Characterization of Admission Medication Reconciliations Performed by Pharmacists in a Pediatric Institution: Resource Allocation

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BACKGROUND Compared with adults, children may be at greater risk of medication errors and potential adverse effects. The American Academy of Pediatrics recommends developing mechanisms for proactively identifying patients at risk for medication-related adverse events and failed reconciliation. This study's primary purpose was to evaluate pediatric patients admitted to identify risk factors requiring pharmacist intervention during medication reconciliation (MedRec).

METHODS This prospective study included pediatric patients admitted during the study time frame until the target population of 500 patient encounters was achieved. During each admission, pharmacy staff completed a medication history, after which a pediatric pharmacist completed a MedRec, as is standard hospital practice. The primary outcome was identification of factors for high-risk transitions of care during pediatric admissions based on the need for pharmacist interventions during the MedRec process.

RESULTS In total, 331 interventions were made for 127 patients (median 2; range, 1–12). Of the 331 interventions, 196 (59.2%) were classified as being of moderate or significant severity. Although patients with at least 2 home medications were significantly more likely to require any intervention ($p < 0.0001$), patients with 5 or more home medications were more likely to have a significant intervention.

CONCLUSION Identifying patients with home medications could allow for focused efforts to intervene. Also, patients admitted to the PICU or those with cardiology- or endocrinology-related diagnoses should be prioritized for MedRec process, because of the likelihood of requiring multiple home medications. This strategy should be tailored to individual pediatric institutions based on internal quality control assessments and available resources.

ABBREVIATIONS GenPeds, general pediatrics; KCH, Kentucky Children's Hospital; MedHx, medication history; MedRec, medication reconciliation; Medical SubSpec, medical subspecialty; Min-I, minor intervention; Mod-I, moderate intervention; PICU, pediatric intensive care unit; Sig-I, significant intervention

KEYWORDS clinical pharmacy; medication history; medication reconciliation; pediatrics; transitions of care

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Background

Timely and accurate medication history (MedHx) and medication reconciliation (MedRec) processes have been shown to be essential in decreasing preventable medication errors in pediatric patients.¹ The Joint Commission 2017 National Patient Safety Goals have continued to emphasize the importance of improving medication use safety, as suggested in NPSG.03.06.01: Record and pass along correct information about a patient's medicines. Find out what medicines the patient is taking. Compare those medicines to new medicines given to the patient. Make sure the patient knows which medicines to take when they are at home. Tell the patient it is important to bring their up-to-date list

of medicines every time they visit a doctor.²

Compared with adults, children may be at greater risk of medication errors and potential adverse drug events because of individualized weight-based dosing, differences in compounded formulations and concentrations, the inability of children to communicate adverse effects, confusion between units of measure (e.g., milligrams versus milliliters). A consensus statement endorsed by the American Academy of Pediatrics recommends developing mechanisms for prospectively and proactively identifying patients at risk for medication-related adverse events and failed reconciliation.³ It is hypothesized that such an alert system would help focus resources on high risk patients and maintain vigilance toward patient safety.³

Figure 1. Process for Medication History (MedHx) and Medication Reconciliation (MedRec) at Kentucky Children's Hospital.

* The pediatric Hematology/Oncology service has dedicated nurse practitioners who may complete the patient's MedRec.

Based on previous literature, there is significant diversity in the methods employed by health systems to address the MedRec process.⁴⁻⁸ Studies on MedHx and MedRec have been completed in subsets of pediatric populations; for example, pediatric intensive/intermediate care,⁴ a pediatric outpatient setting,⁹ and pediatric cardiology.⁵ The role of pharmacy personnel (pharmacist, pharmacy intern, and/or pharmacy technician) in obtaining thorough and accurate MedHx has been established.⁵⁻⁸ Because of finite resources, it remains important that implemented strategies for MedRec, both successful methodologies and key lessons from unsuccessful efforts, should be widely explored and disseminated.³

The purpose of this study was to examine the MedHx and MedRec processes in place upon admission to a

pediatric institution and to identify effective strategies for maximizing efficiency in reducing errors during transitions of care related to these processes. The primary outcome of this study was to identify factors for high-risk transitions of care, defined as patients requiring a pharmacist intervention during admission MedRec. Secondary outcomes included determining the percentages of MedHx and MedRec completed during pediatric patient admissions, determining the time required for completion of MedHx to MedRec, and stratification of pharmacist interventions during the MedRec process.

Methods

This observational study was conducted from Janu-

Table 1. Study Demographics

	Total (N = 1428)	No MedHx, No MedRec n = 212 (14.8%)	MedHx Only n = 243 (17.0%)	MedHx and MedRec n = 973 (68.1%)
Age, yr, median (range)	3.6 (0–18.9)	6.3 (0–18.9)	4.9 (0–18.8)	3.1 (0–18.5)
Sex, male, n (%)	791 (55.4)	127 (59.9)	137 (56.4)	527 (54.2)
Number of medications, median (range)	0 (0–27)	n/a	1 (0–21)	1 (0–27)
Service line, n (%)				
GenPeds	628 (100)	60 (9.6)	85 (13.5)	483 (76.9)
HemeOnc*	86 (100)	3 (3.5)	25 (29.1)	58 (67.4)
Neurology	162 (100)	19 (11.7)	35 (21.6)	108 (66.7)
PICU	123 (100)	13 (10.6)	4 (3.3)	106 (86.2)
Medical SubSpec	114 (100)	28 (24.6)	23 (20.2)	63 (55.3)
Surgery	315 (100)	89 (28.3)	71 (22.5)	155 (49.2)
Admitting diagnosis, n (%)				
Cardiology	49 (100)	6 (12.2)	5 (10.2)	38 (77.6)
Endocrinology	43 (100)	9 (20.9)	9 (20.9)	25 (58.1)
ENT	52 (100)	15 (28.8)	15 (28.8)	22 (42.3)
Failure to thrive	30 (100)	5 (16.7)	1 (3.3)	24 (80.0)
Gastrointestinal	157 (100)	18 (11.5)	38 (24.2)	101 (64.3)
HemeOnc-planned	26 (100)	0 (0.0)	16 (62.5)	10 (38.5)
HemeOnc-unplanned	74 (100)	4 (5.4)	10 (13.5)	60 (81.1)
Infection	371 (100)	46 (12.4)	43 (11.6)	282 (76.0)
Nephrology	25 (100)	4 (16.0)	5 (20.0)	16 (64.0)
Neurology	237 (100)	28 (11.8)	46 (19.4)	163 (68.8)
Orthopedics	33 (100)	9 (27.3)	7 (21.2)	17 (51.5)
Other	95 (100)	16 (16.8)	14 (14.7)	65 (68.4)
Pulmonology	100 (100)	13 (13.0)	12 (12.0)	75 (75.0)
Surgery	113 (100)	32 (28.3)	18 (15.9)	63 (55.8)
Urology	23 (100)	7 (30.4)	4 (17.4)	12 (52.2)

ENT, otolaryngology; GenPeds, general pediatrics; HemeOnc, hematology/oncology; MedHx, medication history; MedRec, medication reconciliation; Medical SubSpec, medical subspecialty; n/a, not applicable

* The pediatric HemeOnc service has dedicated nurse practitioners that may complete the patient's MedRec.

ary 2018 to March 2018 at Kentucky Children's Hospital (KCH), a 150-bed hospital within a 1086-bed tertiary care academic institution. All patients admitted to KCH who were 18 years or younger were included prospectively until 500 patients with a completed MedHx, MedRec, and at least 1 home maintenance medication were captured. This strategy was selected to ensure inclusion of an adequate number of patients with home medications requiring potential admission reconciliation. Over-the-counter acetaminophen, ibuprofen, multivitamin, iron, and vitamin D were excluded from the home medication count because these medications are common, but they generally do not require pharmacist intervention. In addition, neonatal intensive care unit (NICU) patients were excluded from the study because they lack home medications. Pediatric pharmacists involved in MedHx and MedRec processes were educated on the study inclusion criteria and procedures, including appropriate documentation of interventions. Case examples were

used during the training to generate consistency among pharmacist documentation in the electronic data form regarding risk stratification of interventions made.

After completion of the MedHx and MedRec (Figure 1), the pediatric pharmacist completed an electronic data form detailing age, sex, service line to which they were admitted, admitting diagnosis, admission date/time, MedHx date/time, interpreter requirements, MedRec date/time, number of home medications, medication class, pharmacist intervention type (dose decreased, dose increased, change frequency, change medication, change route, discontinue medication, start medication, no changes), and number of interventions stratified by risk (minor [Min-I], moderate [Mod-I], or significant [Sig-I]). Based on staffing patterns, admissions from 7:00 am to 3:30 pm were considered prime time, and admissions from 3:30 pm to 7:00 am were considered non-prime time.

MedHx and MedRec completion times were deter-

Figure 2. Staff member completing Medication History (MedHx).

ED, Emergency Department

* MedHx completed by a combination of listed individuals.

mined from the time of admission to the time the entire process was complete. This includes time spent on any necessary associated processes, such as reviewing the patient profile, interviewing the patient/family, and calling home pharmacies. Risk stratification for interventions were defined as: Min-I for interventions with minimal health consequences (e.g., melatonin for sleep), Mod-I for interventions resulting in improved patient outcome but an overall health consequence that would be considered non-life-threatening (e.g., ranitidine for gastroesophageal reflux and most other clinically relevant interventions), or Sig-I for interventions where the absence of intervention could have created a potential life-threatening situation (e.g., initiating levetiracetam in a patient with status epilepticus).

Study personnel reviewed daily admission lists during the study time frame, cross-referencing patients entered into the database, and identifying remaining patients admitted without a MedHx and/or MedRec completed prior to discharge. Patients who had a MedRec completed via electronic medical record documentation but did not have a pharmacist-completed study survey were assumed to have zero interventions. Patient discharge date/time was retrospectively entered into each electronic data form.

Participation in the study did not affect any intervention or care for patients, because it is standard practice to have MedHx completed by pharmacy personnel and MedRec completed by a pediatric pharmacist. For analysis, data concerning the service line of admission was grouped into bins. This resulted in the creation of 6 service bins: general pediatrics (GenPeds; encompassing 3 teams), hematology oncology (HemeOnc; including both planned and unplanned admissions),

neurology, PICU, medical subspecialty (Medical Sub-Spec; encompassing cardiology, endocrinology, nephrology, pulmonary, rheumatology, and urology), and surgery (encompassing general surgery, neurosurgery, oral maxillofacial surgery, orthopedics, otolaryngology, and plastic surgery).

Microsoft Excel (2016) was used for initial data sorting, validation, descriptive statistics to characterize the patient population, and for secondary outcomes that did not require statistical analysis. All other statistical analyses were completed using SAS 9.4 software (SAS Institute Inc, Cary, NC). ANOVA and MANOVA were used for analyses comparing 3 or more groups, with appropriate α correction.

Results

A total of 1428 admissions to KCH (excluding NICU) occurred during the study period, representing 1281 unique patients. Patients were a median of 3.6 years (range, 0–18.9 years) of age. Most patients were admitted to a GenPeds or surgery service line (44% and 22.1%, respectively; Table 1).

Average time from admission to MedHx was 12.3 ± 12.0 hours. Although not statistically significant, MedHx took less time, on average, to complete during the weekday versus the weekend (11.7 ± 11.1 vs 14.8 ± 15.2 hours), and during prime time versus non-prime time (9.8 ± 10.9 vs 13.2 ± 12.3 hours). Most MedHxs (53.4%) were completed by pharmacy interns at the institution (Figure 2). The MedHx completion rates were largely similar, irrespective of when patients were admitted (85.8% for weekdays vs 82.4% for weekends, and 84.7% for prime time vs 85.2% for non-prime time admissions).

Figure 3. Time to completion of medication history (MedHx) and medication reconciliation (MedRec) by service line.

GenPeds, general pediatrics; HemeOnc, hematology/oncology; Medical SubSpec, medical subspecialty; Neuro, Neurology; PICU, pediatric intensive care unit

Box plots show the interquartile range, with mean (diamond) and median (line) indicated. Error bars delineate minimum and maximum values, with outliers (circles) having values greater than 1.5 times the interquartile range. * $p < 0.05$. Values below day 0 occurred prior to admission (i.e., in the emergency department).

Average time from admission to MedRec was 19.5 ± 14.7 hours. Similar to what was observed with MedHx, although not statistically significant, MedRecs took less time, on average, to complete during weekdays versus weekends (18.7 ± 14.3 vs 23.2 ± 15.7 hours), and during prime time versus non-prime time (17.7 ± 16.1 vs 20.2 ± 14.1 hours). MedRecs were completed in similar proportions of patients admitted on a weekday versus on a weekend (67.5% vs 70.8%), whereas MedHx was completed in a slightly reduced percentage of patients admitted during prime time versus non-prime time (62.4% vs 70.3%).

Surgery, PICU, and Medical SubSpec service lines took significantly longer, on average, to complete MedHx than GenPeds, HemeOnc, and neurology (Figure 3). Medical SubSpec and surgery also completed a significantly lower percentage of MedHx than other services (Figure 4). Similarly, Medical SubSpec and surgery service lines were significantly less likely to complete MedRecs, and the MedRecs that were completed required a significantly longer time (Figures 3 and 4).

Among patients with both a MedHx and MedRec ($n = 973$), 55.3% ($n = 538$) had at least 1 home medication, and 23% ($n = 126$) of those patients required an intervention. Of the patients who had a MedHx and MedRec with no home medications ($n = 435$), 1 patient required

an intervention. This represents 13.1% of patients with a completed MedHx and MedRec and 8.8% of all patients included in the study (Figure 5).

In total, 331 interventions were made on 127 patients (median 2; range, 1–12; Figure 6). There was not a significant difference in the number of interventions made between patients admitted on a weekday versus a weekend ($p > 0.5$) or those admitted during prime time versus non-prime time ($p > 0.5$). Of the 331 interventions, 196 (59.2%) were classified as Mod-I or Sig-I severity (Figure 6). Although patients with at least 2 home medications were significantly more likely to require any intervention ($p < 0.0001$), patients with 5 or more home medications were more likely to have a Sig-I intervention.

Among patients with both a MedHx and MedRec, differences in interventions were observed when patients were stratified by admission to individual service lines. For PICU, 24% of patients required an intervention, compared with 13% of Medical SubSpec patients and 12% of neurology service patients. In contrast, 8% of patients admitted to the GenPeds service, 9% of patients admitted to the HemeOnc service, and 4% of patients admitted to the surgery service required interventions (Table 2). However, patients admitted to the Medical SubSpec and surgery services had low

Figure 4. Completion of Medication History (MedHx) and Medication Reconciliation (MedRec).

GenPeds, general pediatrics; HemeOnc, hematology/oncology; Medical SubSpec, medical subspecialty; Neuro, Neurology; PICU, pediatric intensive care unit

□ Admission; ■ with MedHx only; ■ with MedHx and MedRec

completion of rates of MedRecs (55.3% and 49.2%, respectively; Table 1).

Patients with specific admitting diagnoses required interventions at higher percentages, including patients with a cardiology or endocrinology diagnosis on admission requiring intervention 20% and 19% of the time, respectively, versus patients admitted with a gastrointestinal diagnosis, who required an intervention 3% of the time. The patients admitted with cardiology diagnoses and endocrinology diagnoses required 34 and 19 interventions, respectively, with 28 and 17 interventions of Mod-I or Sig-I severity (82% and 89%). Some admitting diagnoses result in very few interventions (2% admitted with otolaryngology diagnoses, 3% admitted for surgery) but were more likely to require Mod-I or Sig-I intervention (100% and 83%, respectively; Table 2).

Discussion

A study completed in response to The Joint Commission National Patient Safety Goal described the implementation of a pharmacy-led MedHx and MedRec process, including the development of appropriate functionality within the electronic medication record to alert pharmacists of the need to initiate the process.⁶ Our institution has had a MedHx and MedRec process upon admission in place for several years, including documentation of a formal MedHx note, via a template, in the patient's electronic medical record. The Multum Lexicon (Cerner Corporation, North Kansas City, MO)

drug, herbal, and nutraceutical database is used to assist in populating MedHx information. Pharmacy personnel are familiarized with this process during their training period of employment or rotation. Columns within the patient lists of the electronic medical record are used to universally keep track of the status of the MedHx and MedRec; the MedHx is marked as complete once the formal MedHx note is filed in the patient's chart. The MedRec is marked as complete once the pharmacist marks as reviewed the reconciliation tool available within the electronic medical record. Pharmacists intermittently work on MedHx and MedRec activities throughout the workday as time and priority dictate. The purpose of our study was to analyze the processes in place, to characterize the patient population, identify areas for improvement, and determine where to allot finite resources for the highest potential impact.

This study was strategically conducted during the busiest time of the year for pediatric patient admissions, to assess our ability to complete the MedHx and MedRec processes when resources were at their highest level of use. Challenges to completing a MedHx and MedRec included obtaining appropriate sources of accurate information, due to a lack of family members at the patient's bedside; as well as short patient admissions, particularly among surgical patients. Additionally, lack of sufficient personnel resources to complete MedHx and MedRec processes can be a major challenge within pediatric institutions, as demonstrated by

Figure 5. Flowchart of admissions during the study period.

our practice of relying heavily upon pharmacy interns to complete MedHx. This is especially important considering that pharmacy interns may not be available at other institutions. Our pharmacy intern pool included students on introductory and advanced pharmacy practice experiences (i.e., IPPE and APPE) as well as pharmacy intern employees. Pharmacy intern contribution is estimated at a full-time equivalent of 0.85, primarily during the time frame of 7:00 am to 9:00 pm. This program allows for the use of pharmacy interns to augment our processes of MedHx and MedRec. Pharmacy interns are able to alert pharmacists of completion of the MedHx and readiness for the MedRec via the column in the electronic medical record described above; however, verbal communication is often helpful to better prioritize high-risk patients as described above. Some MedHxs were completed, prior to formal patient admission, in the pediatric emergency department of our institution, which is located in an adjacent building. Other institutions may be unable to complete MedHxs in this fashion if not located proximal to their primary institution. Similarly, our Pediatric Pulmonary Clinical Pharmacist completes all MedHxs for planned cystic fibrosis patient admissions in the pediatric pulmonary clinic prior to formal patient admission. Other institutions may be unable to complete MedHxs in

this fashion if ambulatory care services are unavailable. However, these preadmission workflows may be preferred to be able to incorporate communication of potential or identified high-risk patients to the inpatient medical and pharmacy teams.

Previous studies have delineated the role of pharmacist intervention during MedRec in addressing important errors of omission or necessary changes in dose.^{6,8} The severity of interventions observed in our study aligns with previous literature describing most pharmacist interventions as having a potential impact on patient outcomes.^{6,11}

When Coffey et al¹¹ quantified admission medication discrepancies in a tertiary-care, general pediatric population, they reported on 272 pediatric patient admissions with pharmacist MedHx compared to physicians' active medication orders. In that study, nearly one-quarter of patients had an unintentional discrepancy, and more than 3 prescription medications was associated with a risk of a clinically important discrepancy.¹¹ Our study evaluating the total pediatric inpatient population indicates that 2 home medications significantly increased a patient's likelihood of requiring any intervention, with 5 or more home medications signifying a heightened risk of an intervention that may prevent a life-threatening situation. Nearly half of our

Figure 6. Total interventions by service line.

GenPeds, general pediatrics; HemeOnc, hematology/oncology; Medical SubSpec, medical subspecialty; Neuro, Neurology; PICU, pediatric intensive care unit

□ Minor Intervention; ■ Moderate Intervention; ■ Significant Intervention

population with a completed MedHx and MedRec did not have any home medications, and only 1 such patient required an intervention, which was clarification of a severe penicillin allergy. Identifying those patients with home medications immediately upon patient presentation could allow for focused efforts on these patients most likely to require pharmacist intervention.

Unintentional medication discrepancies have the potential to cause patient harm, with the number of preadmission medications shown to be a predictor of medication errors.⁴ Our data support the idea that errors are more likely to occur in patients with chronic disease states, because those patients who required significant interventions frequently received a diagnosis of a chronic condition (e.g., cystic fibrosis, epilepsy, liver failure, lupus). In particular, cardiology admitting diagnoses were largely related to congenital heart disease (e.g., atrial septal defect, Tetralogy of Fallot, hypoplastic left heart syndrome), whereas endocrinology admitting diagnoses were overwhelmingly related to diabetes mellitus. Historically, patients with antiepileptic medications also appear to be at increased risk of medication errors,^{10,11} which we also observed in our patient population. In our study, a higher percentage of patients admitted to the PICU required intervention compared with other service lines. It is speculated that this may

be due to the de-prioritization of resuming chronic maintenance medications upon initial presentation and management of a critically ill patient. Once stabilized and improving, it is often reasonable for most chronic maintenance medications to be restarted, which aligns with the observed timeline of the MedHx/MedRec being completed the day after admission and inquiring with the service whether or not to order these medications (i.e., intervening on medication omissions).

Our MedHx/MedRec completion rate of 68% is similar to the 71% that was reported by Rappaport et al⁹ after a comprehensive intervention incentive strategy was completed in a pediatric outpatient setting, but it was lower than the 85% reported after implementation of a new MedRec process at 2 different pediatric inpatient institutions.^{6,7} Although our study required pharmacists to enter survey information into the study database, there were no changes implemented to our MedHx/MedRec processes prior to the start of this study, and it may therefore more closely represent an accurate baseline for pediatric institutions. It was surprising but reassuring that MedHx and MedRec completion rates and total number of interventions were not significantly different between weekday and weekend admissions, nor were they different during prime time versus non-prime time coverage, despite lower levels of staff cover-

Table 2. Characterization of Interventions

	Number of admits with interventions (n = 127)				Number of interventions (n = 331)			
	Total*	Min-I	Mod-I	Sig-I	Total	Min-I	Mod-I	Sig-I
Service line, n (%)								
GenPeds	48 (37.8)	33	23	3	128 (38.7)	70	55	3
HemeOnc	8 (6.3)	7	2	2	17 (8.9)	12	2	3
Neurology	19 (15.0)	9	12	0	40 (12.1)	19	21	0
PICU	24 (18.9)	6	17	9	72 (21.8)	10	49	13
Medical SubSpec	15 (11.8)	6	9	3	41 (12.4)	9	22	10
Surgery	13 (10.2)	10	7	0	33 (10.0)	15	18	0
Severity, n (%)								
Min-I	71 (44.9)				135 (40.8)			
Mod-I	70 (44.3)				167 (50.4)			
Sig-I	17 (10.8)				29 (8.8)			
Type of intervention, n (%)								
Add medication	96 (51.9)				237 (66.0)			
Discontinue medication	30 (16.2)				46 (12.8)			
Change frequency	14 (7.6)				26 (7.2)			
Increase dose	26 (14.1)				29 (8.1)			
Decrease dose	9 (4.9)				11 (3.1)			
Change medication	7 (3.8)				7 (1.9)			
Change route	2 (1.1)				2 (0.6)			
Identify allergy	1 (0.5)				1 (0.3)			
Admitting diagnosis, n (%)	Total*	Min-I	Mod-I	Sig-I	Total	Min-I	Mod-I	Sig-I
Cardiology	10 (7.9)	3	9	2	34 (10.3)	6	21	7
Endocrinology	8 (6.3)	2	6	0	19 (5.7)	2	17	0
ENT	1 (0.8)	0	1	0	4 (1.2)	0	4	0
Failure to thrive	1 (0.8)	1	0	0	1 (0.3)	1	0	0
Gastrointestinal	11 (8.7)	7	6	3	40 (12.1)	18	18	4
HemeOnc-planned	2 (1.6)	2	1	0	3 (0.9)	2	1	0
HemeOnc-unplanned	8 (6.3)	6	2	3	18 (5.4)	12	2	4
Infection	24 (18.9)	12	16	2	51 (15.4)	17	32	2
Nephrology	2 (2.8)	2	0	1	5 (1.5)	4	0	1
Neurology	25 (19.7)	12	16	1	56 (16.9)	26	29	1
Orthopedics	5 (3.9)	5	2	0	11 (3.3)	7	4	0
Other	12 (9.4)	7	4	1	21 (6.3)	14	6	1
Pulmonology	14 (11.0)	9	5	4	55 (16.6)	23	23	9
Surgery	3 (2.4)	2	2	0	12 (3.6)	2	10	0
Urology	1 (0.8)	1	0	0	1 (0.3)	1	0	0

ENT, otolaryngology; GenPeds, general pediatrics; Heme/Onc, hematology/oncology; MedHx, medication history; MedRec, medication reconciliation; Medical SubSpec, medical subspecialty; Min-I, minor intervention; Mod-I, moderate intervention; Sig-I, significant intervention

* Totals may not equal the sums of Min-I, Mod-I, and Sig-I because individual patients may have interventions in multiple categories.

age. We attribute this finding to our robust pharmacy intern program that augments our pharmacist staffing patterns for the afternoon and evening MedHx/MedRec processes. For patients admitted after 9:00 pm, a MedHx/MedRec was not completed until the following morning unless requested as urgent by a medical provider. This likely contributes to the increased time required for completion of MedHx/MedRec processes without affecting the volume. Additionally, the length of time for process completion was longer on the week-

end and during non-prime time hours, as well as on the surgery and Medical SubSpec service lines, all of which do not have a daily rounding pharmacist. This suggests additional resources (increased staffing) could allow for intervention more quickly after admission. Further, analysis of an institution's unique patient composition may allow for identification of particular service lines that would benefit from additional staffing because these were also areas that had low completion rates of MedHx/MedRec processes yet required interventions.

Limitations of this study include that it focuses on the admission MedHx/MedRec process of a single institution, which may be unlike other pediatric institutions with regard to size, available resources, and/or patient population. Our institution is limited to track in real time interventions made by the pharmacist during MedHx/MedRec processes within the electronic medical record; institutions with this capability built into their system may be at an advantage for a higher level of quality control. Additionally, patients with documentation of their MedRec without a survey were presumed to not require any interventions, which may have underestimated the total number of interventions pharmacists performed. Compared with other services, the low rate of <50% MedRec completion for surgery patients made it difficult to draw any substantial conclusions for this service line. Although this data set did not include information concerning route of admission (emergency department, transfer from outside hospital, direct admission from primary care), it may be worthwhile to examine in a future study.

Conclusion

Given the results of our study, it is important to have an efficient system for determining if the patient has any home medications on admission. This yes or no answer could assist in prioritizing patients most likely to require an intervention during the MedRec process. At our institution, patients admitted to the PICU, or those with cardiology- or endocrinology-related admitting diagnoses, should be prioritized for MedRec process, because of the likelihood of multiple home medications. Because individual pediatric institutions may have varying makeup of medical and surgical subspecialties, this strategy may need to be tailored to the individual institution based on internal quality control assessments and available resources.

ARTICLE INFORMATION

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Ethical Approval and Informed Consent Given the nature of this study, the institution review board/ethics committee at the KCH did not require HIPAA Waiver of Authorization, Waiver of Assent, and Waiver of Parental Permission under exempted criterion.

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