Prediction of Discharge Destination following Laryngectomy

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Abstract

Objective. To identify factors that may predict discharge to intermediate-care facilities following total laryngectomy and may promote earlier discharge planning and optimize resource utilization.

Study Design. Retrospective review of large national data set.

Setting. Academic and nonacademic health care facilities in United States, contributing deidentified, risk-adjusted clinical data to the American College of Surgeons’ National Surgical Quality Improvement Program (ACS-NSQIP).

Subjects and Methods. Retrospective evaluation of the NSQIP database (2011-2014) identified 487 patients who underwent total laryngectomy without free tissue transfer. Risk of discharge to intermediate-care facilities was evaluated. Role of preoperative and postoperative factors and their association with discharge disposition were assessed using multivariable regression analysis.

Results. Compared to reference groups, advanced age (61-70 years: odds ratio [OR], 3.16; 95% confidence interval [CI], 1.12-8.89; >70 years: OR, 3.77; 95% CI, 1.33-10.65), baseline functional dependence (OR, 5.61; 95% CI, 2.62-12.02), cardiac failure (OR, 3.80; 95% CI, 1.08-13.42), and steroid dependence (OR, 3.30; 95% CI, 1.36-8.0) independently predicted discharge to intermediate-care facilities.

Conclusion. Patients with advanced age, functional dependence, cardiac failure, and steroid dependence may benefit from preemptive counseling and discharge planning in anticipation of postlaryngectomy discharge to intermediate-care facilities.

Keywords
laryngectomy, discharge destination, disposition, prediction, discharge planning

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Total laryngectomy is associated with significant physiologic and procedural burden, which may contribute to elevated risk for postoperative complications, lengthy hospitalization, and associated costs.1-3 Indeed, patients undergoing total laryngectomy exhibit a higher likelihood of dependence on postdischarge skilled care.2

However, factors that predict likelihood of requiring discharge to intermediate-care facilities, specific to patients undergoing total laryngectomy, have not been defined. As a result, discharge planning for these patients is often reactive, and not proactive, to the patient’s baseline characteristics and postprocedural needs. The inability to predict which patients may need discharge to intermediate-care facilities and the lack of structured and timely discharge planning may contribute to increased length of hospitalization and diminish patient and provider satisfaction with the process.4

Our study evaluates the baseline characteristics of patients who required discharge to intermediate-care facilities following total laryngectomy and attempts to identify patient comorbidities that independently predict need for such care. Identification of evidence-based risk prediction models may help health care providers develop timely, preemptive, and more efficient discharge plans; enhance communication between health care providers, patients, and their families; and ultimately improve resource management and overall patient satisfaction.

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Materials and Methods

The American College of Surgeons’ National Surgical Quality Improvement Program (ACS-NSQIP) is a national, risk, and case mix–adjusted database that collects deidentified information from over 700 institutions. Preoperative demographics, comorbidities, intraoperative variables, and 30-day outcomes are reported by independent surgical case reviewers through review of patient care records.3 Under the policies and protocols of the institutional review board at University of Nebraska Medical Center, this investigation was exempt from review, since it only used deidentified data from ACS-NSQIP.

A total of 492 patients who underwent total laryngectomy with or without neck dissection (Current Procedural Terminology codes 31360 and 31365) between 2011 and 2014 were identified. Patient selection was tailored to exclude patients who underwent free tissue transfer to reconstruct pharyngeal defects and those with concurrent procedures that represented significant deviation in procedural complexity (eg, concurrent cardiothoracic procedures, exploratory laparotomy, and major vascular reconstruction/bypass). This allowed us to limit the effect of additional surgical sites, added surgical time, and variation in postsurgical care that may complicate the comparison. Following elimination of patients whose discharge destination was unknown, those who were not discharged within 30 days of the index procedure, and patients who died during hospitalization, data from 487 patients were evaluated for demographics, preoperative comorbidities, inpatient adverse events (medical and surgical complications), and discharge disposition. Preoperative variables included age, sex, race, body mass index (BMI), comorbidities signifying diabetes mellitus, baseline dyspnea, chronic obstructive pulmonary disease (COPD), pneumonia, ventilator dependence, coronary artery disease, congestive heart failure (CHF), hypertension, peripheral vascular disease, renal failure, cerebrovascular disease, preexisting open wounds, steroid use, antecedent smoking or alcohol use, weight loss (>10% loss in preceding 6 months), serum albumin, bleeding disorders or recent blood transfusion, preexisting sepsis, recent surgery, prior use of chemotherapy or radiotherapy, and American Society of Anesthesiologists (ASA) classification. In addition, functional status was considered a surrogate for frailty, and patients who were “partially dependent” (requiring assistance for some activities of daily living [ADLs]) or “totally dependent” (requiring assistance for all ADLs) were compared to patients who were “independent.” Intraoperative duration and postoperative outcome variables such as infection, wound, pulmonary, cardiac, renal, and thromboembolism related complications were assessed. In addition, data related to length of hospitalization and reoperative intervention were considered (see Supplemental Table S1 in the online version of the article).

Following discharge, patients could return to their preoperative residence for home-based self-care or to “intermediate-care facilities” such as acute care facilities (for high-intensity care supervised by an in-house physician), skilled care (nursing and rehabilitative care for patients in residence, eg, transitional care units, subacute hospitals, and skilled nursing homes), and rehabilitation facilities (intensive rehabilitation to regain functional abilities), which serve as stations between inpatient care and return to the patient’s preoperative residence. In this study, most patients could be discharged to home-based care. Among patients discharged to “intermediate-care facilities,” most were discharged to skilled care facilities. To avoid statistical biases created by the small number of patients who were discharged to acute care and rehabilitation facilities, patients discharged to these facilities were combined with those discharged to skilled care facilities. This cohort of patients discharged to intermediate-care facilities was compared to patients discharged to home-based care. Comparative analyses using exact Pearson χ² tests, exact Mantel-Haenszel χ² tests, Fisher exact tests, or t tests assessed differences in preoperative variables and intraoperative and postoperative events between the 2 cohorts.

The bivariate impacts of preoperative and postoperative measures on discharge disposition were evaluated using logistic and Cox proportional hazards regression models with effect sizes reported as odds ratios (ORs) and 95% confidence intervals (CIs). To identify independent predictors of discharge disposition, variables of interest had to achieve statistical significance (P < .05) in univariate analysis to be included in the backward selected multivariable model. Preoperative variables in the multivariable regression model included age, functional status, severe COPD, CHF, steroid dependence, serum albumin, and ASA class. Postoperative variables in this model included pneumonia, unplanned intubation, sepsis, and length of hospitalization. For the purpose of multivariable analyses, the P value had to be <.10 for variables to be retained in the model. All analyses were conducted using SAS version 9.3 (SAS Institute, Cary, North Carolina).

Results

In total, 492 total laryngectomy patients were identified. Of these, 4 died during their inpatient stay and disposition remained unknown for 1 patient. Of the remaining 487 patients, 401 (82.3%) were discharged to home-based care. Eighty-six (17.7%) received postdischarge care in intermediate-care facilities, including 61 patients who went to skilled care facilities, 11 discharged to acute care facilities, and 14 who received care at a rehabilitation unit (Table 1).

Most patients in the study were men (399 of 487, 81.9%), with a mean age 63.2 years and of Caucasian descent (354 of 487, 72.7%). On univariate analysis, both patient groups had similar BMI and rate of preoperative comorbidities, including prevalence of dyspnea, diabetes mellitus, hypertension, peripheral vascular disease, cardiac intervention, renal failure, significant weight loss, antecedent history of radiation or chemotherapy, and history of smoking or heavy alcohol use (all CIs exclude 1 [ORs] or 0 [mean comparisons], and all P > .05).

However, patients discharged to intermediate-care facilities had a higher preoperative incidence of partially or totally dependent functional status (20%) compared to patients
who were discharged home (4%) (OR, 5.52; 95% CI, 2.69-11.34). In addition, patients discharged to intermediate-care facilities had a higher incidence of baseline CHF (6% vs 2%; OR, 3.47; 95% CI, 1.08-11.22), steroid dependence (12% vs 4%; OR, 2.97; 95% CI, 1.31-6.74), and severe COPD (31% vs 19%; OR, 1.90; 95% CI, 1.13-3.18).

There was no difference between the groups when considering operative time, wound classification, wound complications, perioperative blood transfusion, urinary tract infections, ventilator dependence, and cardiac or thromboembolic events. Patients discharged to intermediate-care facilities were more likely to have longer hospitalization (mean, 14.4 vs 9.8 days; difference, 4.6; 95% CI, 1.8-7.4), higher incidence of postoperative pneumonia (6% vs 1%; OR, 4.89; 95% CI, 1.38-17.28), sepsis (5% vs 1%; OR, 6.47; 95% CI, 1.42-29.46), and unplanned intubation (5% vs 1%; OR, 6.47; 95% CI, 1.42-29.46).

Preoperative variables (age, functional status, severe COPD, CHF, steroid dependence, serum albumin, ASA class) and postoperative variables (pneumonia, unplanned intubation, sepsis, and length of hospitalization) (all $P < .05$) were included in the backward selected model. On multivariable analyses to identify factors independently associated with likelihood of discharge to intermediate-care facilities, older patients had significantly higher odds for the outcome (age 61-70 years [OR, 3.16; 95% CI, 1.12-8.89] and age >70 years [OR, 3.77; 95% CI, 1.33-10.65] vs reference group with age $\leq$ 50 years). Similarly, patients with functional dependence at baseline were more likely to require non-home-based postdischarge care (OR, 5.61; 95% CI, 2.62-12.02) (Table 2).

Preoperative CHF and steroid dependence independently predicted need for discharge to an intermediate-care facility (OR, 3.80 [95% CI, 1.08-13.42] and 3.30 [95% CI, 1.36-8.0], respectively). In addition, patients with longer hospitalization had higher odds of needing postdischarge skilled care (OR, 1.06; 95% CI, 1.03-1.09) (Table 2). History of preoperative COPD, serum albumin, ASA class, and postoperative events such as pneumonia, sepsis, and unplanned intubation did not retain significance as independent predictors in the multivariable model (all $P > .10$).

### Table 1. Distribution of Patients by Discharge Destination.

<table>
<thead>
<tr>
<th>Discharge Destination</th>
<th>No. (%) of Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home</td>
<td>401 (81.5)</td>
</tr>
<tr>
<td>Total intermediate care facility</td>
<td>86 (17.5)</td>
</tr>
<tr>
<td>Acute rehabilitation facility</td>
<td>14</td>
</tr>
<tr>
<td>Acute care facility</td>
<td>11</td>
</tr>
<tr>
<td>Skilled care facility</td>
<td>61</td>
</tr>
<tr>
<td>Unknown disposition</td>
<td>1 (0.2)</td>
</tr>
<tr>
<td>In-hospital mortality prior to discharge</td>
<td>4 (0.8)</td>
</tr>
<tr>
<td>Total</td>
<td>492 (100)</td>
</tr>
</tbody>
</table>

### Table 2.

<table>
<thead>
<tr>
<th>Factor</th>
<th>OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age 61-70 years</td>
<td>3.16 (1.12-8.89)</td>
</tr>
<tr>
<td>Age &gt;70 years</td>
<td>3.77 (1.33-10.65)</td>
</tr>
<tr>
<td>Preoperative CHF</td>
<td>3.80 (1.08-13.42)</td>
</tr>
<tr>
<td>Preoperative steroid dependence</td>
<td>3.30 (1.36-8.0)</td>
</tr>
</tbody>
</table>

### Discussion

A significant proportion of patients require skilled postdischarge care after total laryngectomy. Since it is difficult to preemptively identify patients who may need discharge to intermediate-care facilities, discharge planning is often delayed and reacts to patient needs as they emerge toward the end of their postlaryngectomy hospitalization. This may contribute to unnecessary extension of hospitalization and diminished patient and provider satisfaction. Proactive identification of patients, who are at risk for requiring discharge to intermediate-care facilities, could allow discharge plans to be set in motion during the planning phase or early postprocedural phase following total laryngectomy.

This study identifies that, in patients undergoing total laryngectomy without use of free tissue transfer, the rate of discharge to intermediate-care facilities is nearly 18%. This finding emphasizes the resource intensive nature of care required for patients undergoing total laryngectomy and provides a benchmark to employ when counseling patients about likelihood for return to home immediately after their hospitalization. This finding matches the 15.7% discharge rate to post–acute care facilities cited by Cramer et al’s pooled analyses of a variety of major head and neck surgery patients but differs from their study in assessing the outcomes for a patient population with relative homogeneity in nature and intensity of surgical procedures. Indeed, the rate of discharge to post–acute care facilities after laryngectomy is highest among a variety of major, moderate, and minor head and neck operations. As a result, understanding the factors associated with discharge disposition for patients undergoing laryngectomy is especially important.

Research in other specialties has identified factors that may predict disposition for postsurgical patients. For example, race, insurance, and morbidity were significantly associated with discharge to acute care nursing facilities following total hip arthroplasty. In a study evaluating patients with anterior cervical discectomy and fusion, race, advanced age, ASA classification, poor functional status, prolonged operative time, and cardiac comorbidity were identified as predictors of nonhome discharge. Cramer et al. investigated factors that predict discharge to post–acute care using a pooled cohort with diverse head and neck surgical procedures that varied in procedural complexity, intensity of postsurgical care, and physiologic impact on the patient. They report that preoperative factors (including advanced age, functional status, major or moderate procedures, tracheostomy, high ASA class, low BMI, and dyspnea) and postoperative factors (including stroke, myocardial infarction or cardiac arrest, ventilator dependency $>$48 hours, pneumonia, sepsis, and hospital stay $>$1 week) contributed to risk of nonhome discharge. In their study, patients undergoing laryngectomy required post–acute care more frequently than any other patient group. While factors influencing discharge destination specific to the laryngectomy population were not studied, inferences drawn from their study may be influenced by the composition of the study cohort where 70% of patients underwent minor surgery on salivary, thyroid, and parathyroid.
glands. As a result, factors that affect likelihood of discharge to intermediate-care facilities for patients considering management strategies centered on laryngectomy are not well established, thus limiting the ability for effective presurgical counseling, shared decision making, and effective and early discharge planning.

In our study, which focused on a relatively homogeneous cohort of patients undergoing total laryngectomy, preoperative patient characteristics such as advanced age, poor functional status, CHF, and steroid dependence were associated with higher odds of discharge to intermediate-care facilities. This information allows a departure from a “one size fits all” approach to discharge planning, patient counseling, resource allocation, and risk management at the organizational level when caring for patients undergoing total laryngectomy.

Indeed, patients anticipated to require post–acute care outside of their home environment may be offered counseling geared to improve their readiness for discharge, which may enhance patient satisfaction through engagement in shared decision making. It may further mitigate the sense of displacement and loss that patients may encounter when plans for discharge to an intermediate-care facility are formalized with little notice. The preemptive recognition of an increased likelihood of discharge to an intermediate-care facility may provide opportunities for more holistic discussion about anticipated surgical outcomes during the process of informed consent. The ability or inability to return to the home environment after hospital discharge may provide a meaningful quality-of-life measure to patients when considering the proposal for total laryngectomy as a treatment strategy.

Besides its value toward patient engagement, the identification of specific factors predicting discharge destination may allow refinement of clinical care pathways in a patient population that requires significant health care resource investment and high likelihood of discharge to intermediate-care facilities. Studies indicate that health care costs and length of hospitalization associated with patients undergoing total laryngectomy have been rising despite an overall decline in the number of laryngectomy procedures that are performed annually. Clinical care pathways have been shown to contribute toward reduction in cost and length of stay, and incorporation of a proactive and predictive discharge planning strategy may amplify the value of protocol-driven care for patients with complex postsurgical and postdischarge needs.

With a health care market that is increasingly sensitive to outcomes and reliant on alternative payment models, identification of patients who require more intense postdischarge care at intermediate-care facilities may make financial sense at the level of health care organizations and payers. Since care delivery at intermediate-care facilities is much more expensive than home-based care, bundled payments for patients at increased risk for requiring such care may be differently negotiated. Moreover, improved discharge planning may bring about reduction in readmission rates and allow better match of patients with a postdischarge care setting that best suits their need for effective recovery. Since patients undergoing total laryngectomy have been shown to be at an increased risk for complications and readmission following discharge, the choice of venue for post–acute care may be of significant implication. Through a system of early triage and identification of patients at risk for requiring skilled postdischarge care, hospital systems may avoid penalties that may be otherwise incurred when patients “bounce back” from postdischarge settings that are poorly matched to the care needed by such patients. These savings may offset any costs incurred on patient screening and counseling offered during the preoperative phase and early postoperative hospital course of patients undergoing total laryngectomy.

Table 2. Backward Selected Model Predicting Discharge to Intermediate-Care Facility.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Odds Ratio</th>
<th>Lower</th>
<th>Upper</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preoperative variables</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (vs reference age group ≤50), y</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>51-60</td>
<td>1.73</td>
<td>0.58</td>
<td>5.14</td>
<td>.019</td>
</tr>
<tr>
<td>61-70</td>
<td>3.16</td>
<td>1.12</td>
<td>8.89</td>
<td></td>
</tr>
<tr>
<td>&gt; 70</td>
<td>3.77</td>
<td>1.33</td>
<td>10.65</td>
<td></td>
</tr>
<tr>
<td>Functional status (partially or totally dependent vs independent status)</td>
<td>5.61</td>
<td>2.62</td>
<td>12.02</td>
<td>&lt; .001</td>
</tr>
<tr>
<td>Antecedent congestive cardiac failure</td>
<td>3.80</td>
<td>1.08</td>
<td>13.42</td>
<td>.038</td>
</tr>
<tr>
<td>Chronic steroid dependence</td>
<td>3.30</td>
<td>1.36</td>
<td>8.00</td>
<td>.008</td>
</tr>
<tr>
<td>Postoperative associations</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Length of hospital stay</td>
<td>1.06</td>
<td>1.03</td>
<td>1.09</td>
<td>&lt; .001</td>
</tr>
<tr>
<td>Postoperative pneumonia</td>
<td>3.14</td>
<td>0.84</td>
<td>11.78</td>
<td>.091</td>
</tr>
<tr>
<td>Postoperative sepsis</td>
<td>3.84</td>
<td>0.80</td>
<td>18.38</td>
<td>.092</td>
</tr>
</tbody>
</table>

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The current study also identified an association of discharge to intermediate-care facilities with prolonged hospitalization. This finding is similar to those by Di Capua et al.\textsuperscript{6} and Hatcher et al.\textsuperscript{15} but it is unclear whether the prolonged hospitalization results from an inefficient discharge process or a consequence of an adverse patient comorbidity profile that subsequently determines discharge to intermediate-care facilities. In our multivariable analyses, we did not observe any significant association between discharge destination and factors such as preoperative COPD, serum albumin, ASA class, or postoperative pneumonia, sepsis, and unplanned intubation. However, a different study of patients undergoing head and neck surgery for diverse conditions suggested that ASA classification may be associated with discharge to intermediate-care facilities but did not find a significant association with variables like preoperative COPD, serum albumin, postoperative pneumonia, sepsis, and unplanned intubation.\textsuperscript{6} The relatively small proportion of patients undergoing laryngectomy in that study\textsuperscript{6} significantly limited its generalizability to the patient cohort in this current study. Additional investigations assessing factors associated with discharge destination among patients undergoing head and neck surgery are lacking. We are cautious in drawing inferences from studies that investigate factors related to discharge destination in cohorts that are dramatically different from patients undergoing total laryngectomy since there are critical differences in the procedural complexity, postoperative anatomy, physiologic impact of surgery, and impact on abilities for respiration, deglutition, and early mobilization between patients undergoing total laryngectomy and other surgical cohorts (eg, thoracic, abdominal or orthopedic surgery). As a result, the influence of these variables on discharge following total laryngectomy may require additional investigation with larger cohorts.

We recognize the limitations of retrospective assessment of large data sets that rely on accurate capture of patient care data in the medical record, as a measure of risk attributes and clinical behavior of the study cohort. However, the NSQIP registry strives to maximize accuracy and validity through independent review and accrual of data through careful review of clinical records from multiple sources, low rate of variance between abstracters, and risk-adjusted nature of data collection.\textsuperscript{5} With over 150 preoperative and postoperative variables included in the data set, ACS-NSQIP provides one of the most comprehensive tools to study clinical outcomes and their relationship to variables of interest. In addition, in comparison to surgeon review of charts or administrative data sets, the mechanisms built into NSQIP promote reliable data gathering by independent chart reviewers that follow specific definitions that promote objectivity and reproducibility. These safeguards provide a distinctly valuable resource that allows investigation of clinically relevant questions and overcomes some of the limitations of institutional databases based on chart review by the surgical team or administrative claims data.\textsuperscript{16, 16}

It is essential to recognize that discharge destination for patients undergoing total laryngectomy may be affected by additional factors, including patient preference, underlying depression, availability of spousal support, home environment, community resources, and, in some cases, availability of financial support for intended postdischarge care setting. In addition, the utilization rate of home health care services for patients discharged to home cannot be determined in the current investigation due to inherent limitations of the data set.

Undoubtedly, preoperative comorbidity profile cannot and should not be the sole determinant of any proposed discharge plan. However, evidence-based risk prediction models that identify total laryngectomy patients with increased likelihood of discharge to intermediate-care facilities may help health care providers facilitate earlier initiation of discharge planning and counseling of patients about anticipated discharge to a non-home-based setting.

Conclusions

Baseline patient factors such as advanced age, functional dependence, CHF, and chronic steroid use may allow providers and patients to anticipate and prepare for a higher likelihood of discharge to intermediate-care facilities following total laryngectomy. Association between discharge destination and length of hospitalization further supports the rationale and importance of optimal perioperative care.

Author Contributions

Aru Panwar, substantial contributions to the conception and design of the work; the acquisition, analysis, interpretation of data for the work; drafting the work and revising it critically for important intellectual content; final approval of the version to be published; agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy and integrity of any part of the work are appropriately investigated and resolved; Fangfang Wang, acquisition, analysis, and interpretation of data for the work; drafting the work; final approval of the version to be published; agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy and integrity of any part of the work are appropriately investigated and resolved; Robert Lindau, interpretation of data for the work, revising it critically for important intellectual content, final approval of the version to be published, agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy and integrity of any part of the work are appropriately investigated and resolved; Oleg Militsakh, interpretation of data for the work, revising it critically for important intellectual content, final approval of the version to be published, agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy and integrity of any part of the work are appropriately investigated and resolved; Andrew Coughlin, interpretation of data for the work, revising it critically for important intellectual content, final approval of the version to be published, agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy and integrity of any part of the work are appropriately investigated and resolved; Russell Smith, interpretation of data for the work, revising it critically for important intellectual content, final approval of the version to be published, agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy and integrity of any part of the work are appropriately investigated and resolved.
the work are appropriately investigated and resolved; Harlan Sayles, acquisition, analysis, and interpretation of data for the work; revising it critically for important intellectual content; final approval of the version to be published; agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy and integrity of any part of the work are appropriately investigated and resolved; Daniel Lydiatt, interpretation of data for the work, revising it critically for important intellectual content, final approval of the version to be published, agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy and integrity of any part of the work are appropriately investigated and resolved; William Lydiatt, substantial contributions to the design of the work and interpretation of data for the work, revising it critically for important intellectual content, final approval of the version to be published, agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy and integrity of any part of the work are appropriately investigated and resolved.

Disclosures

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Supplemental Material

Additional supporting information is in the online version of the article.

References