Research Square

Preprints are preliminary reports that have not undergone peer review.
They should not be considered conclusive, used to inform clinical practice,
or referenced by the media as validated information.

Pharmacist Engagement in Fluid Stewardship in Kuwait: A Cross-Sectional Study

Afrah Alkazemi

afrah.alkazemi@ku.edu.kw

Kuwait University

Sarah Almutairi

Kuwait University

Fatema Fakhra

Al-Amiri Hospital, Ministry of Health

Manahel Salloum

Al-Amiri Hospital, Ministry of Health

Abdulaziz Almutawa

Al-Amiri Hospital, Ministry of Health

Abdulrahman Alfares

Al-Amiri Hospital, Ministry of Health

Research Article

Keywords: Intravenous fluids, Fluid stewardship, Pharmacists, Health workforce, Multidisciplinary care

Posted Date: November 5th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-11105589/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License.
Read Full License

Additional Declarations: No competing interests reported.

Abstract

Background

Intravenous (IV) fluids are among the most commonly administered therapies in hospitalized patients, and their appropriate use requires careful selection, dosing, monitoring, and de-escalation. Fluid stewardship provides a structured, multidisciplinary approach to optimizing these processes. Pharmacists are well positioned to contribute to fluid stewardship; however, their current involvement and the practice factors influencing their participation remain poorly characterized. This study aimed to characterize pharmacists' engagement in IV fluid management and identify practice-level factors relevant to their participation in fluid stewardship in Kuwait hospitals.

Methods

A cross-sectional, web-based survey was conducted among registered pharmacists involved in direct patient care in Kuwait hospitals. The questionnaire assessed pharmacists' perceived professional roles, current practices, training needs, barriers, and factors supporting participation in fluid stewardship. Responses were summarized descriptively, with exploratory comparisons according to professional experience and practice setting.

Results

Eighty-six pharmacists participated. Although most respondents supported pharmacist involvement across fluid assessment, selection and dosing, monitoring, and de-escalation, routine participation was less frequent: 37.2% reported reviewing IV fluid therapy always or often, and 41.9% reported direct involvement in fluid selection or dose adjustment. The absence of institutional guidelines or protocols was the most frequently reported barrier to participation (62.8%), while regular pharmacist training in IV fluid therapy and stewardship was the most frequently supported strategy (86.0%). Engagement did not differ significantly by professional experience or practice setting, although numerically higher engagement was observed among ICU/CCU pharmacists.

Conclusions

Pharmacists recognized a professional role across multiple components of IV fluid management, while their reported routine participation varied. Training, institutional guidance, and multidisciplinary collaboration were identified as factors that may support pharmacist participation in fluid stewardship. These findings provide baseline evidence on pharmacist engagement and practice factors relevant to the future development of multidisciplinary fluid stewardship initiatives in Kuwait and may inform similar efforts in other healthcare settings.

1. Background

Intravenous (IV) fluids are among the most frequently administered therapies in hospitalized patients and are integral to resuscitation, maintenance, replacement of ongoing losses, and medication delivery [1]. Despite their routine use, IV fluids should be regarded as pharmacologically active therapies whose effects depend on fluid composition, dose, timing, duration, and the patient's clinical condition [1, 2]. Fluid overload and positive cumulative fluid balance have been associated with adverse outcomes, including increased mortality, particularly among critically ill patients [3]. These considerations have contributed to the development of fluid stewardship, which applies structured principles of appropriate fluid selection, dosing, monitoring, reassessment, and de-escalation to IV fluid therapy [2, 4].

Integrating fluid-stewardship principles into routine clinical practice requires coordinated participation across healthcare disciplines. International surveys have demonstrated variation in knowledge and practice related to IV fluid therapy among healthcare professionals, including physicians and nurses, as well as variability in fluid-management and deresuscitation practices in critical care [5–8]. Expert recommendations have emphasized multidisciplinary practice, staff education, and consistent application of fluid-management guidance [4]. Together, these findings highlight the importance of considering professional roles, education, and the practice environment when developing multidisciplinary approaches to fluid stewardship.

Within this multidisciplinary model, pharmacists have been proposed as contributors to fluid stewardship through the application of medication-safety and stewardship principles to IV fluid therapy, including appropriate fluid selection, dosing, duration, monitoring, and de-escalation [9]. Evidence has also begun to demonstrate the feasibility of translating these principles into practice. Pharmacist-led implementation of IV fluid guidance has improved aspects of postoperative fluid prescribing, while clinical pharmacist interventions related to fluid therapy have been described in intensive care practice [10, 11]. Hawkins et al. subsequently described the implementation of pharmacist-led fluid stewardship within a medical intensive care unit [12], and more recent work has examined the relationship between medication-regimen complexity and pharmacist-driven fluid-stewardship recommendations among critically ill patients [13].

However, the pharmacist-specific literature remains limited and has largely comprised conceptual frameworks, targeted interventions, and single-center studies, with much of the recent work focused on critical care settings [9–13]. Less is known about pharmacists' current participation in IV fluid management across broader hospital practice and the professional and practice-level factors that may influence their engagement in fluid stewardship. Characterizing current practice alongside perceived professional roles, training needs, barriers, and factors supporting participation can provide useful baseline information for planning and developing multidisciplinary fluid-stewardship initiatives. Evidence from different healthcare systems is also important because professional roles, institutional practices, and models of clinical pharmacy service may vary across settings.

Kuwait provides a relevant setting in which to examine these questions. Pharmacy practice in Kuwait is evolving toward expanded clinical and patient-centered roles [14]. More recently, a hospital in Kuwait was recognized by the International Fluid Academy as a Centre of Excellence in Fluid Stewardship [15]. Within this evolving practice landscape, characterizing pharmacists' current participation can provide baseline information relevant to the continued development of multidisciplinary fluid stewardship in Kuwait while contributing evidence from an underrepresented Middle Eastern healthcare setting.

The objective of this study was to characterize pharmacists' current engagement in IV fluid management and explore practice-level factors relevant to their participation in fluid stewardship in hospital settings in Kuwait, including perceived professional roles, training needs, barriers, and factors supporting participation.

2. Method

2.1. Study design and setting

A cross-sectional, English-language, web-based survey was conducted among registered pharmacists practicing in hospital settings in Kuwait. Eligible participants were aged ≥ 18 years and involved in direct patient care, including pharmacists practicing in intensive care units, medical and surgical wards, and emergency departments. Pharmacists working exclusively in administrative or other non-clinical roles were excluded. Participants were recruited from secondary and tertiary care hospitals across Kuwait, including governmental and specialized healthcare institutions. Data were collected between October and December 2025.

2.2. Questionnaire development

A self-administered, structured questionnaire was developed specifically for this study following a review of published literature on fluid stewardship, IV fluid prescribing practices, and pharmacists' roles in fluid management. The literature review was used to identify relevant concepts and areas of practice and to inform the development of questionnaire items. As no existing questionnaire adequately addressed the study objectives, a new questionnaire was developed by the research team.

The questionnaire captured participant characteristics; perceived professional roles in IV fluid management; current fluid-management practices; awareness of practice-level resources and stewardship activities; training needs; perceived barriers; and factors that may support pharmacist participation in fluid stewardship. Perceived professional roles were assessed using five-point Likert-scale items ranging from 1 (strongly disagree) to 5 (strongly agree). Other items assessed the frequency of IV fluid review and recommendations, practice resources, training priorities, perceived barriers, and factors that may facilitate pharmacist participation. The questionnaire was administered electronically using Google Forms, and responses were collected anonymously.

The questionnaire was developed to provide a descriptive assessment of pharmacist engagement and associated practice-level factors rather than to measure a predefined implementation-readiness construct; therefore, a formal implementation-science or readiness framework was not applied. The questionnaire was developed specifically for this study and has not been published previously. The complete English-language questionnaire is provided as Supplementary 1.

2.3. Expert review and pilot testing

The preliminary questionnaire was reviewed by three clinical pharmacists with experience in hospital practice. Reviewers assessed the relevance, clarity, and comprehensibility of the questionnaire items and provided feedback on wording and content. Minor revisions were made based on their recommendations. The revised questionnaire was subsequently pilot tested among five hospital pharmacists to assess clarity, comprehensibility, questionnaire flow, and completion time. Feedback from pilot testing resulted in minor modifications to item wording and questionnaire structure. Pharmacists who participated in the pilot test were not included in the final study sample.

2.4. Sampling and data collection

A convenience sampling strategy was used. Participants were recruited through hospital pharmacy departments across all six health regions of Kuwait, including Ministry of Health hospitals and specialized healthcare institutions. Heads of clinical pharmacy units and pharmacy supervisors were asked to circulate the electronic survey link to pharmacists within their teams who met the eligibility criteria. Participation was voluntary, and no incentives were offered. Because the survey link was distributed through departmental contacts, the total number of eligible pharmacists who received the invitation could not be determined; therefore, a response rate could not be calculated.

2.5. Data analysis

Categorical and ordinal variables were summarized using frequencies and percentages. Likert-scale items were analyzed descriptively and presented as frequencies and percentages for each response category. Two indicators reflecting reported pharmacist engagement in IV fluid management were selected for exploratory analysis: frequency of routine IV fluid review and direct involvement in IV fluid selection or dose adjustment. For routine IV fluid review, responses of “always” or “often” were categorized as higher engagement, whereas “sometimes,” “rarely,” or “never” were categorized as lower engagement. Direct involvement in IV fluid selection or dose adjustment was categorized as involved when respondents reported making recommendations independently or as part of a multidisciplinary team and as not involved when respondents reported that these decisions were managed by physicians or nurses. Three respondents who selected “not applicable” were excluded from the latter analysis.

Exploratory analyses examined associations between these engagement indicators and professional experience (≤ 5 versus > 5 years) and practice setting (ICU/CCU versus other clinical settings). Fisher’s exact test was used because of small cell counts, and odds ratios (ORs) with 95% confidence intervals (CIs) were reported as effect estimates. Given the exploratory nature of these analyses, findings were

interpreted primarily according to the magnitude and precision of effect estimates, with two-sided p-values < 0.05 considered statistically significant. Data management and descriptive summaries were performed using Microsoft Excel (Microsoft Corporation, Redmond, WA, USA), and inferential analyses were performed using IBM SPSS Statistics version 31.0.1.0 (IBM Corp., Armonk, NY, USA).

2.6. Ethical considerations

Ethical approval

was obtained from the Health Sciences Center and Ministry of Health Joint Ethics Committee (approval number: 13/102025/479). The study was conducted in accordance with relevant guidelines and regulations and the principles of the Declaration of Helsinki. Participation was voluntary and anonymous. Participants were informed about the study, and proceeding to complete the questionnaire indicated informed consent to participate.

3. Results

3.1. Participant characteristics

A total of 86 pharmacists working in clinical or ward-based settings participated in the study. Most respondents were female (83.7%), aged 25–34 years (77.9%) and had ≤ 5 years of clinical pharmacy experience (72.1%). More than half held a PharmD degree (57.0%). Participants represented a range of clinical practice areas, with medical units being the most common (51.2%), followed by intensive care and cardiac care units. Most respondents practiced within Ministry of Health hospitals. Participant characteristics are summarized in Table 1.

Table 1
Demographic and professional characteristics of participating pharmacists (N = 86)

Demographics and Professional Characteristics	n (%)
Age (years)	
< 25	2 (2.3)
25–34	67 (77.9)
35–44	16 (18.6)
45–54	1 (1.2)
≥ 55	0 (0.0)
Gender	
Male	14 (16.3)
Female	72 (83.7)
Highest Pharmacy Credential	
BPharm	8 (9.3)
MPharm	2 (2.3)
PharmD	49 (57.0)
MSc	25 (29.1)
PhD	2 (2.3)
Years of Experience (years)	
< 2	22 (25.6)
2–5	40 (46.5)
6–10	15 (17.4)
11–15	6 (7.0)
> 15	3 (3.5)
Primary Practice Setting	
Intensive Care Unit (ICU)	11 (12.8)
Cardiac Care Unit (CCU)	7 (8.0)
Surgical Unit / Preoperative Unit	6 (7.0)
Medical Unit (including all subspecialties)	44 (51.2)

Demographics and Professional Characteristics	n (%)
Age (years)	
Pediatric Unit/Pediatric ICU/Neonate ICU	4 (4.7)
Emergency Department	5 (5.8)
Outpatient/Dialysis/Day Surgery	1 (1.2)
Oncology Unit	3 (3.5)
Other (nephrology or no defined unit)	5 (5.8)
Primary Place of Practice	
Ministry of Health	
Al-Asimah	6 (7.0)
Hawalli	16 (18.6)
Al-Jahra	8 (9.3)
Al-Ahmadi	5 (5.8)
Al-Farwaniya	21 (24.4)
Mubarak Al-Kabeer	11 (12.8)
Al-Sabah Health Region	11 (12.8)
Kuwait Oil Company Hospital	5 (5.8)
Private Hospitals	3 (3.5)

3.2. Current pharmacist engagement in IV fluid management

Self-reported engagement in routine IV fluid management varied across activities (Table 2). Overall, 32 pharmacists (37.2%) reported reviewing patients' IV fluid therapy for appropriateness always or often, whereas 54 (62.8%) reported doing so sometimes, rarely, or never. Direct involvement in IV fluid selection or dose adjustment was reported by 36 pharmacists (41.9%), including 8 (9.3%) who provided recommendations independently and 28 (32.6%) who contributed as part of a multidisciplinary team. Forty-seven respondents (54.7%) reported that these decisions were managed by physicians or nurses, while three (3.5%) indicated that this activity was not applicable to their practice. The frequency of making direct recommendations regarding IV fluid therapy also varied. Eighteen pharmacists (20.9%) reported making recommendations always or often, 19 (22.1%) sometimes, 35 (40.7%) rarely, and 14 (16.3%) never.

Table 2
Pharmacists' perceptions of their role in intravenous fluid management

Statement	Strongly Disagree n (%)	Disagree n (%)	Neutral n (%)	Agree n (%)	Strongly Agree n (%)
1. Pharmacists should understand the physiology of water and electrolyte homeostasis.	3 (3.5)	2 (2.3)	3 (3.5)	20 (23.3)	58 (67.4)
2. Pharmacists should know about the risks, benefits, and potential harms of IV fluids.	4 (4.7)	1 (1.2)	2 (2.3)	11 (12.8)	68 (79.1)
3. Pharmacists should contribute to assessing patients' fluid and electrolyte needs, including fluid responsiveness.	3 (3.5)	4 (4.7)	13 (15.1)	22 (25.6)	44 (51.2)
4. Pharmacists play an active role in monitoring IV stock, utilization, and wastage.	5 (5.8)	6 (7.0)	14 (16.3)	22 (25.6)	39 (45.3)
5. Pharmacists should play an active role in the initial selection and dosing of IV fluids tailored to each patient.	2 (2.3)	4 (4.7)	16 (18.6)	22 (25.6)	42 (48.8)
6. Pharmacists should take or recommend further action when fluid-related interventions are required, including de-escalation or discontinuation.	3 (3.5)	3 (3.5)	11 (12.8)	23 (26.7)	46 (53.5)
7. Pharmacists should be involved in reporting complications of fluid therapy or administration as incidents to support learning and system improvement.	2 (2.3)	5 (5.8)	14 (16.3)	21 (24.4)	44 (51.2)
8. Fluid stewardship is as important as antimicrobial stewardship.	3 (3.5)	5 (5.8)	20 (23.3)	22 (25.6)	36 (41.9)
9. Interprofessional collaboration (with physicians, nurses, anesthetists) is essential for safe fluid management.	4 (4.7)	1 (1.2)	1 (1.2)	15 (17.4)	65 (75.6)
10. Pharmacists' recommendations on fluid therapy are generally valued by the healthcare team.	5 (5.8)	12 (14.0)	25 (29.1)	17 (19.8)	27 (31.4)

3.3. Practice environment and fluid stewardship activities

Respondents reported different resources and practices supporting IV fluid management across their practice settings (Table Supplementary 2). Internationally recognized guidelines or protocols were the most frequently reported resource (47.7%), followed by hospital- or service-specific guidelines or protocols (34.9%). Consultant or departmental preference (22.1%) and experience-based practice

(18.6%) were also reported, while 16.3% indicated that no formal guideline or resource was available and 16.3% were unsure. Eleven respondents (12.8%) reported that their primary hospital had a fluid stewardship program, 42 (48.8%) reported that it did not, and 33 (38.4%) were unsure. Regarding institutional restrictions on IV fluid use, 48.8% were unsure whether specific fluids were restricted to particular indications or specialties. Regarding fluid availability, 38.4% reported that all listed IV fluids were regularly available at their institution. Balanced crystalloids (30.2%) and human albumin 4–5% (19.8%) were the products most frequently reported as not regularly available, while 32.6% of respondents were unsure about the availability of specific fluids.

3.4. Perceived professional roles in IV fluid management

Respondents generally supported pharmacist involvement across several aspects of IV fluid management (Table 3). Agreement was highest for statements concerning pharmacists' knowledge of the risks, benefits, and potential harms of IV fluids (91.9%), understanding of water and electrolyte homeostasis (90.7%), and the importance of interprofessional collaboration for safe fluid management (93.0%). Most respondents also agreed with pharmacist involvement in assessing patients' fluid and electrolyte needs (76.8%), individualized fluid selection and dosing (74.4%), and intervention when fluid de-escalation or discontinuation was required (80.2%). Regarding pharmacists' current influence within healthcare teams, 51.2% agreed or strongly agreed that pharmacists' recommendations on fluid therapy were generally valued, 29.1% were neutral, and 19.8% disagreed or strongly disagreed.

Table 3
Self-reported pharmacist practices related to intravenous fluid therapy (N = 86)

Survey Item	n (%)
Availability of fluid stewardship program at primary practice site	
Yes	11 (12.8)
No	42 (48.8)
I don't know	33 (38.4)
Frequency of reviewing patients' intravenous fluid therapy for appropriateness	
Always - In nearly all applicable cases (≥ 90% of the time)	7 (8.1)
Often - In most cases (about 60–89% of the time)	25 (29.1)
Sometimes - In some cases (about 30–59% of the time)	24 (27.9)
Rarely - In a few cases (< 30% of the time)	23 (26.7)
Never - I do not review fluid therapy	7 (8.1)
Provision of direct recommendations on intravenous fluid selection or dose adjustment	
Yes, independently as a pharmacist	8 (9.3)
Yes, as part of a multidisciplinary team	28 (32.6)
No, physicians or nurses manage this	47 (54.7)
Not applicable	3 (3.5)
Frequency of providing direct recommendations on intravenous fluid therapy	
Always - In nearly all applicable cases (≥ 90% of the time)	5 (5.8)
Often - In most cases (about 60–89% of the time)	13 (15.1)
Sometimes - In some cases (about 30–59% of the time)	19 (22.1)
Rarely - In a few cases (< 30% of the time)	35 (40.7)
Never - I do not make such recommendations	14 (16.3)
Types of resources available to support intravenous fluid management*	
Internationally recognized guidelines or protocols	41 (47.7)
Hospital or service-specific guideline/protocol	30 (34.9)
Consultant or department preference	19 (22.1)
Experience-based practice	16 (18.6)
*Participants could select multiple responses; therefore, percentages may exceed 100%	

Survey Item	n (%)
Availability of fluid stewardship program at primary practice site	
No formal guideline or resource available	14 (16.3)
Not sure	14 (16.3)
Other (drug databases or cased-based approach)	3 (3.5)
*Participants could select multiple responses; therefore, percentages may exceed 100%	

3.5. Training needs and perceived barriers to engagement

Respondents identified several areas in which additional training would be useful (Table 4). The most frequently selected were calculation of fluid dose, volume, and infusion rates (72.1%), fluid de-escalation or discontinuation (68.6%), assessment of patients' fluid and electrolyte needs (67.4%), and selection of the appropriate IV fluid (64.0%). The most frequently reported barriers to pharmacist involvement in IV fluid management were absence of institutional guidelines or protocols (62.8%), difficulty assessing patients' fluid or volume status (54.7%), time constraints or workload (50.0%), and limited knowledge of fluid types and indications (46.5%). Low confidence in making recommendations to the medical team was reported by 27.9%.

Table 4
Training needs and factors relevant to pharmacists' involvement in intravenous fluid management (N = 86)

Survey Item	n (%)
Area of intravenous fluid management requiring additional training*	
Assessing patients' fluid and electrolyte needs	58 (67.4)
Choosing the appropriate type of intravenous fluid	55 (64.0)
Calculating dosing/volume and infusion rates	62 (72.1)
Monitoring response and detecting complications	47 (54.7)
De-escalation/discontinuation of fluids	59 (68.6)
Documentation and communication with the healthcare team	28 (32.6)
Greatest challenges when recommending or managing intravenous fluids*	
Limited knowledge of fluid types and indications	40 (46.5)
Difficulty assessing patients' fluid or volume status	47 (54.7)
Lack of institutional guidelines/protocols	54 (62.8)
Low confidence in making recommendations to the medical team	24 (27.9)
Time constraints/workload	43 (50.0)
Other	2 (2.3)
Strategies that could enhance pharmacists' roles in fluid management*	
Undergraduate education in fluid management	56 (65.1)
Regular pharmacist training in IV fluid therapy and stewardship.	74 (86.0)
Pharmacist involvement in developing/updating institutional IV fluid guidelines	61 (70.9)
Shared decision-making with physicians and nurses	56 (65.1)
Continuing education in fluid therapy and stewardship	65 (75.6)
Pharmacist-led research on fluid management outcomes	37 (43.0)
Factors that support pharmacists in contributing to the development of a fluid stewardship program*	
Greater authority in prescribing and therapeutic decision-making	55 (64.0)
Clear institutional protocols and guidelines for intravenous fluid use	73 (84.9)
Access to specialized training and continuing education on fluid stewardship	67 (77.9)

*Participants could select multiple responses; therefore, percentages may exceed 100%

Survey Item	n (%)
Area of intravenous fluid management requiring additional training*	
Adequate staffing and protected time to engage in stewardship activities	53 (61.6)
Strong support from hospital leadership and administration	58 (67.4)
Enhanced interprofessional collaboration with other healthcare providers	50 (58.1)
*Participants could select multiple responses; therefore, percentages may exceed 100%	

3.6. Factors supporting pharmacist participation in fluid stewardship

Respondents identified several strategies and practice-level factors that could support pharmacist participation in fluid stewardship (Table 4). Regular pharmacist training in IV fluid therapy and stewardship was the most frequently selected strategy (86.0%), followed by continuing education on fluid therapy and stewardship principles (75.6%), pharmacist involvement in developing or updating institutional IV fluid guidelines (70.9%), and shared decision-making among pharmacists, physicians, and nurses (65.1%). Among practice-environment factors, clear institutional protocols and guidelines were most frequently selected (84.9%), followed by access to specialized training and continuing education (77.9%), support from hospital leadership and administration (67.4%), greater authority in prescribing and therapeutic decision-making (64.0%), adequate staffing and protected time (61.6%), and enhanced interprofessional collaboration (58.1%).

3.7. Exploratory analysis of pharmacist engagement

Exploratory analyses examined whether pharmacist engagement differed according to professional experience and practice setting (Table 5). Routine review of IV fluid therapy was reported by 23 of 62 pharmacists (37.1%) with ≤ 5 years of experience and 9 of 24 (37.5%) with > 5 years of experience (OR 0.98, 95% CI 0.37–2.59; Fisher's exact p = 1.000). Direct involvement in fluid selection or dose adjustment was reported by 26 of 60 pharmacists (43.3%) with ≤ 5 years of experience and 10 of 23 (43.5%) with > 5 years of experience (OR 0.99, 95% CI 0.38–2.62; p = 1.000).

Table 5
Exploratory analysis of pharmacist engagement in IV fluid management

Outcome / Characteristic	Higher engagement, n/N (%)	OR (95% CI)	p-value*
Routine review of IV fluid therapy			
Professional years of experience		0.98 (0.37–2.59)	1.000
≤ 5 years	23/62 (37.1)		
> 5 years	9/24 (37.5)		
Practice setting (ICU/CCU vs other)		1.96 (0.68–5.60)	0.274
ICU/CCU	9/18 (50.0)		
Other settings	23/68 (33.8)		
Direct involvement in fluid selection/dose adjustment			
Professional years of experience		0.99 (0.38–2.62)	1.000
≤ 5 years	26/60 (43.3)		
> 5 years	10/23 (43.5)		
Practice setting (ICU/CCU vs other)		2.51 (0.86–7.34)	0.110
ICU/CCU	11/18 (61.1)		
Other settings	25/65 (38.5)		

*p-values were calculated using Fisher's exact test. OR, odds ratio; CI, confidence interval; ICU, intensive care unit; CCU, cardiac care unit. Three respondents who selected "not applicable" for direct involvement were excluded from analyses of that outcome

Among pharmacists practicing in ICU/CCU settings, 9 of 18 (50.0%) reported routinely reviewing IV fluid therapy compared with 23 of 68 (33.8%) in other clinical settings (OR 1.96, 95% CI 0.68–5.60; p = 0.274). Direct involvement in fluid selection or dose adjustment was reported by 11 of 18 ICU/CCU pharmacists (61.1%) compared with 25 of 65 (38.5%) pharmacists in other settings (OR 2.51, 95% CI 0.86–7.34; p = 0.110). Confidence intervals were wide and included the null value for both practice-setting comparisons.

4. Discussion

This study provides a national practice-based perspective on pharmacists' engagement in IV fluid management in Kuwait and the factors relevant to their participation in fluid stewardship. The principal finding was a distinction between professional role recognition and reported routine participation. Although respondents generally supported pharmacist involvement across multiple aspects of fluid management, 37.2% reported reviewing IV fluid therapy always or often and 41.9% reported direct involvement in fluid selection or dose adjustment. Viewed alongside the reported training needs, barriers, and supportive factors, these findings suggest that recognition of a professional role alone may not be sufficient for that role to become routinely integrated into practice. Rather, pharmacist participation in fluid stewardship may reflect an interaction between individual capability, opportunities for multidisciplinary involvement, and the practice environment in which fluid-related decisions occur.

This interpretation extends the existing pharmacist-specific literature in an important way. Previous studies have primarily demonstrated what pharmacists can contribute through specific fluid-related interventions. Pharmacist-led implementation of IV fluid guidance has improved aspects of postoperative fluid prescribing, while pharmacist interventions related to fluid therapy and formal pharmacist-led fluid stewardship have been described in intensive care practice [10–12]. Pharmacists may also contribute by identifying and addressing medication-related sources of fluid exposure and incorporating fluid balance into pharmacotherapy assessment [16]. More recent work has examined the relationship between medication-regimen complexity and pharmacist-driven fluid-stewardship recommendations among critically ill patients [13]. Collectively, this literature demonstrates several potential pharmacist contributions to fluid management, but predominantly within specific interventions or clinical settings. The present study addresses a different question: how pharmacists report participating in IV fluid management across broader hospital practice and what factors they perceive as relevant to that participation. This distinction is important when moving from demonstrating the feasibility of individual interventions to considering how fluid stewardship might be integrated more broadly into routine multidisciplinary practice.

The exploratory findings provide additional context regarding variation in engagement. Engagement was almost identical between pharmacists with ≤ 5 and > 5 years of professional experience, suggesting that years of professional experience alone may not explain differences in participation. In contrast, pharmacists practicing in ICU/CCU settings reported numerically greater routine review and direct involvement than those in other settings, particularly for fluid selection or dose adjustment. These estimates were imprecise, with wide confidence intervals that included the null value, and should not be interpreted as evidence of a setting effect. Nevertheless, the observed pattern provides a useful hypothesis for future research. Critical care settings may offer more frequent exposure to complex fluid-related decisions and multidisciplinary clinical rounds, potentially creating more opportunities for pharmacists to participate in fluid management. Larger studies could examine whether clinical setting, models of pharmacy service, participation in multidisciplinary rounds, or other organizational characteristics are associated with pharmacist engagement.

The survey findings further suggest that education should be considered within the broader context of practice integration. Respondents identified several areas in which additional training would be useful, particularly calculation of fluid dose, volume, and infusion rates; fluid de-escalation or discontinuation; and assessment of fluid and electrolyte needs. Difficulty assessing fluid or volume status was also frequently reported as a barrier. Educational needs related to IV fluid management have similarly been identified among physicians and nurses [6, 7], reinforcing that fluid-management capability is a multidisciplinary consideration rather than one confined to pharmacy. However, education alone may not address all factors relevant to participation. Respondents simultaneously identified institutional guidance, leadership support, staffing and protected time, multidisciplinary decision-making, and professional responsibilities as factors that could support their contribution. This combination suggests that developing individual capability and creating opportunities to apply that capability in practice are complementary considerations.

Institutional guidance was particularly prominent in respondents' perceptions. The absence of institutional guidelines or protocols was the most frequently reported barrier, while clear institutional protocols were among the most frequently selected factors that could support pharmacist participation. Respondents also reported relying on a mixture of internationally recognized guidance, hospital- or service-specific protocols, consultant or departmental preference, and experience-based practice. These findings should not be interpreted as an assessment of the adequacy of institutional fluid-management systems because institutional characteristics were not independently verified. Rather, they indicate that pharmacists perceive the availability and consistency of practice guidance as relevant to their participation. This is consistent with expert fluid-stewardship recommendations emphasizing coordinated multidisciplinary practice, education, institutional support, and structured approaches to fluid management [4].

Interprofessional practice represents another important component of this integration. Almost all respondents considered interprofessional collaboration essential for safe fluid management, while shared decision-making with physicians and nurses was frequently selected as a strategy that could enhance pharmacist involvement. This is particularly relevant because more than half of respondents reported that fluid selection or dose-adjustment decisions were managed by physicians or nurses. Pharmacist participation in fluid stewardship therefore need not imply transfer of prescribing responsibility from one profession to another. A multidisciplinary model could instead incorporate pharmacists' medication-related expertise into assessment, optimization, monitoring, de-escalation, and communication around fluid therapy [9–12, 16].

Pharmacist involvement may also extend beyond individual patient-level decisions. Luo et al. recently described a pharmacy-led informatics framework integrating electronic health record data on IV fluid utilization with pharmacy inventory data to support fluid stewardship and resource forecasting during a national IV fluid shortage [17]. This illustrates how pharmacist participation can encompass both patient-level optimization and organizational resource stewardship. Such roles position fluid stewardship

as a shared quality and medication-safety activity rather than an intervention owned by a single profession.

The Kuwait context provides an opportunity to consider these findings within an evolving clinical pharmacy environment. Pharmacy practice in Kuwait is moving toward broader clinical and patient-centered roles [14], and fluid stewardship has begun to receive institutional recognition, including recognition of a Kuwait hospital as a Centre of Excellence in Fluid Stewardship by the International Fluid Academy [15]. Against this background, the present findings provide baseline information about pharmacists' reported participation across different areas of hospital practice. They should not be interpreted as an evaluation of individual hospitals or of the national healthcare system; rather, they describe the perspectives and experiences of participating pharmacists and may help inform the continued development of multidisciplinary fluid-stewardship practice.

From a health-services perspective, the findings suggest that pharmacist participation in fluid stewardship may be most appropriately considered as an issue of both workforce development and practice integration. Training can strengthen individual knowledge and capability, but routine participation also requires opportunities for that expertise to be incorporated into clinical workflows and multidisciplinary decision-making. Institutional guidance, leadership support, staffing and protected time, and clarity of professional responsibilities may therefore warrant consideration alongside education when developing fluid-stewardship initiatives. The potential contribution of pharmacists may also operate at different levels, from individual fluid-related decisions and medication-associated fluid exposure to protocol development and organizational monitoring of fluid use [9, 12, 16, 17]. Future implementation research could examine how different models of pharmacist participation are integrated into existing clinical services and evaluate their effects on fluid-use processes, multidisciplinary practice, resource utilization, and patient outcomes.

Several limitations should be considered when interpreting the findings. The cross-sectional, self-reported design may be subject to recall and social desirability bias and does not permit causal inference. Convenience sampling was used, and because the survey was circulated through hospital pharmacy departments, the number of eligible pharmacists who received the invitation could not be determined; consequently, a conventional response rate could not be calculated. The sample size limits statistical precision, particularly for the exploratory subgroup analyses, and the findings may not represent all hospital pharmacists in Kuwait or other healthcare systems. The questionnaire was developed specifically for this study based on published literature and underwent expert review and pilot testing but was not based on a formal theoretical or implementation-science framework and did not undergo formal psychometric validation. Accordingly, the study describes reported practices and factors relevant to participation rather than measuring implementation readiness as a validated construct. Finally, the study assessed pharmacists' perceptions and self-reported practices rather than directly observed activities, independently verified institutional characteristics, or patient outcomes. These considerations should be taken into account when interpreting the findings and their transferability to other settings.

5. Conclusion

Pharmacists in Kuwait recognized a professional role across multiple aspects of IV fluid management, while their reported routine participation varied. Respondents identified training, institutional guidance, multidisciplinary collaboration, and supportive practice structures as factors relevant to pharmacist participation in fluid stewardship. These findings provide baseline information on current practice and suggest that future fluid-stewardship initiatives may benefit from integrating workforce development with multidisciplinary and organizational approaches. Further research should evaluate the implementation and outcomes of such approaches across different hospital settings.

Declarations

Ethics approval and consent to participate

Ethical approval was obtained from the Health Sciences Center/Ministry of Health Joint Ethics Committee (approval number: 13/102025/479). Participation was voluntary and anonymous. Participants were informed about the study and that proceeding to complete the questionnaire indicated consent to participate.

Consent for publication: Not applicable

Availability of data and materials

The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request, subject to applicable ethical and institutional requirements.

Competing interests: The authors declare that they have no competing interests.

Funding: This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Authors' contributions

A.Alk.: Conceptualization, Methodology, Formal Analysis, Supervision, Writing – Review & Editing

S.A.: Methodology, Investigation, Data Curation, Formal Analysis, Writing - Original Draft

F.F.: Conceptualization, Methodology, Investigation, Writing – Original Draft

M.S: Methodology, Data Curation, Writing - Review & Editing

A.Alm: Conceptualization, Methodology, Writing – Review & Editing

A.Alf.: Conceptualization, Methodology, Supervision, Writing- Review & Editing.

All authors read and approved the final manuscript and agree to be accountable for the accuracy and integrity of the work.

Acknowledgements: Not applicable

References

1. Malbrain MLNG, Langer T, Annane D, et al. Intravenous fluid therapy in the perioperative and critical care setting: executive summary of the International Fluid Academy (IFA). Ann Intensive Care. 2020;10:64. 10.1186/s13613-020-00679-3.
2. Malbrain MLNG, Van Regenmortel N, Saugel B, et al. Principles of fluid management and stewardship in septic shock: it is time to consider the four D's and the four phases of fluid therapy. Ann Intensive Care. 2018;8:66. 10.1186/s13613-018-0402-x.
3. Messmer AS, Zingg C, Müller M, et al. Fluid overload and mortality in adult critical care patients: a systematic review and meta-analysis of observational studies. Crit Care Med. 2020;48(12):1862–70. 10.1097/CCM.0000000000004617.
4. Malbrain MLNG, Caironi P, Hahn RG, et al. Multidisciplinary expert panel report on fluid stewardship: perspectives and practice. Ann Intensive Care. 2023;13:89. 10.1186/s13613-023-01177-y.
5. Nasa P, Wise R, Elbers PWG, et al. Intravenous fluid therapy in perioperative and critical care setting–knowledge test and practice: an international cross-sectional survey. J Crit Care. 2022;71:154122. 10.1016/j.jcrc.2022.154122.
6. Leach R, Crichton S, Morton N, et al. Fluid management knowledge in hospital physicians: 'greenshoots' of improvement but still a cause for concern. Clin Med (Lond). 2020;20(3):e26–31. 10.7861/clinmed.2019-0433.
7. Wuyts SCM, Scheyltjens S, Hubloue I, et al. Interdisciplinary knowledge gaps on intravenous fluid management in adult patients: survey among physicians and nurses of a university hospital. J Eval Clin Pract. 2022;28(4):599–606. 10.1111/jep.13663.
8. Silversides JA, McAuley DF, Blackwood B, et al. Fluid management and deresuscitation practices: a survey of critical care physicians. J Intensive Care Soc. 2020;21(2):111–8. 10.1177/1751143719846442.
9. Hawkins WA, Smith SE, Newsome AS, et al. Fluid stewardship during critical illness: a call to action. J Pharm Pract. 2020;33(6):863–73. 10.1177/0897190019853979.
10. Abbood SK, Assad HC, Al-Jumaili AA. Pharmacist intervention to enhance postoperative fluid prescribing practice in an Iraqi hospital through implementation of NICE guideline. Pharm Pract (Granada). 2019;17(3):1552. 10.18549/PharmPract.2019.3.1552.
11. Cerqueira EJ, Lima AM, Neto JA, et al. Fluid stewardship in intensive care: clinical pharmacist's actions analysis. Rev Bras Farm Hosp Serv Saude. 2024;15(3):e1135. 10.30968/rbfhss.2024.153.1135.

12. Hawkins WA, Butler SA, Poirier N, Wilson CS, Long MK, Smith SE. From theory to bedside: implementation of fluid stewardship in a medical ICU pharmacy practice. Am J Health Syst Pharm. 2022;79(12):984–92. 10.1093/ajhp/zxab453.
13. Smith SE, Smith LT, Sikora A, et al. Relationship between medication regimen complexity and pharmacist engagement in fluid stewardship. Am J Health Syst Pharm. 2025;82(11):e529–35. 10.1093/ajhp/zxae369.
14. Al-Haqan A, Moreau P, Alghanem S, et al. Transforming pharmacy practice in Kuwait. Int J Health Plann Manage. 2023;38(4):879–88. 10.1002/hpm.3631.
15. International Fluid Academy. The World of IFA [Internet]. International Fluid Academy; [cited 2026 Aug 6]. Available from: [https://www.fluidacademy.org/international-fluid-academy-centres-of-excellence/]
16. Bissell BD, Mefford B. Pathophysiology of volume administration in septic shock and the role of the clinical pharmacist. Ann Pharmacother. 2020;54(4):388–96. 10.1177/1060028019887160.
17. Luo XS, Chan S, Mason M, Minneci PC, Russo K, Steinmetz K et al. A pharmacy-led dual-source informatics framework for intravenous fluid stewardship during a national shortage. Am J Health Syst Pharm 2026 Jul 30:zxag226. 10.1093/ajhp/zxag226. Epub ahead of print.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- BMCHSCsupplementary1Survey.docx
- BMCHSRSupplementary2.docx