Survey of Nurses' Experiences Applying The Joint Commission's Medication Management Titration Standards

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Background Critical care nurses titrate continuous infusions of medications to achieve clinical end points. In 2017, The Joint Commission (TJC) placed restrictions on titration practice, decreasing nurses' autonomous decision-making.

Objectives To describe the practice and perceptions of nurses regarding the 2017 TJC accreditation/regulatory standards for titration of continuous medication infusions.

Methods A survey of nurses' experiences titrating continuous medication infusions was developed, validated, and distributed electronically to members of the American Association of Critical-Care Nurses.

Results The content validity index for the survey was 1.0 for relevance and 0.95 for clarity. A total of 781 nurses completed the survey; 625 (80%) perceived titration standards to cause delays in patient care, and 726 (93%) experienced moral distress (mean [SD], 4.97 [2.67]; scale, 0-10). Among respondents, 33% could not comply with titration orders, 68% reported suboptimal care resulting from pressure to comply with orders, 70% deviated from orders to meet patient needs, and 84% requested revised orders to ensure compliance. Suboptimal care and delays in care significantly and strongly (regression coefficients ≥0.69) predicted moral distress.

Conclusions Critical care nurses perceive TJC medication titration standards to adversely impact patient care and contribute to moral distress. The improved 2020 updates to the standards do not address delays and inability to comply with orders, leading to moral distress. Advocacy is indicated in order to mitigate unintended consequences of TJC medication management titration standards. (*American Journal of Critical Care.* 2021;30:365-374)

doi:https://doi.org/10.4037/ajcc2021716

The Center for Medicare and Medicaid Services is the US agency that provides federal health and safety regulations for hospitals. The Joint Commission (TJC), the largest national accrediting organization, evaluates hospitals' compliance with health, safety, and quality performance requirements and is approved by the Center for Medicare and Medicaid Services.

The medication management (MM) standards set by TJC outline requirements for safe and effective management of intravenous therapies. Before 2017, the MM standard for titration allowed nurses to titrate medications to a prescribed physiologic goal.[1] Titrating to goal allows nurses autonomy in selecting the rate and increment of titration. This autonomy, however, was removed with an update to MM 04.01.01 implemented in January 2017.[2] The required elements for orders were tightened to include[2]

- medication name
- medication route
- initial or starting dose, rate of infusion (dose per minute), or both
- incremental units for increasing or decreasing the dose
- frequency of incremental doses/rate titration
- maximum dose/rate of infusion
- objective clinical end point (eg, blood pressure)

According to TJC assessment and reassessment standards (Provision of Care 01.02.01, Record of Care 02.01.01), nurses also are required to document each change in dose as it occurs, and the patient's response to the change.[1]

Perceived Problems

As critical care nurses (CCNs) attempted to apply the specific order requirements in clinical practice, challenges with adherence arose. Given the number of dose changes needed to stabilize patients, documentation requirements were burdensome. Physicians had difficulty forecasting an effective titration dose, frequency, or both, leaving nurses with inadequate orders that did not meet patients' needs. The Joint Commission received feedback regarding challenges and patient safety–related concerns from hospital leadership, professional nursing organizations, and individual nurses. Nurses were concerned about limits on their scope of practice, delays in care, and documentation burden. Nursing experts also raised a concern that the standards induced moral distress (distress imposed by being prevented from doing what one believes is right for a patient), leading to disengagement and burnout.[3,4]

Review of Titration Evidence

After thoroughly reviewing the literature, we found no evidence regarding best practices in medication titration. Several large studies showed poor adherence by nurses to providers' titration orders for vasopressors.[5-7] To improve adherence, closed-loop

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controllers have been tested to alert CCNs to titrate infusions when patients meet certain physiologic parameters,[8-10] but these methods are not universally used. We have personal knowledge that organizations have avoided device integration (linking the intravenous pump changes to the electronic health record) because in doing so the real work of nursing would become transparent and visible to surveyors.

The standards were changed because nurses inconsistently applied medication orders in practice, that is, the changes were made in an attempt to decrease titration variation.[2,8,11] The only study we found that measured the effect of these changes indicated that detailed titration instructions delayed the achievement of stable hemodynamics.[12] Nurses must attain specialized knowledge and skills, maintain competencies, and rely on critical thinking to support sound clinical judgment and high-level decision-making when titrating medications.[13] Experienced nurses use experience-derived intuition to recognize and act promptly in critical situations. Intuition plays a crucial role in patient outcomes.[14-16]

Moral Distress

Given the concerns about delays in care, resultant delays in hemodynamic stability, and the restricted scope of practice, we suspected that moral distress may result from adherence to these standards. Jameton[4,17] defines moral distress as occurring "when one knows the right thing to do, but institutional constraints make it nearly impossible to pursue the right course of action." We designed this study to fill a gap in knowledge related to nurses' experiences when titrating infusions according to TJC standards.

Problem Statement and Purpose

Nurses have anecdotally reported an inability to adhere to TJC titration standards, resulting in moral distress and patient safety concerns. This research explored the practices and perceptions of nurses regarding the new TJC accreditation standards for titration of continuous medication infusions.

Definitions

In this article, the term *infusion* refers to a continuous intravenous infusion of medication. *The standards* refers to the 2017 MM standards from TJC.

Research Questions

We developed 5 questions to be answered during this study:

1. What are the current practices of CCNs when titrating infusions?
2. Is clinical judgment that cannot be provided in a predetermined order set necessary in order to meet a patient's needs?
3. What are CCNs' values and preferences regarding the boundaries of nursing scope of practice in relation to infusion titration?
4. Which variables are predictors of nurses' perceptions of preferred boundaries to scope of practice related to titration of infusions?
5. Which variables are predictors of the intensity of moral distress among nurses when practicing according to the new titration standards?

We entered 12 predictor variables into the analysis: level of desired autonomy, years' experience titrating medications, the number of medications a nurse had experience titrating, ability to comply with orders, use of a titration protocol, previous autonomy when titrating, a need to titrate outside orders in order to meet patient needs, a need to request new orders, use of unapproved batch documentation, witnessing suboptimal care, witnessing a nurse being held accountable to standards, and witnessing delays to care.

Methods

Design

We used a predictive, cross-sectional design for this survey, which was intended to replicate the process the Institute of Safe Medication Practices deployed in an earlier study that informed changes to the Center for Medicaid and Medicare Services' 30-minute rule[18] (see Supplement 1, available online only at www.ajcconline.org). This study was considered exempt by the University of California San Diego Institutional Review Board (no. 191438).

Instrument

We designed and validated the Medication Titration Survey (see Supplements 1, 2, and 3, available online only). The validated Moral Distress Thermometer was embedded within the survey (Figure 1; see also Supplement 1, available online only). Participants' responses were anonymous.

Sample

The sample comprised nurse members of the American Association of Critical-Care Nurses (AACN) who had experience titrating intravenous medications. We used a passive recruitment method, posting a link to the survey on the AACN website and making an announcement about the survey in the AACN newsletter. The survey was available to respondents between January and September 2020.We sent no reminders and relied on word of mouth to promote the survey.

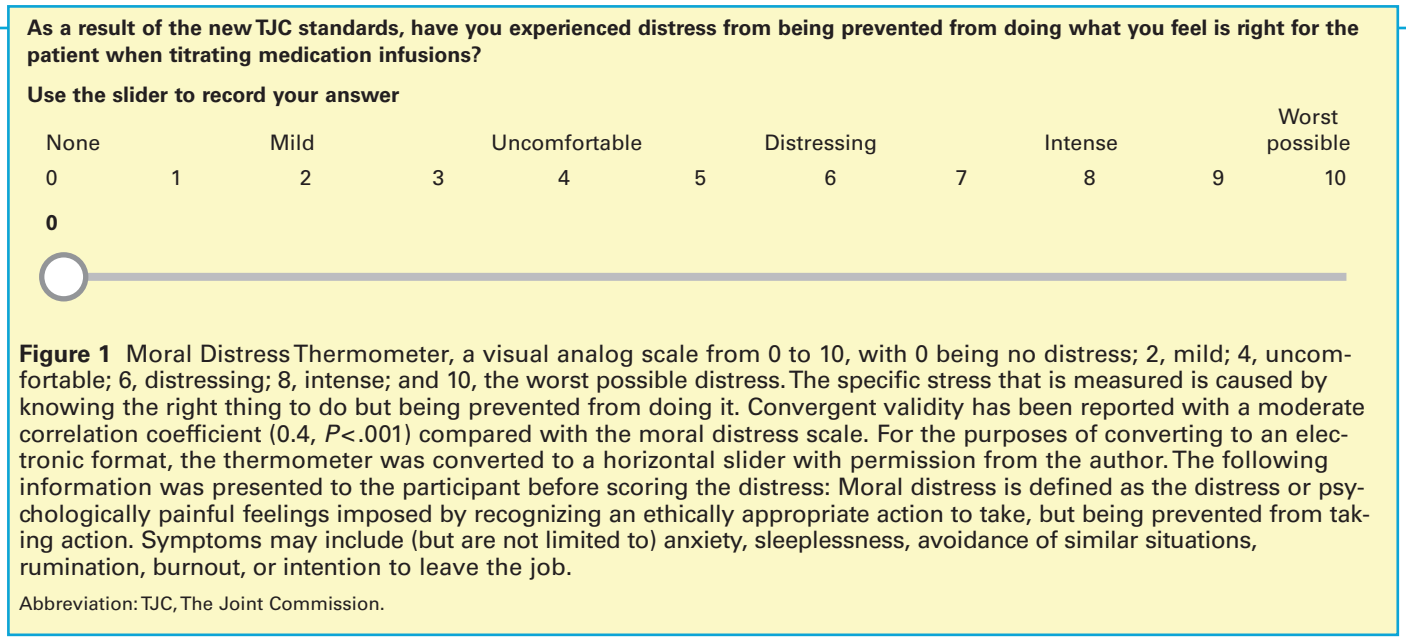

Figure 1 Moral Distress Thermometer, a visual analog scale from 0 to 10, with 0 being no distress; 2, mild; 4, uncomfortable; 6, distressing; 8, intense; and 10, the worst possible distress. The specific stress that is measured is caused by knowing the right thing to do but being prevented from doing it. Convergent validity has been reported with a moderate correlation coefficient (0.4, $P<.001$) compared with the moral distress scale. For the purposes of converting to an electronic format, the thermometer was converted to a horizontal slider with permission from the author. The following information was presented to the participant before scoring the distress: Moral distress is defined as the distress or psychologically painful feelings imposed by recognizing an ethically appropriate action to take, but being prevented from taking action. Symptoms may include (but are not limited to) anxiety, sleeplessness, avoidance of similar situations, rumination, burnout, or intention to leave the job.

Abbreviation: TJC, The Joint Commission.

Analysis

We used descriptive statistics to analyze demographic variables and used standard ordinary least-squares regression models to answer research questions. We excluded from the specific model any respondents with missing data for any predictor or outcome variable (ie, listwise deletion). Nurses were asked to choose any of 7 possible activities associated with titrating medications that they believed should be within the scope of nursing practice. On the basis of their selections, we created a score, from 0 (none of these) to 7 (all of these).

We fit 2 primary regression models. The first examined predictors of desired level of autonomy. The second tested associations with levels of moral distress. For both models, predictors included years of nursing experience, number of medications titrated during the respondent's practice, and items related to experiences with TJC guidelines (Table 1). We used Stata software version 15.0 to conduct analyses. For each model, $\alpha = .05$.

Results

Sample

A total of 941 participants responded to the survey; we included 781 respondents in the analyses after removing those who did not consent, had no experience with titration, or were unable to complete the survey.

Question 1: CCNs' Experiences With Medication Titration

Respondents reported a mean of 12.27 years' experience titrating medications (SD, 10.10 years; median, 9 years). Most respondents reported working in an intensive care unit (82%) and that before 2017 they always or often titrated medications to a goal parameter (86%). Only 24% of respondents had been counseled, or witnessed a nurse being counseled, for not following titration orders. Approximately 80% of respondents perceived that titration standards contributed to delays in care. Almost all nurses (93%) experienced moral distress resulting from adherence to the standards. The mean (SD) score on the moral distress scale (from 0 to 10) was 4.97 (2.67). Correlations between variables of interest are shown in Table 1.

Question 2: Clinical Judgment

The survey included questions to determine whether nurses had to use clinical judgment to titrate medications adequately. One-third of nurses (34%) reported an inability to comply with titration orders as written. As a result of the standards, 68% of CCNs had experienced or witnessed suboptimal care, and to meet patient needs, 70% had titrated a medication outside of the order. Most nurses (84%) reported requesting a revision of goal parameter orders because they did not meet a patient's needs.

Questions 3 and 4: CCNs' Preferences for Scope of Practice and Predictors of Desired Autonomy

A total of 567 respondents had complete data and were included in the analysis of questions 3 and 4. Table 2 reflects activities associated with medication titration that nurses believed to be within their scope of practice. Model results for variables that were predictors of desired level of autonomy are shown in Table 3. Significant predictors of a higher desired level of autonomy included a larger number

Table 1
Bivariate correlations among predictor and outcome variables

Variable	Pearson *r*[a]											
	Moral distress	Desired autonomy	Years of titration experience	Medication count	Protocol	Able to comply	Previous autonomy	Outside order	Require new order	Batch documentation	Witnessed suboptimal care	Witnessed nurse held acountable
Moral distress[b]	—											
Desired autonomy[c]	0.16[d]	—										
Years of titration experience	0.02	0.07[e]	—									
Medication count[f]	0.07	0.23[d]	0.13[d]	—								
Protocol[g]	−0.06	0.03	−0.07[e]	−0.08[e]	—							
Able to comply	0.33[d]	0.08[e]	0.09[e]	0.08[e]	−0.01	—						
Previous autonomy[h]	−0.09[e]	−0.13[d]	−0.17[d]	−0.16[d]	0.05	−0.10[e]	—					
Outside order[i]	−0.27[d]	−0.13[d]	−0.04	−0.14[d]	0.01	−0.46[d]	0.12[d]	—				
Require new order[j]	−0.08[e]	−0.03	−0.08[e]	−0.05	0.01	0.08[e]	0.01	0.02	—			
Batch documentation[k]	−0.05	−0.12[d]	0.01	0.03	−0.00	0.09[e]	0.07	0.08[e]	0.05	—		
Witnessed suboptimal care	−0.48[d]	−0.13[d]	−0.04	−0.05	0.04	−0.34[d]	0.08[e]	0.31[d]	0.19[d]	0.05	—	
Witnessed nurse held accountable[l]	−0.36[d]	−0.05	−0.07[e]	−0.05	0.09[e]	−0.23[d]	0.02	0.22[d]	0.25[d]	0.07	0.50[d]	—
Witnessed delays in care[m]	0.43[d]	0.12[d]	0.01	0.04	−0.07	0.38[d]	−0.05	−0.31[d]	−0.01	0.06	−0.40[d]	0.26[d]

[a] Unless indicated otherwise in a footnote.
[b] Scale from 0 to 10.
[c] Scale from 0 to 7, indicating how many activities associated with titrating medications the nurse stated should be within scope of practice.
[d] $P<.01$.
[e] $P<.05$.
[f] Number of medications a nurse had experience titrating, disclosed from a list of 29 medications (Supplement 2, available online only).
[g] Whether the organization had a protocol or was in the process of developing one.
[h] Whether the nurse previously had the autonomy to titrate to a goal parameter such as mean arterial pressure.
[i] Experienced titrating outside of the ordered parameters to meet the patient's needs.
[j] Needed to ask for new orders because the protocol did not meet the patient's needs.
[k] Documented in batches instead of at each dose change, as required.
[l] Witnessed a nurse being held accountable for acting outside of the standards.
[m] Binary variable, thus all correlation coefficients for this variable are point biserial.

Table 2
Desired scope of practice vs standards

Scope element	Required order elements in titration-specific standards			No. (%) of respondents (N=781)
	Before TJC (before 2017)	TJC (1/2017)	TJC updated (1/2021)	
Initial dose	Yes	Yes	Yes	318 (41)
Maximum dose	Not specified	Yes	Yes	99 (13)
Titration dose	Not specified	Yes	Yes (range appropriate)	512 (66)
Titration rate	Not specified	Yes	Yes (range appropriate)	504 (65)
Titration frequency	Not specified	Yes	Yes (range appropriate)	586 (75)
Choice of medication to titrate when >1 for same titration parameter	Not specified	Not specified	No; if in policy, not prohibited by state board of nursing and competency (or in the order)	252 (32)
Pause-restart as needed/indicated	Not specified	Not specified	No, if restart dose is in policy (or in the order)	534 (68)
All of the above				126 (16)

Abbreviation: TJC, The Joint Commission.

Table 3
Predictors of desired level of autonomy (scale, 0-7)[a]

Predictor[b]	Coefficient	SE	*t*	*P*	β
Intercept	3.38	0.87	3.90	<.001	—
Years of titration experience	0.01	0.01	0.99	.32	0.04
Medication count	0.06	0.01	5.23	<.001	0.21
Protocol	0.50	0.62	0.79	.43	0.03
Able to comply	−0.04	0.08	−0.52	.60	−0.03
Previous autonomy	−0.15	0.08	−1.93	.06	−0.08
Outside order	−0.07	0.07	−0.90	.37	−0.04
Require new order	0.01	0.07	0.11	.92	0.01
Batch documentation	−0.20	0.05	−3.84	<.001	−0.16
Witnessed suboptimal care	−0.09	0.08	−1.09	.28	−0.06
Witnessed nurse held accountable	0.06	0.07	0.92	.36	0.04
Witnessed delays in care	0.08	0.22	0.38	.71	0.02
Moral distress	0.07	0.03	2.19	.03	0.11

[a] Model: $F_{12,554}=5.98$, $P<.001$, $R^2=0.11$.
[b] See Table 1 footnotes for a description of each variable.

of titrated medications, less frequent use of batch documentation, and a higher level of moral distress. Although these effects were significant, they were generally small, with standardized regression coefficients less than 0.25.

Question 5: Predictors of Moral Distress Among CCNs

A total of 582 respondents had complete data and were included in this analysis; the model results are shown in Table 4. Several predictors were associated with a higher level of moral distress: experiencing much difficulty complying with TJC standards; endorsing a previously higher level of autonomy; frequently experiencing or witnessing suboptimal care or counseling of a nurse because of the standards; and perceiving the standards to result in delays in care. Effect sizes remained relatively small, with standardized coefficients less than 0.30, yet collectively these variables accounted for one-third of the variance in moral distress. To better depict these associations, we split the sample into a binary condition across the predictor variables: experienced more or less moral distress. As shown in Figure 2, various groups of participants endorsed higher levels of moral distress: those who were less often able to comply with the standards or who previously had greater autonomy, and those who witnessed suboptimal or delayed care or nurse counseling.

Discussion

Comparison With the Literature

In the absence of evidence-based best practice, it is inappropriate to write policy or restrictive standards.[3] Although studies have evaluated the efficacy and superiority of infusions of vasoactive drugs and sedatives, to our knowledge no studies have evaluated certainty regarding titration doses or frequency limits. This lack of evidence has led to the development of protocols driven by pharmacokinetics and pharmacodynamics, which can be influenced by a patient's specific response and clinical condition. Management of a critically ill patient is a dynamic process that relies heavily on a nurse's evaluation of the patient's response to medication titration.[12]

In addition, to our knowledge, no studies provide data to aid in the titration of multiple medication infusions with the same indication but different target receptors. Finally, we identified no evidence-based, objective clinical measures that guide titration of every medication administered in an intensive care unit. Although recommendations of objective clinical measures to guide titration may be important, a requirement is unnecessary and creates an unreasonable standard that is not based on evidence.

Clinical Judgment and Surveillance

These results suggest that medications cannot be safely titrated simply by increasing or decreasing the rate of an infusion on the basis of a prescriptive protocol. Surveillance by a nurse is necessary because medication titration requires in-depth knowledge of the patient, their disease state, their goals, and the environment. Because critically ill patients respond unpredictably to medications, clinical judgment is an integral part of surveillance and is key to effective, safe medication titration. The Tanner model describes the processes of clinical judgment as noticing, interpreting, responding, and reflecting.[19,20] Titration involves assessing not only the effect of medication titration on a goal parameter (eg, blood pressure) but also other effectors such as pain, anxiety, pulse rate, hemodynamics, neurological parameters, continuous renal replacement therapy settings, and ventilatory parameters—all of which may affect the

Table 4
Predictors of moral distress[a]

Predictor[b]	Coefficient	SE	*t*	*P*	β
Intercept	6.93	1.12	6.17	<.001	—
Years of titration experience	−0.02	0.01	−1.72	.09	−0.06
Medication count	0.01	0.02	0.76	.45	0.03
Protocol	−0.54	0.84	−0.65	.52	−0.02
Able to comply	0.24	0.11	2.25	.02	0.09
Previous autonomy	−0.20	0.10	−2.00	.046	−0.07
Outside order	0.01	0.10	0.11	.92	0.01
Require new order	0.07	0.10	0.78	.44	0.03
Batch documentation	−0.08	0.07	−1.18	.24	−0.04
Witnessed suboptimal care	−0.69	0.11	−6.38	<.001	−0.27
Witnessed nurse held accountable	−0.35	0.09	−3.91	.36	−0.15
Witnessed delays in care	2.00	0.28	7.21	<.001	0.28

[a] Model: $F_{11,570}=5.98$, $P<.001$, $R^2=0.33$.
[b] See Table 1 footnotes for a description of each variable.

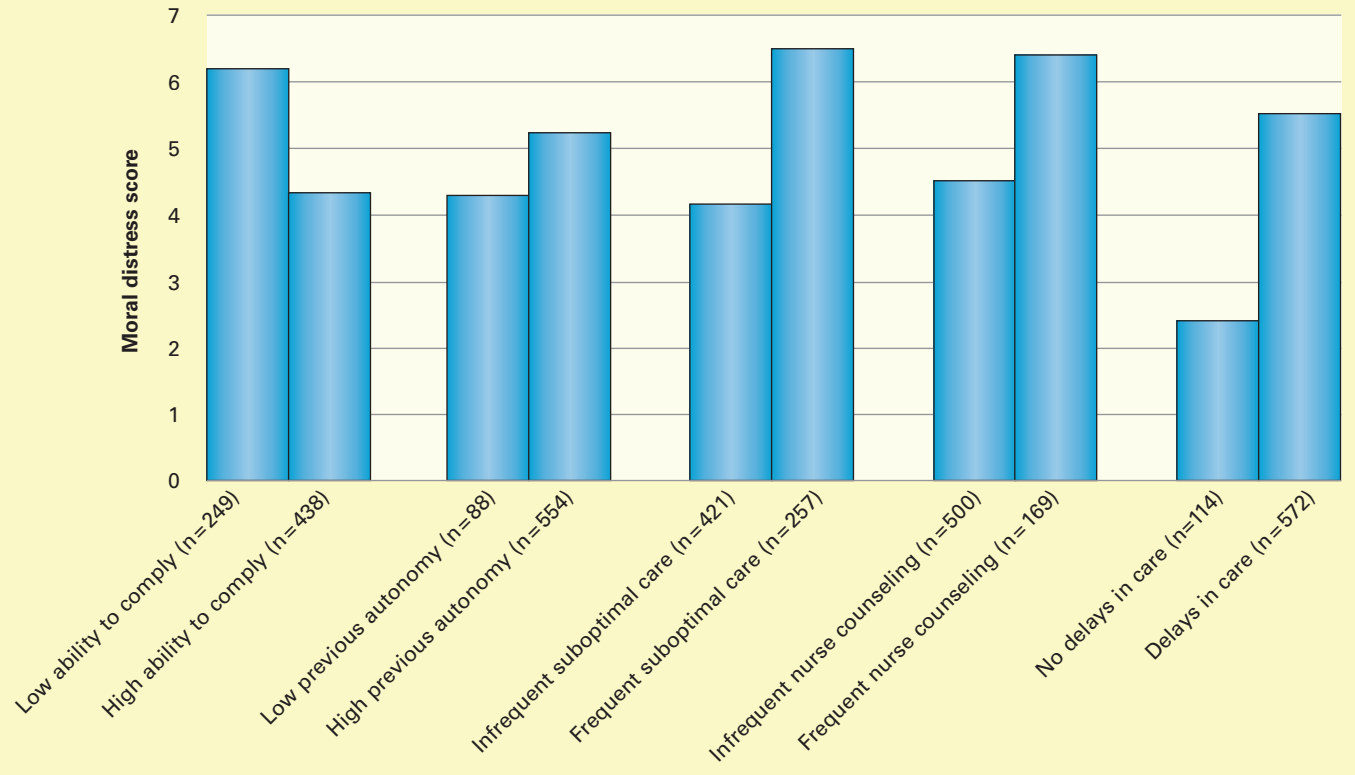

Figure 2 Average moral distress (measured on a scale of 0 to 10) by reported impact of The Joint Commission standards.

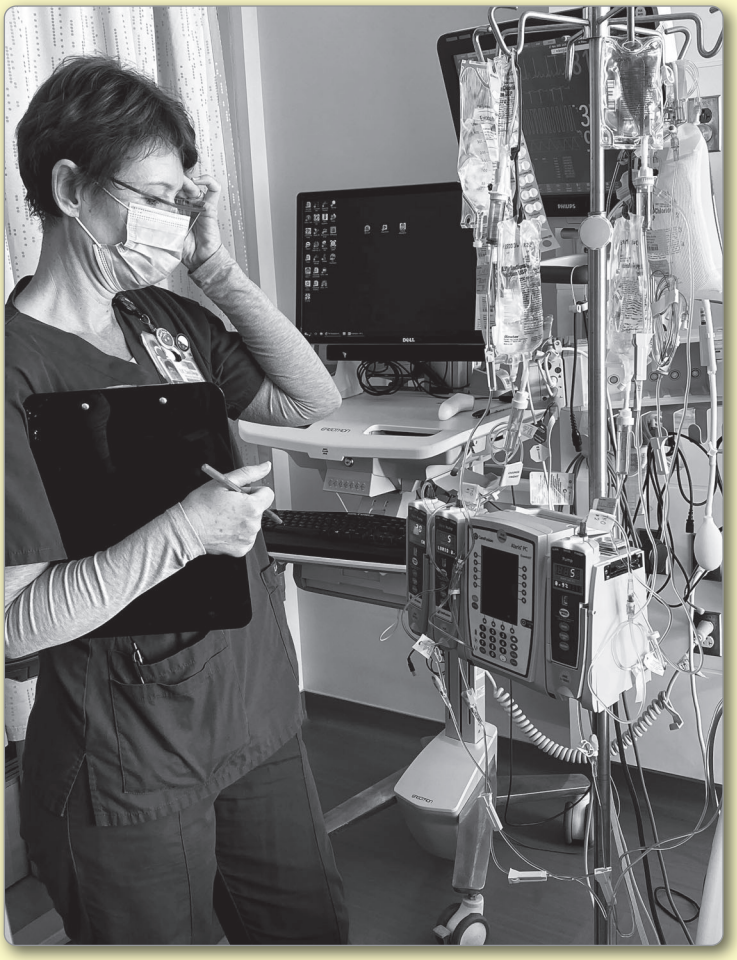

Figure 3 Consternation while titrating medications.

Photograph of Kristina Christiansen, RN, a nurse working in the COVID-19 intensive care unit, taken with permission by Angela Klinkhamer, BSN, RN.

titration goal. Someone without expertise might titrate a medication to achieve a single parameter per a written protocol, without incorporating other data that also affect the outcome. Simply following a titration protocol does not account for these other factors. In our study, nurses responded that they were unable to adhere to titration orders, experienced or witnessed suboptimal care, and had to titrate outside of prescribed orders or request revisions to orders because they did not meet a patient's needs. As Chan et al[12] found, nurses reported delays in the achievement of hemodynamic stability when adhering to standards. These data suggest that to provide safe patient care, nurses use their judgment to titrate medications rather than simply following protocols, albeit against existing standards.

Error Recovery by Nurses

As found in a study of titration practices during simulations,[8] nurse participants reported needing to adjust for errors in medication orders after the new titration standards were put in place. These adjustments included interrupting errors (eg, adjusting medications per their clinical experience and best practice) and correcting errors (requesting a revision of ineffective titration orders). These data suggest that to provide safe patient care, nurses must use judgment to titrate infusions in addition to following protocols, signaling a need for further changes to the accreditation/regulatory standards.

Moral Distress

Patient safety is the cornerstone of clinical nursing practice. Critical care nursing practice relies on vigorous training and experience in caring for dynamic and complex patients. In the absence of input from practicing nurses before the 2017 changes to TJC regulations and standards, the changes unintentionally caused moral distress among nurses. Our results demonstrate that experiencing limits on desired autonomy, being responsible for and witnessing suboptimal care, and witnessing colleagues being held accountable for standards that result in suboptimal care all lead to moral distress.

Moral distress occurs as CCNs are challenged by the ethical conundrum of choosing between using their clinical judgment to act promptly and adhering to standards. Moral distress from the perceived delivery of inappropriate care can contribute to burnout, and CCNs are vulnerable to severe burnout syndrome (Figure 3).[21]

Although the June 2020 revision of TJC standards provided more flexible guidelines for practice in titrating medications,[2] TJC made these changes only after robust conversations with nurses. The philosophy of the AACN has been for nurses to be present at the table and exercise bold voices to ensure safe patient care.[22]

Desired Scope of Practice Compared With That Defined in the Standards

Most nurses reported that they had full autonomy to titrate medications to achieve a goal parameter before the new TJC standards and therefore could compare the 2 experiences. Most of the respondents desired to include within their scope of practice decisions regarding the titration dose, the rate and frequency of titration, and when to pause and restart medication infusions. Interestingly, only one-third of respondents desired to include selection between multiple agents with the same titration parameter as within their scope of practice (Table 2).

Although TJC's revised requirements reflect an improved understanding of the complexity of assessment required to titrate medications effectively

and safely, further improvements are desired and warranted (Table 2). For decades, CCNs have titrated multiple infusions on the basis of specialty training and assessment of a patient's individual response. This complex assessment includes the patient's target clinical parameter along with simultaneous evaluation of adjunctive therapies and changes in the patient's clinical status that may affect the titration (eg, changes in sedation, device settings, pain medication requirements). Of all team members, nurses are uniquely positioned at the bedside—assessing patients, titrating medications, and then reassessing—to determine optimal doses to meet patients' targeted clinical parameters. This dynamic and complex process requires the latitude to rapidly titrate multiple medications simultaneously.

After being briefed on the preliminary findings of this study and the literature review, and on comments from CCNs, the chief clinical officer of the AACN met face-to-face with the persons at TJC who are responsible for the medication titration standards. That meeting resulted in revisions to TJC's medication titration standards, published in June 2020.[23] In September 2020, additional changes included approval of a block charting format (charting for blocks of time rather than immediately), which acknowledges the complexity of titration practices. Other changes to TJC MM 04.01.01 standard became effective in January 2021. Nurses may now select the order of titration when multiple infusions must be titrated, and they can intermittently pause and restart titration infusions on the basis of a hospital policy or an order describing how the restart dose is to be determined. The required criteria include a complete medication order, adherence to the order, and competency for titration as defined by the organization.

Limitations/Strengths

This study is limited by its nonexperimental design, online sampling, and distribution through a professional organization, which may bias the study toward the inclusion of more experienced nurses. The sampling strategy prevented us from calculating a response rate. Although the Medication Titration Survey has been validated, this study is the first use of it. The strengths of the study include the external validity (national sampling, large sample size); the content, construct, and face validity testing; and the research team's breadth of experience.

Implications

The results of this study may be used to advocate for further changes in accreditation standards related to titration of continuous medication infusions. We strongly suggest including nurses who provide direct care in the development of accreditation standards in order to better evaluate the potential impact of those standards on workflow, practice, and outcomes. The importance of autonomy to adjust the frequency and dose of titration, rather than dependence on prescriptive titration protocols, could improve the provision of safe and efficient care to patients and reduce the moral distress that nurses experience. Given that we found no best practices for titration in the literature, future research is warranted in order to test strategies to optimize nurse autonomy while maintaining patient safety. We encourage repeating this study after full implementation of incremental changes to TJC standards in order to evaluate their impact on nursing practice.

The medication titration standards restrained nurses' clinical judgment, resulting in suboptimal and delayed care, difficulty complying with TJC standards, and a loss of autonomy.

Conclusion

We explored the practice and perceptions of CCNs regarding TJC accreditation/regulatory standards for titration of continuous medication infusions. Our CCN respondents reported that the standards restrained their clinical judgment, resulting in suboptimal and delayed care, difficulty complying with TJC standards, and a loss of autonomy. Witnessing suboptimal care led to a higher level of moral distress. The updates to the standards implemented in 2020 and early 2021 improved the situation by allowing batch charting and giving nurses the ability to choose which medication to titrate first. These changes, however, inadequately address the issues uncovered through this study. Further advocacy and collaboration with TJC are indicated so as to optimize patient safety and prevent moral distress among nurses when they attempt to adhere to titration MM standards.

ACKNOWLEDGMENTS

The authors thank the members of the grassroots task force that began with the Society of Critical Care Medicine Nursing Section, and the anesthesia and pharmacy members who worked tirelessly to develop this Medication Titration Survey and advocate for change. The authors also thank Connie Barden, MS, RN, CCO, of the AACN, for advocating with TJC on behalf of the nurses she serves. Finally, the authors thank the more than 900 nurses who took time to participate in nursing research despite the challenges imposed by the COVID-19 pandemic.

FINANCIAL DISCLOSURES
None reported.

REFERENCES

1. Joint Commission Resources. *Comprehensive Accreditation Manual for Hospitals (CAMH).* The Joint Commission; 2017.
2. Standards FAQs: medication administration–titration orders. The Joint Commission. 2019. Accessed June 28, 2021. https://www.jointcommission.org/standards/standard-faqs/hospital-and-hospital-clinics/medication-management-mm/000002114/
3. Davidson JE, Marshall MF, Watanabe JH. Policy impact: when policy fails. *Nurs Forum.* 2019;55(1):37-44.
4. Jameton A. Dilemmas of moral distress: moral responsibility and nursing practice. *AWHONNS Clin Issues Perinat Womens Health Nurs.* 1993;4(4):542-551.
5. Asfar P, Meziani F, Hamel J-F, et al; SEPSISPAM Investigators. High versus low blood-pressure target in patients with septic shock. *New Engl J Med.* 2014;370:1583-1593.
6. Lamontagne F, Meade MO, Hébert PC, et al; Canadian Critical Care Trials Group. Higher versus lower blood pressure targets for vasopressor therapy in shock: a multicentre pilot randomized controlled trial. *Intensive Care Med.* 2016;42(4):542-550.
7. Poukkanen M, Wilkman E, Vaara ST, et al; FINNAKI Study Group. Hemodynamic variables and progression of acute kidney injury in critically ill patients with severe sepsis: data from the prospective observational FINNAKI study. *Crit Care.* 2013;17(6):R295.
8. Fadale KL, Tucker D, Dungan J, Sabol V. Improving nurses' vasopressor titration skills and self-efficacy via simulation-based learning. *Clin Simul Nurs.* 2014;10(6):e291-e299. doi:https://doi.org/10.1016/j.ecns.2014.02.002
9. Joosten A, Delaporte A, Alexander B, et al. Automated titration of vasopressor infusion using a closed-loop controller: in vivo feasibility study using a swine model. *Anesthesiology.* 2019;130(3):394-403.
10. Merouani M, Guignard B, Vincent F, et al. Norepinephrine weaning in septic shock patients by closed loop control based on fuzzy logic. *Crit Care.* 2008;12(6):R155.
11. Joint Commission Resources. *Comprehensive Accreditation Manual for Hospitals.* The Joint Commission; 2019.
12. Chen A, Vogan E, Foglio J, Davis R, Reddy AJ, Lam SW. Effect of detailed titration instructions on time to hemodynamic stability in ICU patients requiring norepinephrine. *Jt Comm J Qual Patient Saf.* 2019;45(9):606-612.
13. Bell L, ed. *AACN Scope and Standards for Acute and Critical Care Nursing Practice.* American Association of Critical-Care Nurses; 2015.
14. Currey J, Botti M. The influence of patient complexity and nurses' experience on haemodynamic decision-making following cardiac surgery. *Intensive Crit Care Nurs.* 2006;22(4):194-205.
15. Melin-Johansson C, Palmqvist R, Rönnberg L. Clinical intuition in the nursing process and decision-making—a mixed-studies review. *J Clin Nurs.* 2017;26(23-24):3936-3949.
16. Purling A, King L. A literature review: graduate nurses' preparedness for recognising and responding to the deteriorating patient. *J Clin Nurs.* 2012;21(23-24):3451-3465.
17. Jameton A. *Nursing Practice: The Ethical Issues.* Prentice-Hall; 1984.
18. Institute for Safe Medication Practices. CMS 30-minute rule for drug administration needs revision. ISMP Medication Safety Alert! September 9, 2010. Accessed February 11, 2016. https://www.ismp.org/resources/cms-30-minute-rule-drug-administration-needs-revision
19. Modic MB. Tanner's model of clinical judgment applied to preceptorship: part 1. *J Nurses Prof Dev.* 2013;29(5):274-275.
20. Schoessler M. Tanner's model of clinical judgment, part 2. *J Nurses Prof Dev.* 2013;29(6):335-337.
21. Moss M, Good VS, Gozal D, Kleinpell R, Sessler CN. A Critical Care Societies Collaborative statement: burnout syndrome in critical care health-care professionals. A call for action. *Am J Respir Crit Care Med.* 2016;194(1):106-113.
22. Barden C. Bold voices: fearless and essential. *Am J Crit Care.* 2003;12(5):418-423.
23. Institute for Safe Medication Practices. CMS 30-minute rule for drug administration needs revision. ISMP Medication Safety Alert, Acute Care. 2010;15. Published September 9, 2010. Accessed June 28, 2021. https://www.ismp.org/resources/cms-30-minute-rule-drug-administration-needs-revision

Research Team Experience

The research team comprised an intergenerational team of clinical nurses, advanced practice nurses, educators, managers, and nurse scientists, and a pharmacist.

Background to Support Choice of Method: Cross-Sectional Survey Design

Years ago, the Centers for Medicare and Medicaid Services' 30-minute rule had been overturned following a cross-sectional survey of nurses issued by the Institute for Safe Medical Practices (ISMP). The problem with that regulatory standard was that it required nurses to administer all medications within 30 minutes on each side of the hour it was ordered. Therefore a medication ordered at 9 AM would have to be given between 8:30 AM and 9:30 AM. The standard had been written before the advent of electronic medication-dispensing systems. Once these became a normal part of practice, given that nurses were required to administer one patient's medications at a time, the number of nurses on a unit, the number of patients in a given unit, and the number of medication-dispensing units, it was mathematically impossible for all nurses to give all patients their 9 AM medications within the hour. The survey asked them direct questions regarding ability to comply with the standards and produced the data needed to overturn the standards.

Therefore, a similar survey was designed to address the problems associated with The Joint Commission titration standards, where nurses were anecdotally reporting inability to meet the patient's needs with predetermined titration dose and frequency orders, the burden of documentation, and the psychological burden of choosing between adhering to the standards or meeting patient needs.[1,2] Open-ended questions were included to explore the context surrounding the quantitative data and are reported elsewhere. The original survey for the ISMP project was obtained and reviewed by the team prior to survey design.

Validation

Investigators designed and validated the survey (see Supplement 3). Items were developed following literature review and development of project aims and research questions. Repeated conference calls were held to iteratively refine the survey. While constructing the questions, care was taken to reflect on bias, given that the survey was being conducted in response to perceived problems with the standards. At each step of the process, the team was asked to review the questions as they were developed to make sure they were written with as neutral a tone as possible.

Once the questions were constructed, a panel of 4 research nurses provided additional advice for revision. From this point, formal content validation of the Medication Titration Survey was performed by using the Lynn method.[3]

To evaluate the role of moral distress, permission was granted to use the Moral Distress Thermometer (Lucia Wocial, email, June 27, 2019).[4]

Expert Content/Construct Validation

Questions (n = 20) were validated by 6 content experts independently and data were pooled onto a de-identified spreadsheet. Each item was rated on a 4-point scale for relevance to the aim/research questions and again on a 4-point scale for clarity. Item relevance and clarity scores were computed by counting the number of items receiving a 3 or 4 divided by the number of experts, with a goal of achieving an index greater than 0.78%. The total tool content validity index (CVI) was calculated by dividing the number of items achieving a 3 or 4 by the number of questions, with a goal of achieving a CVI greater than 0.78 for the tool. Each item received the required value for both relevance (1.0) and clarity (0.95). Twelve questions were reworded for suggested clarity, modified again following suggestions, and finally found to be acceptable by the 6 reviewers in round 2 and presented back to the task force. Validators were also asked whether items were missing from the tool that were needed to achieve the aim of the study or answer the research questions.

End Users/Face Validity (Clinical Nurses)

The final tool was sent to 5 clinical nurses to rescore for face validity, confirming the CVI count. End users were asked to score for relevance and clarity and to assess whether the tool was missing important items. Upon request, the introduction was modified, adding an example of a titration order. The tool was then converted to electronic format. The invitation and electronic survey were tested with clinical nurses for usability without issue.

Internal Validity

The results are similar to that produced by the only other study on this topic that reviewed medical records and concluded that adhering to the standards induced delay to care.[5] Internal validity has also been explored in a separate qualitative thematic analysis of comments that provide confidence or relationships posed between the burden of documentation, moral distress, and accreditation standards.[6]

Criterion Validity

Not applicable as the scale was intended to measure incidence of like experiences, and there were no external or nontest criteria with which to compare. There were no subscales other than the number of medications (a count) and desired scope of practice (a count of items the nurse perceived should be within scope of practice). Moral distress measurement has been previously validated as described.

Medication List

A list of titrated medications was developed by 4 critical care pharmacists to be used to declare experience with titration of infusions. This list was then validated by nurses on the research team and during end-user evaluation of the tool (see Supplement 2).

Data Security and Confidentiality

Validation data were maintained on a password-protected network computer at the University of California San Diego. Survey data were collected electronically in a de-identified manner. No names or identifiers were collected. The survey data were obtained through the Qualtrics survey platform of the University of California San Diego and exported into Excel spreadsheets maintained on a password-protected networked computer.

References

1. Davidson JE, Marshall MF, Watanabe JH. Policy impact: when policy fails. *Nurs Forum.* 2019;55(1):37-44.
2. Institute for Safe Medication Practices. CMS 30-minute rule for drug administration needs revision. ISMP Medication Safety Alert, Acute Care. 2010;15. Published September 9, 2010. Accessed June 28, 2021. https://www.ismp.org/resources/cms-30-minute-rule-drug-administration-needs-revision
3. Lynn MR. Determination and quantification of content validity. *Nursing Res.* 1986;35(6):382-385.
4. Wocial LD, Weaver MT. Development and psychometric testing of a new tool for detecting moral distress: the Moral Distress Thermometer. *J Adv Nurs.* 2013;69(1):167-174.
5. Chen A, Vogan E, Foglio J, Davis R, Reddy AJ, Lam SW. Effect of detailed titration instructions on time to hemodynamic stability in ICU patients requiring norepinephrine. *Jt Comm J Qual Patient Saf.* 2019;45(9):606-612.
6. Davidson JE, Chechel L, Chavez J, Olff C, Rincon T. Thematic analysis of nurses' experiences with The Joint Commission's medication management titration standards. *Am J Crit Care.* 2021;30:375-384.

Supplement 1 Instrument development: Medication Titration Survey.

Vasopressor
- Angiotensin II
- Dopamine
- Epinephrine
- Isoproterenol
- Norepinephrine
- Phenylephrine
- Vasopressin

Analgesic
- Fentanyl
- Hydromorphone
- Morphine

Anxiolytic
- Dexmedetomidine
- Ketamine
- Lorazepam
- Midazolam
- Propofol

Antihypertensive
- Clevidipine
- Diltiazem
- Esmolol
- Labetalol
- Nicardipine
- Nitroglycerin
- Nitroprusside

Diuretic
- Bumetanide
- Furosemide

Inotrope
- Dobutamine
- Milrinone

Neuromuscular blocker
- Cisatracurium
- Vecuronium
- Rocuronium

Supplement 2 Titrated medications.

Medication Titration

Start of Block: Introduction

Consent: Titration of Continuous Infusions of Medications in Critical Care Judy Davidson, DNP, RN, Laura Chechel, MS, RN, Teresa Rincon, PhD, RN, and Susan Scott, PhD, RN, are conducting a research study to find out more about critical care nurses' experience with the change in titration standards regarding infusions of medications in critical care. If you agree to participate in this study, you will complete a 14-item survey that asks questions about how you apply the new standards for titrating continuous intravenous medications within your practice. It should take 5-10 minutes to complete. Research records will be kept confidential to the extent allowed by law. No one will be able to identify you or your answers, and no one will know whether or not you participated in the study. Completed surveys will be kept electronically on a password-protected computer. Data will be maintained on the password-protected UCSDH OneDrive. The results of this research project may be published in professional journals and meetings, but will only be reported as a group and will not include identifying information about you. Participation in this study is entirely voluntary. You may refuse to participate or withdraw at any time by simply exiting the survey. You are free to skip any question that you choose. Choosing not to participate or withdrawing will result in no penalty or loss of benefits to which you are entitled. If you would like additional information or have questions or research-related problems, you may reach Judy E. Davidson at [. . .]. By completing and submitting the survey you are indicating that you are at least 18 years old, have read this consent form, and agree to participate in this research study. Please print a copy of this page for your records.

- ○ Yes - I agree to participate (1)
- ○ No - I do NOT agree to participate (2)

Skip To: End of Survey If Consent: Titration of Continuous Infusions of Medications in Critical Care Judy Davidson DNP, RN,... = No - I do NOT agree to participate

This survey DOES NOT INCLUDE information regarding heparin, insulin, and epidural/intrathecal analgesia-anesthetics.

Background:
Regulatory/accreditation agencies have standards stating that nurses must titrate continuous intravenous medication infusions (examples: sedatives, analgesics, vasoactive medications) per the providers' orders and hospital policies/guidelines.
Documentation of the medication titration must be done in real time.
Deviation from titration orders cannot be done without prior approval by the provider.
TJC interpretation of required elements of a titration order and the example provided below came from The Joint Commission (TJC) Standards FAQ Details webpage.
Required elements for medication titration orders:

- Medication name
- Medication route
- Initial or starting rate of infusion (dose/min)
- Incremental units the rate can be increased or decreased
- Frequency for incremental doses (how often dose/rate can be increased or decreased)
- Maximum rate (dose) of infusion
- Objective clinical end point (sedation, neurological, hemodynamic parameters, etc)

TJC has provided the following example:
Start [medication name] drip at 10 µg/kg/min. Increase by 5 µg/kg/min every 5 minutes until desired patient response numeric target (eg, RASS = 3) is achieved. Maximum rate of 60 µg/kg/min.

End of Block: Introduction

Start of Block: Demographics

Q1 Please indicate your primary area of practice (these are in alphabetical order)

- ○ Acute Hemodialysis (1)
- ○ Burn ICU (2)
- ○ Cardiac Rehabilitation (3)
- ○ Catheterization Laboratory (4)
- ○ Combined Adult/Pediatric ICU (5)
- ○ Combined ICU/CCU (6)
- ○ Coronary Care Unit (CCU or CV ICU) (7)
- ○ Critical Care Transport/Flight (8)
- ○ Emergency Department (9)
- ○ General Medical/Surgical Floor (10)
- ○ Home Care (11)
- ○ Intensive Care Unit (ICU) (12)
- ○ Intermediate Care Unit (IMU) (13)
- ○ Interventional Cardiology (14)
- ○ Longterm Acute Care (15)
- ○ Medical Cardiology (16)
- ○ Medical Intensive Care (MICU) (17)
- ○ Medical-Surgical ICU (18)
- ○ Neonatal ICU (19)
- ○ Neuro/Neurosurgical ICU (20)
- ○ Oncology Unit (21)
- ○ Operating Room (22)
- ○ Outpatient Clinical (23)
- ○ Pediatric ICU (24)
- ○ Progessive Care Unit/Stepdown/DOU (25)

Continued

Supplement 3 Survey.

Q1 Please indicate your primary area of practice (these are in alphabetical order) (*continued*)

- ○ Recovery Room/PACU (26)
- ○ Respiratory ICU (27)
- ○ Subacute Care (28)
- ○ Surgical ICU (29)
- ○ Telemetry (30)
- ○ Trauma ICU (31)
- ○ Virtual/e-ICU or Telemedicine ICU (32)
- ○ Other (33) _____

Q2 Does your practice include titrating continuous intravenous infusions of medications?

- ○ Yes (1)
- ○ No (2)

Skip To: End of Survey If Does your practice include titrating continuous intravenous infusions of medications? = No

Q3 How many years of experience do you have with titrating continuous infusions of medications? Move the slider bar to the number of years experience you have.

Click to write Choice 1 ()

0 55

End of Block: Demographics

Start of Block: Survey Questions

Q4 Does your organization have a policy, procedure, protocol, and/or guideline that requires specific and detailed provider orders for titration of continuous intravenous (IV) medication infusions in which the dose is progressively titrated to achieve a goal parameter?

- ○ Yes, for all titratable continuous IV medication infusions (1)
- ○ Yes, for some titratable continuous IV medication infusions (2)
- ○ Not yet, we are beginning to address this issue (3)
- ○ Unsure (4)
- ○ No (5)

Skip To: End of Block If Does your organization have a policy, procedure, protocol, and/or guideline that requires specifi... = Unsure

Skip To: End of Block If Does your organization have a policy, procedure, protocol, and/or guideline that requires specifi... = No

Q5 Prior to the implementation of the new TJC standards, did you autonomously titrate (doses and/or frequency) to a goal parameter (example: MAP or SBP)?

- ○ Always (1)
- ○ Often (2)
- ○ Sometimes (3)
- ○ Infrequently (4)
- ○ Never (5)
- ○ Unsure (6)

Q6 I am able to comply with the titration orders when administering titratable continuous IV medication infusions to my patients.

- ○ Always (1)
- ○ Often (2)
- ○ Sometimes (3)
- ○ Infrequently (4)
- ○ Never (5)
- ○ Unsure (6)

End of Block: Survey Questions

Start of Block: Titration Actions

Q7 How often do you take these actions when managing a patient receiving titratable continuous IV medication infusions?

	Always (1)	Often (2)	Sometimes (3)	Infrequently (4)	Never (5)	Unsure (6)
Titration by a dose/rate outside of the prescribed orders to achieve a goal parameter in a safe and timely manner. (1)	○	○	○	○	○	○
Request an order revision because the patient is not responding to the orders as written. (2)	○	○	○	○	○	○

End of Block: Titration Actions

Start of Block: Documentation

Q8 How often do you take these actions when managing a patient receiving titratable continuous IV medication infusions?

	Always (1)	Often (2)	Sometimes (3)	Infrequently (4)	Never (5)	Unsure (6)
Document each incremental change as you attempt to achieve the goal parameter. (1)	○	○	○	○	○	○
Document a dose that reflects the overall changes made (eg, in the past hour) as you attempt to achieve the goal parameter. (2)	○	○	○	○	○	○

End of Block: Documentation

Start of Block: Unintended Consequences of the New Standards

Q9 How often do you experience these situations related to titrating continuous infusions of medications according to the new standards?

	Always (1)	Often (2)	Sometimes (3)	Infrequently (4)	Never (5)	Unsure (6)
Personally experienced or witnessed sub-optimal care due to pressure to comply with titration orders. (1)	○	○	○	○	○	○
Personally experienced or witnessed another RN being held accountable for not following titration orders as written. (2)	○	○	○	○	○	○

Q10 Moral distress is defined as the distress or psychologically painful feelings imposed by recognizing an ethically appropriate action to take, but being prevented from taking action. Symptoms may include (but are not limited to) anxiety, sleeplessness, avoidance of similar situations, rumination, burnout, or intention to leave the job.

As a result of the new TJC standards, have you experienced distress from being prevented from doing what you feel is right for the patient when titrating medication infusions?

Use the slider to record your answer

None Mild Uncomfortable Distressing Intense Worst Possible

0 1 2 3 4 5 6 7 8 9 10

0 ()

Q11 Given your experience, does following the prescribed titration orders contribute to delays in reaching the goal parameter?

- ○ Yes (1)
- ○ No (2)

Q12 During the past 3 years, has your organization received findings of noncompliance (eg, from the Department of Health or The Joint Commission) regarding titration of medications following a regulatory or accreditation survey?

- ○ Yes (1)
- ○ Do Not Know (2)
- ○ No (3)

Q13 Which elements of titratable continuous IV medication infusions do you believe should be within the scope of nursing practice? Select all that apply:

- ☐ Initial Dose (1)
- ☐ Maximum Dose (2)
- ☐ Titration Dose (3)
- ☐ Titration Rate (4)
- ☐ Titration Frequency (5)
- ☐ Selecting which of two ordered sedatives or vasoactive agents (eg, Norepinephrine or Vasopressin) to tritrate first. (6)
- ☐ Stop/restart the infusion as needed (7)
- ☐ All of the Above (8)
- ☐ Unsure (9)
- ☐ Other (10) _____

Q14 Which of the following medications do you titrate in your primary area of practice?
Select **all** that apply:

- ☐ Norepinephrine (Levophed) (1)
- ☐ Phenylephrine (Neosynephrine) (2)
- ☐ Epinephrine (Adrenalin) (3)
- ☐ Vasopressin (Pitressin) (4)
- ☐ Angiotensin II (5)
- ☐ Dopamine (6)
- ☐ Isoproterenol (Isuprel) (7)
- ☐ Fentanyl (8)
- ☐ Hydromorphone (Dilaudid) (9)
- ☐ Morphine (10)
- ☐ Dexmedetomidine (Precedex) (11)
- ☐ Propofol (Diprivan) (12)
- ☐ Midazolam (Versed) (13)
- ☐ Lorazepam (Ativan) (14)
- ☐ Ketamine (Ketolar) (15)
- ☐ Diltiazem (Cardizem) (16)
- ☐ Nicardipine (Cardene) (17)
- ☐ Clevidipine (Cleviprex) (18)
- ☐ Labetalol (Trandate) (19)
- ☐ Esmolol (Brevibloc) (20)
- ☐ Nitroglycerin (Tridil) (21)
- ☐ Nitroprusside (Nipride) (22)
- ☐ Furosemide (Lasix) (23)
- ☐ Bumetanide (Bumex) (24)
- ☐ Dobutamine (Dobutrex) (25)
- ☐ Milrinone (Primacor) (26)
- ☐ Cisatracurium (Nimbex) (27)
- ☐ Vecuronium (Norcuron) (28)
- ☐ Rocuronium (Zemuron) (29)

Q15 Additional Comments? (500 word max)

_____
_____
_____
_____
_____

Q16 Thank you for your time. A separate survey is being conducted on the difference between titration protocols.
Email . . . if you are interested in participating in that project.

End of Block: Unintended Consequences of the New Standards

Supplement 3 *Continued*