Retrospective Chart Review: Patients' Characteristics Associated with Medication Reconciliation in a Home-Based Primary Care Practice

Pam Hiransomboon-Vogel

Oregon Health & Science University

The Institute of Medicine (IOM) has estimated that approximately 7,000 people die each year as a result of medication errors (Kohn, Corrigan, & Donaldson, 2000). Errors can occur at anytime during the medication-use process and in any care setting. There are multiple sources of medication errors, such as during prescribing, dispensing, self-administration, and monitoring (Institute of Medicine, 2007). Medication discrepancy resulting in adverse drug events (ADEs) often occurs in the prescribing and monitoring phases of the medication use process (Thomsen, Winterstein, Sondergaard, Haugbolle, & Melander, 2007). Inaccurate medication lists in an ambulatory setting cause a larger number of fatal ADE (one in 131 outpatient deaths) compared to a hospital setting (one in 854 inpatient deaths) (Kohn et al., 2000).

Studies have found that medication reconciliation reduces medication discrepancies, decreases medication errors, and potentially dangerous medication interactions (Boockvar, Carlson LaCorte, Giambanco, Fridman, & Siu, 2006; Gleason et al., 2004; Nickerson, MacKinnon, Roberts, & Saulnier, 2005; Schnipper et al., 2006). According to the Joint Commission, medication reconciliation is "a process of comparing a patient's medication orders to all of the medications that the patient has been taking" (The Joint Commission, 2006). The reconciliation is done to avoid medication errors such as dosing errors, omissions, duplications, or drug interactions. It involves developing a complete and accurate list of all medications a person is currently taking, updating the list, and repeating the reconciliation process whenever medication changes are made (The Joint Commission, 2006).

Significant attention has focused on the medication reconciliation process as a way to prevent medication errors and misuse across different health care settings. Medication reconciliation during care transition is becoming a standard practice during hospital admission

and discharge process as one method to decrease medication errors. For instance, when a patient visits an emergency room or is admitted to a hospital, all medications should be reconciled.

Many studies have focused on the medication errors in acute care settings and in care transition periods. There is limited examination of medication discrepancies in patients who are not in a care transitional state. There is a gap in the literature relating to patient factors associated with medication discrepancy. The focus of the national patient safety movement has been on healthcare providers in the hospital setting. The role of the homebound patient (as defined as a person who finds it taxing to leave their home without assistance) in the medication management process had also received limited investigation (Field, Mazor, Briesacher, Debellis, & Gurwitz, 2007; Smith, Coleman, & Min, 2004).

The process of medication reconciliation could reveal medication discrepancy, thus, reducing the potential for medication errors and harmful ADEs (Boockvar et al., 2006; Nickerson et al., 2005). This Clinical Inquiry Project aimed to identify the association between patient characteristics and uncompleted medication reconciliation (medication non-reconciliation). Because the process of medication reconciliation potentially reveals and reduces medication discrepancy, patients with uncompleted medication reconciliation are at greater risk for medication errors. Homebound patients are at risk for poorer health outcomes due to limited health care access and resources (Ornstein et al., 2011). However, the homebound patient population as a whole is a heterogeneous group with various subsets of characteristics such as age, living arrangement, and medical complexity. This Clinical Inquiry Project gave insight about the different patients' characteristics and their relationship to the medication reconciliation process. Clinical implications, recommendations for future practice improvement and the Doctor of Nursing Practice (DNP) role were also explored.

Population Affected

The number of homebound older adults is growing due to the declining use of nursing homes and a growing aging population (Olsan, Shore, & Coleman, 2009). With a high prevalence of chronic and end-stage diseases, older homebound adults have a significantly higher rate of Emergency Department (ED) utilization and hospitalization compared to their age-matched non-homebound peers (Desai, Smith, & Boal, 2008). In addition, homebound patients are particularly susceptible to poor outcomes due to complex treatment plans, limited resources due to low socioeconomic status, and a high rate of cognitive impairment (Ornstein et al., 2011). Risk factors for being less knowledgeable about one's medications include being a male, being older than 70 years old, having eight years of education or less, and requiring assistance with medication administration (Marks, Schectman, Groninger, & Plews-Ogan, 2010).

Epidemiology

The epidemiology of ambulatory care ADEs differs from that of inpatient care events. Patients are responsible for both obtaining and administering their medications. Furthermore, detection and tracking of ADEs in the outpatient setting is more challenging due to the use of multiple facilities in patient care (Tache, Sonnichsen, & Ashcroft, 2011). Thomsen et al. (2007) found the median incidence of 14.9 (range 4.0-91.3) ADEs per 1000 person-months in ambulatory settings. Bedell et al. (2000) reported a 76% medication discrepancy rate in a combined cardiology and internal medicine outpatient practice. ADEs are more prevalent in the population over 65 years old; up to 30% of hospital admissions in the elderly population are related to ADEs (Tache et al., 2011).

Purpose

The purpose of this project was to identify homebound patients who are at risk for medication non-reconciliation with the ultimate goal of decreasing adverse events related to medication errors and improving health outcomes among homebound patients. The specific aim was to determine patients' characteristics that correlate with medication non-reconciliation. The process of medication reconciliation could reveal medication discrepancy in this high-risk population.

Clinical inquiry question:

What are the patients' characteristics associated with potential medication discrepancy as measured by the lack of routine medication reconciliation (medication non-reconciliation) in a home-based primary care practice?

Review of the Literature

The current state of literature documenting the medication discrepancy phenomenon was reviewed. A literature review of medication discrepancy phenomenon was performed from June 1, 2012 to November 15, 2012. The following databases were searched: Ovid Medline (1946-July 2012), CINAHL (1981-July 2012), and the Cochrane Database of Systematic Reviews. The following search terms were used: medication errors, medication reconciliation, ambulatory care, medication list, medications management, and adverse drug event. Limits on the search included: English language. Literature retrieval was supplemented by searching through the references of articles that were deemed relevant.

Medication Discrepancy Phenomenon

The Institute of Medicine (IOM) report: *To Err is Human: Building a Safer Health System* identified medication errors as the most common type of medical error and attributed

them to 7,000 deaths each year (Kohn et al., 2000). The Institute of Medicine proposed that medication errors are grossly underreported (2007). It was also noted that heterogeneity of the literature was caused by the variation in methodologies used to identify errors. The incidence rates found in the literature depended on the specific detection method used (IOM, 2007). For instance, medication error rates can be reported in varying ways: errors per order/dose/opportunity, errors per 1,000 patient-days, and errors per 1,000 patient admissions. Similarly, rates of preventable ADEs can be presented in various ways: preventable ADEs per 1,000 patient-days and per 1,000 patient admissions (IOM, 2007). The term medication discrepancy, medication error, and adverse drug event (ADE), have been used interchangeably in both medical and nursing literature. The IOM adopted the definitions published by Bates et al. (1995) which defined "medication error" as any error occurring in the medication use process and "adverse drug event" as any injury attributed to medication error. Medication discrepancy found during the reconciliation process that lead to a change in medication orders was also considered a medication error (Gleason et al., 2010).

Medication errors in the hospital setting have been the focus of research for quite some time (Meredith et al., 2001). The most commonly cited reasons of medication errors in the hospital setting include lack of provider's knowledge about the drug and patient, error of omissions, violation of standard practice, transcription errors, faulty interaction with between disciplines, incorrect dosing, equipment, and preparation issues, and a lack of standardization (Leape, Epstein, & Hamel, 2002). Errors in physician prescribing have been cited as the major source of all medication errors (Bates et al., 2005).

There are national patient safety movements to help ensure medication safety in the hospital setting. For instance, the National Quality Forum identified practices that should be

adopted to improve patient safety that include pharmacists' active involvement in the medication-use process, the avoidance of verbal medication orders, the standardization of packaging, the identification of high-alert medications, and the use of standardized abbreviations (National Quality Forum, 2009). Furthermore, reducing medication errors related to medication reconciliation has been a Joint Commission safety goal since 2005 (National Quality Forum, 2009). In 2007, the Joint Commission held a summit to address the challenges associated with medication reconciliation in various healthcare settings, identifying the best practice for, and to create an opportunity to further improve the process of reconciling medications. The consensus from the summit was that the process of reconciling medications, obtaining an up-to-date medication list from the patient, and ensuring its accuracy throughout different healthcare settings improves patient safety. However, more guidance on the specifics of implementation across the care continuum is needed (National Quality Forum, 2009).

Computerized prescriber order entry (CPOE) is an increasingly common method of preventing medication errors in both hospital and outpatient settings. CPOE can effectively implement clinical decision support system and reconcile medications. However, the system is only as good as the data entered into it. CPOE implementation alone without effective reconciling strategies, are not likely to be successful in preventing medication errors (National Quality Forum, 2009).

The distinct difference between medication management in the hospital and the outpatient setting is that there are multiple systems in place to ensure the safe delivery of medications in the hospital setting, but not in the outpatient setting. Nevertheless, medication errors are still pervasive in the hospital setting, even with clinical support systems in place (National Quality Forum, 2009). In the outpatient setting, the prevalence of medication errors

and the factors that contribute to these errors are not well understood. There are fewer clinical support systems or regulations in place compared to the hospital setting. Under home health care regulations, it is required that medication reconciliation occurs upon admission to and discharge from home health service (Centers for Medicare and Medicaid Services, 2012). If patients in the outpatient setting do not receive home health care, medication reconciliation occurs according to each practice's policy and procedure, which can vary greatly.

Medication Adherence

In 2003, the World Health Organization's report shed some light on the prevalence and impact of poor medication adherence on the state of public health (World Health Organization (WHO), 2003). The report estimates adherence to long-term therapy for chronic illnesses in developed countries at 50%. The WHO defines adherence to long-term therapy as "the extent to which a person's behavior—taking medications, following a diet, and or executing lifestyle changes—corresponds with agreed recommendation from a health care provider" (2003). The report highlights poor health outcomes and increased health care costs as consequences of poor adherence to long-term therapies.

The impact of non-adherence grows as the burden of diseases grows worldwide as in the case of human immunodeficiency virus/acquired immunodeficiency disease and tuberculosis, which involves antimicrobial resistance development. In the case of chronic illnesses, poor adherence to long-term therapy compromises the effectiveness of treatment making it a serious issue in public health both from the perspective of quality of life and health care economics (WHO, 2003). Because medication non-adherence can lead to unnecessary disease progression, reduced functional abilities, and even premature death, poor adherence has been estimated to

cost approximately $177 billion dollars in both direct and indirect health care costs (National Council on Patient Information and Education [NCPIE], 2007). Intervention aimed at improving adherence would yield return not only through primary prevention (of risk factors) and secondary prevention of adverse health outcomes (WHO, 2003).

Prescribers often attribute medication errors to patients' non-adherence (Meredith et al., 2001). Non-adherence can be affected by physiological factors, such as impaired cognition, or significant health care system issues, such as insurance coverage or the lack of communication between different prescribers. The NCPIE has categorized the underlying factors for medication non-adherence as medication-related, patient related, prescriber-related, pharmacy-related, or related to federal and state policy impediments (NCPIE, 2007). A review article published in 2005 in the New England Journal of Medicine identified 12 major predictors associated with poor adherence to medication: presence of psychological problem (particularly depression), presence of cognitive impairment, treatment of asymptomatic disease, inadequate follow-up, side effects of medication, patient's lack of belief in benefit of treatment, patient's lack of insight into the illness, poor provider-patient relationship, presence of barrier to care or medications, missed appointments, complexity of treatment, and cost of medication, copayment, or both (Osterberg & Blaschke, 2005). However, adequate follow-up and ongoing communication between the provider and the patient were found to enhance adherence to treatment plan (Osterberg & Blaschke, 2005).

Medication Discrepancy and Patient Characteristics

Advanced age is consistently cited as a factor that is related to medication errors. Older adults (over 65 years of age) have a medication adherence rate of approximately 50% (Morrell,

Park, Kidder, & Martin, 1997). In the geriatric population, advanced age, multiple co-morbidities, and increased susceptibility to ADEs increase the risk of medication errors (Meredith et al., 2001). Aging affects multiple physiological aspects of metabolic processes, which include drug absorption, distribution, metabolism, and excretion of medications (Beer, Baran, & Frenia, 2000). Infrastructures within the health care system to support older adults in managing their medication regimen are insufficient. Meredith et al. (2001) estimated that between 10-30% of older adults are not taking medications as prescribed due to inaccurate information, such as incorrect dose or frequency.

Demographic variables such as gender, marital status, race, and social status, have shown limited value in predicting adherence to medication regimens (DeGeest, von Renteln-Kruse, Steeman, Degraeve, & Abraham, 1998). Caregiving arrangement and family members may reduce medication errors by influencing medication adherence (Prohaska & Glasser, 1996). However, the previous studies were not completed among the homebound population.

Poor health literacy is prevalent among seniors and is associated with poor health outcomes. However, multiple studies have shown no association between health literacy and medication discrepancy (Paasche-Orlow et al., 2006). In a recent study (n=254) that consisted of older adults recently discharged from the hospital, the researchers found that seniors with adequate health literacy have more intentional medication non-adherence whereas seniors with inadequate health literacy have more unintentional medication non-adherence (Lindquist et al., 2012). The study also found no overall association between level of health literacy and medication discrepancy. However, the recent study demonstrates that health literacy was significantly associated with the patient's reason (intentional versus unintentional) behind the medication discrepancy (Lindquist et al, 2012).

Gaps in the Literature

The search revealed a gap in the literature, in that most articles found were focused on the inpatient setting and subsequent hospital discharge. There are numerous studies focusing on the medication reconciliation process at the time of hospital admission, in the emergency department, upon discharge from the hospital to a home health agency or to patients' homes. The literature does not make a direct connection between medication non-adherence, medication reconciliation (or the lack of medication reconciliation), and medication discrepancy. There is also a significant body of literature related to pharmacists' role in medication reconciliation in an acute care setting. Overall, very few studies focused on the ambulatory care setting. Among the studies set in an ambulatory care setting, many are rooted in clinic environments. Nursing literature in the ambulatory setting seems to center around the clinic setting as well as home health specialty. No journal articles specifically addressing medication discrepancy or ADEs in a home-based primary care setting were found. Based on the literature search, the relationship between patient characteristics that are associated with medication discrepancy and the medication reconciliation process in the elderly homebound population has not been established.

In summary, the current state of literature reveals that medication errors occur across the continuum of health care. Medication non-adherence, adverse drug events, and errors can lead to increased morbidity and mortality as well as unnecessary use of health care resources. In the hospital settings, there are systems and clinical support (such as oversight by inpatient pharmacists) in place to ensure safe use of medications. However, limited resources are available to help ensure safe medication-use process in the community setting including the lack of systems or quality measures to ensure ongoing medication reconciliation. There is a gap in knowledge of patient characteristics that are associated with medication non-reconciliation in the

homebound patients. Effective interventions that deserve further examination include continuing patient assessment, ongoing medication reconciliation activities, and improved communication between providers and patients.

Advanced practice nurses are assuming a growing role in healthcare system. With the increasingly complex healthcare climate, advanced practice nurses must develop the skills to interpret knowledge quickly and effectively to benefit patients in the high demand environment of daily practice (Zaccagnini & White, 2011). This is especially true for advanced practice nurses who are doctor of nursing practice (DNP) graduates. DNP graduates have the skills to provide leadership for designing and implementing processes to evaluate outcomes of practice and systems of care (Zaccagnini & White, 2011).

Approach to the Conduct of the Project

Setting

The setting for the project was a private, non-profit organization that provides primary care services to homebound adults. A person is considered homebound if he or she is generally confined or medically restricted to his or her home and leaving home takes considerable and taxing effort (Housecall Providers, 2012a). The mission statement of the organization is; ". . . dedicated to delivering, coordinating and advocating for the quality medical care that homebound seniors and persons with disabilities need to experience healthful lives in their own homes" (Housecall Providers, 2012a) The median age of patients is 83 years old. The current patient census is about 1,300 patients. Over 47% of the patients are below the poverty level (Medicaid patients) (B. Husted, personal communication, November 1, 2012). There are 22 primary care providers (PCPs), each with various patient panel sizes. The primary care provider team consists of 17 Nurse Practitioners, three Physician Assistants, and two physicians. A full-

time panel consists of greater than 80 patients; however, some providers have up to 160 patients. Each clinician serves a certain geographical area within the city designated by zip codes. During the 2012 fiscal year, primary care providers made over 12,000 house calls (B. Husted, personal communication, November 1, 2012). Most patients have at least two chronic illnesses and rely on others for their activities of daily living needs. Patients may live in their own homes, in adult foster homes, mental health group homes, assisted living facilities, or dementia care units (B. Husted, personal communication, November 1, 2012).

In order to enroll in Housecall Providers, patients or caregivers call to request service or they are referred by their former PCPs. Patients or caregivers need to fill out a thorough patient information form. Once a patient is accepted, he or she will be assigned to a PCP. The first visit includes a complete history and physical examination as well as a review of advance directives if these have already been established, and the development of treatment plan in case of medical emergency. The goal is to have a signed Physician Orders for Life-Sustaining Treatment (POLST) or have the goal of care discussion documented for every patient. Most patients are seen once a month, more often if medically necessary. Some patients with less medical complexity are seen three to four times per year.

Primary care providers have weekly meetings to discuss organization news, practice alerts, and difficult clinical cases. The electronic medical record (EMR) was implemented in 2010 to improve patient care and is also being used to capture data for practice improvement projects (PIP) by a quality improvement specialist.

The PCPs or the covering providers document medication changes in the EMR. It is the organization's policy that medication reconciliation must be documented every 90 days and/or

with every transition of care (i.e., discharge from hospital or ED, admission or discharge from hospice etc.) (Housecall Providers, 2012b). Medication reconciliation is documented by clicking the "Reconcile" button under the history section of the encounter note (figure 1), which then would add the phrase "Medications Reconciled" to the end of the medication list included in the encounter note (figure 2).

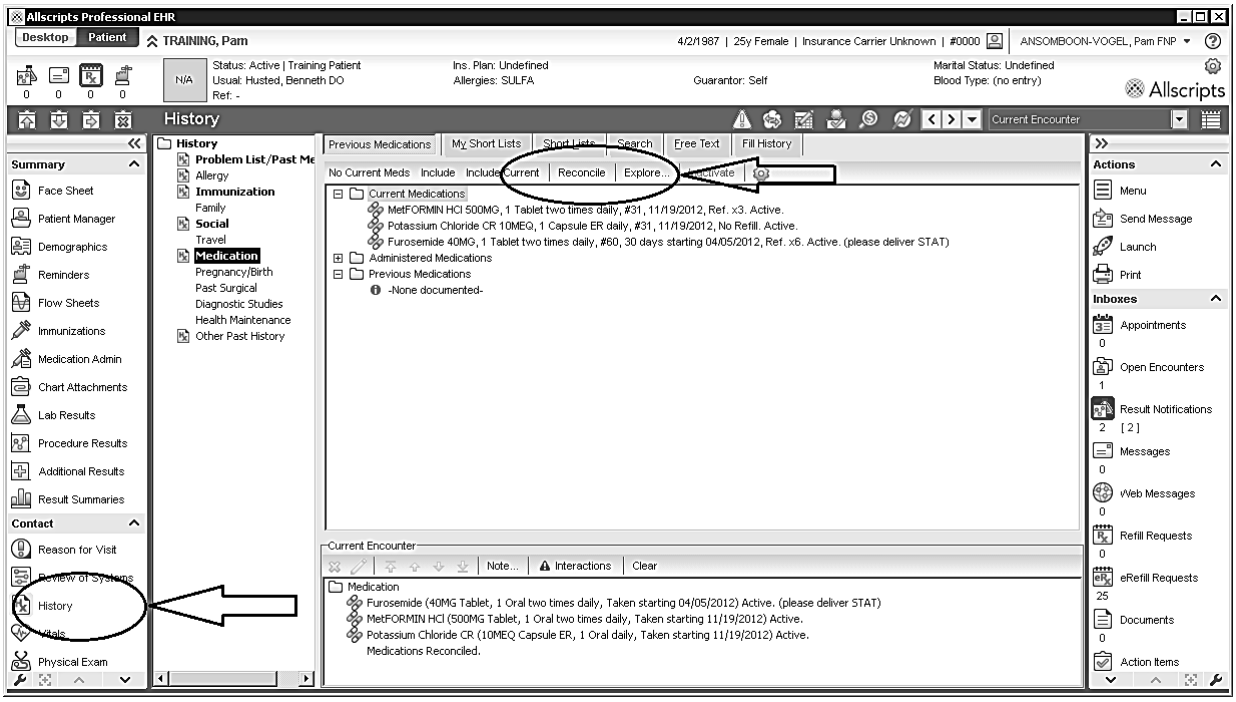

Figure 1. Screenshot showing "Reconcile" button on the EHR for PCPs to document medication reconciliation under the "History" section.

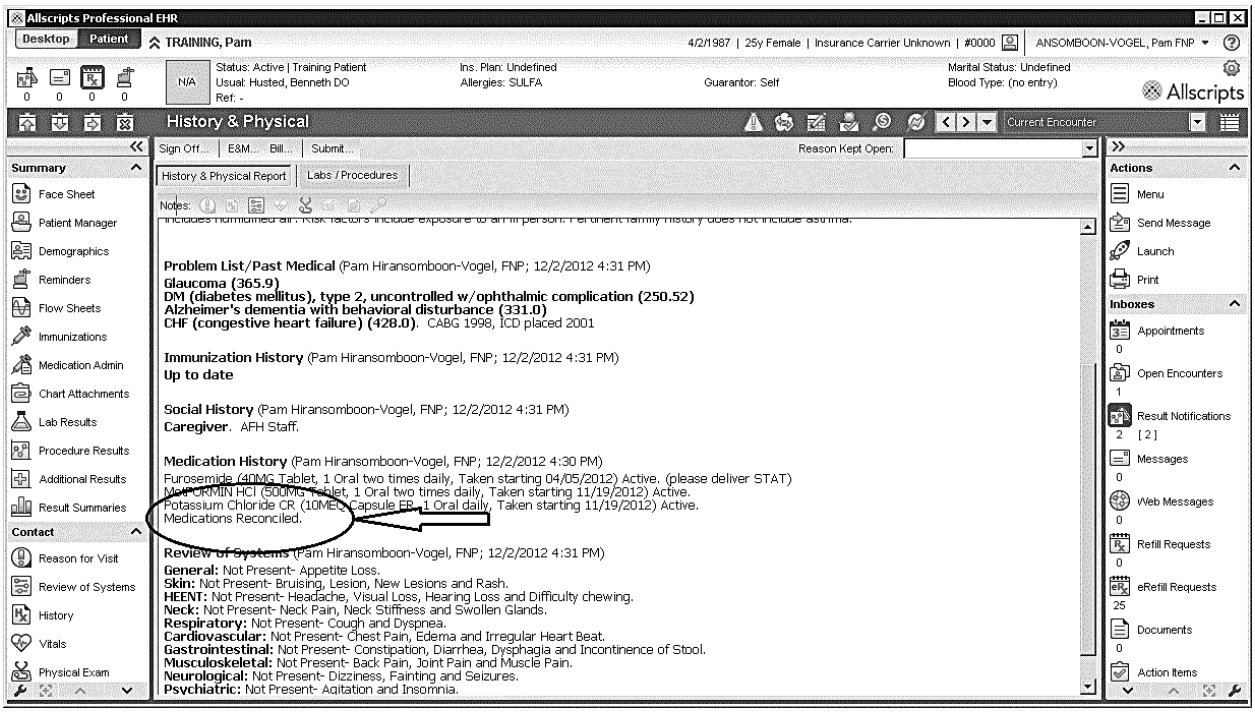

Figure 2. "Medication Reconciled" documentation in the chart note as a result of clicking the "Reconcile" button.

Organizational readiness to change

The organization's readiness to change was deemed to be good. Previous and current practice improvement projects (PIPs) prepared PCPs to be open to new ideas and innovation to optimize patient care.

Anticipated barriers, facilitators, & challenges

There were a number of driving and restraining forces that influenced the potential outcomes of the project. Primary care providers (PCPs) expressed enthusiasm about the idea of identifying patients' characteristics associated with medication discrepancy in order to gain awareness of the issue. The use of EMR was a major driving force to achieve the project's goal. The ability to access and capture data readily was facilitated by having an EMR. Because all data

were extracted from the EMR, incomplete or inaccurate documentation by the PCPs posed a challenge and a major restraining force.

B. Participants/Population

Inclusion & exclusion criteria

All patients enrolled in the organization from December 20th, 2012 to March 20th, 2013 were included. The exceptions included inactivated patients due to temporary transfer to hospitals or skilled nursing facilities, inactivated patients due to other reasons, and patients who have not been seen in the preceding 90 days on March 20th, 2013 by the PCP.

Size & rationale

Two hundred randomly selected charts were reviewed. Based on previously reported estimates of medication discrepancy rates in ambulatory settings, a sample size of two hundred provided sufficient power to conduct the proposed analyses (Gregory, Horn, & Kaprielian, 2008; Siegle, 2012).

Protection of participants

The project received an expedited review by the OHSU Institutional Review Board (IRB). In order to comply with the IRB's protocol on collection of age information, the ages for those over 89 years old were aggregated. Only the quality improvement specialist had access to complete data sets and performed descriptive statistics on the age data set. There were no other changes to the IRB-approved protocol related to data collection.

Microsoft Excel was used to create two data collection forms, which were password-protected. In order to preserve anonymity, the first form linked a unique study ID number to the

patient's ID. The quality improvement specialist selected a random sample of two hundred charts in order to create the first form. The document was kept securely at the organization and did not leave the premises. Only the student and the quality improvement specialist had access to the list.

The second data collection form was used to collect data (unique patient identifier and proposed measures) for analysis. The file was stored on the student's personal computer, which was password protected. No data entered on the computer was identified with personal information. The computer was transported securely from the organization only to the student's home and university where the student met with faculty, the methods expert, and the statistician. Data analysis was performed on the School of Nursing's computer, which was protected by password security in a locked room. Preliminary data analysis was also performed on the student's secured personal computer. When the data analysis file needed to be transferred between computers, a password-protected USB flash drive was used.

C. Proposed Measures/Outcomes

Patient characteristics included age, gender, number of active medications, type of residence, Medicaid insurance (Medicaid insurance versus no Medicaid insurance), active ICD-9 codes, and whether or not the patient had a medication reconciliation completed in the past 90 days. The ICD-9 codes used for billing were used to determine medical complexity using Charlson Co-morbidties Index (Charlson, Pompei, Ale, & MacKenzie, 1987; Deyo, Cherkin, & Ciol, 1992).

Ages, gender, number of active medications, caregiving arrangement, social status, and co-morbidities have been studied in various studies, but not in homebound population (DeGeest, et al., 1998; Meredith et al., 2001; Morrell et al., 1997; Prohaska & Glasser, 1996). A co-

morbidities index reduces all the co-existent medical conditions and the severity of those conditions to a single numeric score, allowing comparison with scores from other patients (Hall, 2006). The Charlson Co-morbidities Index (CCI) was chosen to measure co-morbidity due to its widely demonstrated validity, feasibility, and reliability (Hall, 2006). In this project, the well-validated CCI tool, which captured defined conditions of interest for CCI calculation using ICD-9 codes, was utilized (Deyo et al., 1992; Quan et al., 2005). A measure used to capture the proportion of the documentation of medical reconciliation was not found in the literature. For the purpose of this project, medication non-reconciliation was operationalized as not having "Medication Reconciled" charted in the electronic medical record in the past 90 days (figure 2).

Outcome Evaluation

Outcome Results

Demographic characteristics of 200 study subjects are displayed in Table 1. The majority of the sample consisted of women (66%), and the mean age of subjects was 78.91 years of age (SD 14.73). More than 46% of the subjects were over the age of 85 years. Sixteen percent of subjects (n = 33) were less than 65 years of age, 16 percent (n = 33) were between 65 to 74 years of age, and 20% were 75 to 84 years old.

The majority of the subjects were Caucasian (76%) and race was unreported in 18.5% of the cases. Fifty four percent of the subjects lived in an adult foster home (AFH) and over 14% the subjects lived in a private home. Forty percent of the subjects had Medicaid insurance.

Table 1

Demographic Characteristics of Study Subjects (*n* = 200)

Demographic		*n*	%
Age			
	<65	33	16.5%
	65-74	33	16.5%
	75-84	41	20.5%
	>85	93	46.5%
	Mean: 78.9 Std dev: 14.73 Median: 83.5 Range: 23 to 102		
Gender			
	Male	68	34.0%
	Female	132	66.0%
Race			
	Caucasian	152	76.0%
	African American	4	2.0%
	Asian	5	2.5%
	Native American	1	0.5%
	Unreported	37	18.5%
	Others	1	0.5%
Living Arrangement			
	Adult Foster Home (AFH)	108	54.0%
	Assisted Living Facility (ALF)	34	17.0%
	Residential Care Facility (RCF)	14	7.0%
	Private home	29	14.5%
	Group home	3	1.5%

Table continues

	Memory care	12	6.0%
Medicaid Insurance			
	Yes	80	40.0%
	No	120	60.0%

The numbers of medications were collected on all routine medications that were on subjects' chart. All active routine medications including over the counter (OTC), vitamins, and supplements were included. Medications given on as-needed basis were excluded from the numbers of medications collected. Some as-needed medications were rarely used, such as suppositories or enemas for constipation, whereas some as-needed medications might be used on a daily basis such as acetaminophen for arthritic pain relief. For consistency, only routine active medications that the subjects took on a regular basis were included. The data on the numbers of medications are displayed in Table 2 and Figure 3.

Table 2

The Numbers of Routine Active Medications

Numbers of Medications		*n*	(%)
	0-5	38	19.0%
	6-10	85	42.5%
	11-15	50	25.0%
	16-20	21	10.5%
	>21	6	3.0%

Table continues

Mean: 9.9 Std Dev: 4.97 Median: 9 Range: 0-27

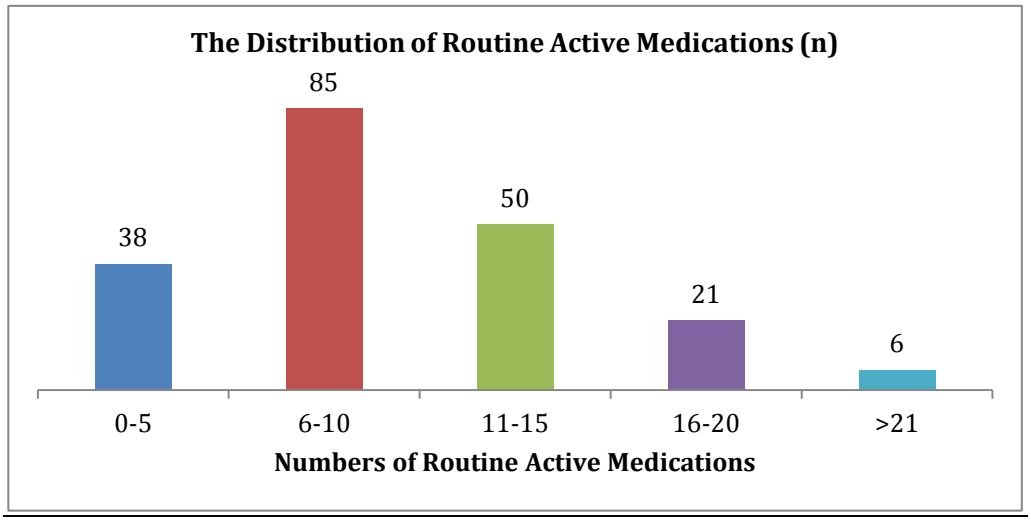

Figure 3. The Distribution of Routine Active Medications

The calculated Charlson Co-morbidities index (CCI) showed an average of 3.87 (standard deviation 1.64), median of 4, and range of 0 to10. An average CCI of 3.87 indicated the moderately high 1-year mortality rate among the selected subjects: 1-year mortality rates of 52%. Out of all the 200 subjects, medication reconciliation occurred in 89%, leaving 11% of the subjects with medication non-reconciliation.

Data Analysis

In order to answer the clinical inquiry question: what are the patients' characteristics associated with the lack of routine medication reconciliation (medication non-reconciliation) in a home-based primary care practice? A chi-square test was used for categorical measures (gender, living arrangement, and Medicaid insurance) to examine differences in demographic and health

characteristics between patients with medication reconciliation and those without medication reconciliation. Race was excluded from the data analysis due to a large number of cases with unreported race (18.5%) as reported in Table 1. Living arrangements were aggregated according to their level of care as following: private homes, assisted living facilities, and residential care facilities (which included adult foster home, memory care facilities, and group homes). For continuous measures (Charlson Co-morbidities index, age, and number of medications), *t*-test was used with unequal variances. Logistic regression was used to determine whether specific patient characteristics were associated with greater risk of medication non-reconciliation after controlling for other measured covariates. All analyses were conducted with Microsoft Excel 2007 and Stata Statistical Software: Release 12.

Comparisons of gender, living arrangement, and Medicaid insurance were done using the chi-square test, which revealed no significant relationship between gender (p= 0.819) and living arrangement (private home p = 0.903, assisted living p = 0.295, and residential care facility p = 0.348) and medication reconciliation. There was a statistically significant relationship between Medicaid insurance and not having medication reconciled (p = 0.016).

Table 3

Chi-squared Test on Categorical Measures: Gender, Living arrangement, and Medicaid insurance

	Medication Reconciled (%)	Medication Not Reconciled (%)	Pearson chi2 *df*=1	*p*
Gender				

Table continues

	Male	89.71	10.29		
	Female	88.64	11.36		
				0.05	$p = 0.819$
Living arrangement					
	Private Home	89.66	10.34		
				0.01	$p = 0.903$
	Assisted Living	87.59	12.41		
				1.10	$p = 0.295$
	Residential care facility	89.00	11.00		
				0.88	$p = 0.348$
Medicaid Insurance	Yes	82.50	17.50		
	No	93.33	6.67		
				5.75	$p = 0.016$

Using two-sample *t*-test, no significant relationships between the number of routine active medications, CCI, and age and medication reconciliation were found (all *p* values were > 0.05).

Table 4

Two-sample T Test on Continuous Measures: Number of Medications, CCI, and Age

	Medication Reconciled		Medication Not Reconciled (%)		two-sample *t*	*p*
	M(SD)	95% CI	M(SD)	95% CI		

Number of routine active medications	9.90 (4.98)	[9.16-10.64]	9.55 (4.96)	[7.34-11.75]	0.31	0.753
Charlson	3.92 (1.60)	[3.69-4.17]	3.36 (1.84)	[2.54-4.18]	1.54	0.124
Age	78.26 (12.95)	[76.35-80.18]	74 (18.60)	[65.75-82.25]	1.04	0.307

Logistic regression analyses revealed that, after controlling for age, gender, living arrangement, number of medications, and comorbid conditions, patients with Medicaid insurance had significantly greater odds of not having medication reconciliation completed (OR 3.76, 95% CI 1.30-10.81, p = 0.014).

Table 5

Logistic Regression Analyses Showing The Effect Of Patients' Characteristics On Medication Reconciliation

Patients' Characteristics	Odds Ratio	95% CI	P>l z l / *p*
Age	1.85	[0.86-3.90]	0.115
Gender	1.32	[0.47-3.76]	0.599
Residential care facilities	0.95	[0.23-3.97]	0.940
Assisted Living	0.45	[0.06-3.37]	0.438
Number of Medications	1.00	[0.90-1.11]	0.952
Charlson	0.66	[0.39-1.10]	0.110
Medicaid Insurance	3.76	[1.30-10.81]	0.014

Post-hoc analysis using two-sample *t*-test revealed that subjects with Medicaid insurance had significantly lower CCI (M=3.25, SD=1.98, p= 0.0001) compared to subjects who do not have Medicaid (M=4.28, SD=1.20). On the other hand, two-sample t test revealed no statistically significant findings related to number of medications for those with Medicaid insurance compared to those who did not have Medicaid (p=0.429).

Analysis of Process/Limitations

Medication reconciliation process

The measure used in this project to capture the lack of up-to-date medication reconciliation (not having the "Reconcile" button clicked in the past 90 days, figure 2) could be potentially inaccurate. The "Reconcile" button was used as a proxy for the completion of medication reconciliation by clinicians. It is possible that the "Reconcile" button is clicked in the absence of actual medication reconciliation or that the "Reconcile" button is not clicked when medication reconciliation was completed. The measure relies on the clinicians' ability to document medication reconciliation accurately and completely in the EHR, which may not have been the case. Furthermore, the presence of medication discrepancy or inaccurate medication lists is typically discovered during medication reconciliation (Boockva et al., 2006; Gleason et al., 2004). Auditing charts and interviewing each subject or their caregivers in order to reveal medication discrepancy can be time-consuming and was not practical for the scope of this project. Because medication discrepancies were not detected in each of the subjects' medication lists, the measure used in this project (lack of up-to-date medication reconciliation) may not be representative of the definite presence of medication discrepancy.

Medications and coding variability

Only the numbers of routine active medications were included in this analysis. However, there may have been as needed medications (prn) that had been used daily; such as bowel regimen medications and opioid pain medications. The exclusion of as needed medications may have underestimated the actual number of medications the subjects took on a daily basis. In order to comply with the IRB's expedited review protocol, subjects greater than 89 years of age were aggregated into one group. This may have led to underestimation of the age-adjusted CCI as each decade of life adds one point to the score (Charlson et al.,1987; Deyo et al., 1992). Furthermore, the validated CCI tool used in this project did not recognize variation of dementias with 331 ICD-9 codes (classified as neurological disorders) such as Alzheimer's dementia (331.0), lewy body dementia (331.82), or frontotemporal lobe dementia (331.19). Only the dementia with 290 ICD-9 codes (classified as mental disorders) were included in the CCI which could lead to coding inconsistency and underestimation of medical complexity given the ICD-9 coding variability in ways dementia could have been classified (Charlson et al.,1987; Deyo et al., 1992).

Collected data

The majority of the subjects in this project had unreported race (18.5%) and the rest were mostly Caucasian (76%). Due to the skewed nature of the distribution, race was not included in the statistical analysis; thus, the effect of race on medication reconciliation could not be determined. The insurance coverage information was categorized as Medicaid versus non-Medicaid. The effect of each different type of insurance coverage such as private health insurance, Medicare only, Medicaid only, dual-eligible coverage (Medicare and Medicaid), and no insurance coverage was not examined. The logistic regression analyses evaluated each of the selected patients' characteristics, revealing a relatively large amount of unexplainable variance by the analysis (pseudo R2 = 0.0757). This suggested that there are other potential unaccounted

factors and that those factors could be potentially better predictors of the lack of medication reconciliation.

Practice improvement project

Potential confounding influences for the project included data collection during a time of an ongoing continuing practice improvement project (PIP) relating to medication reconciliation. The practice improvement project could have impacted all patients in the practice including the randomly selected 200 subjects used in this project. Ongoing PIP may have lead to a falsely elevated rate of medication reconciliation overall. Attempts to address these limitations and influences involved careful evaluation through appropriate statistical analysis, and acknowledgement of the factors that could not be controlled for, such as the ongoing practice improvement project relating to medication reconciliation and the potentially inaccurate information documented in the EHR. Lastly, the findings should not be generalized to other settings and population due to the homogenous nature of the data from a single-practice homebound patient population.

Discussion

Outcomes in Relation to Literature

The major finding of the project highlights health care disparity associated with Medicaid insurance. In this project, homebound patients with Medicaid insurance had significantly greater odds of not having medication reconciliation completed compared to non-Medicaid patients. Health insurance coverage facilitates timely access to health services (Department of Health & Human Services [HHS], 2011). Medicaid is an entitlement program jointly funded by the federal and state governments, which provide health coverage for low-income Americans. In fiscal year 2010, Medicaid spent $414 billion to fund the delivery of primary and acute medical care as well

as long-term care to 1 in 5 Americans or over 62 million people (Herz, 2010; Kaiser Family Foundation [KFF], 2013). Medicaid is based on low income (starting 2014, Medicaid eligibility will include all Americans under the age of 65 with incomes up to 138% of the federal poverty level) and covers one in every five Medicare beneficiaries (KFF, 2013). These individuals are referred to as "dual-eligible" beneficiaries. In 2009, 15% of Medicaid enrollees were dual-eligible beneficiaries: however, dual-eligible beneficiaries used 38% of Medicaid funding.

Disparities in health and health care among Medicaid patients have been documented in a variety of settings and populations. Medicaid enrollees tend to have worse health outcomes than the low-income privately insured population (KFF, 2013). Adults with Medicaid have a higher utilization rate of emergency care compared to privately insured adults across all medical conditions and a higher level of acuities due to greater illness severity, higher burden of illness, and higher rate of disability (KFF, 2013). In the emergency department, Somners, Boukus, & Carrier (2012) found that Medicaid patients had significantly higher acuity ratings compared to those with private insurance ($p < 0.05$). In addition, nonelderly Medicaid patients (age 21-64) tended to have a secondary diagnosis of a mental illness and visits that involved more than one major diagnostic category compared to privately insured patients (Somner et al., 2012). Interestingly, post-hoc analysis of this project revealed that Medicaid patients tend to have lower CCI compared to non-Medicaid patients, indicating that Medicaid patients tend to have less medical complexity compared to non-Medicaid patients. While CCI is a validated and widely used tool to measure co-morbidities, the CCI was not designed to detect mental illnesses. The aforementioned coding variability may have led to incomplete data capturing.

Studies conducted on low-income population not specific to Medicaid insurance found that low-income individuals experience more barriers to accessing health care and receive poorer

quality of care when they successfully access care (The Agency for Healthcare Research and Quality [AHRQ, 2011]. In terms of mortality, Sorlie, Johnson, Backlund, & Bradham (1994) found that nonelderly persons (age 25-64 years old) with Medicare and Medicaid had the highest mortality compared to those with private insurance. Additionally, mortality was highest in those in the lowest income bracket (< $10,000 annual income) in comparison with those who had higher income (Sorlie et al.,1994).

The relationships between Medicaid insurance and disease-specific outcomes had also been established. Adult patients with cystic fibrosis who had Medicaid were found to have lesser odds of being accepted for lung transplant (Quon et al., 2012). One study examining the relationship between health insurance status and outcomes in children with juvenile rheumatoid arthritis found that despite similar health care utilization and joint damage severity, having Medicaid insurance was associated with significantly higher disability and lower health-related quality of life (Brunner et al., 2006). Koroukian, Bakaki, & Raghavan (2012) explored the survival rate and 5-year mortality in adults diagnosed with one of the eight types of selected cancers and found that Medicaid insurance was associated with less favorable survival rates compared to the non-Medicaid population.

The main outcome of this project was consistent with outcomes reported in the literature with regards to health disparities associated with Medicaid insurance. In terms of the remaining collected measures, advanced age did not appear to have any predictive value in medication issues, which is inconsistent with previous studies (Meredith et al., 2001; Morrell et al.,1997). Gender and caregiving arrangement also did not appear to have a significant effect on medication errors (DeGeest et al., 1998; Prohaska & Glasser, 1996). However, it is important to stress that the measure obtained from this project (medication non-reconciliation) was not the same as the

measures obtained from previous studies, which had more to do with the actual presence of medication errors or non-adherence.

The measure used in this project to capture the lack of up-to-date medication reconciliation (clicking of the "Reconcile" button) and its relationship to medication discrepancy could not be determined. The definite presence of medication discrepancy could not be confirmed simply by measuring the completion of medication reconciliation; therefore, the measure might not represent accurate measurement of medication discrepancy. Consequently, outcomes from this project should be interpreted with caution in relation to the available literature. In addition, there are other potential factors that may impact the medication reconciliation process but were not discussed in this project. Other factors include: hospice or home health enrollment status, health care providers' factors such as type (medical doctors versus advanced practice nurses versus physician assistants), educational level (masters-prepared versus doctorally-prepared), other providers' characteristics (age, gender, years of experience, or national certification), or the use of high-risk medications (such as the medications listed on the Beers Criteria for potentially inappropriate medication use in older adults). There are multiple opportunities for research translation and further research that may inform practice associated with the medication reconciliation process.

Clinical Implications

A full clinical inquiry report will be presented in writing and orally to the organization where the project took place. Presentation of the findings will occur at both a national and local level. Possible venues to present findings via poster presentation include OHSU Research Week,

the American Geriatrics Society National Conference, and the American Association of Nurse Practitioners National Conference.

Collaboration among different health disciplines is crucial for optimizing health outcomes to ensure patient safety. The pharmacist's role was not addressed in this project but the use of pharmacists, as a part of health care team needs to be considered. Maximizing the use of pharmacists to provide medication management services can promote medication safety and decrease medication-related adverse events (Smith, Giuliano, & Starkowski, 2011). Health informatics is another area that should be considered in an effort to improve collaboration among providers from different health disciplines. Electronic health information exchange in which health data is shared among the providers in a secure environment with the patients' permission would allow providers and pharmacists to access medical records, update medication lists, and send correspondences across disciplines. Health information exchange could be very useful for medication reconciliation as patients move from one care setting to another. A complete and up-to-date medication list accessible across care settings can prevent medication errors associated with therapies started or discontinued by multiple providers such as discrepancies in medication list, poor patient recall, and limited health literacy (Smith et al., 2011).

In the era of healthcare reform where Medicaid coverage will be expanded beginning in 2014 under the Affordable Care Act to cover currently uninsured people under the age of 65 with income at or below 138% of the federal poverty level, it is important for providers to recognize health care disparities associated with lower socioeconomic status. The underlying reasons for disparities in health care for Medicaid patients are likely complex and multi-factorial. In order to develop effective strategies in decreasing such disparities, providers' awareness of such disparities is crucial. The Agency for Healthcare Research and Quality (AHRQ), the Department

of Health and Human Services (HHS), and the Kaiser Family Foundation (KFF) have documented the prevalence of health disparities along with proposed strategies to eliminate disparities.

To summarize, key strategies in place to reduce disparities include:

1. Data collection to enhance the current knowledge of disparities, expand research for health disparities to inform disparities reduction initiatives, and to disseminate progress made by current interventions (AHRQ, 2011; James, 2007; HHS, 2011).
2. Transforming health care by increasing the proportion of patients with health insurance coverage and a regular primary care provider, and increasing the number of patient-centered medical homes (AHRQ, 2011; HHS, 2011). Collaboration between community-based health care teams such as community health workers and primary care providers may help improve care coordination (HHS, 2011).
3. Many states and local organizations are engaged in efforts to reduce health disparities by implementing community-focused interventions such as outreach programs, cultural competency training, and provider education (AHRQ, 2011; KFF, 2012).
4. The true impact of interventions to reduce disparities remains unclear. However, best practice trends are starting to emerge; the most effective strategies seem to address multiple determinants of health (KFF, 2012).

In this clinical inquiry project, the key finding offers opportunities for targeted quality improvement for ongoing medication reconciliation process in the homebound Medicaid population. One of the strategies is to increase recognition of health disparities among healthcare

providers. Provider awareness can be accomplished by formal presentation of the findings to the practice, scholarly publication, and poster presentation at national conferences.

Conclusions

The clinical inquiry project identified the association between Medicaid insurance and the lack of routine medication reconciliation in a home-based primary care practice. Medication reconciliation prevents medication errors, and is an important part of safe and coordinated health care. The findings from this project highlight disparities in health and health outcomes among the Medicaid population, which is consistent with the current literature. Effective strategies include promotion of provider awareness and effective care coordination. The finding from the project allows for focused ongoing quality improvement of the medication reconciliation process in homebound Medicaid populations with the ultimate goal of reducing medication discrepancies, decreasing adverse events related to medication errors, and improving health outcomes among homebound patients.

Future work related to this project will include continued effort to improve and sustain medication reconciliation rates, exploration of the potential role for pharmacists in medication management therapy, and initiatives to improve care coordination using health informatics. Doctor of Nursing Practice (DNP) graduates have the skills to provide leadership for designing and implementing processes to improve practice and systems of care (Zaccagnini & White, 2011). As the population becomes more and more diverse (and ages), it will be essential for the health care system to increase focus on best practice in an effort to address the wide range of factors that contribute to disparities, including economic and psychosocial factors that extend beyond the health care system. Over the current and future course of health care reform, DNP

graduates will play a critical role to systematically assess, implement, evaluate, and disseminate vital best practice information in order to improve the health and health outcomes for individuals and entire populations

Summary

Adverse drug events and medication errors lead to mortality and jeopardize safe patient care (Institute of Medicine, 2007; Kohn et al., 2000). According to the Joint Commission, medication reconciliation is "a process of comparing a patient's medication orders to all of the medications that the patient has been taking " (The Joint Commission, 2006). The medication reconciliation process has been put in place across different health care settings in order to prevent medication errors and improve patient safety (National Quality Forum, 2009). There is a gap in knowledge about the medication reconciliation process and patient factors associated with medication discrepancy in homebound population. Homebound patients are at higher risk for having poor outcomes and higher prevalence of chronic disease compared to non-homebound peers (Desai et al., 2008; Ornstein et al., 2011). This clinical inquiry project revealed a significant correlation between Medicaid insurance and the lack of routine medication reconciliation in a home-based primary care practice. The finding was largely consistent with the presence of disparities in health and overall health outcomes among Medicaid population found in the current literature (Brunner et al., 2006; KFF. 2013; Koroukian et al., 2012; Somner et al., 2012; Sorlie et al., 1994; Quon et al., 2012). Potential solutions found in the current literature include promotion of provider awareness and effective care coordination (AHRQ, 2011; HHS, 2011; KFF 2012). The result from this clinical inquiry project contributes to the ongoing quality improvement for the medication reconciliation process with the ultimate goal of decreasing medication discrepancy in homebound Medicaid populations

References

Agency for Healthcare Research and Quality (AHRQ) (2011). National Healthcare Disparities Report. Retrieved from www.ahrq.gov/research/findings/nhqrdr/nhdr11/nhdr11.pdf

Bates, D. W., Boyle, D. L., Vander Vliet, M. B., Schneider, J. & Leape, L. (1995). Relationship between medication errors and adverse drug events. *Journal of General Internal Medicine, 10*(4), 199-205.

Beer, M. H., Baran, B. W., & Frenia, K. (2000). Drugs and the elderly, part 1: the problems facing managed care. *American Journal of Managed Care, 6(*12), 1313-1320.

Bedell, S. E., Jabbour, S., Goldberg, R., Glaser, H., Gobble, S., Young-Xu, Y., . . . Ravid, S. (2000). Discrepancies in the use of medications: Their extent and predictors in an outpatient practice. *Archives of Internal Medicine, 160*(14), 2129-2134.

Boockvar, K. S., Carlson LaCorte, H., Giambanco, V., Fridman, B., & Siu, A. (2006). Medication reconciliation for reducing drug-discrepancy adverse events. *The American Journal of Geriatric Pharmacotherapy, 4*(3), 236-243. doi: 10.1016/j.amjopharm.2006.09.003

Brunner, H. I., Taylor, J., Britto, M. T., Corcoran, M. S., Kramer, S. L., Melson, P. G., . . . Passo, M. H. (2006). Differences in disease outcomes between medicaid and privately insured children: Possible health disparities in juvenile rheumatoid arthritis. *Arthritis & Rheumatism, 55*(3), 378-384.

Centers for Medicare and Medicaid Services. (2012). Home health agency center. Retrieved from http://www.cms.gov/Center/Provider-Type/Home-Health-Agency-HHA-Center.html?redirect=/center/hospice.asp#

Charlson, M. E., Pompei, P., Ales, K. L., & MacKenzie, C. R. (1987). A new method of classifying prognostic comorbidity in longitudinal studies: Development and validation. *Journal of Chronic Diseases, 40*(5), 373-383.

De Geest, S., von Renteln-Kruse, W., Steeman, E., Degraeve, S., & Abraham, I. L. (1998). Compliance issues with the geriatric population: Complexity with aging. *The Nursing Clinics of North America, 33*(3), 467-480.

Department of Health and Human Services (HHS). (2011). HHS action plan to reduce racial and ethnic disparities: A nation free of disparities in health and health care. Retrieved from http://minorityhealth.hhs.gov/npa/templates/content.aspx?lvl=1&lvlid=33&ID=285

Desai, N. R., Smith, K. L., & Boal, J. (2008). The positive financial contribution of home-based primary care programs: The case of the Mount Sinai visiting doctors. *Journal of the American Geriatrics Society, 56*(4), 744-749. doi: 10.1111/j.1532-5415.2007.01641.x

Deyo, R. A., Cherkin, D. C., & Ciol, M. A. (1992). Adapting a clinical comorbidity index for use with ICD-9-CM administrative databases. *Journal of Clinical Epidemiology, 45*(6), 613-619.

Field, T., Mazor, K., Briesacher, B., Debellis, K. & Gurwitz, J. (2007). Adverse drug events resulting from patient errors in older adults. *Journal of the American Geriatrics Society, 55*(271-276).

Gleason, K. M., Groszek, J. M., Sullivan, C., Rooney, D., Barnard, C., & Noskin, G. A. (2004). Reconciliation of discrepancies in medication histories and admission orders of newly hospitalized patients. *American Journal of Health-System Pharmacy : AJHP : Official Journal of the American Society of Health-System Pharmacists, 61*(16), 1689-1695.

Gregory, B.H., Horn, C. V., & Kaprielian, V. S. (2008). 8 steps to a chart audit for quality. *Family Practice Management, 15*(7)

Hall, S. (2006). A user's guide to selecting a comorbidity index for clinical research. *Journal of Clinical Epidemiology, 59*, 849-855.

Herz, E. J. (2010). Medicaid: a primer. Congressional Research Service. Retrieved from http://aging.senate.gov/crs/medicaid1.pdf

Housecall Providers. (2012a). Housecall Providers. Retrieved from http://www.housecallproviders.org/

Housecall Providers. (2012b). *Clinician handbook.* Portland, OR: Author.

Institute of Medicine. (2007). *Preventing medication errors.* Washington, D.C.: National Academy Press.

James, C. (2007). *Race, ethnicity, and health care* [Online Presentation]. Retrieved from http://www.kaiseredu.org/tutorials/REHealthcare/player.html

Kaiser Family Foundation (KFF). (2012). *Disparities in health and health care: five keys questions and answers.* Retrieved from http://kff.org/disparities-policy/issue-brief/disparities-in-health-and-health-care-five-key-questions-and-answers/

Kaiser Family Foundation (KFF). (2013). *Medicaid: A primer*. Retrieved from http://www.kff.org/medicaid/upload/7334-05.pdf

Kohn, L. T., Corrigan, J., & Donaldson, M. S. (2000). *To err is human: Building a safer health system*. Washington, D.C.: National Academy Press.

Koroukian, S. M., Bakaki, P. M., & Raghavan, D. (2012). Survival disparities by Medicaid status: An analysis of 8 cancers. *Cancer, 118*(17), 4271-4279.

Leape, L., Epstein, A.M., & Hamel, M. B. (2002). A series on patient safety. *The New England Journal of Medicine, 347*(16), 1272-1274.

Lindquist, L. A., Go, L., Fleisher, J., Jain, N., Friesema, E., & Baker, D. W. (2012). Relationship of health literacy to intentional and unintentional non-adherence of hospital discharge medications. *Journal of General Internal Medicine, 27*(2), 173-178.

Marks, J, R., Schectman, J. M., Groninger, H. & Plews-Ogan, M. L. (2010). The association of health literacy and socio-demographic factors with medication knowledge. *Patient Education and Counseling, 78*(3), 372-376.

Meredith, S., Feldman, P., Frey, D., Hall, K., Arnold, K., Brown, N., et al. (2001). Possible medication errors in home healthcare patients. *Journal of the American Geriatrics Society, 49*(6), 719-724.

Morrell R. W., Park, D. C., Kidder, D. P., & Martin, M. (1997). Adherence to antihypertensive medications across the life span. *Gerontologist, 37*(5), 609-619.

National Council on Patient Information and Education. (2007). *Enhancing medication adherence: A national act plan*. Retrieved from http://www.talkaboutrx.org/documents/enhancing_prescription_medicine_adherence.pdf

National Quality Forum. (2009). *Safe practices for better healthcare-2009 update; a consensus report*. Retrieved from http://www.qualityforum.org/Publications/2009/03/Safe_Practices_for_Better_Healthcare–2009_Update.aspx

Nickerson, A., MacKinnon, N. J., Roberts, N., & Saulnier, L. (2005). Drug-therapy problems, inconsistencies and omissions identified during a medication reconciliation and seamless care service. *Healthcare Quarterly (Toronto, Ont.), 8 Spec No*, 65-72.

Olsan, T. H., Shore, B., & Coleman, P. D. (2009). A clinical microsystem model to evaluate the quality of primary care for homebound older adults. *Journal of the American Medical Directors Association, 10*(5), 304-313.

Ornstein, K., Smith, K. L., Foer, D. H., Lopez-Cantor, M. T., & Soriano, T. (2011). To the hospital and back home again: A nurse practitioner-based transitional care program for hospitalized homebound people. *Journal of the American Geriatrics Society, 59*(3), 544-551. doi: 10.1111/j.1532-5415.2010.03308.x; 10.1111/j.1532-5415.2010.03308.x

Osterberg, L., & Blaschke, T. (2005). Adherence to medication. *The New England Journal of Medicine, 353*(5), 487-497. doi: 10.1056/NEJMra050100

Paasche-Orlow, M. K., Cheng, D. M., Palepu, A., Meli, S., Faber, V., & Samet, J. H. (2006). Health literacy, antiretroviral adherence, and HIV-RNA suppression: A longitudinal perspective. *Journal of General Internal Medicine, 21*(8), 835-840. doi: 10.1111/j.1525-1497.2006.00527.x

Prohaska, T., & Glasser, M. (1996). Patients' views of family involvement in medical decisions and encounters. *Research on Aging, 18,* 52-69.

Quan, H., Sundararajan, V., Halfon, P., Fong, A., Burnand, B., Luthi, J. C. , . . . Ghali, W. A. (2005). Coding algorithms for defining co-morbidities in ICD-9-CM and ICD-10 administrative data. *Medical Care, 43*(11), 1130-1139.

Quon, B. S., Psoter, K., Mayer-Hamblett, N., Aitken, M. L., Li, C. I., & Goss, C. H. (2012). Disparities in access to lung transplantation for patients with cystic fibrosis by socioeconomic status. *American Journal of Respiratory & Critical Care Medicine, 186*(10), 1008-1013.

Schnipper, J. L., Kirwin, J. L., Cotugno, M. C., Wahlstrom, S. A., Brown, B. A., Tarvin, E., . . . Bates, D. W. (2006). Role of pharmacist counseling in preventing adverse drug events after hospitalization. *Archives of Internal Medicine, 166*(5), 565-571. doi: 10.1001/archinte.166.5.565

Siegle, D. Sample size calculator. Retrieved from http://www.gifted.uconn.edu/siegle/research/samples/samplecalculator.htm

Smith, J. D., Coleman, E. A., & Min, S. J. (2004). A new tool for identifying discrepancies in postacute medications for community-dwelling older adults. *The American Journal of Geriatric Pharmacotherapy*, *2(*2), 141-148.

Smith, M., Giuliano, M. R., & Starkowski, M. P. (2011). In Connecticut: Improving patient medication management in primary care. *Health Affairs, 30*(4), 646-654.

Somners, A., Boukus, E. R., & Carrier, E. (2012). Dispelling myths about emergency department use: Majority of Medicaid visits are for urgent or more serious symptoms. HSC Research Brief No. 23. Retrieved from http://www.hschange.com/CONTENT/1302/#ib5

Sorlie, P. D., Johnson, N. J., Backlund, E., & Bradham, D. D. (1994). Mortality in the uninsured compared with that in persons with public and private health insurances. *Archives of Internal Medicine*, *154*(21), 2409-16

Tache, S. V., Sonnichsen, A., & Ashcroft, D. M. (2011). Prevalence of adverse drug events in ambulatory care: A systematic review. *Annals of Pharmacotherapy*, *45*(7-8), 977-989.

The Joint Commission. (2006). Using medication reconciliation to prevent errors. *Sentinel Event Alert*, (35), 1-2.

Thomsen, L. A., Winterstein, A. G., Sondergaard, B., Haugbolle, L. S., & Melander, A. (2007). Systematic review of the incidence and characteristics of preventable adverse drug events in ambulatory care. *The Annals of Pharmacotherapy, 41*(9), 1411-1426. doi: 10.1345/aph.1H658

World Health Orgnization. (2003). *Adherence to long-term therapies: evidence for action.* Retrieved from http://www.who.int/chp/knowledge/publications/adherence_introduction.pdf

Zaccagnini, M.R. & White, K. W. (2011). *The doctors of nursing practice essentials: A new model for advanced practice nursing*. Sudbury: Jones and Bartlett Publishers.