used Partners in Safety Medication List	31%			
Used Partners in Safety Medication Bag	13%			
Used Both*	7%			
Used Neither of the Project Materials	64%			

*Percentages also included in entries above for use of lists and bringing medications.

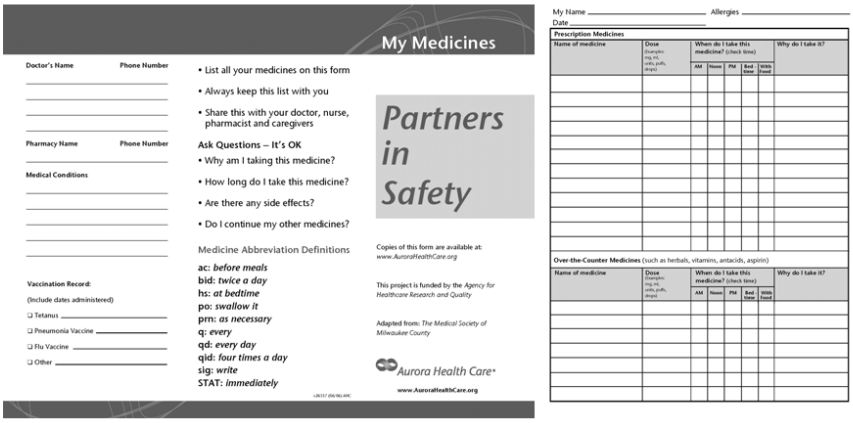

Figure 1: Partners in Safety Medication Bag and Medication List