



Published in final edited form as:

*BMJ Qual Saf.* 2012 February ; 21(2): 145–151. doi:10.1136/bmjqs-2011-000233.

## Organizational Characteristics Associated with the Use of Daily Interruption of Sedation in US Hospitals: A National Study

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### Abstract

**Objective**—Daily interruption of sedation (DIS) has multiple proven benefits, but implementation is erratic. Past research on sedative interruption utilization focused on individual clinicians, ignoring the role of organizations in shaping practice. We test the hypothesis that specific hospital organizational characteristics are associated with routine use of DIS.

**Design & Setting**—National, mailed survey to stratified random sample of United States (US) hospitals in 2009. Respondents were the lead infection control professionals at each institution.

**Methods**—Survey items inquired about DIS use, institutional structure, and organizational culture. Multivariable analysis was used to evaluate the independent association of these factors with DIS use.

**Results**—A total of 386 hospitals formed our final analytic sample; the response rate was 69.4%. Hospitals ranged in size from 25 to 1359 beds. 26% of hospitals were associated with a medical

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**Competing Interests** The authors have no competing interests to declare regarding this manuscript.

school. Almost 80% reported regular use of DIS for ventilated patients. While 75.4% of hospitals reported having leadership focus on safety culture, only 42.7% reported that their staff were receptive to changes in practice. In a multivariable logistic regression model, structural characteristics such as size and academic affiliation were not associated with use of DIS. However, leadership emphasis on safety culture ( $p=0.04$ ), staff receptivity to change ( $p=0.02$ ) and involvement in an infection prevention collaborative ( $p=0.04$ ) were significantly associated with regular DIS use.

**Conclusions**—Several elements of hospital organizational culture were associated with regular use of DIS in US hospitals. Our findings emphasize the importance of combining specific administrative approaches with strategies to encourage receptivity to change among bedside clinicians in order to successfully implement complex evidence-based practices in the intensive care setting.

### Keywords

Organizational Culture; Conscious Sedation; Intensive Care; Mechanical Ventilators

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## INTRODUCTION

Daily interruption of sedation (DIS) in mechanically ventilated patients involves stopping sedation every day until patients are awake or agitated. This intervention has been shown to decrease the duration of mechanical ventilation and intensive care unit (ICU) length of stay. [1] A multicenter study also demonstrated a decrease in one-year mortality.[2] Despite strong evidence and advocacy by prominent critical care guidelines—including the Surviving Sepsis Campaign, the Institute for Healthcare Improvement's (IHI's) 100,000 Lives Campaign and the Society for Healthcare Epidemiology of America/Infectious Diseases Society of America[3–5]—implementation of DIS has been erratic.[6–8] Past research on this phenomenon has focused on individual clinicians, with little attention to the role of the organization in shaping practice. We thus sought to investigate the hospital organizational characteristics associated with use of DIS.

Complex interventions in hospitalized patients, for example infection prevention and control practices, are known to be influenced by organizational factors and context.[9, 10] As such, we hypothesize that there may also be important organizational determinants of DIS use, given similarities between DIS and infection prevention practices like limiting indwelling catheter use and use of maximum sterile barrier precautions for central line placement. For instance, DIS requires collaboration between medical teams and nursing similar to the collaboration that is necessary in order to maximize compliance with maximal sterile barrier precautions in central line placement.[9] Additionally, the use of a reminder or protocol may be helpful to improve utilization of DIS,[2] similar to the interventions used to limit indwelling urinary catheter use.[11, 12] Like these infection prevention practices, DIS use may be strongly influenced by institutional and unit culture. However, there has been limited research that examines the organizational context of DIS. Therefore, we used data collected as part of a national survey investigating infection prevention perceptions and practices among United States (US) hospitals to test the hypothesis that specific organizational characteristics are associated with routine use of DIS. We evaluate self-report of routine DIS

use, in contrast to previously reported bedside audit or other patient-level measures of compliance in order to study what institutions think of themselves as doing – the extent to which DIS use is a part of the culture of practice at a hospital.

## MATERIALS AND METHODS

### Study Design and Sample

We conducted a nationwide mail survey of a stratified random sample of US hospitals in 2009. The survey was part of a longitudinal study evaluating the prevention of healthcare-associated infections in the US, about which greater detail is available elsewhere.[11, 13, 14] Hospitals were included in the initial cohort if, based on data from the American Hospital Association (AHA) Annual Survey Database™ fiscal year 2003, they had at least 50 beds and an ICU. Hospitals were stratified by size, at less than or greater than 250 beds. Survey respondents were the lead infection control professionals at each institution. Because DIS is designed to reduce the duration of mechanical ventilation and has been promoted along with other practices as a strategy to reduce ventilator-associated complications such as pneumonia, we suspected that infection control professionals would either be aware of current DIS practices in their hospitals or have access to individuals who do. Prior work has demonstrated that targeting ICU directors for surveys about ICU organization and management is inefficient, as a majority of ICUs do not have dedicated physician directors. [15] The survey focused on use of particular evidence-based practices often monitored by infection control professionals and various organizational attributes thought to influence uptake of these practices including cultural attributes of the institutions. The Institutional Review Board of the University of Michigan Medical Center approved the study.

### Measures

**Outcomes Variable – Regular Use of DIS**—Respondents were asked for mechanically ventilated adult patients, “Using a scale from 1 to 5 (1 being never and 5 being always), please indicate how frequently ‘sedation vacation’ (e.g., regular interruption of sedation) is used in your facility.” Based on prior work,[13] these responses were dichotomized, with responses of 4–5 defined as always or almost always using the practice.

**Institutional Structure**—Respondents were also asked to report the number of ICU beds at their facility, and whether the institution had an academic affiliation, as defined by association with a medical school. The AHA Annual Survey Database™ fiscal year 2007[16] was used to determine the current number of acute care beds for each facility. Given our stratified sampling frame, we dichotomized hospital size to less than or equal to 250 beds and greater than 250 beds for use in the multivariable analysis.

**Organizational Culture**—Organizational factors of interest, including general structural characteristics and measures of organizational culture were determined *a priori* by the research team. Cultural variables were chosen based on previous qualitative and quantitative work. Saint and colleagues examined the role of leadership in preventing healthcare-associated infections, therefore we included leadership emphasis on safety culture.[17] Krein et al., in exploring the factors present in institutions successful in implementing

evidence-based practice, found that a combination of staff unity and commitment to patient care as well as active and engaged leadership was present in successful institutions, and that external motivation, such as involvement in an infection prevention collaborative, might be helpful in those institutions that did not have unified staff and leadership focus on quality and safety.[9] We therefore surveyed respondents about staff receptivity to change in clinical processes, involvement in an infection prevention collaborative, and whether the respondent would feel safe being treated at the facility as a patient.

Perceptions of leadership-driven safety culture and staff receptivity, as well as perceptions of the safety of care were measured on a 5-point Likert scale ranging from 1 (“Strongly Agree”) to 5 (“Strongly Disagree”). These responses were dichotomized to a positive response (1–2) or a negative response (3–5). Respondents were also asked if their institution participated in a collaborative to prevent healthcare-associated infections.

### Statistical Analysis

Taking into account the stratified sampling approach, all of our analyses use sample weights based on the original probability of selection within each stratum resulting in estimates that represent the full population of US non-federal acute care hospitals with 50 or more hospital beds and an ICU. We conducted a descriptive univariate analysis, incorporating the weights and strata derived from the original survey sample, as well as bivariable analysis to assess the association of each of our factors of interest with regular use of DIS. We used logistic regression with regular DIS use as the outcome to evaluate continuous exposure variables and Rao-Scott chi-square tests to evaluate dichotomous exposure variables. We also evaluated the associations of the cultural variables with each other using Rao-Scott chi-square tests. Multivariable logistic regression was used to evaluate the association of institutional structure and organizational culture characteristics with regular use of DIS. All analyses were performed with SAS 9.2 (Cary, NC) using proc survey commands.

## RESULTS

A total of 406 hospitals responded to the survey resulting in an overall response rate of 69.4%. For this analysis, 20 observations were eliminated due to missing data in the covariates in question, bringing our final complete case analytic sample to 386 hospitals. Hospital characteristics are shown in Table 1. Hospitals ranged in size from 25 to 1359 beds, with a mean of 227 beds; 33.5% were categorized as large, that is, having more than 250 beds. The mean number of ICU beds was 21.9. More than one-quarter (26.4%) of the hospitals were associated with a medical school. For the primary outcome variable, 79.0% of respondents reported regular use of DIS (“always” or “almost always”) in their institution.

Just over 2/3 (67.8%) of institutions were involved in a collaborative to reduce healthcare-associated infections. Three-quarters of respondents felt that leadership was driving them to be a safety-centered institution (75.4%) but only 42.7% felt that staff members in their institutions were receptive to change in clinical processes (difference  $p < 0.0001$ ). A total of 77.2% of respondents reported they would feel safe being treated as a patient in their own institutions.

## Unadjusted Associations

There was marked heterogeneity in cultural characteristics among hospitals. The associations among the measures of culture are shown in Table 2. Staff receptivity to change in clinical processes, perception of the safety of care in the institution, and leadership driving safety culture were associated with each other in bivariable analysis. However, participation in a collaborative effort to prevent healthcare associated infections was not significantly associated with the other cultural features. For those variables that were associated with each other, odds ratios were not uniform. There was no strong evidence of collinearity.

Unadjusted associations with self-reported regular DIS use are summarized in Table 3. Several cultural variables were significantly associated with reported regular DIS use: leadership-driven safety culture, staff receptivity to change in clinical processes, and involvement in a collaborative effort to prevent hospital-acquired infections. Hospital size, number of ICU beds, and academic affiliation were not significantly associated with self-reported regular DIS use.

## Adjusted Associations

In the adjusted models, there was no association between the structural characteristics of the hospital (size, number of ICU beds, and academic affiliation) and self-reported regular use of DIS, even when analyzed without the addition of cultural variables (data not shown). When adjusting for structural characteristics, certain aspects of organizational culture were significantly associated with reported regular use of DIS. Specifically, leadership-driven safety culture ( $p=0.04$ ), staff receptivity to change in clinical processes ( $p=0.02$ ), and involvement in an infection prevention collaborative ( $p=0.04$ ) were associated with self-reported regular use of DIS. (Table 4) Pertinently, the odds ratio for the variable “I would feel safe being treated here” was not only statistically insignificant but was very nearly 1.

## DISCUSSION

In this nationally representative sample of US hospitals, regular use of DIS as reported by infection control professionals was common but not omnipresent; one in five centers reported lack of routine use. Hospitals that did not report regular use of DIS were not different from hospitals that did with respect to the structural characteristics of the hospital. However, hospitals did differ based on organizational culture. Involvement in a collaborative effort to prevent healthcare associated infections, leadership-driven safety culture, and staff receptivity to change were independently associated with self-reported regular DIS use.

In this study, we chose to evaluate the association of organizational characteristics with self-reported routine use of DIS. This outcome measure identifies the extent to which DIS use is a part of the institutionalized hospital culture – that is, the extent to which DIS is thought of as “something we do”. This attitudinal measure is not, it must be noted, the same as a bedside audit. Instead, self-reported routine use of DIS measures aspirations that likely

provide the cultural milieu within which sustained bedside use can be achieved. It therefore provides a complementary perspective to other previously reported work.[6–8, 18]

Translation of DIS use into everyday practice has been incomplete.[7] Clinician and patient-level data show persistent failure of performance with many seemingly eligible patients.[6–8] Previously identified barriers to DIS include difficulties in care coordination and concerns about patient safety.[7, 18] However, DIS is only one of many evidence-based processes in the ICU requiring extensive care coordination, and randomized trials demonstrate no increase in adverse events associated with DIS.[1, 2] Previously, DIS use has been approached as an individual practitioner issue—that decreased compliance is due to individual use or lack of use. To our knowledge, this is the first nationally representative survey of US hospital use of DIS. Our data suggest that DIS can be reframed as an organizational issue, supporting efforts to integrate it into a structured protocol coordinating spontaneous breathing trials, delirium management and early mobilization.[19] Moreover, experience in infection prevention, particularly with regard to central line infections, suggests that while protocolization leads to marginal improvement over individual-clinician-based approaches, a more organizationally focused approach could substantially enhance implementation.[20–22]

From an organizational standpoint it is clear that leadership matters, as our data affirm in the specific case of DIS. Previous work by Saint and colleagues has shown that characteristics such as cultivating a culture of clinical excellence, overcoming barriers, inspiring staff and acting strategically were instrumental in leaders successful in implementing infection prevention practices.[17] Shortell et al. found that the presence of a team champion was instrumental to improving team effectiveness in improving quality of care,[23] while Damschroder and colleagues demonstrated the role of the champion in infection control.[20] Indeed, much of the emphasis in the safety culture literature starts with involvement of leadership.[24] In our data, the importance of leadership is reflected in the significance of a leadership-driven safety culture, yet past discussions of DIS rarely mention the role of organizational leadership in bringing this evidence to the bedside.[19] An organizational approach with clear leadership may be an important opportunity for improved translation.

A staff-level culture of commitment to patient care combined with leadership focus was present in hospitals that had previously been found to be most successful in implementing new initiatives fostering evidence-based practice.[9] Our quantitative analysis supports this finding, given the significance of staff receptivity to change in clinical processes in those institutions reporting regular use of DIS. However, while nearly three-quarters of organizations already report strong leadership focus on safety, prevalence of staff receptivity was measured at less than 50%. That is, improved staff receptivity to change may be a more widely available point of leverage. Some tools may already exist to improve staff receptivity to change, most prominently the Comprehensive Unit-Based Safety Program (CUSP)[25, 26] in which local institutional teams are utilized to identify important safety hazards in an effort to improve teamwork and culture. (We note, however, that CUSP also focuses on the importance of leadership.) Given the overall low staff receptivity in our nationally representative data, new tools focusing on staff receptivity may be of value.



Unexpectedly, the perception by respondents that they “would feel safe being treated” at the hospital in question was not associated with routine use of DIS. We might speculate that DIS is not universally seen as a patient safety issue, despite its association with leadership emphasis on safety culture. This finding correlates with previous reports of clinicians' concerns regarding adverse events associated with DIS.[18] The persistent fear of adverse events associated with DIS suggests strategies to enforce the notion of DIS as safe (given the lack of increase in serious adverse events in performing DIS in randomized controlled trials[1, 2]) and beneficial to patients by decreasing exposure to other risks, such as mechanical ventilation and ICU stay, might help improve utilization. When further considered in light of the beneficial effects of DIS on long-term mortality, it might be argued that routine performance of DIS is, in fact, a key component of providing safe care to mechanically ventilated patients

Our findings should be interpreted in the context of the following limitations. First, we report a survey, not a bedside audit of compliance or patient exclusion for specific interventions; infection control professionals are unlikely to precisely measure bedside compliance with DIS. Given our respondents' roles as monitors of several aspects of patient safety and organizational culture, however, they are well-positioned to accurately reflect both institutional philosophy and culture as well as awareness of unit-level policies and infection control issues. We have been careful, therefore, to comment only on hospitals' self-report of regular use of DIS, rather than a precise operational cut-off for what constitutes “regular”. Likewise, infection professionals' perceptions of staff receptivity to change may be present initially, or may result from observation of desired change. For purposes of our analysis, however, we feel that either interpretation of staff receptivity is relevant. Second, this survey focused on hospital-wide infection prevention practices, and did not inquire about specific unit characteristics, such as unit type or intensivist staffing in the ICU. Many authors have shown that intensivist staffing improves outcomes in ICUs,[27–29] and Kahn and colleagues found that intensivist-staffed patients are more likely to receive DIS.[6] One advantage to intensivist staffing is likely consistency of care and protocol adherence, and intensivists may play an important role in shaping the unit cultural variables that we examined. The presence of intensivists will be an important organizational characteristic to include in future studies. Third, organizational culture may differ significantly across units; [30] however, hospital-wide culture is also likely important. The difference in culture between units may be especially important given Gonzalez-Roma and colleagues' findings that the strength of organizational climate may actually be an effect modifier of the relationship between climate and performance.[31] Fourth, although our response rate of nearly 70% is quite high relative to other published response rates for mail surveys,[32] there was some non-response. There was no evidence of differential non-response by academic status, but larger hospitals were somewhat less likely to respond (data not shown). Thus we cannot rule out the possibility that the associations between organizational culture and DIS use might be different in non-responders than among responders. Finally, perceptions of culture can vary significantly between professions. Thomas et al. found different perceptions of teamwork between nurses and physicians.[33] Rosen and colleagues found that leadership perceptions of culture often differ from frontline staff, and that staff perceptions more closely correlate with patient safety indicators.[34] However, in their role

as intermediaries between hospital leadership and bedside staff, infection control professionals are structurally positioned to be able to make informed generalizations about the institution as a whole.

## CONCLUSIONS

In conclusion, our data show the importance of several organizational culture characteristics on utilization of DIS, leadership emphasis on safety culture, involvement in a collaborative to prevent healthcare associated infections, and staff receptivity to practice change. Notably, more general and less malleable institutional characteristics, such as size and academic affiliation, were not associated with regular use of DIS. This study presents a case for the usefulness of a multi-center study linking actual compliance with DIS to the organizational characteristics of specific institutions, controlling for individual units. The usefulness of these associations should be rigorously evaluated in the context of interventions targeting leadership and staff receptivity as a mechanism to improve patient receipt of DIS – with plausible benefits not only for DIS, but also other new evidence-based interventions.

## Acknowledgments

**Funding** This study was supported by the National Institute of Health NIH/NHLBI T32: HL07749-17 (MAM) and K08: HL091249-03 (TJJ), as well as by the Blue Cross Blue Shield of Michigan Foundation. The funding organizations were not involved with the study's design, conduct, or reporting.

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**Table 1**

## Sample Characteristics

<b>Variable</b>	<b>Mean (standard error) or percent*</b>
Number of intensive care unit (ICU) beds	21.9(1.03)
<i>Outcomes Variable</i>	
Regular use of daily interruption of sedation (DIS) (always or almost always)	79.0%
<i>Institutional Structure</i>	
Large Hospital (>250 beds)	33.5%
Medical school affiliation	26.4%
<i>General Organizational Culture</i>	
Involvement in collaborative effort to prevent healthcare-associated infections (HAI) (yes)	67.5%
Leadership driving safety culture (agree or strongly agree)	75.4%
“I would feel safe being treated here as a patient” (agree or strongly agree)	77.2%
Staff receptivity to change in clinical processes (agree or strongly agree)	42.7%

\* All results are weighted to account for survey design

**Table 2**

Inter-Relationships of Culture Measures.

<b>Variables</b>	<b>Involvement in collaborative effort to prevent HAI</b>	<b>Leadership driving safety culture</b>	<b>“I would feel safe being treated here as a patient.”</b>	<b>Staff receptivity to change in clinical processes</b>
Involvement in collaborative effort to prevent HAI		OR 1.03 95% CI [0.60–1.75] p=0.92	OR 0.66 95% CI [0.38–1.14] p=0.13	OR 0.95 95% CI [0.60–1.50] p=0.82
Leadership driving safety culture			OR 3.90 95% CI [2.27–6.70] p<0.0001	OR 3.00 95% CI [1.71–5.26] p<0.0001
“I would feel safe being treated here as a patient.”				OR 6.85 95% CI [3.41–13.74] p<0.0001

**Table 3**

Unadjusted associations with self-reported use of DIS

Variable	% among those not using DIS (weighted)	% among those using DIS (weighted)	p-value
<i>Organizational Structure</i> *			
Large Hospital (>250 beds)	25.3	35.7	0.06
Medical school affiliation	19.4	24.2	0.10
<i>General Organizational Culture</i>			
Involvement in collaborative effort to prevent HAI	57.1	70.2	0.03
Leadership driving safety culture	62.0	78.9	0.003
“I would feel safe being treated here as a patient”	70.7	78.9	0.14
Staff receptivity to change in clinical processes	26.2	47.1	0.001

\* The number of ICU beds as a continuous variable was not associated with regular DIS use: OR 1.01 per additional ICU bed, 95% confidence interval (1.00, 1.03), p=0.12

**Table 4**

Adjusted associations with self-reported regular use of DIS

Variable	OR [95% CI]	p
<i>Organizational Structure</i>		
Large hospital (>250 beds)	1.11 [0.59–2.10]	0.75
# ICU beds	1.01 [0.99–1.02]	0.54
Academic affiliation	1.41 [0.72–2.74]	0.31
<i>Organizational Culture</i>		
Involvement in collaborative effort to prevent HAI	1.78 [1.02–3.12]	0.04
Leadership driving safety culture	1.87 [1.02–3.43]	0.04
“I would feel safe being treated here as a patient”	1.07 [0.56–2.05]	0.8
Staff receptivity to change in clinical processes	2.17 [1.16–4.06]	0.02