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Evaluating Ways to Reduce Errors in Medication Reconciliations Performed by Nurses in a Rural Hospital Setting

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Evaluating Ways to Reduce Errors in Medication Reconciliations Performed by Nurses in a Rural Hospital Setting

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Table of Contents

Executive Summary	3
Acknowledgements.....	4
Background.....	4
Literature Review.....	7
Research Design.....	11
Results	13
Implications for Hospital Policy Decisions	22
Limitations.....	24
Conclusion.....	26
References	27

I. Executive Summary

Medication reconciliation, also known as “med recs”, are an important part of a patient’s care during their hospitalization. A med rec is when hospital personnel generate a list of the medications the patient takes at home. Med recs are vital in the hospital admission process because home medications need to be restarted at appropriate times to fully care for the patient. Also, mistakes in a home medication list can lead to serious consequences in the patient’s health. This study focuses on med recs being performed at Marcum and Wallace Hospital in Irvine, Kentucky. More specifically, the study explores the different areas in which nurses at Marcum and Wallace Hospital make the most errors when completing med recs. Such errors include leaving a home medication off the patient’s med rec list, reporting a medication that the patient does not actually take at home, reporting the incorrect medication strength, reporting the incorrect medication frequency, and reporting the incorrect formulation (tablet, capsule, liquid, etc.).

Multivariate regressions were utilized in this study to evaluate whether there is an association between the length of the patient’s home medication list, the time of admission, and disease states with different types of med rec errors. Several results of this study were statistically significant, one showing that med rec errors overall increase as the length of the patient’s home medication list increases. Additionally, errors by nurses increased when the patient had a congestive heart failure (CHF) or chronic obstructive pulmonary disease (COPD) diagnosis. While the results of the study showed these associations exist, factors such as the length of the patient’s medication list, time of admission, and disease state do not demonstrate

causation for these errors made by nurses during med recs. Further studies are necessary to rule out other factors that could be contributing to such errors.

II. Acknowledgements

The author expresses thanks to Kristen Blankenbecler, Pharm.D.; Lisa Patton, Pharm.D.; John Isfort; Dillon Thompson, Pharm.D. Candidate 2020 at Marcum and Wallace Hospital in Irvine, Kentucky, for use of their medication reconciliation data and technical support. Additionally, the author expresses gratitude to Joseph L. Fink III, B.S.Pharm., J.D. at the University of Kentucky College of Pharmacy for guidance and support throughout the capstone project. Completion of this project would not have been possible without the support of each person listed above.

III. Background

Marcum and Wallace Hospital is a rural Critical Access Hospital in Irvine, Kentucky. This hospital is unique in that it houses a program called "Project HOME" in which a clinical pharmacist is contracted to go out into the community and perform medication therapy management (MTM) within many of the local physician offices that are affiliated with the hospital. Another important role of this pharmacist is that he or she will perform med recs within the hospital as well. While the clinical pharmacist with the Project Home Network and Marcum and Wallace Hospital has several roles, this study focuses on the med recs being performed by the pharmacist.

A med rec has three steps, including verification (collection of the patient's medication history), clarification (ensuring the doses are appropriate), and reconciliation (making changes

to medication orders within the hospital). The collection process can sometimes be a daunting task as many patients take chronic medications at home but are unsure of the names of their medications or any directions for use. To gather a complete and accurate list, pharmacies are often consulted to obtain names and directions of medications that the patient has recently received with the pharmacy. Once this list has been gathered and entered into the electronic medical record (EMR) for the patient, the patient's physician reorders the medications that the patient has been using at home if they are appropriate to be restarted within the hospital.

The current policy for med recs at Marcum and Wallace Hospital is for the nursing department to complete the med rec for the patient. The nurse in the emergency department (ED) generally completes the med rec if he or she has time while the patient is in the ED; otherwise the nurse on the floor completes the med rec after the patient has been admitted and transferred to the floor. However, at Marcum and Wallace Hospital there is currently not a standard process for the nurses to complete med recs. Some nurses look at the patient's medication list from their last primary care visit and use this as the foundation for the patient's home medication list, while others call the patient's home pharmacy and get a list of the medications that the patient has used recently. While nurses vary in their approach to completing a med rec, they all review the list with the patient verbally to ensure accuracy.

Since there is not a standard way to complete a med rec at this hospital, several errors have been made by nurses when completing these med recs. The physicians at the hospital and the pharmacy department noticed these errors being made when reordering home medications and have tasked the clinical pharmacist to do a second med rec after the nurse completes the initial med rec. The clinical pharmacist starts the second med rec by calling the

patient's home pharmacies and comparing their dispensing history with the med rec that the nurse completed. If needed, the pharmacist speaks to the patient to clarify any questions and discrepancies they identified. Then, the pharmacist documents any changes made within an Excel sheet.

This study seeks to determine this question: what are the areas in which nurses most frequently make errors when completing med recs? In answering this question, the data collected by pharmacists during the second med rec will be analyzed to identify problem areas and used to make recommendations on how to decrease errors in home medication lists upon admission. In terms of practical management and policy implications, this study will be very beneficial for Marcum and Wallace Hospital. The findings of this study will be utilized to form policy recommendations for a protocol for nurses to complete med recs. Such a policy should greatly reduce errors among nurses when performing med recs, ultimately improving the safety of patients at Marcum and Wallace Hospital. Additionally, the hospital only pays a portion of the clinical pharmacist's salary since most of the salary is funded by a grant with the Project Home Network that runs out this year. This study will evaluate the justification for continued support of the pharmacist in the Project Home Network after the grant is completed.

IV. Literature Review

According to a report conducted by the Institute of Medicine, an average of at least one medication error per day occurs for a hospitalized patientⁱ. One of the most common sources of medication errors is inadequate medication reconciliations being performed and handed off to appropriate personnel. In fact, more than 40 percent of medication errors result from inadequate medication reconciliationsⁱⁱ. The solution that hospitals have been implementing is standardizing medication reconciliation processes.

Ensuring that the med rec list for the patient is correct is the most important part of the med rec process. For example, missing that the patient takes a blood thinner at home and not including it on their med rec list can lead to the patient forming a blood clot in the hospital since the physician would not know to restart the blood thinner. This review will take an in-depth look at best practices for how med recs should be completed and which hospital personnel have shown best accuracy in completing med recs.

Nurses are one of the most common hospital personnel who complete med recs. One study showed that nurses spend in excess of an hour per patient admission or transfer trying to formulate a list of the medications that the patient takes at homeⁱⁱ. A study was completed by Chevalier, et. al (2004) in an acute inpatient care setting where they examined nurses' perceptions of the med rec process. More than 60% of nurses reported in this study that the med rec process was time-consuming with time requirements and lack of staffing being barriers to performing a complete and accurate med recⁱⁱⁱ.

Other than nurses, pharmacists are the other large group of professionals who often complete med recs. Multiple studies have been done to show how effective pharmacists are at

reducing errors in the med rec process. Compared to physicians in a study of 55 patients, pharmacists identified 353 medication discrepancies, 58 of which were not identified by the physicians^{iv}. Another study found that pharmacists reduced overall medication discrepancies in the med rec process by 33% in the emergency department alone ($p < 0.0001$)^v.

Some hospitals have transitioned from nurses performing med recs to pharmacists performing the med recs. Pharmacists were shown in a study by Nester, et. al (2002) to identify a significantly higher number of medications taken per patient compared to nurses (5.12 +/- 3.14 vs 1.52 +/- 1.61, $p < 0.001$). Such medication included identifying herbals or non-prescription medications (98% vs 70%, $p < 0.001$) when obtaining medication histories^{vi}. Additionally, pharmacists contacted outpatient pharmacies significantly more than nurses did during the med rec process (24% vs 4%, $p < 0.001$). While this study favors pharmacists performing med recs to nurses, there are limitations to this study, the largest one being that the study was conducted in 1999 and published in 2002^{vi}.

Newer studies have been performed, however, that compare pharmacy technicians completing med recs to nurses rather than pharmacists. Many large hospitals have pivoted from pharmacists performing med recs to pharmacy technicians since pharmacist resources are often constrained. A study cited by the American Society of Health-System Pharmacists (ASHP) found that potential errors were decreased by 82% from baseline rate when trained pharmacy technicians completed the med recs^{vii}. Markovic, et. al (2017) showed that pharmacy technicians had an accuracy rate of 94.4% with med recs in the emergency department compared to 14% with nurses^{viii}.

Even though med recs can be very time-consuming for health care personnel initially, the process can become more efficient once proper procedures are in place. For example, a study completed by Rozich, et. al (2001) found that establishing a systematic approach to med recs decreased the amount of time it took to transfer a patient by 20 minutes per patient^{ix}. One of the main challenges of gathering an accurate medication list is the lack of a standardized location for where medication information can be found. Rozich, et. al (2001) found in their study that details of a patient's home medications in an inpatient chart were either nonexistent or incorrect 85% of the time prior to conducting a med rec^{ix}. Additionally, Nickerson, et. al (2005) found that 83% of these discrepancies in the patient's chart had the potential for harm^x. It has been shown that establishing a systematic med rec process can reduce this potential for harm in as many as 75% of cases^{xi}.

A systematic review published in 2016 recommends that utilizing a variety of sources is essential in obtaining an accurate med rec, and that the patient/caregiver must be included as a source of medication information^{xii}. The systematic review recommends interviewing the patient or caregiver first, and then reviewing at least one other reliable source to confirm the information from the patient and to potentially find medications that the patient might have missed. However, this review also states that an overall systematic approach for how to complete an accurate med rec has not been identified through literature^{xii}.

Conversely, several studies have shown a number of individual medication reconciliation processes that are successful. For example, a study implemented by the Massachusetts Coalition for the Prevention of Medical Errors and the Massachusetts Hospital Association found that strategies most strongly correlated with success included active physician and

nursing engagement, having an effective improvement team established within the hospital, and, last, having an actively engaged senior administrator^{xiii}.

A consensus statement was published by Greenwald, et. al (2010) in The Joint Commission Journal on Quality and Patient Safety that looked at key principles and necessary first steps when building med rec programs within a hospital. This publication recommended that designing a hospital-based med rec program should employ a multidisciplinary approach that involves nurses, pharmacists, and other appropriate personnel^{xiv}. Additionally, a med rec program should involve hospital leaders who support, provide guidance, and remove barriers for the multidisciplinary team working together, and roles should be given to each professional so that the same work is not being completed multiple times. Feedback systems should also be in place to allow for a clinically significant process improvement, and measurement tools should be used to assess both the positive and negative impact of the med rec program^{xiv}.

Ultimately, med recs are an important piece of the patient care process in all hospitals. This review has provided an overview on what med recs are, which professions have performed med recs the best through studies, and best practices for med rec programs. However, there still remains information about med recs needed to form sound policies for specific hospitals to ensure patient safety. It is the goal of this study to shed light on such information so that a med rec policy can be recommended for Marcum and Wallace Hospital.

V. Research Design

The purpose of this study is to evaluate the efficacy and safety of nurses performing med recs in a rural hospital setting. This study is being conducted at Marcum and Wallace Hospital in Irvine, Kentucky, where the policy is currently for nurses to perform the med recs on patients when admitted to the hospital. As stated, the clinical pharmacist has been tasked with performing a second med rec after the nurse and to document any changes that were made. After the pharmacist makes a change to the med rec, the change is documented in an Excel spreadsheet. Of note, the clinical pharmacist performed this med rec most of the time, but 3rd and 4th year pharmacy students from the University of Kentucky College of Pharmacy on clinical rotations with pharmacists at Marcum and Wallace Hospital also performed these second med recs. Data in this study represents data generated by both the clinical pharmacist and pharmacy students performing the second med rec.

Information documented in the Excel spreadsheet include the number of medications left off the med rec list by the nurse, the number of incorrect medications added to the med rec list, the number of medications with incorrect strengths, the number of medications with incorrect frequencies, the number of medications with incorrect formulations, the total number of med rec errors made by the nurse, and the patient's diagnosis. Of note, there were six main diagnoses that the pharmacy team at this hospital were looking at since they were identified as the most common problem areas in the Irvine, Kentucky community. These six diagnoses include Asthma, Behavioral Health, CHF, COPD, Diabetes, and Hypertension. While this information was easily identifiable in the Excel sheet provided by Marcum and Wallace Hospital, there was information that was only available by consulting each individual patient's

chart in their electronic medical chart (EMR). The time of admission and the number of medications the patient was reported to be taking at home in the nurse's initial med rec were determined through review of the EMR.

The timeline for this study was 9 months (1/1/18 – 9/31/18). This time period was chosen as the med rec data was first documented in January 2018 and my clinical rotation with Marcum and Wallace Hospital ended in September 2018. Two-hundred total patients had a second med rec performed by the pharmacist during this time period and were included in this study. There are three independent variables in this study, including the number of home medications listed in the nurse's initial med rec, the time of admission for the patient, and the patient's disease state. The dependent variables in this study are the number of medications left off the med rec list, the number of incorrect medications added to the med rec list, the number of incorrect medication strengths, the number of incorrect medication frequencies, the number of incorrect medication formulations, and the total number of errors made by the nurse in the initial med rec.

A multivariate linear regression was performed among the independent and dependent variables to identify problem areas in med rec performance by nurses at Marcum and Wallace Hospital. For example, it is anticipated that these regressions should reveal whether there is a statistical association between the number of medications a patient takes at home and the total number of errors made by the nurse or the number of incorrect medication strengths the nurse reported during the med rec. Results from this multivariate linear regression are shown in Tables 1 through 6.

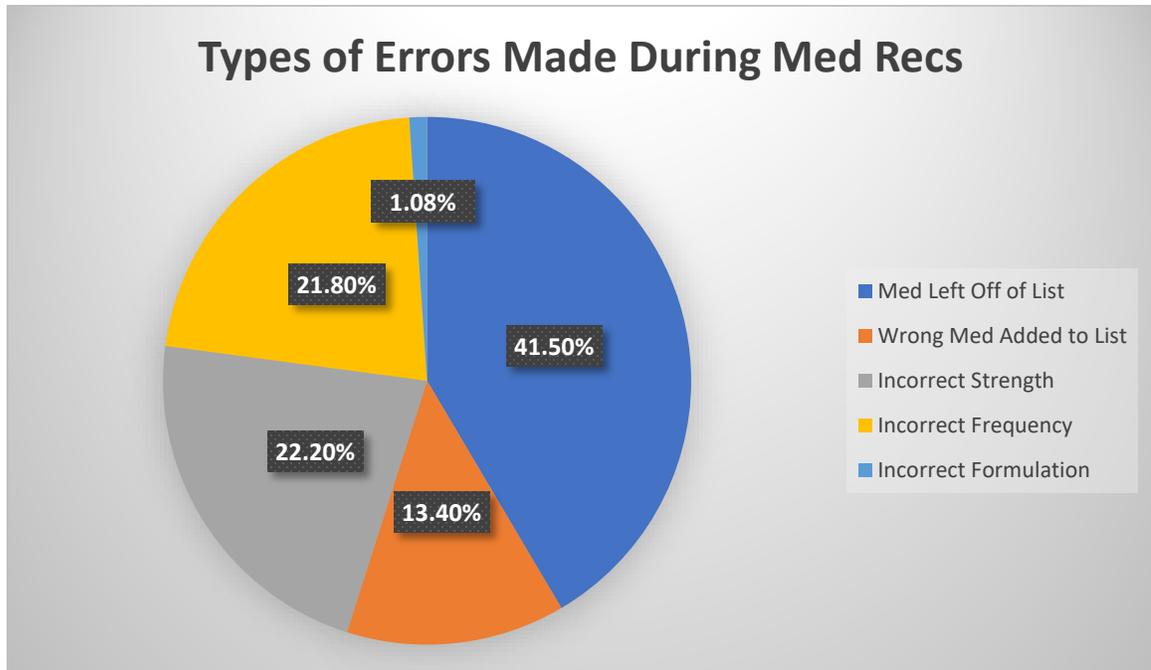
The data looking at the effect of the patient's disease state on med rec errors was documented slightly differently than with the other independent variables in the study. This is due to the disease state being categorical data rather than numerical. A dummy variable for disease state was used to solve this issue. If the patient was documented to have the disease state (hypertension, COPD, etc.), then a 1 was recorded for that patient. Conversely, a 0 was recorded if the patient did not have that particular disease state.

Overall, it is hopeful that this study will improve the care that the hospital is giving patients by identifying problem areas in med recs and by decreasing potential medication errors in the future. The full results will be presented to hospital leadership along with recommendations for policy changes for how nurses should approach performing med recs.

VI. Results

Nurses made 461 overall errors when completing med recs for 200 patients at Marcum and Wallace Hospital over the 9 month period of the study. There was an average of 2.3 errors made per patient during this time period with an average number of 14.3 home medications per patient as well. Additionally, the average time of being admitted for the patients in this study was at 1420. Figure 1 below shows a breakdown of the types of errors made by nurses when completing med recs. The most common error made was leaving a medication off the med rec list (41.5% of errors), and reporting incorrect strengths and frequencies were the next highest errors (22.2% and 21.8%, respectively).

Figure 1: Types of Errors Made by Nurses When Completing Med Recs



The following tables show the associations between the independent variables and the errors made by nurses during med recs. These errors are broken down into six categories: total number of med rec errors made by nurse, number of medications left off med rec list, number of incorrect medications added to med rec list, number of medications with incorrect strength, number of medications with incorrect frequency, and number of medications with incorrect formulation.

Table 1: Total Number of Med Rec Errors Made by Nurse

Dependent Variable: Total Number of Med Rec Errors Made by Nurse				
	P-Value	Coefficient	Confidence Interval	R-Squared
Number of Home Medications	0.050	0.0587386	0.0000878 to 0.1173894	0.1203
Time of Admission	0.568	-0.0001888	-0.0008395 to 0.0004618	
Asthma	0.684	-0.8299636	-4.843409 to 3.183482	
Behavioral Health	0.052	0.8432654	-0.0065976 to 1.693128	
CHF	0.192	1.055764	-0.5332899 to 2.644819	
COPD	0.013	1.191368	0.2492732 to 2.133463	
Diabetes	0.917	-0.0478822	-0.9531821 to 0.8574176	
Hypertension	0.130	0.6831397	-0.2021425 to 1.568422	

As shown above, there is a statistically significant association between the number of errors made by the nurse and the number of medications that the patient takes at home. For every 1 medication that is added to the patient’s home medication list, the number of errors made by the nurse performing the med rec increases by ~0.06. Additionally, there is a statistically significant association between having a COPD diagnosis and the total number of errors made by the nurse as the p-value is 0.013.

There is no association between the total number of errors and the time of admission for the patient. The r-squared for the total number of med rec errors made by the nurse is 0.1203. This means that the number of home medications, the time of admission for the

patient, and the patient’s diagnosis all account for approximately 12% of the variability in total errors made by nurses during med recs.

Table 2: Number of Medications Left Off Med Rec List

Dependent Variable: Number of Medications Left Off Med Rec List				
	P-Value	Coefficient	Confidence Interval	R-squared
Number of Home Medications	0.776	0.0066455	-0.0394472 to 0.0527382	0.0784
Time of Admission	0.936	0.0000208	-0.0004905 to 0.0005321	
Asthma	0.918	0.1648514	-2.98925 to 3.318953	
Behavioral Health	0.121	0.527861	-0.1400324 to 1.195754	
CHF	0.011	1.624047	0.3752351 to 2.872859	
COPD	0.087	0.6448566	-0.0955205 to 1.385234	
Diabetes	0.290	-0.3828295	-1.09429 to 0.3286308	
Hypertension	0.186	0.4679092	-0.2278196 to 1.163638	

There were 192 total medications that were left out by nurses when completing the initial med rec for the 200 patients in this study. The average number of medications left off the med rec list was 0.96 per patient. There is not a statistically significant association between the number of medications left off the med rec list by the nurse and the number of medications the patient takes at home since the p-value is 0.776. Additionally, the number of medications left off the med rec list by the nurse is not associated with the time of admission for the patient as the p-value is 0.936.

There is a positive statistical association between having a CHF diagnosis and the number of medications left off the med rec list though as the p-value is 0.011 and the coefficient is 1.624047. Also, the r-squared for the number of home medications left off the med rec list is 0.0784. This means that the number of home medications, the time of admission for the patient, and the patient’s diagnosis all account for approximately 7.8% of the variability in errors made by nurses in regard to leaving medications off the patient’s med rec list.

Table 3: Number of Incorrect Medications Added to Med Rec List

Dependent Variable: Number of Incorrect Medications Added to Med Rec List				
	P-Value	Coefficient	Confidence Interval	R-squared
Number of Home Medications	0.625	0.0039927	-0.0121007 to 0.0200862	0.0579
Time of Admission	0.840	-0.000182	-0.0001968 to 0.0001603	
Asthma	0.813	-0.01324477	-1.233716 to 0.9688208	
Behavioral Health	0.160	0.1666395	-0.0665584 to 0.3998375	
CHF	0.275	0.2422447	-0.1937835 to 0.6782729	
COPD	0.024	0.2978445	0.0393386 to 0.5563504	
Diabetes	0.898	0.0162163	-0.2321932 to 0.2646258	
Hypertension	0.317	0.1234543	-0.1194625 to 0.3663711	

There were 62 medications that were added to the med rec list by the nurses when completing the med rec but were removed by the pharmacist as the patient was not actually taking it at home. The average number of incorrect medications added to the med rec list was 0.3 medications per patient. There is not a statistically significant association between the

number of incorrect medications added to the med rec list and the number of medications the patient takes at home as the p-value is 0.625. Additionally, this dependent variable is not associated with the time of admission as the p-value is 0.840.

There is a positive statistically significant association between having a COPD diagnosis and the number of incorrect medications added to the med rec list as the p-value is 0.024 and the coefficient is 0.2978445. Also, the r-squared for the number of incorrect medications added to the med rec list is 0.0579. This means that the number of home medications, the time of admission for the patient, and the patient’s diagnosis all account for approximately 5.8% of the variability in errors made by nurses in regard to adding incorrect medications to the patient’s home medication list.

Table 4: Number of Medications with Incorrect Strength

Dependent Variable: Number of Medications with Incorrect Strength				
	P-Value	Coefficient	Confidence Interval	R-squared
Number of Home Medications	0.037	0.0198088	0.001237 to 0.038305	0.0929
Time of Admission	0.963	-0.00000481	-0.0002108 to 0.0002012	
Asthma	0.538	-0.397948	-1.668806 to 0.8729097	
Behavioral Health	0.194	0.1776566	-0.0914526 to 0.4467658	
CHF	0.079	-0.4506523	-0.9538265 to 0.0525218	
COPD	0.152	0.217291	-0.0810234 to 0.5156054	
Diabetes	0.104	0.2375473	-0.0491159 to 0.5242105	
Hypertension	0.683	0.0582112	-0.2221134 to 0.3385359	

There were 103 medications that had the incorrect strength listed on the med rec by the nurse. The average number of medications with the incorrect strength listed by the nurse was 0.5 medications per patient. There is a statistically significant association between the number of medications with the incorrect strength and the number of medications the patient takes at home as the p-value is 0.037. As the number of medications that a patient takes at home increases by 1 medication, the number of incorrect medication strengths that a nurse reports during the med rec increases by ~ 0.02 .

There is not a statistically significant association between the number of medications with the incorrect strength and the time of admission for the patient as the p-value is 0.963. This dependent variable is not associated with any of the six disease states identified in this study either. Also, the r-squared for the number of medications with incorrect strengths is 0.0929. This means that the number of home medications, the time of admission for the patient, and the patient's diagnosis all account for approximately 9.3% of the variability in errors made by nurses when documenting medication strengths.

Table 5: Number of Medications with Incorrect Frequency

Dependent Variable: Number of Medications with Incorrect Frequency				
	P-Value	Coefficient	Confidence Interval	R-Squared
Number of Home Medications	0.001	0.0271478	0.012003 to 0.0422927	0.1306
Time of Admission	0.067	-0.0001567	-0.0003247 to 0.000113	
Asthma	0.437	-0.4093815	-1.445737 to 0.6269743	
Behavioral Health	0.484	-0.0779288	-0.2973812 to 0.1415237	
CHF	0.102	-0.3422185	-0.7525457 to 0.0681087	
COPD	0.363	0.1124248	-0.1308439 to 0.3556935	
Diabetes	0.769	-0.0348188	-0.2685862 to 0.1989486	
Hypertension	0.272	0.1276339	-0.1009645 to 0.3562324	

There was a total of 101 medications that had incorrect drug frequencies listed when the nurse completed the initial med rec. The average number of medications with the incorrect frequency was 0.5 medications per patient. There is a statistically significant association between the number of medications with incorrect frequencies and the number of medications on the patient's med rec as the p-value is 0.001. As the number of medications that a patient takes at home increases by 1 medication, the number of incorrect medication frequencies that a nurse reports during the med rec increases by ~0.03.

There was not an association between the number of medications with incorrect frequencies and the time of admission for the patient as the p-value is 0.067. The r-squared for the number of medications with incorrect frequencies is 0.1306. This means that the number

of home medications, the time of admission for the patient, and the patient’s diagnosis all account for approximately 13.6% of the variability in errors made by nurses when documenting medication frequencies.

Table 6: Number of Medications with Incorrect Formulation

Dependent Variable: Number of Medications with Incorrect Formulation				
	P-Value	Coefficient	Confidence Interval	R-Squared
Number of Home Medications	0.161	0.0027572	-0.0011107 to 0.0066252	0.0288
Time of Admission	0.831	-0.00000465	-0.0000476 to 0.0000383	
Asthma	0.916	-0.0142177	-0.2788993 to 0.2504639	
Behavioral Health	0.250	0.0327697	-0.0232776 to 0.088171	
CHF	0.444	-0.0407623	-0.1455584 to 0.0640338	
COPD	0.872	0.005074	-0.057056 to 0.067204	
Diabetes	0.352	0.0282471	-0.0314562 to 0.0879505	
Hypertension	0.470	-0.0214042	-0.0797874 to 0.036979	

There was a total of 5 medications that nurses reported incorrect drug formulations on while completing med recs. The average number of medications with incorrect formulations was 0.03 per patient. There is not a statistically significant association between the number of incorrect medication formulations reported by nurses and the number of medications that the patient takes at home as the p-value is 0.161. Additionally, there is not a statistically significant association between the number of incorrect medication formulations and the time of admission by the pharmacist as the p-value is 0.831.

There is not an association between number of incorrect medication formulations and diagnosis. Also, the r-squared for the number medications with incorrect formulations is 0.0288. This means that the number of home medications, the time of admission for the patient, and the patient's diagnosis all account for approximately 2.9% of the variability in errors made by nurses when documenting medication formulations.

VII. Implications for Hospital Decisions

The results from the study show that the longer a patient's home medication list becomes, the number of total errors that a nurse makes during a med rec and the number of incorrect medication strengths and frequencies the nurse reports all increase as well. It should be noted though that while statistical associations were shown to exist through this study, variables such as number of home medications, time of admission, and disease state do not provide causation for these errors that nurses have made during med recs. These variables together only accounted for 12% of the total med rec errors made by nurses in this study, demonstrating that they only play a minor part in the errors that nurses make when completing med recs. Regardless, it is the hope that the recommendations based upon the results of this study do lead to a reduction in med rec errors at Marcum and Wallace Hospital. Additionally, it is hopeful that observation of errors is continued at this hospital so that a second study can be completed in the future to see if the errors do indeed reduce.

The first policy recommendation is that a pharmacist should perform a second med rec for all admitted patients to reduce the error of incorrect information being reported. This recommendation is given as pharmacists were shown in this study to be a valuable asset to the

hospital by catching on average 2.3 errors per patient and 461 overall med rec errors. As mentioned in the literature review earlier, pharmacists have been shown to significantly identify a higher number of home medications taken per patient compared to nurses^{iv}.

The results in this study also show that the number of overall med rec errors nurses at Marcum and Wallace Hospital make increase when a patient has a COPD diagnosis. Additionally, there was a positive association between nurses leaving a medication off the med rec list if the patient has a CHF diagnosis and nurses reporting the incorrect medications on the med rec list when the patient has a COPD diagnosis. These results are applicable to Marcum and Wallace Hospital in that they can be factored into further policy decisions.

To address the association between the patient having a CHF diagnosis and the nurse leaving a home medication off the list, it is recommended that the med rec training for nurses include a portion where they learn about regimens commonly prescribed for patients with CHF. This would allow the nurses to identify when a medication is missing from the patient's CHF regimen and dig deeper within the patient's medication history to see if the patient is taking a medication within that class. For example, noticing a common CHF medication is missing from a patient's list could prompt the nurse to call the patient's home pharmacy and check their dispensing history or interview the patient a second time about which medications they take at home.

Additional policies are recommended due to the association between having a COPD diagnosis and the nurse reporting the incorrect medications on the med rec list. Potential policies would include requiring the nurse performing the med rec to verbally ask the patient

which inhalers they use at home for their COPD and obtain a dispensing history from the patient's pharmacy. This recommendation is due to insurance requirements for inhalers. An example is that patients with COPD are often prescribed an initial inhaler by their physician, but when they go to the pharmacy their insurance prefers a different brand. Thus, the doctor verbally agrees to this interchange of inhalers but it may not get documented in the patient's chart. This leads to the nurse performing the med rec to believe that the patient is using the inhaler that the physician initially prescribed, but they are actually using the inhaler that insurance covers. Patients are also often prescribed several different inhalers, and it is easy to mix up the strengths among them. Speaking to the patient about the inhalers being used and obtaining a dispensing history from the patient's home pharmacy helps eliminate this error from occurring.

VIII. Limitations

While the data gathered by Marcum and Wallace Hospital provided for a robust study, there are a few limitations to the study. The first limitation is the small number of patients studied. While the hospital admitted more than 200 patients in the time period for this study, the clinical pharmacist is often in the off-site clinics providing MTM services, so he or she was not always on site to perform med recs. Thus, this facet of the hospital staffing structure led to a smaller sample size than desired. For further validity of the results of this study, the study should be repeated at a larger hospital with a larger pharmacist staff available to complete the med recs.

Another limitation to this study is that the actual medications that nurses made errors in were not included in the study. Medication name was not a metric that was recorded in the Excel sheet when the clinical pharmacist made a change. The specific medications which led to errors within the patient's chart was not always documented by the pharmacist or pharmacy students in the note, making it difficult to retrospectively retrieve this information for analysis. The third limitation in this study is that med rec errors could not be compared between location within the hospital. Comparing med rec errors between the emergency department and inpatient floor would have been a great addition to this study, but this metric was not feasible since the location where a med rec is completed is not documented in the patient's chart once they are discharged. Comparing med rec errors between locations could easily be analyzed if the study is repeated in the future either with a different electronic medical record system or if the authors collect this information prior to the patient being discharged.

The fourth and last limitation to this study is that the independent variables in this study together accounted for only a small percent (12%) of the total variability in the errors that nurses made when completing med recs. As discussed, there were many variables that were not feasible to research due to limitations in data collection and staffing capabilities of the hospital. It is hopeful that the results of this study make a positive impact on med rec error reduction at Marcum and Wallace Hospital; however, further studies would need to overcome the barriers that were present in this study.

IX. Conclusion

This study has taken an in-depth look into the common errors that nurses make while performing med recs at Marcum and Wallace Hospital in Irvine, Kentucky. Overall, 461 errors were made by nurses during med recs, which were corrected by the pharmacist performing a second med rec. There were many statistically significant results in this study, all factoring into policy recommendations that will be given to the administration at Marcum and Wallace Hospital. Some of the main results from this study showed that the number of overall med rec errors increased as patients' home medication lists became longer and when patients have a diagnosis of COPD, and also that med rec errors were not associated with the time the patient was admitted to the hospital.

Policy recommendations based upon these results included requiring a pharmacist to perform a second med rec and to provide med rec training where nurses learn to identify common CHF and COPD medication regimens. It is hopeful that another study will be completed in the future at Marcum and Wallace Hospital to observe any reductions in med rec errors based upon the policy recommendations provided in this study and to further investigate sources of med rec errors made by nurses.

X. References

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