STOP-BANG QUESTIONNAIRE AND THE MODIFIED MALLAMPATI SCORE TO PREDICT DIFFICULT INTUBATION

by

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DNP Capstone Project Approval Form

This is to certify that

Ryan Stahl
(Name of Student)

successfully defended his/her Capstone project entitled:

STOP-BANG Questionnaire and the Modified Mallampati Score to Predict Difficult Intubation

on November 29, 2018.

(Date)

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Committee Member 1*
(Typed Name)

(Signature)

Committee Member 2*
(Typed Name)

(Signature)

Committee Member 3*
(Typed Name)

(Signature)

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Abstract

Objective: There are a number of assessments an anesthetist can perform preoperatively to assess for possible difficult intubation (DI). Preoperative tests that screen, predict, and ultimately prevent the untoward effects of DI are of infinite value in anesthesia. To better predict DI, the STOP-BANG questionnaire (SBQ) created for identifying risk for obstructed sleep apnea was studied in conjunction with a widely accepted preoperative anesthetic screening test, the Modified Mallampati Score (MMS). In adult patients undergoing general anesthesia requiring endotracheal intubation, will use of the SBQ and the MMS predict DI? There is an abundance of literature supporting the use of the MMS, however, no literature was revealed studying the SBQ and MMS.

Theoretical Framework: Lewin’s theory of planned change

Methods: Retrospective chart review of 105 patients undergoing general anesthesia requiring endotracheal intubation at Bassett Hospital in Cooperstown, New York.

Data Analysis: Multiple and logistic regression was tested to identify statistically significant predictability of the MMS and SBS on predicting number of intubation attempts, use of airway adjuncts for obtaining an airway, and Cormack-Lehane grades (extent of anatomy viewed during direct laryngoscopy). All of which are indicators of DI.

Results: There was a positive correlation between high SBS and MMS and use of airway adjuncts and DI.

Conclusion: The SBQ is another pre-anesthetic test that can be performed to better predict and prevent DI. The SBQ needs to be studied with other commonly used pre-anesthetic airway assessment tests.

Keywords: STOP-BANG, difficult intubation, Mallampati, anesthesia
STOP-BANG Questionnaire and the Modified Mallampati Score to Predict Difficult Intubation

Difficult intubation (DI) is a significant cause of morbidity and mortality in anesthesia; there are a number of preoperative assessments that can be performed on patients, but none have shown particular specificity or accuracy (Torres et al., 2017). The STOP-BANG questionnaire (SBQ) was developed to screen for obstructed sleep apnea (OSA) and may have applicability to pre-anesthetic testing of patients undergoing general anesthesia. The SBQ will be combined with a widely implemented pre-anesthetic bedside screening assessment for determining difficult airway, the Modified Mallampati Score (MMS). A high MMS and a high SBQ score may increase predictability of difficult to intubate or manage airways. In adult patients (18 years and older) undergoing general anesthesia requiring endotracheal intubation, will use of the SBQ and the MMS predict DI (as evidence by high Cormack-Lehane grades [structures viewed upon direct laryngoscopy], number of intubation attempts, and use of airway adjuncts)?

Significance

Currently, it is not common practice to include STOP-BANG scores (SBS) in an anesthesia pre-operative assessment. However, there is alarming evidence suggesting SBS should be included; DI rates are as high as 3.4% to 8.75% in obese adult patients and an increased risk of failed intubation of 7% is noted per one kilogram per meter squared increase in body mass index (Eiamchareonwit et al., 2017). Major complications are rare but when they occur can be life threatening. For example, Cook and Macdougall-Davis (2012) explain how a can’t intubate and can’t ventilate scenario occurs in about one in every 5000 general anesthetics requiring an emergency surgical airway in about one in 50,000 general anesthesics. This accounts for up to 25% of all anesthesia related deaths. Most often a difficult airway is
encountered when it is unanticipated. This speaks to the lack of preoperative airway test reliability (Cook & Macdougall-Davis, 2012). Airway assessment and recognizing a difficult airway is a high priority for anesthesia providers as the unrecognized or unanticipated difficult airway can lead to negative neurological outcomes or even death.

### Literature Review

Several articles were identified having significance in supporting the justification for the proposed capstone project. A search of literature was conducted using three data bases: CINHAL, MEDLINE, and PUBMED.

A prospective cohort study was conducted by Acar, Uysal, Kaya, Ceyhan, and Dikmen (2014) which studied 200 adult surgical patients undergoing surgery under general anesthesia. Eighty three of the 200 patients were deemed at high risk for OSA based on the SBS; 83 patients had a 13.3 percent incidence of DI, with the remaining patients having a 2.6 percent incidence of DI (Acar et al., 2014). Fourteen of the 200 patients were difficult to intubate, all of which had a STOP-BANG of greater than or equal to three (Acar et al., 2014). The study concluded that STOP-BANG can be a useful tool, however there was no comparison with MMS. Could it be that 2.6 percent incidence of DI be a smaller percentage had the correlation between STOP-BANG and MMS been made?

Corso et al. (2014) conducted a multisite, prospective observational study which studied the clinical utility of STOP-BANG on predicting difficult airway management and perioperative complications. In the study, 3452 patients were screened for OSA with 2997 identified as low risk and 455 identified at high risk for OSA. Results did show significantly higher percentages of difficult mask ventilation and DI in the high risk OSA group (Corso et al., 2014). The authors also showed an independent risk for postoperative complications with higher body mass index
(greater than or equal to 30 kilograms per meters squared) and high risk for OSA (Corso et al., 2014). MMS was not used in this study and had a study showed clinical significance between high MMS and high SBS, this would warrant primary alternative airway strategies such as awake fiberoptic intubation, glidescope usage, or having a difficult airway cart present during induction with aims to decrease DI and its negative effects (Henrichs & Walsh, 2012).

Eiamcharoenwit, Itthisompaiboon, Limpawattana, and Siriussawakul (2017) conducted a prospective observational study testing the performance of an intubation difficulty scale (IDS). The IDS is a subjective assessment completed by the anesthetist after intubation. The study used the IDS scoring on 517 obese parturients revealing relatively high DI rate of 14.5 percent (Eiamcharoenwit et al., 2017). A correlation is observed with obesity and DI. The authors also discuss their definition of DI (the seven variables of the IDS), some of which are included in the capstone’s measurable outcomes.

An article by Fassbender, Herbstreit, Eikermann, Teschler, and Peters (2016) reviewed the perioperative risk factors of OSA. They concluded that OSA can very often be first discovered by the anesthetist, and depending on the severity of OSA, it should tailor a specific anesthetic plan (Fassbender et al., 2016). This is similar to an article by Henrichs and Walsh (2012) who outline different anesthetic techniques to employ for severe OSA, also demonstrating a correlation between DI and OSA as well as other perioperative complications.

Mahmoodpoor et al. (2017) study the MMS and its pairing with other pre-anesthetic assessments in 132 patients undergoing elective maxillofacial surgeries under general anesthesia. They concluded there is not one specific test that is an absolute predictor of DI, however, they did find the MMS having the highest specificity of 94.5 percent and when paired with a facial angle test, the sensitivity was 87.5 percent (Mahmoodpoor et al., 2017). Although the results
were promising, an x-ray must be obtained with the calculation of the facial angle coming from two anatomical points which may make this test unfeasible. A similar study by Selvi et al. (2017) also compared the MMS with another pre-anesthetic assessment, the thyromental height (TMH) measurement test. The study demonstrated high sensitivity of the MMS and TMH when used together. However, use of TMH routinely is not practical because the test is digitalized and not simple to perform. The authors do recommend different methodology, such as taking into account age, sex, weight, and race (some variables present in the SBQ) in place of the TMH test (Selvi et al., 2017). A search for test of pairing of MMS and the SBQ revealed no present studies.

Torres et al. (2017) conducted a prospective study using a scale consisting of neck circumference and acromion distance measurements (NEMA). They found a correlation between their NEMA scale and MMS with DI. Also it concluded that there are no known bedside test that are sufficiently able to rule out DI (Torres et al., 2017). The NEMA scale is actually a mathematical equation that takes into account different patient measurements, which begs to question its clinical practicality. The SBQ is easy to use and often already completed as part of the admission process which can easily be compared to the MMS.

Two articles were discovered during the literature search which contradicted the above articles. Riad et al. (2016) conducted a prospective non-intervention observational study which looked at neck circumference and weight as predictors of DI and difficult mask ventilation. The study revealed inconsistencies with DI and obesity. The study did find DI being multifactorial with increased DI rates associated with males, increased neck circumference, and body mass index (Riad et al., 2016). This is important to the basis of the proposed capstone, because the SBQ is several questions that incorporate the above patient factors. This along with the addition
of the MMS, may increase the predictability of DI. The last article reviewed is a retrospective, case-control study design consisting of 171 patients with 90 of those patients documented as difficult to intubate (Vest, Lee, Newcome, & Stamper, 2013). After statistically analyzing their patient data, they concluded there was no correlation between OSA and DI, however, they concluded the MMS was a reliable test to determine DI (Vest et al., 2013).

The articles reviewed serve as a strong justification for the proposed capstone project. There seems to be a correlation in some aspects of the SBQ and DI. A search for MMS and the SBQ used together revealed no studies.

**Theoretical Framework**

The purpose of this proposed capstone is to identify if the use of the SBQ and the MMS can better predict DI or airway management than use of the MMS alone. If results show a statistically significant predictability of DI, SBQ incorporation into the pre-anesthetic assessment should be considered. However, even though the results may be compelling anesthesia providers are accustomed to “their own way” of assessing or any element of their anesthetic care.

Lewin’s theory of planned change (TPC) takes into account factors that drive behaviors to take place in a given situation (Shirey, 2013). The current situation being the pre-anesthetic assessment which gives an anesthetist an idea of how difficult an airway may be to manage with unanticipated difficult airway being a possible unfortunate outcome. Lewin’s TPC can serve as the basis for making a practice change that can positively affect outcomes; his TPC consists of three phases: unfreezing, moving or transitioning, and refreezing (Shirey, 2013).

**Unfreezing**

Shirey (2013) states that unfreezing occurs when a nurse leader (capstone proposer) recognizes a problem, identifies why we need to change, conducts a gap of knowledge analysis,
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and identifies a possible solution. This is extremely similar to the beginning steps of organizing and proposing a capstone project.

**Transitioning**

The second stage of Lewin’s TPC entails creating a detailed plan of action for the proposed change (Shirey, 2013). For this proposed capstone, this step would occur after statistical analysis; education would be provided to anesthesia providers detailing the study results and outlining why the proposed change has to occur. Shirey (2013) states that this stage may be difficult due to provider fear of the unknown or change. It is important to present capstone results and explain the positive implications of the new change.

**Refreezing**

The last stage of Lewin’s TPC involves stabilizing the change and ensuring it becomes accepted into policy, practice, and culture (Shirey, 2013). This step is a necessity and must occur because without a hundred percent staff buy-in and acceptance, the change could be forgotten. Stage three of Lewin’s TPC can be implemented by incorporating the SBQ in the anesthesia pre-operative assessment.

**Methodology**

**Study Design and Sample**

The study’s design is a retrospective chart review. Sample inclusion criteria include adult patients (eighteen years and older) and general anesthesia patients requiring endotracheal intubation. Exclusion criteria include patients under the age of 18, currently intubated patients, pregnant parturients (pregnancy increases intubation difficulty), and patients with first attempt of intubation by an anesthesia student or resident. After approval from the University at Buffalo’s Institutional Review Board (IRB) (Appendix A) the chart review began. The sample is
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comprised of 105 patients undergoing general anesthesia at Bassett Healthcare Hospital located in Cooperstown, New York.

**Instruments**

As previously stated, the MMS, Cormack-Lehane grading scale, and the SBQ results were used in this study. The MMS is a highly accepted pre-anesthetic airway assessment tool; Mahmoodpoor et al. (2017) concluded the MMS has a DI specificity of 94.5 percent. Vest et al. (2013) concluded and also affirmed the reliability of the MMS. To perform the MMS assessment, the patient is instructed to sit up straight, fully extend his neck, and open his mouth without phonating; the degree of visualization corresponds with a grade between one and four; grade or class one and two are associated with no difficulty where grade three and four are probable for difficulty (Nagelhout & Plaus, 2014;2013). Figure B1 is a visual representation of the MMS.

The Cormack-Lehane grading system is also a highly accepted airway assessment scale. An airway is given a grade based off of the extent of anatomy viewed during direct laryngoscopy. Grades one and two being associated with easy intubation, and three and four being associated with difficult intubation. Figure C1 is a visual representation of the Cormack-Lehane grading system.

The SBQ’s creation was intended to screen for OSA (Henrichs & Walsh, 2012). It consists of eight questions with positive predictors of OSA including loud snoring when sleeping, daytime fatigue, observed apnea when sleeping, diagnosis of hypertension, body mass index greater than 35 kilograms per meters squared, being over the age of 50, neck circumference greater than 40 centimeters, and male gender (Henrichs & Walsh, 2012). Three or more of the above positive predictors indicates a high risk for OSA and possible further work up
beyond the scope of this capstone. Nishadh, Ameer, and Arjun (2017) studied the SBQ and showed it has a sensitivity and specificity of 90.6 percent and 90 percent respectively, and also proved that the higher the SBS the higher risk for OSA.

**Measurements, Variables, and Data Collection**

The primary measure of this study includes DI rates as evidence by more than one intubation attempt, a high Cormack-Lehane grade score, and use of airway adjuncts. MMS and SBS was obtained from the pre-anesthetic assessment. A MMS of three or four and an SBS of greater than or equal to three was classified as a high risk for DI. Pieters, Maas, Knape, and van Zundert (2017) conducted a meta-analysis of nine studies and described their outcome parameters to identify a difficult airway or DI. These outcome parameters include the ability to intubate on the first attempt, time from induction to intubation, number of attempts, Cormack-Lehane grade view, use of airway adjuncts (fiberoptic scope, video laryngoscope, bougie, etc.), and trauma to soft tissue and/or teeth (Pieters, Maas, Knape, & van Zundert, 2017). Cormack-Lehane grade view scores, first attempt intubation, and use of airway adjuncts were used to determine intubation difficulty in this study.

Variables include skill of the anesthetist (controlled for by excluding students and residents; all anesthetists will have at least two years of experience intubating patients including experience gained while in school) and documentation variability.

As mentioned before, MMS and SBS were obtained from the pre-anesthetic assessment. The intraoperative note for these patients had the documentation for Cormack-Lehane grades, number of intubation attempts, and use of airway adjuncts.
Ethical Considerations

Prior to the retrospective chart review, IRB approval was obtained through the University at Buffalo. Permission through Bassett Hospital was also obtained prior to the start of data collection. No patient contact occurred after IRB approval, however patient data, such as information described above was obtained through chart review. No identifying data was obtained. Each patient was assigned a patient number which correlates with their SBS, MMS, gender, and DI criteria explained above. All data is stored on a password protected computer owned and only accessible by the principle researcher.

Data Analysis

Data were compiled in Microsoft Excel for statistical analysis using IBM Statistical Package for Social Sciences (SPSS), version 23. Standard multiple regression and binomial logistic regression statistical analysis was used to determine statistical significance for the use of MMS and the SBS in predicting number of intubation attempts, Cormack-Lehane grades, use of airway adjuncts, and a separate category of difficult intubation. Scoring criteria for the difficult intubation category was one or more indicators as follows, greater than one intubation attempt, use of an airway adjunct (such as video laryngoscope/glidescope), and a Cormack-Lehane grade of three or four. Prior to performing the statistical analysis, assumption testing for linearity was performed using the Box-Tidwell procedure and Bonferroni correction.

Results

There were a total of four individual research questions that were statistically analyzed; does the MMS and SBS predict the number of intubation attempts, Cormack-Lehane grades, use of airway adjuncts, and overall difficult intubation? A standard multiple regression was planned to test the predictability of the SBS and MMS on number of intubation attempts. However, of
the 105 cases, 102 cases had one intubation attempt. With little variation in the number of intubation attempt category, statistical analysis could not be performed.

Statistical analysis to test the predictability of the SBS and MMS on Cormack-Lehane grades was performed. Assumption testing for multicollinearity and proportional odds was performed with no violations noted. The variables in the analysis and descriptive statistics are contained in Table 1. With no assumptions violated the Pearson goodness-of-fit test and deviance goodness-of-fit test both indicate a good fit for the observed data ($p = .970$ and $p = .963$). This data was then assessed using the likelihood-ratio test, however, the results did not add significance according to the intercept-only model, $p = .165$. This finding acknowledges that the MMS and SBS do not significantly predict Cormack-Lehane grade views in the data collected and was confirmed with the Wald test for each independent variable. Table 2 shows the logistic regression analysis for each variable at each level.

A logistic regression was performed to test the predictability of the SBS and MMS on use of airway adjuncts in the sample ($N=105$). The Box-Tidwell procedure was used to assess the assumption of linearity, and a Bonferroni correction was applied which used the variables in the model resulting in a statistical significant cutoff of $p < .025$. Tests for linearity ($p$ ranged between .696 and .999) and multicollinearity (tolerance values in data shown to be less than 0.1) showed no assumption violation. The descriptive statistics and coding for variables are contained in Table 3. The logistic regression results were statistically significant, $p < .001$. The Hosmer and Lemeshow Goodness-of-Fit test was also applied and found to be not statistically significant, which suggests that SBS and MMS may predict the categorical outcomes of whether an anesthesia provider will need an airway adjunct to intubate the patient.
Additional statistical analysis using the Cox and Snell $R$ Square and Nagelkerke $R$ Square, showed a 20.5% to 38.8% variance in the use of airway adjuncts for intubation; this model correctly classified 90.5% of cases. Of the records reviewed ($N=105$), the sensitivity calculation was 38.5% who were intubated with the use of an airway adjunct who were predicted by using the SBS and MMS model. The calculated specificity of the tested model was 97.8% of the patients who were not intubated with airway adjuncts were predicted to have not needed one. The positive and negative predictive values for MMS and SBS on predicting the use of airway adjuncts are 71.43% and 91.84% respectively. Both predictor variables (SBS and MMS) were statistically significant, $p<.05$ and are contained in Table 4.

The final analysis performed was a logistic regression to examine the influence on the SBS and the MMS on whether or not the anesthesia provider had difficulty intubating their patient ($N=105$). Again, the Box-Tidwell procedure was used to assess the assumption of linearity, and a Bonferroni correction was applied which used the variables in the model resulting in a statistical significant cutoff of $p<.025$. Tests for linearity ($p$ ranged between .896 and .999) and multicollinearity (tolerance values in data shown to be less than 0.1) showed no assumption violation. No extreme data outliers were noted. With no assumption violations, a logistic regression was conducted. The descriptive statistics are contained in Table 5. Results of this logistic regression were statistically significant, $p<.001$. The Hosmer and Lemeshow Goodness-of-Fit test was also applied and found to be not statistically significant, which means the model determines the predictability of the MMS and SBS on difficult intubation.

The Cox and Snell $R$ Square and Nagelkerke $R$ Square, respectively, accounted for 16.5% to 29.5% of the variance in whether or not the intubation was difficult. The logistic regression also classifies 87.6% of cases. The sensitivity calculation demonstrated that 26.7% of
participants who were difficult to intubate were predicted to be difficult. The specificity calculation demonstrated that 97.8% of patients who were not difficult to intubate were correctly predicted to be not difficult. The positive predictive value indicated that of all cases predicted as difficult to intubate, 66.67% were correctly predicted using the model. The negative predictive value indicated of all cases predicted as not difficult to intubate, 83.3% were correctly predicted using the model. Both predictor variables were statistically significant and are contained in Table 6.

**Discussion**

Of the four statistical analyses performed, there were statistical significance for the SBS and MMS predicting the use of airway adjuncts and predicting at least some level of difficulty in intubation. The statistics revealed that the higher the SBS and MMS scores the more likelihood the anesthesia provider will use an airway adjunct (such as video laryngoscope/glidescope) for the intubation. The statistics also revealed that the higher the SBS and MMS scores the more likely the anesthesia provider will have a difficult time intubating the patient (based on the variables presented: intubation attempts, Cormack-Lehane Grade, and use of airway adjuncts). Additionally, Table 4 shows the odds ratio for MMS and SBS being 10.004 and 1.335, respectively. An increase in MMS from two to three will increase the odds of using an airway adjunct by 10.004 per score increase. As with the SBS, an increase in score correlating with 1.335 odds increase of using an airway adjunct.

As a graduate student nurse anesthetist, patient safety is of great importance. The anesthetist has to adequately evaluate a patient for past medical/surgical history and identify any possible complications that may occur perioperatively. This included avoiding or mitigating major complications, including a scenario where the anesthetist has airway management issues
and a difficult or impossible intubation of a patient. The results of this study affirm another airway assessment test that can help predict and thus prepare the anesthetist for a possible difficult intubation. Cook & Macdougall-Davis (2012) state that often difficult airways are unrecognized or unanticipated preoperatively. Coupled with the statistical findings of this study, there is a compelling argument for consideration in viewing or performing the SBS preoperatively.

Strengths and Limitations

This study is unique because the literature review process identified no other studies that look at the SBS coupled with the MMS for predicting difficult intubation. Other studies presented in the literature review show measurements for possible new preoperative airway tests, however these airway tests may be difficult to perform or impractical for everyday use. The SBQ is often completed as part of an admission process and is easily accessible to the anesthetist; if not completed, the SBQ can easily be assessed. The results of this study suggest the applicability of using the SBQ as a pre-operative screening assessment to predict use of airway adjuncts and overall difficult intubation.

Limitations identified in this study include skill of the anesthetist. As previously stated, students and residents attempting intubation on the first attempt were excluded from the sample, however, there still remains provider to provider skill differences as well as decision making skills. Documentation variability and assessment subjectivity can also affect or skew the results of this study. Lastly, the study was not surgery specific leaving to question airway difficulty situations in a particular group of patients, such as in head and neck surgery.
Future Implications and Recommendations

The results of this study strongly suggest incorporation of the SBQ into the pre-operative anesthetic airway assessment. It is recommended to further study the SBQ and difficult intubation in conjunction with other commonly implemented airway assessment tests to further increase the predictability of difficult intubation. To ensure less variance in data, the author suggests limiting data collection for future studies to surgery specific patient pools. It is also recommended to study this topic further on a larger patient population to test for similar results.

Conclusion

The statistical findings of this capstone project suggest use of the SBQ as part of an anesthesia pre-operative airway test. The SBQ and MMS are identified to be statistically significant in predicting the use of airway adjuncts and DI in adult patients undergoing general anesthesia requiring endotracheal intubation. DI and airway assessment is a heavily studied topic with infinite value in anesthesia. The SBQ is another tool that can be used by an anesthetist to screen, assess, predict, and ultimately prevent unanticipated DI and its negative outcomes and effects.
References


Nishadh, M. J., Ameer, K. A., & Arjun, P. (2017). The accuracy of the stop bang questionnaire in the identification of obstructive sleep apnoea (OSA) with polysomnography as the gold standard in adult patients with symptoms of sleep disordered breathing in a tertiary care centre in south India. Sleep Medicine, 40, e144-e145. doi:10.1016/j.sleep.2017.11.422


Torres, K., Błoński, M., Pietrzyk, Ł., Piasecka-Twaróg, M., Maciejewski, R., & Torres, A. (2017). Usefulness and diagnostic value of the NEMA parameter combined with other

Table 1

*Descriptive Statistics and Coding for Cormack-Lehane Grade views (N = 105)*

<table>
<thead>
<tr>
<th></th>
<th>M</th>
<th>SD</th>
<th>Mdn</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cormack-Lehane</td>
<td>1.21</td>
<td>.50</td>
<td>1.00</td>
</tr>
<tr>
<td>Stop- Bang Score</td>
<td>2.86</td>
<td>.227</td>
<td></td>
</tr>
<tr>
<td>Modified Mallampati Score</td>
<td>2.23</td>
<td>.058</td>
<td></td>
</tr>
</tbody>
</table>
Table 2

*Results of the Logistic Regression Analysis of SBS/MMS for Determining Cormack-Lehane Grade at Each Level*

<table>
<thead>
<tr>
<th>Parameter</th>
<th>B</th>
<th>Exp(B)</th>
<th>Wald Chi-Square</th>
<th>p</th>
<th>df</th>
</tr>
</thead>
<tbody>
<tr>
<td>MMS=1</td>
<td>-.675</td>
<td>.265</td>
<td>.607</td>
<td>.509</td>
<td>10</td>
</tr>
<tr>
<td>MMS=2</td>
<td>-.516</td>
<td>.637</td>
<td>.425</td>
<td>.597</td>
<td>10</td>
</tr>
<tr>
<td>MMS=3</td>
<td>0*</td>
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<td>.</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>SBS=0</td>
<td>-.984</td>
<td>.677</td>
<td>.411</td>
<td>.374</td>
<td>10</td>
</tr>
<tr>
<td>SBS=1</td>
<td>-1.897</td>
<td>3.084</td>
<td>.079</td>
<td>.150</td>
<td>10</td>
</tr>
<tr>
<td>SBS=2</td>
<td>-1.392</td>
<td>2.369</td>
<td>.124</td>
<td>.248</td>
<td>10</td>
</tr>
<tr>
<td>SBS=3</td>
<td>-2.332</td>
<td>5.106</td>
<td>.024</td>
<td>.097</td>
<td>10</td>
</tr>
<tr>
<td>SBS=4</td>
<td>-.199</td>
<td>.028</td>
<td>.867</td>
<td>.819</td>
<td>10</td>
</tr>
<tr>
<td>SBS=5</td>
<td>-21.609</td>
<td>.000</td>
<td>.999</td>
<td>4.123E-10</td>
<td>10</td>
</tr>
<tr>
<td>SBS=6</td>
<td>-.135</td>
<td>.015</td>
<td>.903</td>
<td>.874</td>
<td>10</td>
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<tr>
<td>SBS=7</td>
<td>-21.984</td>
<td>.000</td>
<td>1.000</td>
<td>2.836E-10</td>
<td>10</td>
</tr>
<tr>
<td>SBS=9</td>
<td>0*</td>
<td>.</td>
<td>.</td>
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<td>10</td>
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Table 3

*Descriptive Statistics and Coding for use of Airway Adjuncts*

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
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<tbody>
<tr>
<td>Use of airway adjuncts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>13</td>
<td>87.6</td>
</tr>
<tr>
<td>No</td>
<td>92</td>
<td>12.4</td>
</tr>
<tr>
<td><strong>M SD</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stop- Bang Score</td>
<td>2.86</td>
<td>.227</td>
</tr>
<tr>
<td>Modified Mallampati Score (MMS)</td>
<td>2.23</td>
<td>.058</td>
</tr>
</tbody>
</table>
Table 4

*Results of the Logistic Regression Analysis for SBS/MMS on use of Airway Adjuncts*

<table>
<thead>
<tr>
<th></th>
<th>B</th>
<th>Wald</th>
<th>df</th>
<th>p</th>
<th>Exp(B)</th>
<th>(odds ratio)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MMS</td>
<td>2.303</td>
<td>7.753</td>
<td>1</td>
<td>.005</td>
<td>10.004</td>
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<tr>
<td>SBS</td>
<td>.289</td>
<td>5.012</td>
<td>1</td>
<td>.025</td>
<td>1.335</td>
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</tbody>
</table>
### Table 5

*Descriptive Statistics and Coding for Difficult Intubation*

<table>
<thead>
<tr>
<th>Difficult Intubation</th>
<th>Frequency</th>
<th>Percentage</th>
<th>Coding</th>
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</thead>
<tbody>
<tr>
<td>Yes, difficult</td>
<td>15</td>
<td>85.7</td>
<td>1</td>
</tr>
<tr>
<td>No, Not Difficult</td>
<td>90</td>
<td>14.7</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stop- Bang Score</td>
<td>2.86</td>
<td>.227</td>
</tr>
<tr>
<td>Modified Mallampati Score (MMS)</td>
<td>2.23</td>
<td>.058</td>
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</tbody>
</table>
Table 6

*Results of the Logistic Regression Analysis for SBS/MMS on Difficult Intubation*

<table>
<thead>
<tr>
<th></th>
<th>B</th>
<th>Wald</th>
<th>df</th>
<th>Sig.</th>
<th>Exp(B)</th>
<th>(odds ratio)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MMS</td>
<td>1.627</td>
<td>6.248</td>
<td>1</td>
<td>.012</td>
<td>5.088</td>
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<tr>
<td>SBS</td>
<td>.260</td>
<td>4.735</td>
<td>1</td>
<td>.030</td>
<td>1.297</td>
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</table>
STUDY EXEMPTION

August 30, 2018

Dear Ryan Staib,

On 8/30/2018, the University at Buffalo IRB reviewed the following submission:

<table>
<thead>
<tr>
<th>Type of Review:</th>
<th>Initial Study</th>
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<tr>
<td>Title of Study:</td>
<td>STOP-BANG QUESTIONNAIRE AND THE MODIFIED MALLAMPATI SCORE TO PREDICT DIFFICULT INTUBATION</td>
</tr>
<tr>
<td>Investigator:</td>
<td>Ryan Staib</td>
</tr>
<tr>
<td>IRB ID:</td>
<td>STUDY00002689</td>
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<tr>
<td>Funding:</td>
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<td>IND, IDE, or HDE:</td>
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Documents Reviewed:
- Protocol, Category: IRB Protocol;
- HIPPA Waiver, Category: Other;
- Data sheet, Category: Other;

The University at Buffalo Institutional Review Board has considered the submission for the project referenced above on 8/30/2018 and determined it to be Exempt.
Appendix B

Figure 1. Modified Mallampati Score Classification (Nagelhout & Plaus, 2014;2013).

Figure 1. Modified Mallampati Score Classification (Nagelhout & Plaus, 2014;2013).
Appendix C

Figure 1. Cormack-Lehane Grading System (Nagelhout & Plaus, 2014;2013).
STOP-BANG Questionnaire and the Modified Mallampati Score to Predict Difficult Intubation
Ryan Staib, BSN, SRNA, DNP-c, University at Buffalo, Nurse Anesthesia Program

Introduction
There are a number of assessments an anesthetist can perform preoperatively to assess for possible difficult intubation (DI). Preoperative tests that screen, predict, and ultimately prevent the untoward effects of DI are of infinite value in anesthesia. To better predict DI, the STOP-BANG questionnaire (SBQ) created for identifying risk for obstructed sleep apnea was studied in conjunction with a widely accepted preoperative anesthetic screening test, the Modified Mallampati Score (MMS). In adult patients undergoing general anesthesia requiring endotracheal intubation, will use of the SBQ and the MMS predict DI? There is an abundance of literature supporting the use of the MMS, however, no literature was revealed studying the SBQ and MMS.

Purpose
• Assess the predictability of SBS and MMS on three factors
  • Number of intubation attempts
  • Cormack-Lehane Grade views
  • Use of airway adjuncts

Theoretical Framework
• Lewin’s Theory of Planned Change
  • Basis for practice change
    • Unfreezing (problem recognition)
    • Transitioning (dissemination, education, implementation into practice)
    • Refreezing (solidifying the change)

Methods
Retrospective chart review of 105 patients undergoing general anesthesia requiring endotracheal intubation at Bassett Hospital in Cooperstown, New York.

Inclusion Criteria
• Adult patients (at least 18 years of age)
• Patients undergoing general anesthesia requiring endotracheal intubation

Exclusion Criteria
• Patients under the age of 18.
• Pregnant parturients (pregnancy increases airway difficulty)
• Patients with first attempt intubation by student registered nurse anesthetist or anesthesia resident

Data Analysis
Data were compiled in Microsoft Excel for statistical analysis using IBM Statistical Package for Social Sciences (SPSS), version 23:
• Standard multiple regression and binomial logistic regression statistical analysis was used to determine statistical significance for the use of MMS and the SBS in predicting number of intubation attempts, Cormack-Lehane grades, use of airway adjuncts, and a separate category of difficult intubation.
• Scoring criteria for the difficult intubation category was one or more indicators as follows, greater than one intubation attempt, use of an airway adjunct (such as video laryngoscope/glide scope), and a Cormack-Lehane grade of three or four

Results
There were a total of four individual research questions that were statistically analyzed; does the MMS and SBS predict the number of intubation attempts, Cormack-Lehane grades, use of airway adjuncts, and overall difficult intubation?

Number of Intubation Attempts
• Of the 105 cases analyzed, 102 only required one attempt. With little variation in data no analysis could be performed.

Cormack-Lehane Grades
• No statistical significance was noted p<.165. Each category was one or more indicators as follows, greater than one intubation attempt, use of an airway adjunct (such as video laryngoscope/glidescope), and a Cormack-Lehane grade of three or four

Airway Adjuncts
• Specificity of 97.8% (not intubated with use of airway adjuncts, and predicted to not need adjunct)
• Positive and negative predicted values are 66.67% and 83.3% respectively (positive: all cases predicted to be difficult were correctly predicted using the model, negative: all cases predicted to not be difficult were predicted by the model)

Conclusion
As an anesthetist, patient safety is of great importance. The anesthetist has to adequately evaluate a patient for past medical/surgical history and identify any possible complications that may occur perioperatively and of course avoid or mitigate them (one major complication being a scenario where the anesthetist has airway management issues and a difficult or impossible to intubate patient). The results of this study affirm another airway assessment test that can help predict and thus prepare the anesthetist for a possible difficult intubation. Cook & Macdougall-Davis (2012) state that often difficult airways are unrecognized or unanticipated preoperatively, coupled with the statistical findings of this study, there is a compelling argument for consideration in viewing or performing the SBQ preoperatively.

Future Implications
The findings of this study support the use of the SBQ for anesthetic preoperative consideration. Further larger studies are needed as well as inclusion of other airway assessment tests to further increase statistical predictability of DI.

Acknowledgements
Thank you to Dr. Cheryl Spulecki in the advisement in this capstone project. Special acknowledgement to my wife and family for your love and support.

References
References available upon request