MEDICATION RECONCILIATION AT A RURAL PRIMARY CARE CLINIC

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Abstract

Background

Medication Reconciliation (MR) is the process by which healthcare providers collaborate with patients, caregivers, and families to ensure that an accurate and comprehensive patient medication information is communicated throughout the transitions of care.

Local Problem

A primary care physician clinic on the East Coast provided approximately 5700 patient visits annually. It was standard practice at the clinic to assess and treat patients without a formal medication reconciliation process.

Interventions

The MR quality improvement (QI) project was implemented in a 14 week period. The first four weeks were educational. The Plan, Do, Study, Act (PDSA) cycle was implemented in weeks 5 through 7, and the QI was fully implemented in weeks 8 through 14. The Medications at Transition and Clinical Handoff (MATCH) medication reconciliation (MR form) was used to document the patients' current medications that were omitted from their Electronic Medical Record (EMR).

The secretary printed a MR form along with the patient medication list, and placed them on a clipboard. The MR form was accessed through the MR folder added to the computer system. The patients reviewed their patient medication list, and added any medication that were omitted, or discontinued on the MR form. The MA's reviewed the patient's current medications and reconciled them with the clinics EMR. They highlighted the changes made on the EMR, and on the patients MR form for the provider's approval.

The MR form and patient medication list were placed in a clearly marked folder in a locked cabinet in the secretary's office. The secretary printed an accurate medication list at checkout from the updated EMR, and encouraged the patients to carry the list to all appointments. They scanned the MR form and patient medication list into the clinics EMR, under the MR folder. The forms were shredded once completed.

Results

The QI project was implemented on a total sample (N= 343). Sixty-six percent of the sample population completed the MR form. The percentage of reconciled EMRs from the MR forms was 66 percent; an increase of 48.5 percent from baseline. An average of 1.3 medication discrepancies per participant was identified (N= 239), with 64.4 percent of participants experiencing at least one discrepancy. Sixteen-point-three percent were discrepancies of omission. A total of 49 (n= 49) sample observations were made to determine the percentage of the sample who received a copy of their updated medication list at check-out. Forty-seven percent of the observed sample received an updated medication list at check-out; an increase of 47 percent from baseline.

Conclusions

MR leads to an increased patient safety, and a higher quality of care. The results from this quality improvement project provides support for the implementation in other settings. However, patients with multiple over the counter medications increased interview time and had the potential for error. The DNP practitioner has an integral role in the partnership with the community in synthesizing and translating the evidence, and promoting education in compliance with their training.

MEDICATION RECONCILIATION AT A RURAL PRIMARY CARE CLINIC

Medication Reconciliation (MR) is an important process in which healthcare providers collaborate with patients, caregivers, and families to ensure an accurate and comprehensive patient medication information is communicated throughout the transitions of care. The World Health Organization (WHO) has listed MR as a top five patient safety strategy, and The Joint Commission (TJC) has recognized MR as a critical patient safety initiative (McCarthy et al., 2016).

Medication Reconciliation

Medication reconciliation is a formal process of identifying the most accurate list of current medications a patient is taking and should be taking. MR includes several important factors including medication name, dosage, frequency, route, purpose, and duration. MR is a patient safety priority geared towards preventing harm from medications, or adverse drug events (ADE). Many organizations that have implemented MR have demonstrated its effectiveness in decreasing patient harm and preventing ADE.

A medication discrepancy is any difference between medications taken by the patient and medications prescribed by a healthcare provider. Mendes et al. (2016) did a randomized controlled study (RCT) which showed a hospital admission medication discrepancy prevalence rate of 67%. The discrepancies were related to the medications the patients' were actively taking, as opposed to the medications their provider had ordered. This underscores the importance of MR, since the unintentional discrepancies at admission have the potential to cause harm.

A qualitative assessment of the discrepancies identified omission of medications as the most common type of unintended discrepancy, representing 60% of the unintentional discrepancies. Medication discrepancies pose a safety risk to patients' health. According to Rose,

Jaehde, & Koberlein-Neu (2018), there is a profound discrepancy between the drugs currently taken by patients' at home and medications documented at the providers Electronic Medical Record (EMR). Many of the discrepancies carried a considerable risk and were relevant to medication safety with majority of the discrepancies leading to actual drug related problems affecting the patients'.

Purpose Statement for MR

A primary care physician clinic in rural Maryland provides approximately 5700 patient visits annually, and has a 9 person staff including, a provider, a nursing manager, an information technology technician, three secretaries, and three MA's. It was standard practice at the clinic to assess and treat patients' without a formal medication reconciliation process. The purpose of this quality improvement was to implement MR at the primary care clinic in the fall of 2018. The implementation of the MR was anticipated to ensure that most of the patients' had an accurate medication list in the electronic medical record (EMR), which has been shown to improve health outcomes.

MR Short and Long Term Goals

The short term goals of the project included: By September 2018, 50 % of the medical assistants would be able to help patients list all their medications, dosages, and frequency, at check-in. Thirty percent of the patients would have an accurate patient medication list as part of check-in. The providers would have 30% of the patients' medication list with errors of omission highlighted for review. The long term goals were: by December 2018, 60% of patients' at the clinic would have an accurate EMR and 60% of patients' would have an accurate patient medication list handed to them at check-out.

The Deming Cycle Theoretical Framework

The Plan, Do, Study, Act (PDSA) cycle, also known as the Deming cycle was a QI model that was designed by the Institute of Health Improvement (IHI) with a goal of improving patient outcomes such as decreasing medication discrepancy rates of omission and increasing patient medication list accuracy. The Deming was a process improvement tool with two distinct parts: the foundation which entailed setting aims, establishing measures and selecting changes, and PDSA testing changes (Ungvarsky, 2016).

The major concepts of implementation of the Deming cycle begun with the formation of a team, setting aims, establishing measures, selecting changes, and testing changes. The team included all the stakeholders necessary for a successful MR implementation. Setting Aims, the short term, and long term goals would be succinct, time specific, and measurable. Establishing measures, these are the measurable outcomes that indicated change. Selecting changes, this was the implementation of the logic model. The second part of the Deming cycle was the testing changes. Testing changes included the implementation of the PDSA cycle: planning of action steps, describing what actually happened with the small scale implementation, studying and analyzing the data collected from the small scale test, and acting based on what was learned (IHI, 2018).

The Deming Cycle and MR

The Deming cycle was used to guide the MR project. The stakeholders who were part of the team and endorsed the project included the two providers, the clinical manager, the IT coordinator, the three medical assistants, and the two secretaries. The team understood the aim of the project was to implement MR at the primary care clinic in the fall of 2018. The overarching theme was patient safety. The stakeholders were also aware of the short and long term goals.

The team understood that everyone would be affected by the changes in MR; however, the clinical manager had the expertise to guide decision making and run the day to day challenges that were expected in the implementation of MR. The technical expert at the primary care clinic were the providers.

The outcome measures of evaluating improvement included the percentage of patients' who completed their medication list at check-in, the percentage of completed medication lists, and the percentage of patients' with an accurate patient medication list at checkout. The process changes included the implementation of a medication list at check-in. The patients' were informed to bring an accurate medication list to appointments. The patients' filled the medication list accurately with the MA's assistance, and the patients' were discharged with an accurate medication list. These changes were run through the PDSA cycles to test the changes on a small scale to assess improvement in outcomes.

Testing changes involved stating the objectives, making predictions, and developing a plan to test the change. Documenting problems, the unexpected observations, and analyzing the data. Studying the analysis of data, summarizing and reflecting on the data. Preparing a plan for the next test.

Literature Review

The World Health Organization has listed Medication Reconciliation (MR) as a top patient safety priority. Medication discrepancy is any difference between the patient's own medication list and the providers recorded Electronic Medication Record (EMR) (Lee et al., 2014). The need for a formal MR with an emphasis on the reduction of omissions on the patient medication list was the focus of the evidence in the literature review. The review begun with evidence supporting the need of an accurate patient list during the outpatient visit, including

sources of personal patient medication lists. The discussion was followed by the evidence review on medication discrepancies with omissions being the most common discrepancy. The review concluded with evidence supporting MR and the subsequent improved patient safety outcomes.

Analysis and Synthesis of Research on Medication Reconciliation

Patient medication list. An accurate patient list depicting current medications that the patients' are taking is crucial in the effort to reduce medication errors. According to Mendes et al. (2016), 64 percent of patients had at least one medication discrepancy at the time of hospital admission. According to Armor, Wight, & Carter (2016), pharmacists identified 171 medication discrepancies among patients' transitioning from the hospital to the primary care clinic. Eighty-one percent of the patients' had at least one medication discrepancy.

A brown bag source of data is whereby patients' are encouraged to bring their medications with them to appointments. According to Alexander, Matzke, & Goode (2012) brown bag initiatives led to a 40 percent increase in patients' carrying their medications to appointments and increased the accuracy of the medication list when added to the patient interview. Although brown bag requests are common, less than one-third of patients' actually carry their medications. According to Lee et al. (2014), 40 percent of patients carried a medication list from a hospital or a clinic. However, the study population was surgical patients' and this may not be generalizable to other populations.

The sources of patient medication list's included patient interviews, brown bag, caregiver information, hospital discharge orders, and outpatient provider medication lists. The most common source of patient medication lists were patient interviews**.**

Discrepancy of omission. According to Stewart & Lynch (2012), the most common type of medication discrepancy was the reporting of a medication that was not documented in the

EMR, this constituted the discrepancy of omission. Fifty-two percent of their participants had the discrepancy of omission. Omission had the greatest potential for patient safety issues because it could lead to drug interactions, duplicate therapy, or contraindications which could cause severe risk to the patient's health. One limitation to the study was the clinical severity of the discrepancies were not described. Similarly, seven studies in the meta-analysis study by Mekonnen, Abebe, McLachlan & Brien, (2016), reported omissions as the most common type of discrepancy. However, the meta-analysis showed no fatal errors, and most errors were minor in severity. According to Lee, Nishimuar, Ngu, Tieu, & Auerbach (2014), taking 10 or more medications is a statistically significant risk factor for discrepancy of omission.

According to Comer, Couto, Aguiar, & Elliott (2015), nearly a third of the patients' had a discrepancy involving controlled substances. The study revealed a 28 percent discrepancy in controlled substances between pharmacy claims data and provider medication list.

Among the studies, the most common type of medication discrepancy was drug omissions. The drug omissions ranged from Over the Counter (OTC) medications, herbals, vitamins, to prescription medications that patients' voluntarily stopped taking without medical advice, and prescriptions that patients' failed to refill and stopped taking. Age, and polypharmacy are patient factors related to increased prevalence of medication discrepancies.

Medication reconciliation. A systematic review demonstrated that the intervention of MR significantly reduced drug omissions by 63 percent (Mekonnen, Abebe, McLachlan & Brien, 2016). A limitation to the systemic review was the reporting of findings that were derived from a subset of studies that reported outcomes of interest. In an observational study by Stewart & Lynch (2012), they demonstrated a statistically significant ($P<0.001$) difference between the number of medications reported by the patient, and medications documented in the EMR.

According to Conkling, Togami, Burnett, Dodd, & Ray (2014), the majority of medication discrepancies identified were related to patient variables and nonadherence. MR resolved 70 percent of the discrepancies identified.

According to Vejar, Makic, & Kotthoff-Burrell (2015), at baseline the medication reconciliation rate was 64 percent at a primary care senior clinic. Post intervention of MR, the MR rate increased to 96 percent, a statistically significant improvement. Similarly, according to Khalil, deClifford, Lam, & Subramanian (2016), the implementation of a MR resulted in a statistically significant improvement in accuracy of medication charts with a greater than 80 percent of relative reduction in errors. However, a potential threat to the validity of the study was the independent medication reviewer was not blinded. According to (Philips et al., 2016) nearly 40 percent of the medication discrepancies that were related to drug omission, discrepant frequency, discrepant dose, and incorrect drug were associated with a potential of moderate level of patient harm. One percent of the discrepancies had the potential to cause severe patient harm or clinical deterioration.

Among the studies, MR significantly reduced the rate of drug discrepancies. Omissions discrepancy was the major error. Some studies showed a statistical significant reduction of discrepancies following the implementation of MR. Most studies reported minimal patient harm caused from medication discrepancies; however, one study showed potential for moderate to severe patient harm. In all the studies, MR led to increased medication safety and increased patient safety outcomes.

Description of Project

A quality improvement (QI) project focused on MR was implemented in a rural primary care clinic in Maryland. Inclusion criteria for the project were patients' aged 18 and above who

visited the clinic. The exclusion criteria were any patients' with cognitive impairment that would limit their ability to manage their medications independently at home. The estimated sample size of 450 was calculated from the average patient visits per week of 75, multiplied by the 14 weeks of QI implementation.

Procedures and Timeline

The QI project of MR occurred over a 14 week period. During the first and second week, the project leader met with the provider, the clinical manager, the MA's and the secretaries. The provider and clinical manager endorsed the MR form to be part of the check-in process (see appendix C).

A multi-disciplinary meeting of the stakeholders (see appendix D), was held to educate them on the importance of MR. They were informed of the process change and their varying roles. Education of the stakeholders included how to fill the MR form accurately and reconcile with the EMR, instructions on how to highlight the changes made on the MR form and EMR, and the importance of reminding the patients' to carry an accurate medication list for appointments. The secretaries learned how to print the MR form and place it on a clipboard as part of the check-in process, how to instruct patients' to fill the MR form accurately and inform the patients' on the availability of MA's to help fill the form during the interview. They were taught how to print an updated medication list from the EMR at the end of the patient visit. Additionally, they learned how to encourage the patients' to carry the list with them to all appointments including emergency room (ER) visits.

During weeks three and four, the project leader placed educational flyers in the lobby and three of the exam rooms informing the patients' on the importance of MR. The secretaries demonstrated to the project leader how to fill out the MR form, print an accurate medication list

from the EMR, and how to instruct patients' to carry the reconciled medication list to all appointments. The MA's demonstrated to the project leader how to help a patient complete the MR form, interview a patient regarding their current medications, reconcile the patient's medication list to the EMR, and how to highlight the changes made on the patient's medication list for the provider's review.

During week five through seven, the DNP project leader performed a pilot test on the implementation of MR. The secretaries printed seven MR forms and placed them on clipboards. The patients' were instructed to complete the MR form and they were advised on the availability of MA's to help them complete the form during the exam room interview. The MA's reviewed the patient's MR form for accuracy. The MA's conducted interviews to determine the patient's current medications and reconciled them with the recorded EMR. The MA's highlighted the changes made on the recorded EMR, on the patient's MR form for the provider's approval. The provider reviewed the patient's MR form and noted the highlighted changes. The MR forms were placed in a clearly marked folder in a locked cabinet in the secretaries' office. The secretaries printed an accurate medication list at checkout and instructed the patient's to carry the list to all appointments including the emergency room. These process changes were run through the PDSA cycle.

The pilot test resulted in a change in the patient check-in process. The DNP project leader with the assistance of the nursing manager decided it would be more efficient to print a copy of the patient's medication list from the EMR at check-in, in addition to the MR form, and hand them both to the patient with instructions to use the old medication list as a guide in filling out the MR form. This additional process enabled patients' to accurately determine their active

medications. The MR form was used to fill any omitted medications from the old medication list, and any new medications the patients were taking.

During weeks eight through fourteen, the quality improvement of MR was fully implemented with all patients' who met the inclusion criteria. The DNP project leader was present to observe and support the change.

Data Collection and Tools

The Medications at Transition and Clinical Handoff (MATCH) medication reconciliation form was used by the clinic to document the patient's current medications that were omitted from their EMR (see appendix C). According to Gleason, Brake, Agramonte, & Perfetti (2010), the MATCH medication reconciliation form when used as a patient medication list upon admission was a significant protective factor against errors (OR=0.35; 95% CI, 0.19-0.63). Furthermore, The MATCH Toolkit is in the public domain and may be used and reprinted without permission. The patients' were presented with their current medication list from the EMR and the MR form at check-in. The secretaries instructed the patients' to review their current medication list and update any missing medications on the MR form.

The MR form had three sections. The first section recorded the patient's name, and the date. The second section was the allergy section, it recorded the source of the allergy (i.e. penicillin) and the reaction (i.e. hives). The third section was the medications. The medication section listed the prescribed drug in addition to vitamins, minerals, and over the counter medications. The strength listed the dosage: the number of tablets, or capsules, frequency, and the last dose taken. The MR form was completed by the patient's at check-in, and during the MA's interview. The MA reviewed the current medication list, and the MR form for accuracy.

Data was collected on medication reconciliation process during week five through fourteen. The data included the percentage of patients' who completed the MR form at check-in, the percentage of reconciled MR forms to the EMR, and the percentage of patients' who were handed an updated medication list at check-out. The above data was collected through the MR form and patient medication list, and scanned into the Medication Reconciliation tab in the patient medical record. Additionally, the project leader performed observations on the number of patients' that were handed an updated medication list at check-out.

Data Analysis plan

The project leader generated a data report for analysis. The analysis included the percentage of patients' who completed the MR form, the percentage of reconciled EMR, and the percentage of patients' who received a copy of their medication list at check-out.

Human Subjects Protection

The project leader submitted a project description to the University of Maryland, Baltimore (UMB) Institutional Review Board (IRB) for a Non-Human Subjects Research (NHSR) determination.

Results

During the project implementation period 358 patients' were seen. Fifteen patients were excluded due to an age below 18. The final number of patients' who participated in the project were 343. The mean age of the sample was 59.8 (SD= 17.4) with a range of 18 to 95. The majority of the sample were female who made up 62 percent of the population (Figure 2). There was an increase in the percentage of reconciled EMR's from 32% at baseline, to 66% at fourteen weeks (Figure 1). An average of 1.3 medication discrepancies per participant was identified with 239 patients' (64.4 percent of the sample). Forty-eight percent were discrepancies of commission

(medications patients were not taking) and 16.3 % were discrepancies of omission (missing medications). A sample of 49 patient observations were made to determine the percentage of the sample who received a copy of their updated medication list at check-out. Forty-seven percent of the observed sample received an updated medication list at check-out.

There was an observed increase in compliance with MR on the days when the project leader was present. There was a higher compliance in MR among patients' who had a scheduled appointment, as opposed to same day visits.

The unavailability of the morning secretary was associated with a decrease in MR during week 12 and 13. The check-in and check-out process was dependent on the secretaries. The project leader had to train the new secretary regarding her role in the process of MR.

Discussion

The short term goals of the MA's assisting with MR, the patients having a medication list at check-in, and the providers having MR completed before their assessment were achieved. The long term goal of 60% of the patients having an accurate EMR in 14 weeks was achieved. However, the long term goal of handing a medication list to 60% of the patients' at check-out was not achieved. The project successfully implemented the procedures within the timeline as planned, incorporated the PDSA cycle, collected the data on MR, and analyzed the data.

The availability of the patient medication list increased the accuracy of MR by providing a list of previously prescribed medications. The MA's reviewed the MR form and medication list provided to the patient as part of the patient interview, this increased accuracy in listing the patient's active medications. The secretaries printed an accurate medication list at check-out, this process change increased the accuracy of the patient medication list for future visits.

Armor, Wright, & Carter (2016), identified an average of 3.9 discrepancies per participant (N= 174), with 81 percent of the sample experiencing at least 1 discrepancy in their study of medication reconciliation. Additionally, in a randomized controlled study by Mendes et al. (2016), 64 percent of patients' had at least one medication discrepancy at the time of hospital admission which is consistent with this project. Other studies with similar results include Vejar, Makic, & Kotthoff-Burrell, (2015); Rose, Jaehde, & Köberlein-Neu, (2018); Philips, Wilson, Aly, Wood, Poyer, Drost, & …Carver (2016); and Lee, Chian, Hou, Wu, Hsu, & Chen, (2013).

A total of 49 patient observations were made to determine the percentage of the sample who received a copy of their updated medication list at check-out. Forty-seven percent of the observed sample received an updated medication list at check-out, an increase of 47 percent from baseline. The anticipated goal was to increase the percentage of patients' who received an updated medication list at check-out to 60 percent. One of the reasons the goal was unable to be met was the secretaries competing tasks of scheduling for follow up visits, making referrals for patients, and calling prescriptions to the pharmacy. A recommended solution to this problem is to delignate specific tasks to the secretaries and consider hiring adequate staff members.

The most common discrepancy in this sample was commission. The difference in the most common discrepancy may be related to the clinics baseline history of not inactivating discontinued medications in the EMR. The strengths of the quality improvement project included an acceptance of the provider's and the nurse manager of the importance of medication reconciliation and integrating evidence based practice in the primary care setting. The provider's and the patients' benefitted by having an increased safety in their medication administration. The staff members benefited by gaining an understanding of medication safety, training in patient medication interviews and the ability to play a larger part in the patient experience. The provider

benefited by having an improved medication management system which is a national standard for medication reconciliation per Patient Protection and Affordable Care Act.

A limitation of the project was utilizing MA's rather than a health care provider for patient interviews and reviewing the MR form along with the patient medication list prior to the provider approval. Most researched studies used a registered nurse, or a pharmacist for MR. However, the provider was usually able to identify duplication of medications, and identify non-compliance with prescribed medications. Another limitation was the inclusion criteria. Patient's younger than 18 years old and patients with cognitive impairment were excluded from the study. The providers plan on including all the patients' seen in the clinic. A family member is usually present accompanying the cognitively impaired patient or patients below 18 years old. The family will be included in the MR process in both populations.

A validity threat to the generalizability of the project is the small sample size of 343. Additionally, the sample population demographics was rural, mean age 59.8 (SD= 17.4), and predominantly female (62 percent). This system may not be as effective in larger practice settings or in a place with a different patient demographics.

Conclusion

The outcomes from this quality improvement project may be used to improve medication reconciliation in other settings. MR leads to an increased patient safety, and a higher quality of care. The project implementation tool, the implementation plans, measures of data collection, and the project findings may be used to implement process changes in other similar practice settings.

As part of the sustainability of the project, we instituted a MR process change in the check-in and check-out process at this setting. The project outcomes will be sustainable as new

employees are oriented in the check-in and check-out process. The provider and nurse manager understand the national standard per the Patient Protection and Affordable Care Act of 2010, and will encourage compliance.

The results from the quality improvement project supports the implementation of quality improvement in other settings, and the continual evaluation of practice and processes of care. This allows for effective changes in any clinical practice. Primary care clinics are fertile ground for implementing quality improvement projects based on evidence based practice and the results from the project. The Doctor of Nursing Practice (DNP) training in evidence based practice, systems leadership, and quality improvement allow for opportunities to focus on improving the quality of the healthcare delivery in primary care.

The DNP practitioner has an integral role in the partnership with the community in synthesizing and translating the evidence, and promoting education in compliance with their training. The medication reconciliation quality improvement project paralleled the role of the DNP in critically analyzing data and evidence for improving advanced nursing knowledge. Additionally, it enabled the translation of research to improve practice processes and outcomes.

The DNP prepared provider is essential for knowledge dissemination of medication safety and improving patient safety outcomes. Dissemination of the project's findings will further the knowledge translation of the best practices in Medication reconciliation.

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Tables

Table 1

Evidence Review Table

Author, Year	Study objective/ intervention	Design	Sample (N)	Outcomes studied measurement	Results	Level and Quality Rating
Vejar, Makic, & Kotthoff-Burrell, (2015)	Usefulness of medication reconciliation in primary care	Retrospective cohort study	N= 609	Multivariate logistics and log linear regression models.	A significant predictor of discrepancy was the number of medications taken.	IV B
Armor, Wight, & Carter, (2016)	Medication discrepancies and adverse drug events between hospital discharge and primary care followup	Retrospective observational study	N=43	Univariate analyses described type of ADE, medication classes associated with ADE's, and actions taken to resolve ADE's.	81 percent of participants experienced at least 1 medical discrepancy with an average of 3.9 medication discrepancies per participant.	VI B
Rose, Jaehde, & Köberlein-Neu, (2018)	Medication discrepancies between home medications and primary care providers EMR.	Cohort study	N= 142	The analysis were stratified to gender, age, and medication plan.	94 percent of the patients had a medication discrepancy, with an average of 2.8 drugs per patient missing from the primary care EMR.	IV B
Alexander, Matzke, &	To improve the accuracy of patients	Cohort study	N= 379	Percentage of patients who brought their	A total of 199 discrepancies were	V1 B

Goode (2012)	medication lists in the EMR			medications to the clinic.	identified, and 79% of discrepancies were resolved.	
Philips, Wilson, Aly, Wood, Poyer, Drost, & …Carver (2016)	Medication reconciliation in an outpatient nephrology clinic	Retrospective cohort study	N= 180	Descriptive statistics for medication reconciliation characteristics were represented as means and standard deviations (M ± SD). Inter-rater reliability was validated using Cohen's Kappa methods.	MR in the nephrology clinic led to improved safety. Medication discrepancies were identified in 80% of the patients	IV B
Neufeld, Fernandez, Christo, & Williams (2013)	Assess positive reinforcement on performance improvement models by resident physicians	Pre-post intervention	N= 36	$X^{2\ Tests}$ were used. The crude odds ratio of compliance post intervention relative to preintervention was calculated, and a logistic regression model was used to adjust for year.	Positive recognition substantially improved resident physician compliance on medication reconciliation	VI B
Conkling, Togami, Burnett, Dodd, & Ray (2014)	Comprehensive medication reconciliation across the	A single qualitative study	N= 191	SPSS. Univariate poisson regression models were	Medication reconciliation is needed at admission, and	VI B

	continuum of care			used. A priori level of significance of 0.2 was chosen.	throughout the continuum of care. Each additional medication above 3 led to a 6% increase in discrepancy.	
Khalil, deClifford, Lam, & Subramanian, (2016).	Implementation and evaluation of a pharmacist's medications reconciliation and charting service for medical inpatients in a hospital	A prospective parallel study of medication errors was undertaken	N=110.	A two-tailed independent student t-test was used to measure the continuous variables in the intervention or control arms.	The implementation of a medication reconciliation resulted in statistically significant improvement in accuracy of medication charts with a greater than 80% relative reduction in errors.	IV B
Lee, Chian, Hou, Wu, Hsu, & Chen, (2013).	The study evaluated the efficacy of a medication reconciliation program.	Cohort study. Patients admitted between May 2008 and September 2009 were recruited	N= 3013	The inter-rater reliability for classifying discrepancies was assessed using the Fleiss kappa (κ) score for multiple evaluators	8% of the patients interviewed had a medication discrepancy. About 2.4 discrepancies per patient were identified. Medication omission was the most common discrepancy found.	IV B
Mendes, Lombadi, Andrezejevs	Medication reconciliation	A 6 month, randomized,	N= 133	Student's t test for continuous	The number of discrepancies	II B

ki, Frandoloso, Correr, & Carvalho, (2016)	at patient admission	controlled trial		variables in independent samples. Chi-square test for categorical variables. Mann-Whitney test was used for continuous variables in independent samples	were strongly correlated with age and number of medications at preadmission. Medication errors are common at hospital admission.	
Sarzynski, Luz, Zhou, & Rios-Bedoya, (2014).	The study researched whether chart medication lists are more accurate among individuals who bring medications to outpatient appointments compared with those who do not	cross-sectional pilot study	N= 46	Univariate statistics were performed, including Fisher exact test and *t*-tests, to compare proportions and mean differences between brown baggers and non-brown baggers, using a Type I error of .05 to determine statistical significance	Few chart medication lists were accurate. 76% of chart medication lists contained discrepancies . Within Point of Contact lists, there were fewer inclusion and omission discrepancies .	VI B
Lee, Nishimura, Ngu, Tieu, & Auerbach, (2014)	To assess completeness of patient medication lists and identify factors associated with incomplete	Cohort study	N= 82	Bivariate and multivariate logistic regression models were implemented to identify predictors of our primary outcome of	Patient medication lists are often incomplete and frequently contain discrepancies with chart	IV B

	personal lists and discrepancies between personal and clinic medication lists.			incomplete personal medication lists (incomplete vs complete information of name, dose, and frequency for all medications reported).	medication lists.	
Stewart, & Lynch, (2012).	Medication reconciliation as part of patient interview and concurrent chart review.	Observational case series study. From April 2009 to May 2010	N= 219	Inferential statistics were conducted using chi-square and Fisher's exact tests for dichotomous variables. Mann-Whitney *U* test was used to compare the number of charted medications with the number of medications reported by patients.	50% medications had a discrepancy present between patient-reported and charted medications. 52% were medications reported by patients that were not listed in the chart medication list.	IV B

Medication Reconciliation Run Chart

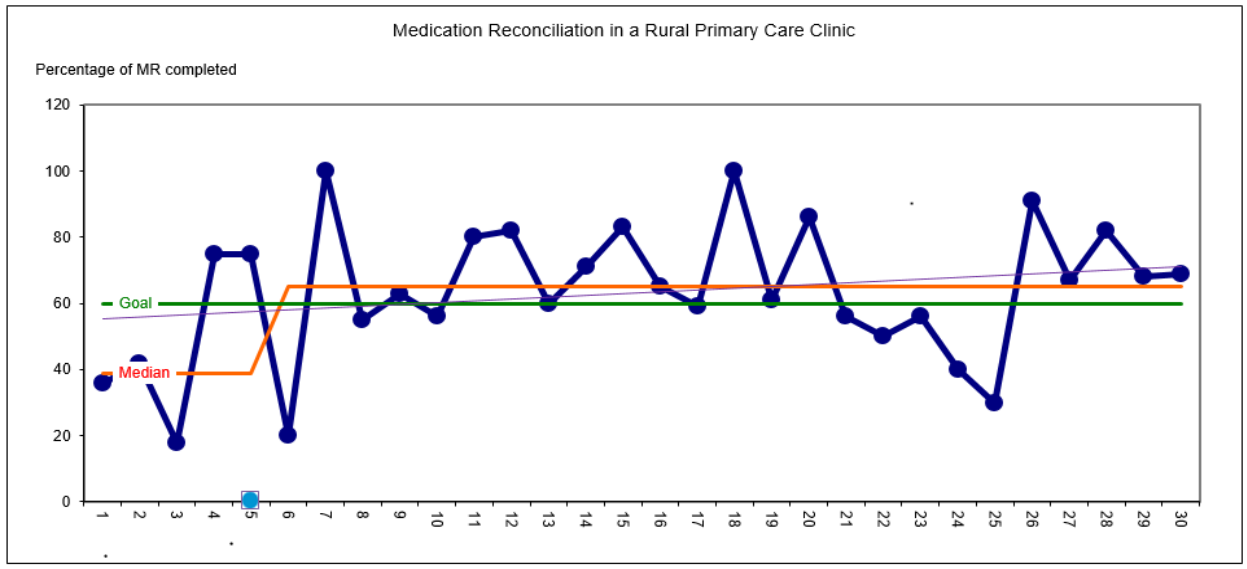

Figure 1. Run chart showing median medication reconciliation. Data point 1 to 3 represent baseline medication reconciliation. Data point 4 through 30 represent the implementation period of the quality improvement.

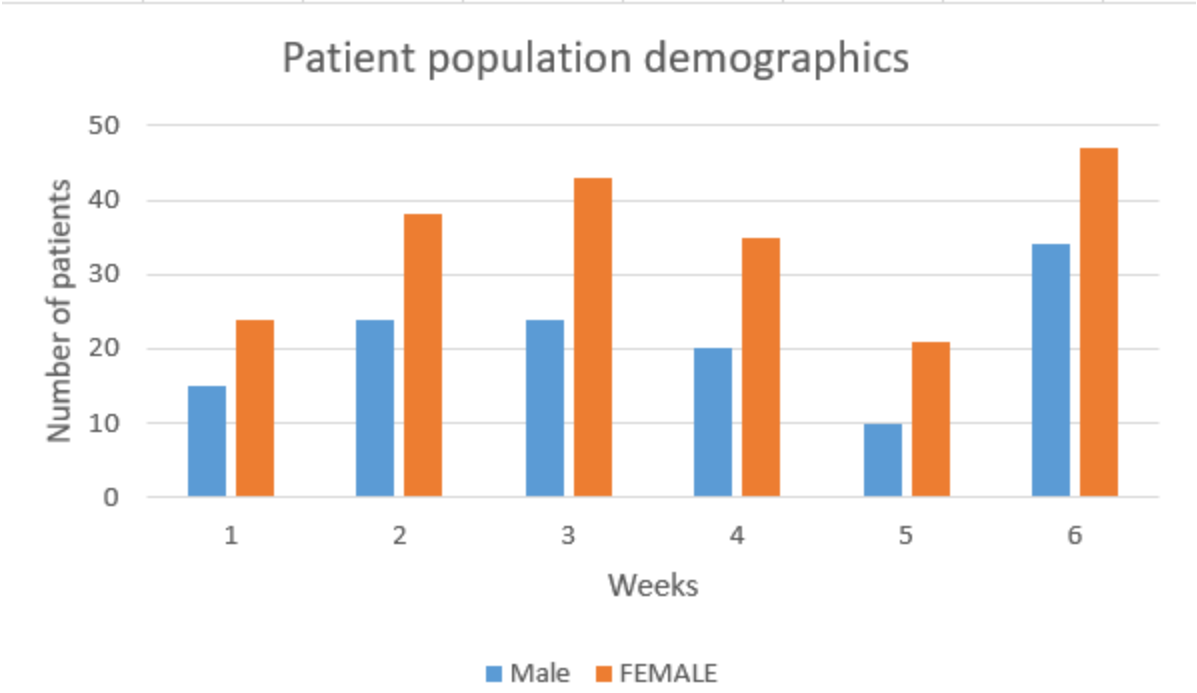

Figure 2. Patient gender demographics in the 6 weeks of quality improvement.

Appendix B

DNP Project Name: Medication Reconciliation at a Rural Primary Care Clinic (MRRPCC)

DNP Project Purpose Statement: The purpose of the project is to implement a Medication Reconciliation (MR) at a rural primary care clinic in the fall of 2018. The implementation of the MR is anticipated to ensure that most of the patients will have an accurate medication list and electronic medical record (EMR), which have been shown to improve health outcomes

Short-Term SMART Objective: By August 2018, 50 percent of the medical assistants will be able to help patients list all their medications, dosages, and frequency, at check-in. 30 percent of patients will have an accurate patient medication list as part of check-in. lastly, providers will have 30% of the patient medication list, and EMR with errors of omission highlighted for the provider to review

Long-Term SMART Objective: By December 2018 60% of patients at EOPCC will have an accurate Electronic Medication Record (EMR), and 60% of patients will have an accurate patient medication list at check-out.

Population/Context: Emmitsburg Osteopathic Primary Care Center (EOPCC) is a medical center in Emmitsburg, Maryland. EOPCC provides about 5,700 office visits a year. Majority of the office visits are from adults, and geriatrics. Majority of the patients have one to two chronic diseases with diabetes type 2, and essential hypertension high on the prevalence rate. Dr. Bonita Portier built and founded the clinic and has been in practice at the site for 23 years. The community is rural, and most of the patients lack adequate healthcare resources.

Mobilize: *WHO will help facilitate the changes in structures and processes (practices)?*
List of Core Team Members –

1. DR. Bonita Portier
2. Clinical Manager: Nancy
3. 2 Medical Assistants (MA)
4. IT coordinator
5. 2 secretaries

Others I will mobilize after the draft plans have been developed-

1. Medical and Nurse Practitioner Students

Assess: *WHAT structures and processes (practices) need to change and WHY? What structure, process, and outcome measures will be used to measure progress?*

1. A medication reconciliation form will be included as part of the check-in process: At present, EOPCC does not have a formal process of medication reconciliation. Patients are not requested to carry their current medication list to update their Electronic Medical Record (EMR). A practice change is needed to implement a formal medication reconciliation form to accurately depict all the medications the patient is currently taking. This may increase patient medication safety, and improve health outcomes. The percentage of patients who fill out the MR form will be the outcome measured.
2. MA's will assist patients in completing their medication lists at check-in: At present, EOPCC does not require the MA's to complete a medication reconciliation. Some patients may need assistance in filling out the MR form. The sections of the form include listing allergies and the specific reaction to the allergen. The medication strength, dose, frequency, and last dose taken. Some patients may not be able to fill out the sections independently. The percentage of patients who have been assisted in completing the MR form will be the outcome measured.
3. MA's will reconcile the MR form to the EMR: the MA's will review the completed MR form and compare it to the EMR. The MA will clarify any discrepancy between the MR form and the EMR. The MA will add to the EMR any medications omitted from the MR form. Any changes made to the EMR will be

highlighted in the MR form for the physician revision and approval. The percentage of reconciled MR forms and EMR will be the outcome measured. The completed MR forms will be collected for evaluation.

4. Approval of MR: At present, the provider is tasked with inquiring on the medications the patient is currently taking, and adding the medications to the EMR. This is a mundane arduous task that can be delegated to the MA's who are capable of accomplishing this task effectively. The provider will have a completed MR form with highlighted medication discrepancies. The provider will have a reconciled MR form and EMR for approval as part of the patient assessment. The provider will make the final changes to the EMR. The percentage of patients who have had their medications reconciled will be the outcome measured. This practice change will enable the provider to focus on other aspects of their assessment
5. The secretaries will print an accurate patient medication list at check-out: At present, EOPCC does not routinely give patients a copy of their accurate patient medication lists, unless requested. The practice change of supplying patients with a copy of their accurate patient medication list will increase patient medication safety, and improve health outcomes. The patients are informed to keep the list with them and carry it to all appointments or hospital visits. The patient is encouraged to edit the medication list as appropriate to reflect current medication usage. The percentage of patients that are handed a copy of their accurate patient medication list at check-out will be the outcome measured.

Plan: *HOW will these changes be made (strategies and tactics)? WHEN will these changes be made?*

1. Meeting with the provider and clinical manager to get their endorsement of the MR form to be part of the check-in process. This will be accomplished in July 2018.
2. Meeting with the provider to inform them of the practice change and their role. This will be done in July 2018.
3. Meeting with the clinical manager to inform her of her role and educate her on the MR project. This will be done in July 2018.
4. Meeting with the MA's to educate them on the importance of MR and to introduce the MR form. Education on how to fill out the form and reconcile with the EMR. Instructions on importance of highlighting the changes made to the EMR on the MR form. This will be accomplished in July 2018
5. Meeting with the Secretaries to educate them on the importance of MR and to introduce the MR form. Education on how to fill the form. Instructions on reminding patients to carry an accurate medication list when making appointments, handing the MR form at check-in with instructions to fill it out completely, informing the patients of MA's availability to help fill the form, and to print a copy of an accurate EMR at the end of the patient visit at check-out. This will be accomplished in July 2018.
6. Placement of educational flyers in the exam rooms, and check-in lobby on the importance of MR. July 2018
7. The secretaries will print 20 MR forms daily. The MR forms will be placed in a clipboard with a pen ready for check-in. This will be done in July 2018.
8. The patients will be handed the clipboard with the MR form at check-in. They will be instructed to fill the form with their current medications. They will be encouraged to ask any questions regarding the form. The secretaries will be able to answer basic questions on the form. However, they will advise the patient to fill the form to the best of their capabilities and that the MA's will be able to help them complete the form at the exam room. This will be accomplished in August 2018.
9. The MA's will lead the patients to the exam rooms. The patient will be interviewed by the MA. The interview will include completing the MR form accurately, reconciling the MR form to the EMR, and highlighting any changes made to the EMR on the completed MR form. This will be accomplished in August 2018.
10. The provider will have a completed MR form with changes made to the EMR. The MR form will include highlighted portions of changes made to the EMR. The provider will review the changes. This will be accomplished in August 2018.
11. All the completed MR forms will be placed in a bin. There will be 1 bin clearly marked for completed MR forms, in each of the 4 rooms. The MR forms will be used to evaluate progress. This will be accomplished in August 2018.
12. At check-out, the secretaries will print a copy of the accurate EMR and hand it to the patient. The secretaries will encourage the patient to carry the patient medication list in their wallet or purse, and

produce it each time they come for an appointment, or when they visit the emergency room. This will be accomplished in August 2018.

Implement: *WHAT strategies and tactics were used? WHEN were the desired changes made?*
Step 1: Perform small tests of change

Step 2: Full-scale implementation

Track: *WHAT structures and processes (practices) were changed based on the metrics we used to measure progress (including frequency of assessment)? HOW did these changes affect outcomes? WHAT do we need to do differently to make greater progress toward improving outcomes?*

Date: _____ Re-Assessment Date 1: _____ Re-Assessment Date 2:_____, etc.

Plan Developed by (List all contributors): _____
_____

Reference: Guidry, M., Vischi, T., Han, R., & Passons, O. MAP-IT: a guide to using healthy people 2020 in your community. U.S. Department of Health and Human Services. The Office of Disease Prevention and Health Promotion, Washington, D.C. https://www.healthypeople.gov/2020/tools-and-resources/Program-Planning

Appendix C

[Insert your Organization's Logo Here]

Patient Name:
MR#:
Date:
Fin #:

Your Current Medication List (Name _____

_____)

Please complete the following information. A registered nurse will review this list and update it, if needed, when you arrive for your surgery, procedure, or test.

ALLERGIES: None _____ (please check none) or list:

Source of Allergy	**Reaction**	**Source of Allergy**	**Reaction**
Example: Penicillin	Hives	3.	
1.		4.	
2.		5.	

Medication List the names of any medications you are taking. Please include any over the counter medicines (including vitamins, minerals, and herbal supplements). Also include any medications you held for your procedure.	**Strength** List the strength of each tablet, capsule, etc.	**Dose** How much are you taking? (number of tablets, capsules, units, etc.)	**Frequency** How often do you take the medication? (daily, twice a day, monthly, etc.)	**Route** How are you taking this medication? (by mouth, injection, patch, etc.)	**Last Dose Taken** Indicate the date and time of the last dose taken
Example: Toprol XL	*100mg*	*1 Tablet*	*every day*	*by mouth*	*this morning*

Appendix D

Stakeholder	Learning Objectives	Content Outline	Method of instruction	Method of Evaluation
Primary Care Provider	At the end of the meeting, the provider will endorse the MR form.	MR form introduction and implementation.	Discussion	Endorsement of MR form.
Clinical Manager	At the end of the meeting, the clinical manager will endorse the MR form.	MR form introduction and implementation. Clinical managers role in the project	Discussion	Endorsement of MR form.
Medical Assistants	At the end of the meeting, the provider will endorse the MR form.	MR form introduction and implementation. MA's role in the project.	Discussion. Role play.	Endorsement of MR form. Role play.
Secretaries	At the end of the meeting, the provider will endorse the MR form.	MR form introduction and implementation. Secretaries' role in the project.	Discussion Role play.	Endorsement of MR form. Role play.

Appendix E

Project Proposal Summary

Medication reconciliation (MR) is a formal process of identifying the most accurate list of current medications a patient is taking, and should be taking. MR includes several important factors including medication name, dosage, frequency, route, purpose, and duration. MR is a patient safety priority geared towards preventing harm from medications, or adverse drug events (ADE). Many organizations that have implemented MR have demonstrated its effectiveness in decreasing patient harm, and preventing adverse drug events.

Emmitsburg is a rural town in Frederick County, Maryland. A primary care physician clinic at the heart of the town provides approximately 5700 patient visits annually, and has a 9 person staff. Currently, it is standard practice to assess and treat patients without a formal medication reconciliation process. The purpose of the project is to implement MR at the primary care clinic in the summer of 2018. The implementation of the MR is anticipated to ensure that most of the patients have an accurate medication list and electronic medical record (EMR), which have been shown to improve health outcomes.

An accurate patient list depicting current medications that the patient are taking is crucial in the effort to reduce medication errors. According to Armor, Wight, & Carter (2016), pharmacists identified 171 medication discrepancies among patients transitioning from the hospital to the primary care clinic. 81 percent of the patients had at least one medication discrepancy. Among the studies, the most common type of medication discrepancy was drug omissions. The drug omissions ranged from Over the Counter (OTC) medications, herbals, vitamins, to prescription medications that patients voluntarily stopped taking without medical advice, and prescriptions that patients failed to refill and stopped taking. Age, and polypharmacy are patient factors related to increased prevalence of medication discrepancies.

According to Vejar, Makic, & Kotthoff-Burrell (2015), at baseline the medication reconciliation was 64% at a primary care senior clinic, post intervention MR increased to 96%, a statistically significant improvement.

The QI project of medication reconciliation is anticipated to run over a 14 week period. During the first and second week, the DNP project leader will meet with the provider, clinical manager, Medical Assistants (MA) and secretaries. During weeks three and four, the DNP project leader will role play on the MR process. During week five through seven, the DNP project leader will perform a small test on the implementation of MR. During weeks eight through fourteen, the MR will be fully implemented to all patients.

The Medications at Transition and Clinical Handoff (MATCH) medication reconciliation form will be used by the clinic to document patient current medications and it will be the tool implemented in the MR project. According to Gleason et al., (2010), the MATCH medication reconciliation form when used as a patient medication list upon admission was a significant protective factor against errors (OR=0.35; 95% CI, 0.19-0.63). The DNP project leader will generate a data report for analysis. Data analysis will include the mean, range, and percentage.

The DNP projects leader will submit a project description to the University of Maryland, Baltimore (UMB) Institutional Review Board (IRB) for a Non-Human Subjects Research (NHSR) determination.