

## Original Research

# Characteristics Contributing to a Pharmacy Services Excellence Model in a Large Health System

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## Abstract

### Objective

To identify characteristics that contribute to and promote a pharmacy services center of excellence model in a large health system.

### Methods

In 2019, a survey was conducted of 161 acute care pharmacy departments of health system-affiliated hospitals. Information captured included pharmacy practice models, pharmacist resource allocation, training of pharmacy residents, postgraduate training and pharmacist certifications. Results were combined with clinical pharmacy metric performance and centralized electronic data to identify features of top performing pharmacy departments.

### Results

Survey results were received from 141 of 161 affiliated hospitals (88%). Hospitals with 100 to 299 beds comprised 54% (n = 16 of 30) of the hospitals “at goal” and 66% (n = 26 of 40) of hospitals with “opportunity”. Hospitals with top performing pharmacy services had greater participation in interdisciplinary rounds, reporting “always” participating in Adult Critical Care (67% versus 43%) and Medical/Surgical (30% vs. 8%) rounds. Hospitals that trained pharmacy residents had a greater number of clinical pharmacy metrics at goal ( $5.89 \pm 1.59$  versus  $4.16 \pm 1.86$ ,  $p < 0.001$ ), employed more board-certified pharmacists ( $2.32 \pm 1.49$  versus  $1.57 \pm 1.62$ ,  $p = 0.019$ ), more postgraduate year 1 (PGY1) trained pharmacists ( $2.06 \pm 1.33$  versus  $1.19 \pm 1.19$ ,  $p < 0.001$ ) and more PGY2 trained pharmacists ( $0.58 \pm 0.64$  versus  $0.19 \pm 0.44$ ,  $p = 0.002$ ). When including several key hospital characteristics into a single model, hospitals that trained pharmacy residents were significantly associated with achieving “at goal” status ( $p = 0.011$ ).

### Conclusion

Defining characteristics of a pharmacy services center of excellence model included “at goal” clinical pharmacy metrics performance, clinical pharmacist time dedicated to patient care activities, accredited pharmacy residency training programs, presence of pharmacists with advanced training or board certification and optimal operations and scheduling.

### Keywords

pharmacy; hospital pharmacy service; center of excellence; metrics; benchmarking; health care quality indicators; internship and residency; board certification; pharmacist to patient ratio

## Introduction

Benefits of pharmacist-delivered patient care include reduction in medication errors, adverse events, mortality and costs resulting in improved patient outcomes and financial performance.<sup>1-5</sup> While literature describes hospital and

health system pharmacy models that expand pharmacist roles to include greater clinical patient care activities, the extent of clinical pharmacist services allocation varies based on operational workflow and resources.<sup>6-9</sup> In 2020, the ASHP Pharmacy Forecast provid-

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ed strategic recommendations for leaders to advance pharmacy practice through center of excellence recognition.<sup>5</sup> It is anticipated that designation as a pharmacy services center of excellence may improve organizational branding and recruitment of the best talent. However, measures resulting in outstanding patient and organizational outcomes have not been defined.<sup>1,10,11</sup>

Our health system sought to identify successful pharmacy services with the goal of advocating for the implementation of best practices to other pharmacy departments. Our organization used internal survey results, clinical pharmacy metrics performance and health system electronic data to identify high-performing pharmacy departments. After collating the results, an assessment tool was developed based on ASHP Practice Advancement Initiative 2030 recommendations.<sup>12</sup> This initiative explored themes to support continued advancement of the pharmacy profession in areas such as patient-centered care, use of data and technology, roles of pharmacists/pharmacy technicians and medication use safety.<sup>12</sup> This paper aims to describe optimization opportunities and supporting evidence for pharmacy leaders to strategically pursue characteristics of a pharmacy services excellence model.

## Methods

An internally conducted survey was distributed in February 2019 to 161 acute care pharmacy departments, each representing individual affiliated hospitals in our health system. Exclusion criteria were acute care hospitals that did not have Clinical Pharmacist Workflow (CPW) real time surveillance technology implemented, results for fewer than 9 of 10 clinical pharmacy metrics (minimum denominators were required for each metric), incomplete survey responses and single service line hospitals. The survey included a glossary of terms and definitions along with explicit instructions in an effort to limit interpretation bias and was piloted by two hospitals prior to distribution. Hospital pharmacy departments were instructed to provide information based on calendar year 2018 and report their bed size, presence of satellite pharmacies and hours of operation (i.e., non-24 hour pharmacy services, 24-hour pharmacy services). They were also asked to use standard shift

times in their survey responses, defined as first shift (0700 – 1500), second shift (1500 – 2300) and third shift (2300 – 0700).

Clinical pharmacist was defined as a pharmacist who performed clinical activities other than order entry, order verification and dispensing functions (e.g., checking automated dispensing cabinet lock-lidded pockets, checking intravenous admixtures) and did not include pharmacy residents or students. Clinical pharmacist allocation was defined as dedicating time and resources to clinical activities other than order entry, verification and dispensing functions. Clinical pharmacy specialist was defined as a pharmacist that spent greater than or equal to 70% of their time performing clinical activities in a specialized area of practice (e.g., internal medicine, oncology, cardiology and antimicrobial stewardship). The overall level of training involved board certifications, residency completion and other programs that required additional expertise. Patient care activities were defined as clinical pharmacists available and located physically outside of the main pharmacy department (decentralized) dedicated to performing activities, not including order entry/verification. Clinical pharmacist time spent performing patient care activities was further defined as one of the following: 1) They spent less than 25% of their time performing patient care activities, with interaction occurring only during order verification/performing operational functions or when pharmacy presence on each of the floors was inconsistent; 2) They spent 25–50% of their time performing patient care activities, but their interactions to influence patient therapy were limited due to operations responsibilities, other factors or the pharmacist presence on each of the floors was often inconsistent; 3) Greater than 51% to 75% of their time was spent on patient care activities and interacting with the health care team to influence patient therapy with the service provided on each of the floors consistently; 4) Greater than 75% of their time was spent interacting with the health care team to influence patient therapy and manage medication therapy for health care providers, with the service provided on each of the floors consistently; or 5) there was a variation not described in 1 through 4. Interdisciplinary rounds, rounds and rounding were defined as in-person interdisciplinary meetings in any setting where a physi-

cian or other type of provider was available to discuss patient care with the health care team where the pharmacist was able to make recommendations and perform interventions. Study approval was received by the University of Tennessee Health Science Center Institutional Review Board.

Survey question responses captured pharmacy services practice models, pharmacist resource allocation, training of pharmacist residents, pharmacist postgraduate training and pharmacist certifications. In combination with centralized staffing data, survey responses were used to evaluate clinical pharmacist to inpatient ratios, clinical pharmacists' specialties, allocation of clinical pharmacist time and pharmacist time spent in interdisciplinary rounds. Clinical pharmacy metrics were used as a proxy to indicate the strength of the pharmacy's clinical services. Our health system reported metric performance monthly by hospital. Performance to goal was not adjusted for pharmacist coverage by shift or day of the week. A composite of 10 individual clinical pharmacy metrics for performance to goal were used to benchmark pharmacist impact on medication therapy outcomes:

- Response time to potential high priority clinical interventions (Goal  $\leq$  4 hours)
- Completed interventions (Goal  $\geq$  40%)
- Oral to intravenous (IV) dose ratios (Goal  $\geq$  70%)
- IV to oral conversion (Goal  $\geq$  50%)
- Warfarin administration and subsequent international normalized ratio (INR)  $>$  5 (Goal  $\leq$  3%)
- Oral to IV opioid dose ratio (Goal  $\geq$  70%)
- Proton-pump inhibitor (PPI) and histamine 2 (H<sub>2</sub>) receptor blocker days of therapy per 1,000 patient days present (Goal rate decreased by at least 10% or rate is less than 200)
- Antimicrobial de-escalation (Goal  $\geq$  30%)
- Vancomycin troughs within range (Goal  $\geq$  80%)
- Fluoroquinolone use in urinary tract infection (UTI) (Goal  $\leq$  20%).

Pharmacy departments with the most clinical pharmacy metrics at goal identified top performing hospitals, and, conversely, hospitals with the least number of metrics at goal identified hospitals with the greatest opportunity for improvement. Breakpoints were established

based on 2018 metric performance goals, which were in place for the time period informing the survey responses. Within each bed size category, hospitals with greater than or equal to 7 metrics at goal were defined as at goal. Those with 4 to 6 metrics at goal were defined as close to goal. Hospitals with less than or equal to 3 metrics at goal were defined as hospitals with opportunity. A comparison of hospitals at goal and with opportunity was completed to determine the optimal pharmacy services model to support the best medication therapy outcomes.

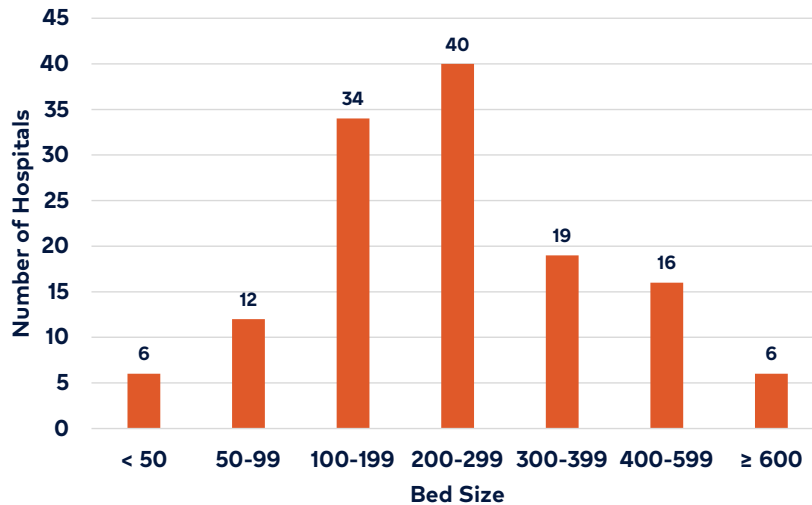
Results were examined by hospital demographics, including pharmacy hours of operation, number of beds, service lines, average daily census, adjusted patient days (APD), average length of stay (LOS), percent-completed interventions and cost savings per intervention. To assess pharmacist to inpatient ratios in the adult critical care and medical/surgical units, a subgroup of respondents, representing the majority high-performing pharmacy departments by geographic area, was evaluated for further analysis.

### Statistical Analysis

Descriptive statistics were used to detail the characteristics of the hospitals and their pharmacy models. To test for associations between categorical variables, chi-squared tests or Fisher's exact tests were used. Two-sample t-tests were used to assess the relationship between level of training, presence of residency programs and clinical pharmacy metrics. Logistic regression was used to assess the relationship between achieving status of an at-goal hospital and key hospital characteristics. Statistical analyses were done in Microsoft Excel (Microsoft Corporation; Redmond, Washington) and R (R Foundation for Statistical Computing; Vienna, Austria).

### Results

In our health system, 161 acute care hospital pharmacy departments had CPW implemented. Responses were received from 141 (87.6%) surveyed hospital pharmacy departments. A total of 8 hospitals were excluded from the results. Four hospitals submitted incomplete surveys. Two hospitals did not meet the threshold for 9 of 10 metrics. Two hospitals



**Figure 1.** Number of hospitals listed by bed size category.

were single service line hospitals. A total of 133 hospital pharmacy departments were included in the analysis. Thirty hospitals were identified as “at goal”, 63 were identified as “close to goal” and 40 hospitals were identified as with “opportunity”. Survey respondent pharmacy departments were first considered by bed size category groupings and number of clinical pharmacy metrics at goal. Hospitals were stratified in the following bed size categories: less than 50 beds, 50 to 99 beds, 100 to 199 beds, 200 to 299 beds, 300 to 399 beds, 400 to 599 beds, and greater than or equal to 600 beds. The majority of hospitals, 56% (n = 74), reported between 100 and 299 beds. (**Figure 1**) Distribution of at-goal hospitals, close-to-goal hospitals and hospitals with opportunity by bed size categories were assessed. (**Table 1**)

A logistic regression model was used to assess the relationship between at-goal hospitals

and key hospital characteristics. When including several key hospital characteristics into a single model, hospitals that trained pharmacy residents were significantly associated with achieving at-goal status (p = 0.011). (**Table 2**) Among survey respondents (n = 133), 35 (26%) hospitals reported training pharmacy residents. Of the 35 hospitals that trained pharmacy residents, 50% (n = 15 of 30) of at-goal hospitals and 5% (n = 2 of 40) of hospitals with opportunity were included.

A statistically significant difference was found between hospitals that trained pharmacy residents and those that did not in several key areas. (**Table 3**) On average, hospitals that trained pharmacy residents were found to have a greater number of clinical pharmacy metrics at goal (5.89 ± 1.59 versus 4.16 ± 1.86, p < 0.001). Hospitals that trained residents also employed more board-certified pharmacists (2.32 ± 1.49

**Table 1.** Hospitals with Clinical Pharmacy Metrics at Goal

Bed Size Category	“At Goal” Hospitals n = 30 (%)	“Close to Goal” Hospitals n = 63 (%)	“Opportunity” Hospitals n = 40 (%)
	7 to 10 Metrics at Goal	4 to 6 Metrics at Goal	0 to 3 Metrics at Goal
< 50	0 (0%)	3 (5%)	3 (8%)
50-99	2 (7%)	8 (13%)	2 (5%)
100-199	11 (37%)	16 (25%)	7 (18%)
200-299	5 (17%)	16 (25%)	19 (48%)
300-399	4 (13%)	10 (16%)	5 (13%)
400-599	6 (20%)	6 (10%)	4 (10%)
≥ 600	2 (7%)	4 (6%)	0 (0%)

**Table 2.** Contributing Factors of Hospitals with ≥ 7 Clinical Pharmacy Metrics “At Goal”\*

Factor	Odds Ratio	95% Odds Ratio CI	p value
Number of Board-Certified Pharmacists (Per 100 Beds)	1.32	(0.92, 1.90)	0.133
Residency Training Program (Yes vs. No)	3.66	(1.35, 9.94)	<b>0.011</b>
Number of PGY1 and PGY2 Trained Pharmacists (Per 100 Beds)	0.87	(0.58, 1.30)	0.503
≥ 51% of Clinical Pharmacist Time Dedicated to Patient Care Activities (First Shift)	2.27	(0.73, 7.00)	0.154

\*Hospitals (n = 124) responding to all factors above are included

versus 1.57 ± 1.62, p = 0.019), more postgraduate year 1 (PGY1) trained pharmacists (2.06 ± 1.33 versus 1.19 ± 1.19, p < 0.001) and more PGY2 trained pharmacists (0.58 ± 0.64 versus 0.19 ± 0.44, p = 0.002) than hospitals without residency training programs. (Table 3)

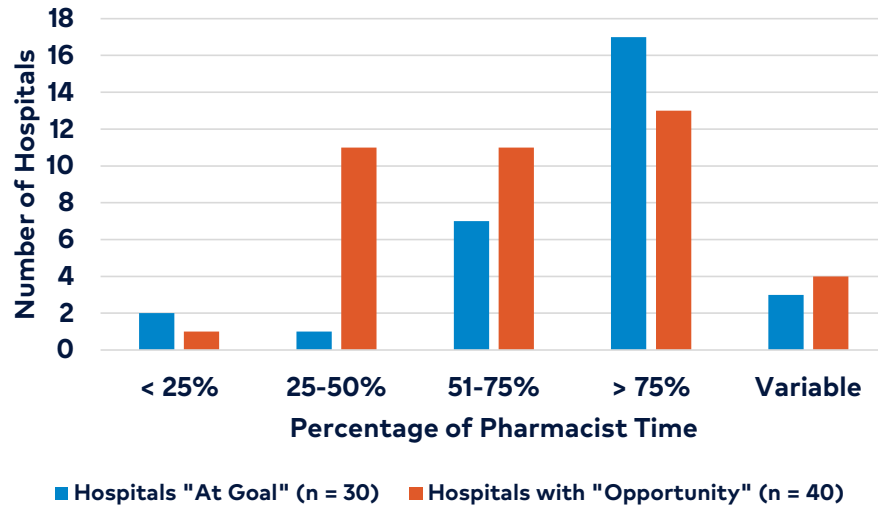
Overall, pharmacy departments achieved greater than or equal to 7 metrics at goal when a greater percentage of pharmacists’ time was dedicated to patient care activities (less than or equal to 50% dedicated time: n = 3 at goal hospitals versus n = 12 hospitals with opportunity). (Figure 2) Weekday, unit-based clinical pharmacist coverage was also evaluated; 73% (n = 22) of at-goal hospitals had first shift pharmacists providing clinical services compared to 48% (n = 19) of opportunity hospitals. Limited unit-based pharmacist coverage was noted for all shifts on weekends with 20% of both at-goal (n = 6) and opportunity (n = 8) hospitals reporting first shift unit-based clinical pharmacy services. Only 14 hospitals (47%) meet-

ing at-goal criteria (n = 30) reported rotating clinical pharmacists through different areas on a weekly basis compared to 27 hospitals (68%) with opportunity (n = 40). The average number of different pharmacists covering clinical areas on weekdays during first shift was also less for at-goal hospitals compared to hospitals with opportunity for 5 of 8 service lines (i.e., lower average number of different pharmacists indicated consistency in pharmacist scheduling). (Table 4)

More at-goal hospitals reported dedicated clinical pharmacist coverage than hospitals with opportunity for adult critical care (70% versus 63%), behavioral health (23% versus 10%), emergency department (30% vs. 20%), hematology/oncology (27% versus 23%) and medical/surgical (57% versus 45%) service lines. Hospitals reporting always participating in rounds were greatest for adult critical care (n = 64, 48%), medical/surgical (n = 18, 14%) and neonatal intensive care units (n = 64, 48%).

**Table 3.** Comparison of Hospitals with and without Pharmacy Residency Training Programs

Hospital Characteristics	Hospitals with Pharmacy Residency Training Programs (n = 35 hospitals)	Hospitals without Pharmacy Residency Training Programs (n = 89 hospitals)	p value
	Mean ± SD	Mean ± SD	
Clinical Pharmacy Metrics At Goal	5.89 ± 1.59	4.16 ± 1.86	<b>&lt;0.001</b>
Board-Certified Pharmacists (Per 100 Beds)	2.32 ± 1.49	1.57 ± 1.62	<b>0.019</b>
PGY1 Trained Pharmacists (Per 100 Beds)	2.06 ± 1.33	1.19 ± 1.19	<b>&lt;0.001</b>
PGY2 Trained Pharmacists (Per 100 Beds)	0.58 ± 0.64	0.19 ± 0.44	<b>0.002</b>
PGY1 or 2 Trained Pharmacists (Per 100 Beds)	2.63 ± 1.72	1.39 ± 1.33	<b>&lt;0.001</b>



**Figure 2.** Pharmacist time dedicated to patient care activities.

For at-goal hospitals, the distribution of participation in interdisciplinary rounds was more heavily weighted towards greater than 50% of the time responses, with distribution more heavily weighted at less than 50% of the time responses for opportunity hospitals. At-goal hospitals reported always participating in adult critical care (67% versus 43%) and medical/surgical (30% versus 8%) rounds more than hospitals with opportunity. Clinical pharmacists in at-goal hospitals dedicated twice as much time per month on average to hospital committees compared to hospitals with opportunity (12 ± 21 versus 6 ± 10).

A subgroup analysis was completed by geographic area to encompass the majority high-performing pharmacy departments to

further discern pharmacist-to-patient ratios of at-goal hospitals. This subset included 49 hospitals from 4 United States geographic areas: the Northeast, Midwest, South Central and South. Within the subset were 22 hospitals at goal and 4 hospitals with opportunity. The at-goal hospitals within the subset represented 73% (22 of 30) of the full data set of hospitals at goal with 100 to greater than or equal to 600 beds. The average pharmacist-to-inpatient ratios were evaluated for an average weekday on first shift for the at-goal subgroup. For at-goal respondents, medical/surgical units were found to have an average pharmacist-to-patient ratio of 1 pharmacist to 48 patients on weekdays, first shift. In the adult critical care unit, this ratio was 1 pharmacist to 23 patients on weekdays during the first shift. The at-goal

**Table 4.** Consistency in Pharmacist Coverage on Weekdays, First Shift

Patient Care Area	Number of Different Pharmacists Rotated Through a Patient Care Area on Weekdays, Avg ± SD*	
	At-Goal Hospitals	Opportunity Hospitals
Neonatal Intensive Care Unit	<b>1 ± 0</b>	5 ± 9
Pediatric Unit	<b>1 ± 0</b>	3 ± 3
Pediatric Intensive Care Unit	<b>1 ± 1</b>	4 ± 3
Behavioral Health	<b>1 ± 1</b>	4 ± 3
Medical / Surgical	<b>3 ± 3</b>	4 ± 7
Adult Critical Care	2 ± 1	2 ± 1
Emergency Department	2 ± 1	2 ± 1
Hematology / Oncology	2 ± 1	2 ± 1

\*Bold font indicates greater consistency in pharmacist coverage of "At Goal" Hospitals compared to "Opportunity" Hospitals



**Table 5.** At-Goal Subgroup Pharmacist-to-Patient Ratios (First Shift, Weekdays)

Patient Care Unit, <i>h</i> *	Patients Per Pharmacist, <i>n</i>	
	Average	Range
Adult Critical Care, <i>h</i> = 22	23	4–98
Behavioral Health, <i>h</i> = 22	47	13–70
Emergency Department, <i>h</i> = 22	40	0–125
Hematology/Oncology (inpatients), <i>h</i> = 18	39	10–72
Medical/Surgical, <i>h</i> = 22	48	5–92
Neonatal ICU, <i>h</i> = 14	28	3–68
Pediatric ICU, <i>h</i> = 10	10	4–16
Pediatrics, <i>h</i> = 10	16	3–36

\**h* = Number of hospitals contributing to the pharmacist to patient ratios for each Patient Care Unit type; subgroup hospitals provided number of pharmacist productivity hours per area (some pharmacists covered multiple areas) and average number of patients by Patient Care Unit

subgroup ratios for all service lines were also evaluated. (Table 5)

## Discussion

Our health system includes over 180 acute care hospitals in 21 states and employs approximately 5,500 pharmacists. Approximately 1.9 million hospital admissions and 9.2 million emergency room visits occur each year across this health system. According to IBM Watson Health's 2020 "100 Top Hospitals" annual study, 17 hospitals in our health system were recognized as best performers in the nation.<sup>13</sup> Pharmacy services in our health system vary based on hospital size, staffing matrix, resource allocation and services provided. Clinical activities are completed 24 hours per day, 7 days per week regardless of whether hospitals have non-24 hour or 24-hour pharmacy services. Clinical pharmacy services include safe and effective medication use through drug selection, timing of therapy, monitoring for therapeutic outcomes and adverse events, drug therapy optimization, interdisciplinary rounding, daily electronic health record review, pharmacy directed consults and collaboration with the care team.

In 2005, our health system began initiatives to provide the framework to support the goal of 24/7 clinical pharmacy services. Pharmacist-delivered patient care improves patient outcomes, increases cost efficiency and alleviates pressures on the healthcare system.<sup>89</sup> However, competing priorities and responsi-

bilities coupled with inefficient processes and workflow can dramatically reduce the amount of time pharmacists are able to dedicate to comprehensive patient-centered care. Traditional pharmacist-to-patient ratios have been reported as ranging from 1:50 to 1:100, with suggested ratios of 1:20 (ICU specific) to 1:30 for optimal care.<sup>14</sup> Survey results revealed most unit-based pharmacist resources are located in the adult critical care and medical/surgical units, and adult critical care pharmacist-to-patient ratios were lower in comparison to the ratio in medical/surgical units. The subgroup hospitals which informed the ratios were selected to include a geographically diverse sample of high performing pharmacy departments. The ratio ranges from this subgroup highlighted the variability in clinical pharmacist allocation by area. The range of ratios was comparable in both the adult critical care and medical/surgical units and the largest range was reported in the emergency department. Adult critical care units have higher patient acuity and require more resources including lower patient to pharmacist ratios. From this data, we were able to optimize pharmacist-to-patient ratios in the medical/surgical units, thereby allowing clinical pharmacists to deliver more comprehensive services. Pharmacists use CPW, a real time surveillance technology that captures patient-specific data from the electronic health record, to improve patient safety and streamline the daily workflow. CPW empowers pharmacists to anticipate, identify and prevent adverse drug events. CPW also optimizes drug therapy by creating

more timely responses to IV to oral medication conversions, renal dosing adjustments, anti-microbial management program interventions and drug-laboratory triggers. For the past 3 years, clinical pharmacy metrics have measured medication therapy outcomes tied directly to clinical pharmacist services by using parameters from CPW such as laboratory data, medication administration data and ICD-10 diagnosis codes. The metrics are measured on actual results or outcomes and are not reliant on documentation.

Hospitals must have achieved greater than or equal to 7 clinical pharmacy metrics to be considered at goal. These hospitals demonstrated optimization of the workflow and continuously performed clinical pharmacy services around the clock. Of hospitals in our health system that were at goal, unit-based pharmacists spent greater than 75% of their time performing direct patient care activities compared to hospitals with opportunity. It is not surprising that results comparing at-goal and opportunity hospitals revealed that at-goal hospitals dedicated more pharmacist time to patient care activities, consistently scheduled the same clinical pharmacists to cover designated clinical areas weekly and provided greater dedicated clinical pharmacist service line coverage. Consistent operations and scheduling to provide optimal patient care was demonstrated to be an important differentiator between at-goal hospitals and hospitals with opportunity. These results indicated that ensuring pharmacist time dedicated to patient care activities benefited patients as reflected by clinical pharmacy metric performance.

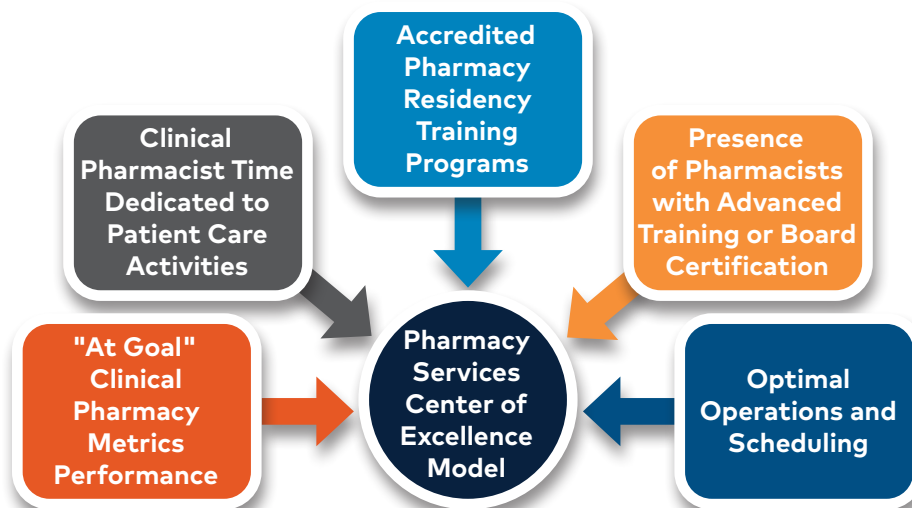
Furthermore, 50% of at goal hospitals trained pharmacy residents compared to 5% of opportunity hospitals. The year 2018 encompassed portions of 2 residency years, and growth was seen in the number of residents trained from residency year 2017–2018 to 2018–2019. Over this period there was an 18% growth in PGY1 residents trained (67 to 79), and the number of PGY2 residents trained more than doubled (14 to 29). Hospitals that trained pharmacy residents were significantly associated with achieving at goal status, connecting residency programs to improved clinical pharmacy metric performance. Survey results reported nearly 600 residency-trained pharmacists

and 444 Board of Pharmacy Specialties (BPS) certified pharmacists working in our health system's pharmacies. Hospitals with residency programs employed significantly more pharmacists statistically with advanced training or board-certification, which supports continued development of innovative models that promote the pharmacist's role in an advanced level of practice.<sup>6,9,15-19</sup> Pharmacy practice models vary by organization, hospital and services offered, and direct clinical patient care continues to expand to pharmacist credentialing and privileging.<sup>6,7,20-25</sup> In 2018, 32.3% of 811 surveyed hospitals reported pharmacist privileged activities that included prescribing medications pursuant to diagnosis of a medical disease or condition.<sup>25</sup> While center of excellence specific qualities and metrics have not been formally established, survey results and internal data were used to identify programs that fit this model and support the future growth of our health system's pharmacy services. The defining characteristics of our center of excellence model represented in **Figure 3** included: 1) At-goal clinical pharmacy metrics performance, 2) Clinical pharmacist time dedicated to patient care activities, 3) Accredited pharmacy residency training programs, 4) Presence of pharmacists with advanced training or board certification, and 5) Optimal operations and scheduling.

At goal hospitals spent twice as much time serving on committees compared to hospitals with opportunity. Clinical pharmacist representation on committees promotes visibility and the ability to advocate for evidence-based best practices, which enhances medication therapy outcomes. With insight that clinical pharmacist scheduling consistency provides greater continuity of care, ownership of the patient care unit and improved healthcare professional rapport, a pharmacy services model assessment tool was developed for pharmacy leaders to evaluate services provided daily by shift by employee. This tool is completed and reviewed semi-annually to ensure clinical pharmacist time is optimized. (**Appendix 1**) Recognizing pharmacy programs that embody this center of excellence model will support the growth of pharmacy services across our health system.

Our survey had several limitations, including reliance on respondent survey responses,





**Figure 3.** A diagram showing the characteristics of the Health System Pharmacy Services Center of Excellence Model.

descriptive nature of responses and interpretation bias. While the survey was constructed to limit the variability of responses, there were survey questions that respondents did not answer or selected as "other" and provided free text explanation. This hospital-specific detail was challenging to incorporate into the analysis. According to the Centers for Disease Control and Prevention (CDC) health trends, 47% (n = 2,301) of reporting hospitals indicated greater than or equal to 100 beds in 2015.<sup>26</sup> Our results revealed that the majority of at-goal hospitals were greater than or equal to 100 beds and only included 2 hospitals with less than or equal to 99 beds. Nearly 50% of United States hospitals are similar in size to defining characteristics of at-goal hospitals studied and are relevant considerations when implementing a pharmacy services center of excellence model. An area of future study will include smaller sized hospitals that have hybrid clinical/operational pharmacy services models, as there may be limited applicability of results for smaller sized hospitals.

While the subgroup analysis of manageable pharmacist-to-patient ratios appeared to be associated with optimized clinical pharmacy services, future research is needed to further understand the ideal pharmacist ratios required to improve patient outcomes. Areas of future study include validation of optimal best practice models, specifically the impact of advanced pharmacist training, board cer-

tification and accredited residency programs on achieving clinical pharmacy metric goals and improved patient outcomes. As at-goal hospitals were larger in size, additional study is needed to identify excellence models for pharmacy services with hospitals less than or equal to 99 beds.

### Conclusion

Survey results and internal data were used to identify excellence qualities for our health system's pharmacy services. Defining characteristics of our pharmacy services center of excellence model included at-goal clinical pharmacy metrics performance, pharmacist time dedicated to patient care activities, accredited pharmacy residency training programs, presence of pharmacists with advanced training or board certification and optimal operations and scheduling. Pharmacy services assessment results have encouraged health system leaders to implement actions to achieve and advance pharmacy services best practice models to improve patient care.

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### Conflicts of Interest

The authors declare they have no conflicts of interest.

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