Trends in Infusion Administrative Practices in US Health Care Organizations: An Exploratory Analysis

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ABSTRACT

While specialized infusion clinical services remain the standard of care, widespread curtailing and disbanding of infusion teams as a cost-cutting measure has been documented in health care organizations for nearly 2 decades. Owing to this trend, as well as recent government interventions in medical error control, the authors engaged in an exploratory study of infusion administration practices in the US health care industry. This article presents the authors' exploratory findings, as well as their potential implications.

Key words: deskilling, hospital, infusion practice, infusion teams, occupations, reallocation

As "one of the most invasive, complex, and pervasive therapies in the current health care system,"[1(p278)] infusion therapy represents an important element of the ongoing debate regarding health care cost and quality. The use of infusion teams remains a standard of infusion practice,[2] and while research repeatedly has shown the clinical[2-7] and economic[8-12] benefits of using specialized infusion teams rather than bedside nurses for infusion practice, evidence suggests that many health care organizations in the United States have "cut back" or disbanded infusion teams in an effort to lower health care costs.[1] Interestingly, the curtailing of infusion teams in many health care organizations has occurred during an era of unprecedented attention to medical errors,[13,14] which has led to government intervention,[15] having a further impact on the ways in which US health care organizations administer infusions.

While the countervailing industry cost-saving trends and government interventions to promote clinical quality have undoubtedly affected infusion administration practices throughout the health care landscape, research has yet to map infusion administration practices across the US health care industry. As the comprehensive understanding afforded by this mapping constitutes a vital first step in better understanding the effects of infusion administration practices on patient safety and nurse employment outcomes,

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this study represents an urgently needed contribution to the health care literature.

Using data gathered from a 2017 survey of nurses affiliated with the Infusion Nurses Society (INS), the Academy of Neonatal Nurses (ANN), and the Immunoglobulin National Society (IgNS), the authors presented an exploratory study of infusion administration practices in US health care organizations across the country. Focusing primarily on the practice of 10 infusion subtasks, the investigators examined (1) differences in infusion administration practices between hospitals and nonhospital health care organizations, such as clinics, rehabilitation centers, nursing homes, and home health agencies; (2) shifts in occupational responsibilities over infusion subtasks during the past 10 to 15 years; and (3) changes in occupational responsibility for infusion practice in organizations in which the infusion team has been reduced or disbanded. These data provide a comprehensive map for understanding both contemporary differences and industry-wide shifts in infusion administration practices, from which important implications for both patient outcomes and nurse employment outcomes can be derived.

LITERATURE REVIEW

Consistent with prior research,[16] infusion teams have been defined here as interdependent groups of skilled clinicians, typically led by infusion nurse specialists, which serve as a resource for all infusion-related tasks in an organization, and which are involved with the insertion of all vascular access devices in that organization. Unlike vascular access teams, which typically are small groups comprising skilled experts who focus primarily on vascular access of peripherally inserted central catheters and central vascular access devices (CVADs) during limited hours of service, infusion teams are typically larger teams available throughout office hours and, in many cases, 24 hours a day, 7 days a week.[16] Infusion teams also specialize in infusion services beyond initial vascular access, which is a function that further separates them from vascular access teams.[16]

In developing this exploratory study, the authors turned primarily to the health care literature, the history of infusion practices, and the management literature to propose hypotheses regarding the changing nature of infusion practice. First, it is important to note that infusion administration practices hinge principally on cost. While this may seem obvious, given that cost plays a central role in all organizations, idiosyncratic accounting practices—through which infusion work is not billed to clients—have created a unique situation in which infusion work typically is not reimbursed financially.[16] While infusion teams are necessarily assigned to cost centers, resulting in expenses for health care organizations, infusion work—though clinically important—usually does not generate revenue.[1] Thus, despite the extensive literature that demonstrates the superior clinical outcomes associated with specialized infusion administration,[3-6] infusion teams are often perceived as a luxury among health care organization executives, who typically prioritize the financial viability of the organization ahead of clinical quality.[1]

At a time when many health care tasks are being reallocated from physicians to nurses[17] and from nurses to other health care professionals and paraprofessionals[18] to mitigate costs, relatively few health care organizations have been willing to incur and maintain the costs associated with specialized infusion services. In comparing types of health care organizations, hospitals seem more likely to incur specialized infusion costs than nonhospital health care organizations. This is due to 3 key differences between hospital and nonhospital health care organizations. First, as centers for acute and complex medical care, hospitals are more likely than nonhospital health care organizations to require the full spectrum of specialized infusion services available to patients. Second, hospitals typically generate higher levels of revenue than nonhospital health care organizations, and profitable hospitals have the financial resources[19] needed to absorb the costs associated with specialized infusion care from physicians, nurse practitioners, and infusion teams. Finally, government regulations hold hospitals to a higher standard of infusion quality than that expected of nonhospital organizations.[15] Thus, the following was hypothesized:

> **Hypothesis 1:** Hospitals will assign infusion subtasks to occupational groups with more formal education and training (ie, physicians, nurse practitioners, and infusion teams) than nonhospital health care organizations.

There is ample evidence that many health care organizations began curtailing or disbanding infusion teams at the start of the 21st century.[20] Although a variety of alternatives to the infusion team have been developed, these alternatives generally fall into 1 of 2 categories of infusion administration: vascular access teams and the primary care model of infusion administration.[16] Vascular access teams typically represent a hybridization of the infusion team model and the primary care model, with vascular access clinicians primarily responsible for performing initial vascular access, device placement, and device removal,[16] and providing education to empower individual nurses to perform all other infusion-related subtasks.[8] The primary care model of infusion administration refers to the practice of individual nurses performing the majority of subtasks associated with infusion administration, with the exception of the most complex—such as CVAD placement, which are reserved for physicians and registered nurses (RNs) deemed competent to perform the procedure.[16]

Shifts away from the infusion team model to either vascular access teams or the primary care model of infusion practice suggest deskilling, which is a systematic process by which tasks requiring judgment and skill are broken down into smaller, routinized subtasks, and then reassigned to a

variety of employees.[21] This approach attempts to balance efficiency and quality in production, as organizations save money by assigning routine and less consequential subtasks to employees with less formal education and training who typically earn lower wages than their counterparts with more specialized education and training, while focusing the efforts of more highly educated and trained employees on performing more consequential subtasks to meet relative quality standards. The literature has demonstrated many ways in which this cost-saving approach has already affected multiple facets of health care delivery.[22] For that reason, it was hypothesized that:

> **Hypothesis 2:** Over the last 10 to 15 years, infusion subtasks have been reassigned to employees from occupational groups that require less infusion-specific education and training.

Despite the push to maximize efficiency, health care organizations must maintain certain levels of clinical quality because of the negative ramifications of medical errors. Infusion-related errors are particularly dangerous, with many mistakes resulting in relatively high patient mortality rates.[1,2] In addition, the relative frequency of medical malpractice lawsuits requires additional vigilance over employee practices in health care organizations.[5] Increased general attention to medical errors during the past 20 years has also spawned government action to incentivize improvements to health care quality. In response to medical error rates, the United States federal government passed the Hospital-Acquired Condition Reduction Program, which incentivizes infection reduction in US hospitals, including central line-associated bloodstream infection, which is attributable to infusion-related medical errors, by enforcing a financial penalty on organizations that fail to meet clinical standards.[15] It is likely that this increased oversight and attention to medical errors has resulted in some organizations opting to escalate responsibility for key infusion subtasks back to specially trained nurses, nurse practitioners, or physicians. Thus, while a general shift of the infusion process to those with less specialized education and training is anticipated, it is also anticipated that US hospitals will have allocated key infusion subtasks to more educated and qualified employees to mitigate errors:

> **Hypothesis 3:** During the past 10 to 15 years, key infusion subtasks have been reassigned to professionals with more formal, infusion-specific education and training.

METHODS

To ascertain infusion administration practices at health care facilities throughout the United States, a survey was disseminated to nurses associated with INS, ANN, and IgNS. This survey, disseminated during the late summer/early fall of 2017, was the second survey of the Purdue Infusion Study, which represents a collaboration between INS and scholars from Purdue University, Michigan State University, and Vanderbilt University.

Before developing the survey, the research team met with infusion experts affiliated with the 3 specialty practice associations to develop a more nuanced understanding of the subtasks involved in performing an infusion. In working with infusion experts, a list of 10 subtasks associated with infusion administration was developed, as well as a list of 9 occupational groups that could potentially complete any of those tasks. The infusion-related subtasks identified were infusion assessment/preparation, vascular access (peripheral catheter placement), vascular access (CVAD placement), infusion administration, monitoring the infusion (ie, what and how much), monitoring the insertion site, infusion dressing changes, flushing and locking devices, catheter/device removal (peripheral), and catheter/device removal (CVAD). The occupational groups identified by the experts were physicians, physician assistants, pharmacists, nurse practitioners, nursing infusion teams, individual RNs, respiratory therapists, licensed practical nurses/licensed vocational nurses (LPNs/LVNs), and nonclinical staff. Respondents were given the opportunity to specify which of the 9 occupational groups were primarily responsible for the completion of each of the 10 infusion subtasks in the organizations in which they worked. Respondents were then asked which occupational group was primarily responsible for the completion of each of the 10 infusion subtasks in the organization in which they currently worked when they started working at that organization.

To measure the extent to which infusion subtasks have been moved to occupational groups with more or less formal infusion-specific training, the 9 occupational groups identified by subject matter experts as potentially involved with infusion administration were organized according to the number of years of formal education required for baseline credentials in that occupational group. The rigor of formal education, more so than demonstrated skill and expertise, corresponds with status hierarchies in multioccupational organizations, such as health care.[23] In consultation with subject matter experts, 1 exception to rank ordering by years of formal education for baseline credentials was made; registered pharmacists were placed between infusion teams and individual nurses in the hierarchy. This exception was made because of pharmacists' unique knowledge and skills regarding infusions. While they are recognized experts in medication administration and monitoring, they typically lack the education and training associated with other infusion subtasks and, consequently, lack the relevant skills that would place them higher in the rank ordering. The rank ordering for our analysis was as follows: (9) physician, (8) physician assistant, (7) nurse practitioner, (6) infusion team, (5) registered pharmacist, (4) individual RN, (3) respiratory therapist, (2) LPN or LVN, and (1) nonclinical staff. It is important to note here that, because of its members' specialized training and centrality in the infusion process in many facilities,

the term *infusion team* was included as an occupational group and catch-all for formal teams involved in infusion practice. This decision was made in consultation with infusion experts from INS, ANN, and IgNS, who indicated that by including *infusion team* as an option, variance in the subtask responsibilities of both infusion teams and vascular access teams, which clinician respondents with limited infusion experience may simply refer to as *infusion teams*, would be better captured.

In an effort to better understand infusion practice across the diverse health care landscape, respondents were also asked to describe the organizational settings in which they worked, to indicate how long they had worked in the organizations in which they were currently employed, and to state whether the organization had cut back or disbanded its infusion team during the time in which the respondent had worked at the organization. Finally, the research team included basic demographic items to better understand the characteristics and traits of survey respondents. Data were analyzed using Stata software (StataCorp LLC; College Station, TX).[24]

RESULTS

In total, 1127 individuals responded to the survey. Ninety-four percent of respondents indicated that they were female, and 88% indicated that they were white. Eighty-one percent of respondents stated that they were employed full-time, and 90% indicated that they worked in clinical settings.

On average, respondents had worked for their current employers for 13.5 years. In keeping with the original purposes of the research, the data were analyzed according to (1) current differences between hospital and nonhospital health care organizations, (2) differences within organizations over time, and (3) changes in occupational responsibility for infusion subtasks in organizations in which respondents indicated that the infusion team had been cut back or disbanded. These 3 approaches provided a multidimensional perspective on the changing nature of infusion administration across the US health care landscape.

Mapping Contemporary Infusion Administration: Hospital vs Nonhospital Organizations

The first focus was on mapping the current landscape of infusion administration practices in US health care organizations by looking at differences in current infusion administration between hospital and nonhospital settings. Sixty-three percent of respondents indicated that they worked in a hospital setting, either in an inpatient or an outpatient setting or in both inpatient and outpatient settings, such as a specialty clinic in a hospital; 37% of respondents specified that they worked in nonhospital settings. Table 1 shows the differences between occupational responsibilities for each infusion subtask when comparing hospital and nonhospital health care organizations. While all statistical tests were conducted using the raw scores given by respondents, Table 1 shows percentages of respondents who indicated that the task was primarily performed by the corresponding occupational group. We chose to use percentages rather than raw scores because of the sizable difference in the number of respondents from hospitals compared with those from nonhospital settings. As stated previously, nearly two-thirds of all respondents indicated that they worked in hospitals. For this reason, percentages, with each row totaling to 100%, better illustrate differences in occupational responsibilities for infusion subtasks among respondents working in hospital and nonhospital health care organizations.

Hypothesis 1, that hospitals use occupational groups with greater formal education and training for infusion administration than nonhospital health care organizations, was tested using analysis of variance. Statistically significant differences were found among 7 of the 10 infusion subtasks. Hospitals more frequently assigned infusion assessment duties ($F = 16.91$, $P < .001$), peripheral vascular access ($F = 15.45$, $P < .001$), vascular access for CVAD placement ($F = 26.54$, $P < .001$), medication monitoring ($F = 4.88$, $P < .05$), dressing changes ($F = 83.83$, $P < .001$), peripheral catheter removal ($F = 5.85$, $P < .05$), and CVAD removal ($F = 32.86$, $P < .001$) to occupational groups with greater formal education and training—such as physicians, nurse practitioners, and infusion teams in particular—than did nonhospital health care organizations. The occupational responsibilities associated with administering infused components ($F = .44$, ns), monitoring the insertion site ($F = .24$, ns), and flushing or locking infusion devices ($F = .01$, ns) did not vary significantly between hospital and nonhospital health care organizations. These findings generally support Hypothesis 1.

The Changing Nature of Infusion Administration in US Health Care Organizations

In addition to measuring differences in how hospital and nonhospital health care organizations assign infusion subtasks to various occupational groups, the ways in which organizations reallocated infusion subtasks over the time in which respondents have worked at the organization were measured. This type of analysis is made possible by the relatively high average tenure (13.5 years) reported by survey respondents, which provides a window to changes in infusion administration for many of the organizations represented in this sample over the past 10 to 15 years. Hypothesis 2, that infusion subtasks have been reassigned to employees from occupational groups with less infusion-specific education and training, was tested using paired *t* tests. Specifically, occupational responsibilities for infusion subtasks when the respondent started working for the organization were compared with current occupational responsibilities for infusion subtasks as indicated by the respondent to determine whether the changes over

TABLE 1

Differences in Occupational Responsibility for Infusion Subtasks by Percentage of Responses: Hospital vs Nonhospital Organizational Settings

Infusion Subtask	Health Care Setting	Physician	PA	NP	Infusion Team	RPh	Individual RN	RT	LPN/ LVN	Non-clinical
Infusion assessment[a]	Hospital	2%		3%	6%	9%	80%			
	Nonhospital	2%	1%		10%	5%	69%		2%	11%
Peripheral access[a]	Hospital	1%		1%	13%		83%		1%	
	Nonhospital				6%	1%	92%		2%	
CVAD placement[a]	Hospital	29%	2%	11%	40%		17%	1%		
	Nonhospital	27%	1%	1%	20%		48%	1%	1%	1%
Infusion administration	Hospital				4%		96%			
	Nonhospital				5%		93%		2%	
Medication monitoring[b]	Hospital	4%		2%	4%	7%	81%			2%
	Nonhospital				13%	10%	69%		2%	6%
Insertion site monitoring	Hospital				5%		94%		1%	
	Nonhospital				7%		91%		2%	
Dressing changes[a]	Hospital			5%	26%		68%	1%		
	Nonhospital				7%		90%		3%	
Flushing and locking	Hospital				2%		98%			
	Nonhospital				5%		92%		3%	
Removal—peripheral infusion[b]	Hospital	1%		1%	6%		91%		1%	
	Nonhospital				5%		92%		3%	
Removal—CVAD[a]	Hospital	15%		8%	24%		52%	1%		
	Nonhospital	11%	1%		9%		78%		1%	

Abbreviations: CVAD, central vascular access device; LPN, licensed practical nurse; LVN, licensed vocational nurse; nonclinical, staff without a clinical degree or certification; NP, nurse practitioner; PA, physician assistant; RN, registered nurse; RPh, registered pharmacist; RT, respiratory therapist.

[a] $P < .001$.

[b] $P < .05$.

time indicated meaningful shifts in infusion administration practices.

As shown in Table 2, occupational responsibilities for 7 of the identified infusion subtasks have remained relatively stable during the time survey respondents have worked in the health care organizations in which they're currently employed. The subtasks include infusion assessment (t = 1.08, ns), peripheral vascular access (t = 0.47, ns), infusion administration (t = −0.25, ns), monitoring medications for infusion administration (t = 0.31, ns), insertion site monitoring (t = 0.04, ns), flushing and locking infusion devices (t = −0.46, ns), and removal of peripheral catheters (t = 1.72, ns). Though not statistically significant, it is interesting to note a subtle similarity in shifting responsibilities regarding the performance of these "stable" subtasks. Table 2 shows that individual RNs appear to be absorbing peripheral vascular access, insertion site monitoring, flushing, locking, and peripheral device removal responsibilities both from professionals with more formal, infusion-specific education, such as infusion teams, and from those with less formal, infusion-specific education, such as LPNs/LVNs. This subtle trend has been noted in previous literature, which has indicated that the individual RN position is increasingly becoming a repository for infusion subtasks.[1,16,20]

Occupational responsibilities have shifted more dynamically in recent years for 3 infusion subtasks: vascular access for CVAD placement, CVAD removal, and infusion dressing changes. As shown in Figure 1, nurse practitioners and infusion teams have absorbed responsibility for CVAD placement from both physicians and individual RNs. These shifts are statistically significant (t =3.03, $P <$ .01), providing support for Hypothesis 2 and indicating an increased organizational reliance on vascular access teams. Similarly, Figure 2 shows that nurse practitioners, infusion teams, and individual RNs have absorbed physicians' CVAD removal responsibilities, indicating that CVAD removal is being reallocated to professionals with less formal infusion-specific education. This change is also statistically significant (t = 3.57, $P <$ .001), providing further support for Hypothesis 2.

TABLE 2

Occupational Responsibility for "Stable" Subtasks

Infusion Subtask	Point in Time	Physician	PA	NP	Infusion Team (%)[a]	RPh	Individual RN	RT	LPN/ LVN	Non-clinical
Infusion assessment	When respondent started with organization	30		11	75 (8%)	64 (7%)	721 (76%)		13	29
	Currently	19	2	17	67 (7%)	70 (7%)	731 (77%)		10	36
Peripheral access	When respondent started with organization	14		1	110 (12%)	6	793 (84%)		20	1
	Currently	6		8	103 (11%)	6	822 (86%)		11	1
Infusion administration	When respondent started with organization	6			38 (4%)	1	883 (87%)		17	
	Currently	2	1	1	39 (4%)	1	901 (95%)		8	
Medication monitoring	When respondent started with organization	34		9	63 (7%)	60 (6%)	739 (79%)		12	22
	Currently	27	1	14	63 (7%)	66 (7%)	728 (78%)		10	28
Insertion site monitoring	When respondent started with organization	2			63 (7%)	1	856 (90%)		22	2
	Currently				54 (6%)	1	891 (93%)	1	9	1
Flushing and locking	When respondent started with organization	2			32		885 (94%)	1	22	
	Currently			1	29		915 (96%)		11	
Removal—peripheral infusion	When respondent started with organization	15	2	7	61 (6%)		829 (88%)	4	26	
	Currently	5		6	52 (5%)		873 (91%)	3	15	1

Abbreviations: LPN, licensed practical nurse; LVN, licensed vocational nurse; nonclinical, staff without a clinical degree or certification; NP, nurse practitioner; PA, physician assistant; RN, registered nurse; RPh, registered pharmacist; RT, respiratory therapist.
[a]Percentage of total responses included for categories that include more than 50 total responses from survey respondents.

However, Figure 3 shows a different pattern of infusion task reallocation. Nurse practitioners and infusion teams have absorbed an increased amount of responsibility associated with infusion dressing changes from individual RNs and LPNs/LVNs. This change is also statistically significant ($t = -2.68$, $P < .01$) and lends narrow, but substantial, support to Hypothesis 3 in that dressing changes have been reallocated to professionals with higher levels of infusion-specific education during the last 10 to 15 years.

Infusion Responsibilities When Infusion Teams Are Cut Back or Disbanded

While many of the changes over time noted in the occupational assignment of these infusion subtasks were not statistically significant, each task is allocated primarily to individual RNs, suggesting the possibility that the reallocation of infusion tasks to occupational groups that require less formal infusion-related training already commenced before the respondents started working in the organizations in which they currently work.

In an effort to better understand how organizations reallocated infusion tasks to occupational groups requiring less formalized education and training, cases were identified in which respondents had witnessed, during their time in the organization in which they currently work, the cutting back or disbanding of infusion teams in their organization. Paired *t* tests were used to assess how infusion subtasks are reallocated after an infusion team is cut back or disbanded. A total of 254 respondents (26%) indicated that the infusion team in the organization in which they worked had been discontinued or cut back during the time in which the respondent had worked at the organization.

Table 3 shows the occupational responsibility changes before and after the infusion team was cut back or disbanded. In support of Hypothesis 2, infusion assessment ($t = 2.64$, $P < .01$), vascular access for CVAD placement ($t = 4.17$, $P < .001$), medication monitoring ($t = 1.96$, $P < .05$), peripheral device removal ($t = 2.80$, $P < .01$), and CVAD removal ($t = 4.62$, $P < .001$) all demonstrate reallocation of infusion tasks to occupational groups that require less formal infusion-specific education and training after cutting back or disbanding an infusion team. By contrast, consistent with Hypothesis 3, occupational responsibility for infusion dressing changes ($t = -2.28$, $P < .05$) moved to occupational groups that require more infusion-related education after infusion teams were cut back or disbanded. However, occupational responsibilities for vascular access of peripheral devices ($t = 0.61$, ns), administration

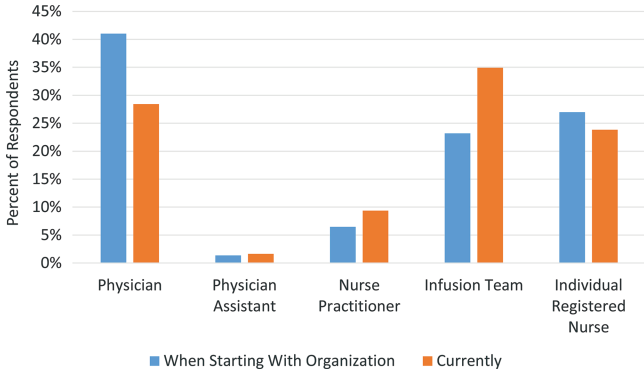

Figure 1 Occupational responsibility for CVAD placement by percentage. *Abbreviation: CVAD, central vascular access device.*

of infusion components ($t = -1.56$, ns), monitoring of the insertion site ($t = 0.44$, ns), and the flushing and locking of infusion devices ($t = 1.26$, ns) did not significantly change when infusion teams were cut back or disbanded.

It is interesting to note that many respondents who indicated that infusion teams in their organizations had been cut back or disbanded also indicated that infusion teams still perform a number of infusion-related tasks and that their role in some tasks, such as CVAD placement, had actually expanded over time. This could mean that infusion teams were given more work after cutbacks or that some organizations decided to reconstitute or grow their infusion teams after cutting them back initially.

IMPLICATIONS

The findings of this study reveal a nuanced and textured perspective on the changes in infusion administration over time, cautioning against the use of sweeping generalizations in describing infusion administration practices in US health care organizations. First, partial support was found for Hypothesis 1, which indicated that hospitals assign infusion subtasks to occupational groups with more formal education and training (ie, physicians, nurse practitioners, and infusion teams) than do nonhospital health care organizations. While the data showed that hospitals allocated 7

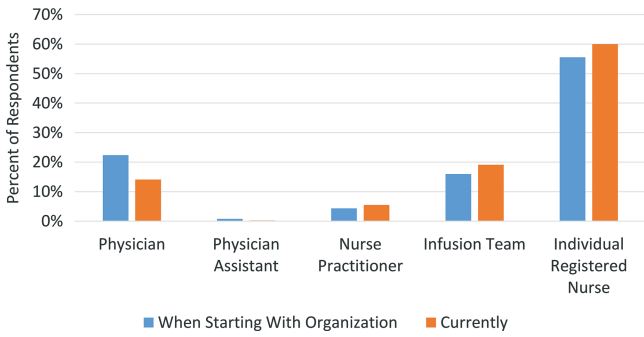

Figure 2 Occupational responsibility for CVAD removal by percentage. *Abbreviation: CVAD, central vascular access device.*

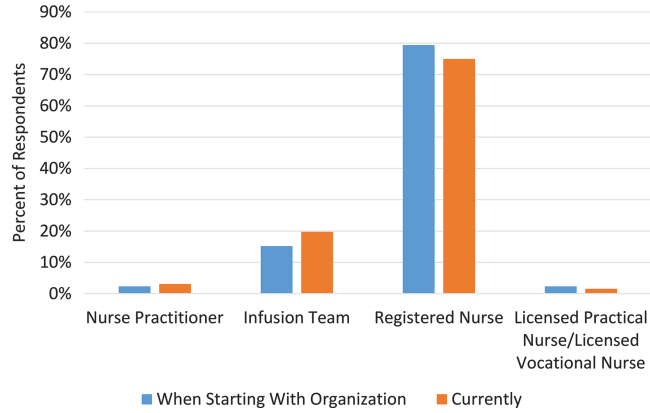

Figure 3 Occupational responsibility for infusion dressing changes by percentage.

of the infusion subtasks (assessment, peripheral catheter access, CVAD placement, medication monitoring, dressing changes, peripheral catheter removal, and CVAD removal) to occupational groups with more formal infusion-related education than did nonhospital health care organizations, this was not the case for 3 of the infusion subtasks (infusion administration, infusion-site monitoring, and device flushing and locking).

The study also found significant, albeit partial, support for Hypothesis 2, which stated that over the past 10 to 15 years, infusion subtasks have been increasingly reassigned to employees from occupational groups that require less infusion-specific education and training. Over time, both hospital and nonhospital health care organizations have reallocated the majority of infusion subtasks to individual RNs, as respondents indicated that 9 of the 10 infusion subtasks are performed primarily by individual RNs in their organizations. The 1 infusion subtask that is not yet performed primarily by individual RNs—CVAD placement—has been reallocated during the past 10 to 15 years, indicating that organizations increasingly rely on teams to perform the most complex of infusion tasks.

Limited support for Hypothesis 3 was also found, which posited that some key subtasks had been reallocated to employees with greater amounts of infusion-specific education and training as organizations attempt to limit infusion-related medical errors. Only the dressing changes infusion subtask showed a pattern of reallocation to more highly educated and trained professionals. Finally, responses provided by respondents who worked in their respective organizations when the infusion team was either cut back or disbanded were analyzed. While it appears that infusion teams continue to maintain a presence in organizations in which they've been cut back, there has been a significant reallocation of infusion subtasks from professionals with more extensive infusion-related education and training within those organizations to individual RNs.

Scholars have indicated that the reallocation of infusion tasks to individual nurses is indicative of a fundamental change in how nurses are perceived as an occupational

TABLE 3

Occupational Responsibilities for Infusion Subtasks: Before and After Infusion Team Cutback or Disbanding

Infusion Subtask	Before/After Cutback or Disbanding	Physician	PA	NP	Infusion Team (%)[d]	RPh	Individual RN	RT	LPN/ LVN	Non-clinical
Infusion assessment[a]	Before	5			38 (15%)	17	184 (73%)		4	4
	After	2			22 (9%)	14	208 (82%)		2	5
Peripheral access	Before	2			60 (24%)	1	186 (74%)		4	
	After	3		1	48 (19%)	1	198 (78%)		2	
CVAD placement[b]	Before	108	2	7	74 (32%)		40 (17%)			
	After	70	6	8	111 (48%)	1	32 (14%)	4		
Infusion administration	Before				16 (6%)		232 (92%)		4	
	After	1	1		16 (6%)		234 (92%)		1	
Medication monitoring[c]	Before	9			26 (11%)	14	192 (78%)		4	1
	After	7		1	19 (8%)	18	194 (78%)		2	7
Insertion site monitoring	Before				28 (11%)		216 (86%)		6	2
	After				19 (8%)		232 (92%)		1	1
Dressing changes[c]	Before			1	72 (29%)		174 (69%)		4	
	After			4	83 (33%)		163 (64%)	2	1	
Flushing and locking	Before	1			11 (4%)		236 (93%)		5	
	After				4 (2%)		249 (98%)		1	
Removal—peripheral infusion[a]	Before	3		1	28 (11%)		213 (85%)	1	6	
	After	1		1	16 (6%)		228 (90%)		6	1
Removal—CVAD[b]	Before	54	2	4	69 (28%)		114 (47%)			
	After	30		9	73 (30%)		134 (54%)			

Abbreviations: CVAD, central vascular access device; LPN, licensed practical nurse; LVN, licensed vocational nurse; nonclinical, staff without a clinical degree or certification; NP, nurse practitioner; PA, physician assistant; RN, registered nurse; RPh, registered pharmacist, RT, respiratory therapist.

[a] $P < .01$.

[b] $P < .001$.

[c] $P < .05$.

[d] Percentage of total responses included for infusion team and individual RN totals.

group. While nurses increasingly have been recognized as independent clinicians,[25] there still exists a perspective that clinical tasks assigned to nurses can be performed by anyone with relative ease. As stated more compellingly by Benner and colleagues[26(p333)] and restated by Hadaway[1(p279)]: "The view that 'a nurse is a nurse' is quickly translated in an era of health care efficiency, productivity, and profitability into the stance that 'anyone can do it.'" However, from a managerial perspective, the reallocation of infusion tasks does not represent a mere delegation of tasks from specialist nurses to individual nurses.

A key aspect of delegation[27,28] is the availability of an expert that assists, as needed, the employee to whom the task has been delegated. In many cases, however, infusion teams have been cut back or disbanded for the purpose of terminating some or all of the infusion nurses on those teams, who were often more costly to employ than less experienced individual nurses.[1] As these specialized infusion nurses are terminated, the organizations in which they worked lose significant infusion-related expertise and tacit knowledge in the process, requiring individual nurses to proactively develop their own knowledge, skills, and abilities, known in the management literature as *human capital*,[29] regarding infusion administration.[1] Future research should focus on formal organizational strategies and informal practices that encourage individual nurses to improve their infusion-related knowledge, skills, and abilities in order to increase the safety and reliability with which infusion tasks are performed. Additionally, future research should document how and under what conditions individual nurses learn to develop and maintain complex infusion knowledge, skills, and abilities. Specifically, research should explore the processes by which nurses acquire complex vascular access skills, since the data presented here show a great deal of variance in which occupational groups are responsible for this critical subtask across health care organizations.

Shifts in infusion administration practices that rely on clinicians to develop their own human capital mirror a larger trend in employment across all industries. Since the 1980s, organizations increasingly have limited their long-term investment in employees in an effort to cut costs and remain flexible.[30] This limited investment, in concert with the increasing ease with which employees can change jobs,[31] has fundamentally altered the relationship between employer and employee, resulting in what scholars refer to in contemporary career development as "boundaryless" careers.[32] While framed as free and open movement from organization to organization by an employee, "boundarylessness" places the responsibility for human capital development squarely on the employee.[32] Owing to this broader occupational trend toward boundaryless careers, as well as the continued economic difficulties facing health care organizations in the United States,[33] this trend of reallocating infusion tasks to professionals with less infusion-specific training will likely continue in US health care organizations. Additional research will need to examine both the clinical and employee attitudinal costs associated with infusion subtask shifts. For example, while some health care organizations may have developed strategies and resources to limit the clinical costs associated with shifts in infusion subtask responsibilities, costs associated with increasing the workload of individual RNs—such as increased stress, withdrawal, and voluntary turnover—may become significantly higher, negating the cost savings anticipated by shifting infusion subtasks.

LIMITATIONS

This study has several limitations. For example, because it was primarily exploratory and cross-sectional in nature, causation cannot be inferred from its findings. Causal modeling requires longitudinal designs, ideally in which an organization or group of organizations is studied during a change in infusion administration practices.

In collecting the data for this study, 3 specialty practice associations assisted the investigators, which allowed them to sample from a wide array of health care organizations, as well as a number of nursing specialties. While this breadth allowed the comparison of a wide array of infusion administration practices across a variety of different types of health care organizations, future research will be needed for a more fine-grained organizational analysis of the form and effects of infusion task reallocation. For example, a research design that focuses on a few specific organizations may include data regarding financial outcomes both before and after infusion practices change, which would make it possible to directly ascertain financial costs and gains associated with creating, changing, or disbanding infusion teams in health care organizations.

Finally, while the quantitative nature of the study is especially useful in articulating larger trends associated with infusion task reallocation, it does not allow readers to understand how nurses and other clinical professionals experience and interpret the reallocation of infusion-related tasks. Qualitative research methodologies, such as interviewing or ethnographic fieldwork,[34] would be well suited in providing a more comprehensive understanding of how clinicians perceive the reallocation of infusion tasks in the health care organizations in which they work.

CONCLUSION

In this exploratory study, infusion administration practices throughout US health care organizations have been documented. In doing so, evidence for significant shifts in infusion administration practice has been found, most notably the reallocation of infusion subtasks to occupational groups that require lower levels of infusion-specific education and training. This research lays an important foundation for future research, which may delve more deeply into understanding the consequences of changes in infusion administration practices on patient health and nurse employment outcomes.

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