Evidence-based Bedside Swallowing Assessment by Nurses for the Patients with Stroke

Submitted by

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Background and Purpose

Stroke is the loss of brain’s function caused by hypoxia of brain cells depending on the severity and the location of the stroke. In Hong Kong, strokes are the 4th leading cause of death and morbidity in the year of 2010. Dysphagia is a common morbidity related to stroke. Approximately, 50% of stroke patients with dysphagia are suffered with aspiration and aspiration pneumonia which may lead to increased length of stay in hospitals, mortality rate and medical costs. An early nursing dysphagic screening and assessment protocol can help in early detect of dysphagia and therefore help to reduce incidence of aspiration and pneumonia. In order to understand the effectiveness of the nursing dysphagic screening and
assessment protocol for the acute stroke patients, a number of studies have been reviewed to gather evidences for the translational research. A bedside nursing swallowing screening and assessment for patients with stroke is developed by incorporating findings from the literature review.

Review Question

In comparison to the routine care, is the nursing dysphagia assessment intended for the acute stroke patients more effective in reducing (1) the waiting time for having swallow assessment and the (2) the incidence of aspiration and pneumonia?

Methods

A systematic review of literatures from Ovid Medline (from 1946 to 2012), Pubmed (all dates), CINAHL Plus (from 1971 to 2012) and China Journal Net (from 1912 to 2012) was conducted. Five studies of bedside swallow screening and assessment that can be performed by nurses were selected and critically appraised using the recognized assessment criteria.

Results

The key components identified from the reviewed studies including swallowing assessment should be performed by trained nurses and acute stroke patients should be alert and able and can keep the sit up position during the swallowing assessment. Moreover, water swallowing test must be included as a part of the
swallow assessment and assessment should best be performed in daily basic. Patients should be keeping nil of mouth when they failed the screening and referred for further assessment and management. Implementation potential in terms of transferability, feasibility and the cost benefit ratio of the proposed innovation were assessed. A communication plan was developed for the integration of the proposed innovation into the clinical setting. Outcome measures such as positive predictive value of detecting dysphagia, mean waiting time of waiting the initial swallow screening, occurrence of pneumonia, staff knowledge and compliance were identified to evaluate the effectiveness of the proposed innovation and guideline.

**Conclusion**

The findings of this systematic review showed that the nursing dysphagic swallow screening and assessment is effective in detecting the dysphagia of the acute stroke patients. Further development of the proposed innovation will be conducted in the clinical setting in order to satisfy the needs of the acute stroke patients.
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Declaration

I declare that this thesis represents my own work, except where due acknowledge is made, and that has not been previously included in a thesis, dissertation or report submitted to this university or to any other institution for a degree, diploma or other qualifications.

Signed: .....................................................

Wong Oi Chi
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CHAPTER 1
INTRODUCTION

1.1 BACKGROUND

Stroke is the loss of brain’s function caused by hypoxia of brain cells. Depending on the severity and the location of the stroke, sufferers will experience different levels of disabilities. If the strokes occurred in the area of cerebral, cerebellum or brain stem area of the brain, the physiology of the swallowing may be impaired and dysphagia may also occurred.

In Hong Kong, strokes are the 4th leading cause of death and morbidity in the year of 2010 (Centre for Health Protection, 2001-2010) and strokes can bring serious and long-term disability to sufferers. The disability related to strokes include limited motor activity, lost of sensation and ability of hearing, vision, cognitive function (e.g. reasoning, judgment, thinking), and ability to speak, articulate, chew and swallow.

Dysphagia is defined as the difficulty in swallowing food in the solid, semisolid, or liquid form (Marik and Kaplan, 2003; Wieseke, Bantz, Siktberg and Dillard, 2008).

Dysphagia is a common morbidity related to stroke in which, based on estimate, 42%
to 76% of stroke patients are diagnosed with this condition (Martino, 2005, Katzan, Cebul, Husak, Dawson and Baker, 2003). Unfortunately, dysphagia brings lots of complications to stroke patients. These complications include malnutrition, dehydration, electrolyte imbalance and pulmonary infections (Falsetti et al. 2009). Approximately, 50% of stroke patients with dysphagia are suffered with aspiration (Hinchey et al. 2005). It is a condition which is defined as the misdirection of the food down to the larynx and further down to the lower respiratory tract (Katzan et al. 2003). It can bring to aspiration pneumonia, which is the most severe complication related to dysphagia. Although dysphagia has a range of related negative consequences, it is a potentially preventable complication (Lagoe et al. 2010).
1.2 AFFIRMING THE NEED

As described in above, approximately 42% to 76% of strokes patients are estimated having dysphagia (Katzan et al. 2003) and around 50% of dysphagic patients after stroke would experience aspiration. Of which, around one-third of them would develop pneumonia and required treatment. Studies showed that dysphagia screening can reduce the incidence of aspiration and pneumonia (Hinchey et al. 2005, Ramsey, 2003). In the setting where the researcher of this dissertation is currently worked in, (i.e. an acute neurological and neurosurgical ward), dysphagia screening and assessment are all performed by speech therapists and the services provided by them are only available at office hours during weekdays. Patients can only eat and drink after their assessments and patients may need to wait for more than 2 days sometimes. According to Hinchey in (2005), an early detection of dysphagia by screening protocol can prevent pneumonia. From the Canadian Best Practice Recommendation for stroke care (2006) with an evidence level of B, all patients with stroke should have a simple, valid and reliable bedside swallow screening protocol before they start any oral intake and the initial screening can be performed by trained clinicians such as nurses. (Canadian Best Practice Recommendation for stroke care, 2006). Nurses have an important role in identifying dysphagia patients (Werner, 2005). Travers (1999) stated that, since nurses frequently supervise and observe patients in ward, they are
probably the first health care professional to detect the signs and symptoms of
dysphagia. Moreover, Davies (2002) described that nurses, who are available to
patients 24 hours a day, are the ideal health care professional to identity patients with
dysphagia and initiate interventions to prevent complications until a formal
assessment is undertaken (Davies, 2002).

In most of the hospitals in Hong Kong, nursing dysphagic screening and assessment
protocol is not set up in the clinical settings. Also, nurses also do not have any formal
training on it. However, in order to shorten the patient’s waiting time for food and
drink, there is a need to set up an early and reliable bedside swallow screen and
assessment in the clinical setting that can be performed by nurses. The setup of this
screening protocol will make patient feel happy and satisfied, and may subsequently
promote their well-being. Also, due to the early detection of dysphagia based on the
screen, oral drug can be resumed or commenced to patients as soon as possible. This
can help to provide early cure and may eventually lead to a better patient’s outcome.
Moreover, the screen may help to reduce incidence of aspiration and pneumonia and
thereby shorten the length of stays of the patients in hospitals. The utilization of the
medical resources and hospital expenditures may therefore be reduced. For nurses,
the use of the bedside swallow assessment protocol can help to reduce their worries
and increase their level of confidence to give fluids or diet to patients, even the speech therapists have not performed the assessment for the patient. Moreover, nurses’ level of autonomy and satisfaction may be enhanced and, hence, can provide a standard and good quality of care to patients.

The purpose of this project is to translate the best evidence into the current nursing practice via the development of a clinical guideline of bedside swallow screen and assessment for stroke patients.
1.3 SIGNIFICANCE

An evidence-based clinical guideline is beneficial to patients, caregivers, nurses, other health care professionals as well as the hospital. In this study, a clinical guideline of nursing dysphagia swallow screen and assessment is proposed. It can reduce patient’s waiting time for initial swallow screen and therefore patients can resume their food, fluid and medications, and that may enhance their health and satisfaction. Moreover, the psychosocial function of patients can be improved and thereby improve their psychological health and their health outcome. For caregivers, the proposed guideline can make them to feel contented and less worried when the patient is allowed to eat or drink. It is because caregivers often can do nothing when they receive the patient’s complaints of hunger and thirst. They may feel guilt or pity. For nurses, the initial swallow screen and assessment can enhance their knowledge about dysphagia and its management and will also reduce their worries and increase their level of confidence for giving fluids or diet to patients even before the formal assessment is performed by the speech therapists. Nurses’ autonomy will also be enhanced and will reduce their confusion of performing the dysphagia screening and assessment. Nurses can then perform it in a practical and systematic way. Good quality of care therefore can be provided to patients. And at the hospital levels, the successful establishment of the swallow screen can help to reduce incidence of aspiration and aspiration pneumonia
and thus may lead to a reduced admission rate. Also, the hospital expenditures and the
total health care cost may be reduced as patient’s length of hospitalization is shortened.
Therefore, a nursing swallow screen and assessment should be introduced to clinical
settings after the best evidences are extracted, synthesized and translated.
1.4 RESEARCH QUESTION

Based on the concept of Melnyk & Fineout-Overholt (2005), a structured question is formulated in the PICO format. It describes the elements of the clinical question including patient problem or population interest, intervention of interest, comparison and the outcome of interest. And in the clinical setting of the researcher of this dissertation, the clinical question is stated as,

In comparison to the routine care, is the nursing dysphagia assessment intended for the acute stroke patients more effective in reducing (1) the waiting time for having swallow assessment and the (2) the incidence of aspiration and pneumonia?

PICO Elements:

Patient population of interest (P): Acute stroke patients

Intervention of interest (I): Nursing dysphagia screening and assessment

Comparison of interest (C): Routine Care

Outcome of interest (O): the reduction of the waiting time of having swallow assessment, the reduction of the incidence of aspiration and pneumonia
1.5 OBJECTIVES

The objectives of this study are:

1. To identify and define the problem of dysphagia caused by stroke.

2. To gather the data about dysphagia swallow screen and assessment from the literature

3. To extract the information from the literature that are in good quality and to identify the best evidences for dysphagia swallow screen and assessment

4. To develop a clinical nursing guideline of dysphagia swallow screen and assessment for the patients with acute stroke

5. To assess the feasibility and the implementation potential of the proposed nurse-led swallow screen and assessment

6. To develop an implementation plan as well as an evaluation plan for the proposed nursing swallow screen and assessment with acute stroke patients
CHAPTER 2
CRITICAL APPRAISAL

2.1 SEARCHING AND APPRAISAL STRATEGIES

The search of the literature was conducted in July 2012 with a focus on the swallow screen and assessment that can be performed by nurses. Four electronic searching engines were used for the search of the potential relevant journals papers. They are Ovid MEDLINE, Pubmed, CINAHL Plus and China journal net. The English keywords used in the search include “stroke”, “CVA”, “cerebral infarction”, “cerebral hemorrhage”, “intracerebral hemorrhage”, “cerebrovascular disorder”, “cerebrovascular disease”, “cerebrovascular accident”, “dysphagia”, “screen”, and “assessment” and the Chinese keywords used in the searching process were “腦卒中”, “中風”, “吞咽困難”, “吞咽障礙”, “测试” and “评估”. As there are not much recent literature documenting the swallow screen and assessment that are performed by nurses, limitations were not set for the date of publishing during the search. With the use of the above mentioned English keywords, 283, 205 and 877 possible journals were obtained from Ovid Medline, CINAHL Plus, and Pubmed respectively. Also, 58 Chinese journals were obtained from the China journal net with the use of the above mentioned Chinese keywords. In total 1423 papers were obtained from the search.
Then, the title and the abstract of these 1423 papers were read. Duplicated and irrelevant studies were eliminated. Finally, 5 papers were selected and are included in the review. Details of the searching process are listed in appendix A (1-4) and are summarized in appendix B.
2.2 ELIGIBILITY

2.2.1 Inclusion Criteria

The papers selected in the review are limited to adult stroke patients who had admitted to an acute ward setting. And only the papers describing the dysphagia swallow screen and assessment are included in the review. Also, the review only includes papers that are written in English or Chinese language due to the language barrier.

2.2.2 Exclusion Criteria

Papers reporting qualitative studies and opinion of the author are excluded. If the targeted study population of the papers is not adult (e.g. pediatric patients) or non-stroke patient, they will be excluded. For studies that describe the swallow screen and assessment that have not been validated or performed by physicians, they will also be excluded.

2.2.3 Data Extraction

In total five studies were included in the review. (Massey & Jedlicka, 2002; Trapl et al., 2007; Martino et al., 2009; Lim et al., 2001 and Edmiaston, Connor, Loehr & Nassidf, 2010). Data of these studies were extracted and are recorded in the form of
table of evidence (Appendix C). The table of evidence (Appendix C) consists of information of the selected studies including bibliographic citation, study type, evidence level, purpose of the study, numbers and characteristics of the patients, details of the screen, the outcome measure, the gold standard and the results of the selected studies. The level of evidence is rated using the Scottish Intercollegiate Guidelines Network (SIGN, 2008). (Appendix D)
2.3 SUMMARY OF RESULTS

2.3.1 Study Design

All of the selected studies are prospective studies.

2.3.2 Purpose

The purpose of all the selected studies was to develop a swallow screening and assessment. Their aims were to validate the screening tool with the gold standard or other methods and to test the validity and the reliability of the swallow screening tool.

2.3.3 Level of Evidence

Level of evidence of the identified studies is rated according to the Scottish Intercollegiate Guidelines Network (SIGN, 2008) (Appendix D). The evidence level are divided into four levels in which evidence level one is the highest quality of meta-analyses or systematic reviews of randomized controlled studies. The level two is the high quality case control or cohort studies. Evidence level three is the non-analytic studies such as case reports and case series while evidence level four is the expert opinions. A “++” sign is rated in the evidence level one and two indicated very low risk of bias and the “+” sign rated in the evidence level one and two
indicated low risk of bias. A “-” sign is rated in the evidence level one and two means a high risk of bias. Among the five identified studies, two of them are graded as 2++, two of them graded as 2+ and one of them are categorized as 2-.

2.3.4 Number and Characteristic of Participants

The sample sizes of three of the selected studies were ranged from 25 to 50 (Massey & Jedlicka, 2002; Trapl et al., 2007, Lim et al., 2001) and the remaining two studies had a sample sizes ranging from 300 to 311 (Martino et al., 2009; Edmiaston, Connor, Loehr & Nassidf, 2010). Four of the selected studies had reported the general demographic characteristic of the participants including age and gender (Massey & Jedlicka, 2002; Trapl et al., 2007, Martino et al., 2009; Lim et al., 2001). All participants in the selected studies were stroke patients and only two of the studies reported the types of stroke of their participants (Massey & Jedlicka, 2002; Martino et al., 2009). The age range of the participants was 39 to 87. However, no studies mentioned the ethnicity of their participants. Most of the participants were male (Massey & Jedlicka, 2002; Trapl et al., 2007, Martino et al., 2009; Lim et al., 2001). Three out of the five selected studies reported the length of the hospitalization of the participants, which was ranged from 2 days to 24 days (Massey & Jedlicka, 2002; Martino et al., 2009; Lim et al., 2001). However, only one study reported the
2.3.5 Settings of performing the Intervention

Among the five identified studies, four of them were conducted in stroke units and one of them was in the acute care hospital (Massey & Jedlicka, 2002.)

2.3.6 Peoples who perform the Intervention

Nurses performed the intervention in four of the selected studies and one of the studies did not mention. (Lim et al., 2001)

2.3.7 Details of the Screen

All the swallow screening and assessment described in the selected studies were differed in terms of the assessment of the participants and the content of the swallow screen. Three of the selected studies required the participants to be alert, awake and to follow commands (Massey & Jedlicka, 2002; Trapl et al., 2007; Edmiaston, Connor, Loehr & Nassidff, 2010) and two other studies required the participants to be able to sit upright or at least 60 degree when performing the swallow screen (Trapl et al., 2007; Lim et al., 2001). And three of the studies assessed the symmetry or movement of the tongue (Massey & Jedlicka, 2002; Martino et al., 2009; Edmiaston,
Connor, Loehr & Nassid, 2010) and all of the studies focused on the signs and symptoms of choking or aspiration during or after swallow including cough, choking, and voice change. And only one study used semi-solid texture food, rather than water, as the initial swallow material to test the participant for dysphagia. (Trapl et al., 2007)

2.3.8 Outcome Measures

All the selected studies used different outcome measures. Massey & Jedlicka, (2002) used 14 items of the screen and Martino et al., (2009) used the results of the Toronto Bedside Swallowing Screening Test (TOR-BBST) to assess the presence of dysphagia among their patients. Trapl et al., (2007) used the Gugging Swallow Screen (GUSS) score and Lim et al., (2001) used the results from the combined test to detect the aspiration risks of their patients. Moreover, signs and symptoms of the aspiration and pneumonia were also assessed retrospectively in this study. In the study of Edmiaston, Connor, Loehr and Nassid, (2010), the results of Acute Stroke Dysphagia Screen (ASDS) which was validated by the Mann Assessment of Swallowing ability (MASA) was used to estimate the dysphagia and the aspiration risks of the patients. Also, the time lag between the performance of ASDS by nurse and the MASA by the speech therapist was mentioned.
2.3.9 Gold standard

Gold standard, means a standardized clinical assessment, method, procedure, intervention or measurement with known validity and reliability that is generally regarded as the best available, against new tests or results and protocols are compared (Segen’s medical dictionary, 2011). Two of the studies using FEES as the gold standard (Trapl et al., 2007; Lim et al., 2001) and the other two used VFSS or Modified Barium Swallow (MBS) to validate their swallow screens (Massey & Jedlicka, 2002; Martino et al., 2009). The remaining study used MASA which was performed by the speech therapists (which was validated against the MBS) to validate the ASDS (Edmiaston, Connor, Loehr & Nassidf, 2010).

2.3.10 Summary of the Results of the Reviewed Studies

For the results of the recruited studies, all of them reported the sensitivity and the specificity of the screen. Four of them reported the predictive values (Trapl et al., 2007; Martino et al., 2009; Lim et al., 2001, Edmiaston, Connor, Loehr & Nassidf, 2010). Two of them reported the content validity (Massey & Jedlicka, 2002; Trapl et al., 2007). Four of them reported the interrater reliability (Massey & Jedlicka, 2002; Trapl et al., 2007; Martino et al., 2009; Edmiaston, Connor, Loehr & Nassidf, 2010)
and one of them reported test-retest reliability (Edmiaston, Connor, Loehr & Nassidf, 2010).

All the swallow screens in the selected studies had high sensitivity (ranged from 91% to 100%), which means that all swallow screens can identify the patients with dysphagia correctly. However, the specificity of the swallow screens was different (ranged from 50% to 100%), which indicates that the ability of the swallow screen for detecting non-dysphagia patients is varied. Four of the identified studies reported positive predictive value (PPV) and negative predictive values (NPV) (Trapl et al., 2007; Martino et al., 2009; Lim et al., 2001, Edmiaston, Connor, Loehr & Nassidf, 2010) in which the PPV ranged from 44%-83.3% and the NPV ranged from 76.9-100%. High PPV indicated that a large proportion of the true positives patients having dysphagia can be detected and a high NPV indicated that a large proportion of the true negative patients (without dysphagia) can be tested correctly. Interrater reliability of all screens has a high grade which means that different raters can reach consensus with the assessment criteria of the respective swallow screen.
2.4 QUALITY ASSESSMENT OF THE STUDIES

As all studies are prospective diagnostic studies, the quality assessment of them is assessed with the use of the methodology checklist 5 (diagnostic study) of Scottish Intercollegiate Guidelines Network (SIGN, 2008), which helps in the evaluation of the accuracy of the respective swallow screen, assists in determining the level of the evidence of the selected studies, and guides in making recommendations. The summary tables of the quality assessment of the five identified studies are shown in Appendix E.

2.4.1 High Level of Evidence

In the five selected studies, two of them (Trapl et al., 2007; Lim et al., 2001) are graded as “2++”, indicating that the studies are cohort studies that are in high quality and with a very low risk of bias or confounding. It also suggested that the studies fulfilled all or most of the criteria in the checklist and the results of the respective study are very unlikely to be altered (SIGN, 2008)

Both of the studies addressed the spectrum of the patients and the selection criteria of the participants well. Trapl et al., (2007) reported that fifty consecutive patients with first-ever stroke and suspected dysphagia and were admitted to the acute stroke unit
on weekdays between Monday and Thursday were recruited in their study.

The reference standard of both studies was FEES and it is regarded as one of the golden standards for determining the presence of dysphagia of the stroke patients. The reference test, FEES, and the index swallow screen were performed within twenty-four hours of the onset of the participants’ stroke and the time period between the reference test and the index test was short enough for ensuring the stroke patients’ condition between two tests was not changed. This procedure minimized the potential disease progression bias. Moreover, all participants were verified by the reference standard to confirm dysphagia in both studies and this can minimized the partial verification bias. Furthermore, all the participants received the same reference standard regardless of the results of the index swallow screen. Specifically participants proceed to FEES regardless of the Gugging Swallowing Screen (GUSS) scores in the study of Trapl et al. (2007) and this reduced the chance of having differential verification bias. Moreover, the reference standard in both of the studies was independent to the index test, which is the index test that did not form part of the reference test.

Furthermore, the execution of the index test and the reference test was reported with
sufficient detail to allow replication of the test respectively in the study of Lim et al., (2001). However, there is not enough information about the execution of the reference test in the study of Trapl et al., (2007). This may be due to the overestimation of the reference test which is well known by the reader.

The interpretation of the results of the index test should not be influenced by the reference test in both studies, or vice versa, as Trapl et al.’s study (2007) reported that the participants were tested by GUSS and assessed by FEES and the neurologist who performed the FEES was not aware of the GUSS’s score of patients. And in Lim et al.’s study, (2001), it also reported that the FEES were done by the speech therapists who was blind to the result of the water swallow test and the oxygen desaturation test. This reduced the chance of getting review bias.

In the study of Trapl et al., (2007), it described the validation of the GUSS by the FEES. Participants were divided into two groups for assessment. The first group, who were recruited from May to October in 1995, was assessed by two therapists for GUSS independently. And the second group who were recruited from September to December in 2006, was assessed by trained nurses for GUSS and both groups had undergone FEES for validation within twenty-four hours from the onset of the stroke.
The sensitivity of the GUSS in both groups is 100%, which suggests that GUSS is a good screening tool which can detect the patients with dysphagia correctly. The specificity of the GUSS in the first group and the second group are 50% and 69% respectively and it is a satisfactory result, suggesting that non-dysphagic patients may sometimes be regarded as dysphagic patients. This result is acceptable in some ways because of the safety issue for the patients. Therefore, reevaluation is recommended by the authors in order to screen out the false-positive patients. Total fifty participants were recruited in a hospital in Singapore. Clinical history and neurological examination was taken before the start of all tests.

In Lim et al.’s study, (2001), it described that the validation of the 50ml water swallow test and the oxygen desaturation test and its combination test was performed with the use of FEES. Results of the combined test, which was the 50ml water swallow and oxygen desaturation test reached 100% sensitivity and 70.8% specificity, positive predictive value of 78.8%, negative predictive value of 100%, and the results were highly significant ($X^2=27.904$, $p$ value$=0.000001$). This indicates that the combined test can identify difficulty in swallowing that is not visible and also those who silently aspirate without symptoms.
In both studies, all test results were reported and explanations of the withdrawal of the participants were well addressed. In Lim et al.’s study (2001), it reported that fifty-eight patients were eligible for participating in the study but eight patients refused to undergo FEES and therefore did not participate in the study. And in Trapl et al.’s study, (2007), it reported that only one patient refused the FEES.

2.4.2 Medium Level of Evidence

In the five selected studies, two of them (Martino et al., 2009; Edmiaston, Connor, Loehr & Nassidf, 2010) are graded as “2+”, which means that the studies are well conducted cohort studies and with a low risk of bias or confounding. Also, they are in moderate level of evidence and fulfilled some of the criteria in the checklist and the results of the respective study are unlikely to be altered (SIGN, 2008).

Both of the studies are adequately addressed the representative of the spectrum of the patients and the selection criteria of participants.

The reference standard of Martino et al.’s study (2009) is VFSS and it is one of the golden standards for determining the presence of dysphagia of the stroke patients. The time period between the reference test and the index test is short enough (within
twenty-four hours) for ensuring the stroke patients’ condition between two tests was not changed. This minimized the disease progression bias. However, not all participants were verified by the VFSS at the end of the study and it may lead to partial verification bias. And in the study of Edmiaston, Connor, Loehr & Nassidf, (2010), although all participants were validated with the MASA (reference test) that was performed by speech therapists, it is an indirect validated measure for dysphagia, as the MASA is only validated with the MBS with a sensitivity of 93%. And the study did not mention how many speech therapists were involved for performing the MASA. Therefore, low reliability may occur. Moreover, the article did not describe the details of the MASA, whether there was any duplication with the index test and the possibility of replication is unknown.

In both studies, all test results were reported and the reason of drop-out was explained in Martino’s study.

In Martino et al.’s study (2009), it developed the TOR-BBST and validated it with VFSS. The sensitivity of the screen was high (96.3%) and the negative predictive value was 93.3% in acute patients and the specificity was 63.6% which might lead to increase false positives. However, author explained that they prefer to increase the
sensitivity and trade off the specificity because the participants later would be assessed by speech therapists. And in the study of Edmiaston, Connor, Loehr & Nassidif, (2010), the ASDS was developed and was validated by MASA. The sensitivity of the ASDS for dysphagia and aspiration was high (91% and 95% respectively) and the negative predictive value was 98% for detecting aspiration and 95% for detecting dysphagia. Moreover, it had the high interrater reliability with 93.6% of the Cohen kappa and the test-retest reliability was 92.5%. All this indicated that it is a reliable tool to detect both dysphagia and aspiration risk among the participants.

2.4.3 Low Level of Evidence

In the five selected studies, only one study (Massey & Jedlicka, 2002) is graded as “-” which means that the study is a cohort study which have high risk of bias or confounding and is in low level of evidence that fulfilled few or none the criteria in the checklist (SIGN, 2008).

In this study, only selection criteria and the execution of the index test was described. As the author seek consultation from speech therapy, the performance of MBS and any special diet and signs of pulmonary infection was regarded as the reference of
dysphagia, the time between the reference and the index test was up to five days, which is too long as the disease status of the participants may have already changed. As the index test and the reference were in different format, the result might not be applicable for direct comparison. However, the results of the index test and the reference would not influence each other.

Nevertheless, the sensitivity and the specificity of this screen reached 100% which is highest among all the selected studies. However, the sample size of this study is small (twenty-five participants) and they were convenience sample and the recruitment was limited to one centre. Therefore the generalizability of the result is limited.

After assessing the internal validity of the five studies, two of them are regarded as studies with high level of evidence. Two of them are regarded as studies with medium level of evidence and one of them regarded as study with low level of evidence. However, all of them are considered as valid studies and they will be used for the development of the evidence based guideline.
CHAPTER 3
TRANSLATION AND IMPLEMENTATION

3.1 INTRODUCTION

50% of dysphagic stroke patients suffered from aspiration and aspiration pneumonia and early detection of dysphagia by a formal dysphagia screening protocol can prevent pneumonia (Hinchey et al., 2005). In the study of Barnard (2011), she described that nurses play an important role in caring, identifying swallowing difficulties of patients and advocate for necessary services for patients who have dysphagia. Therefore, there is a need to translate the best evidence practice about swallow screen and assessment of detecting dysphagia and aspiration risk into the daily nursing care. As the nursing swallow screen and assessment is a new innovation to the researcher’s current setting, the implementation potential of the innovation including the transferability, feasibility and cost-benefit ratio should be considered before implementation (Polit and Beck, 2008).
3.2 IMPLEMENTATION POTENTIAL

3.2.1. Target Setting

The proposed setting is a neurosurgical and neurological ward in an acute public hospital in the Central Kowloon region of Hong Kong. Patients who admitted to this setting are usually from the Central Kowloon and Eastern Kowloon regions or other private sectors and they usually suffer from cerebral infarction or hemorrhage, which is a kind of stroke. Patients who suffered from brain tumors, epilepsy or other neurological problems will also be admitted or transferred to this setting. The proposed setting always have 100% occupancy rate and around 50% of the patients are suffered from stroke.

3.2.2 Target Audience

The proposed audience is the patients who are eighteen years old or above, admitted to the proposed setting and diagnosed with stroke. The target audience should be alert and conscious, and therefore can follow the simple commands during the proposed innovation. Patients who have pre-existing dysphagia, dementia or with current respiratory compromise will be excluded because it may lead to inaccurate results obtained from the proposed innovation.
3.3 TRANSFERABILITIY OF THE FINDINGS

3.3.1 Similarity of the Target Setting and Target Audience

The swallow screen and the assessment of the five reviewed studies were carried out in the acute stroke unit of the hospital which is similar to our proposed setting (Massey, 2002; Edmiaston et al., 2010; Martino et al., 2008; Lim et al., 2001 and Trapl et al., 2007). One of the studies (Lim et al., 2001) was performed in a hospital in Singapore which is similar to the researcher’s setting in Hong Kong.

The target audiences of the five reviewed studies included both genders and have patients who aged 60-80 (except one study that did not mention the age of the participants), which are also similar to our proposed target audience.

3.3.2 Philosophy of Care

Our innovation is to help to identify dysphagia and aspiration risk in order to prevent aspiration and pneumonia among the stroke patients. It meets the philosophy of care held by both the Hospital Authority and Kowloon Central Cluster of the Hospital Authority, which is to provide safe and better quality services to our clients and support patient-centered care via modernized service delivery that is in line with international best practices. Moreover, assessment tool used by nurses is widely
acceptable in clinical areas around the world, e.g. Glasgow Coma Scale (GCS) and various pain scales. Therefore, the nursing dysphagia swallow screen and assessment should be promoted in Hong Kong in order to help the stroke patients to identify, assess, manage and prevent complications induced by dysphagia.

3.3.3 Clients Benefit from the Innovation

According to the statistics in the proposed setting, there are around fifty stroke patients admitted to the researcher’s ward each month. In addition, it is estimated that around two hundred patients will be benefited from the innovation in four months time.

3.3.4 Time for the Implementation and the Evaluation of the Innovation

The duration of the innovation will be around sixteen months. Four weeks time will be used to identify the problem and two months time will be used for the researcher to perform literature review about the innovation. Another four weeks will be used to identify and communicate with the stakeholders and staffs at the managerial level in order to introduce the new innovation to them and obtain their permission and support for the implementation of the innovation. After managerial support is obtained, the researcher will use two weeks to set up the Steering Committee and invite speech
therapists, doctors, nurse specialists, etc to join to help work out the innovation. And
the Steering Committee will spend two weeks to communicate with the frontline staff
about the implementation of the innovation and will spend another two weeks to
develop the pilot plan. However, the innovation requires the nursing staff to learn new
skills and knowledge; two four-hour teaching sessions within two weeks will be
developed in order to train the nurses on the administration and the interpretation of
the innovation. Materials will be arranged in two weeks. Moreover, a four-week pilot
test will be implemented and another two weeks will be spared for the evaluation of
the pilot test. After the evaluation of the pilot test, the Steering Committee will modify
the innovation if needed in two weeks of time. The formal implementation of the
innovation will be started afterwards. Patients will be recruited and the innovation
will be implemented in a course of twenty weeks. After that, the data will be obtained
and analyzed in four weeks of time. Evaluation will be done in ten weeks to evaluate
the outcome and the effects of the innovation. The timeline of the implementation and
evaluation of the innovation is shown in Appendix F.
3.4 FEASIBILITY OF THE INNOVATION

3.4.1 Introduction

In order to ensure that the innovation can be successfully implemented in the proposed setting, the availability of the resources and the manpower should be assessed and the support and co-operation of the administration and frontline staffs should be obtained before the implementation of the innovation.

3.4.2 Support from the Organization, Administration and the Frontline Staffs

The new innovation can only be implemented upon the approval and permission of the administration and the organization in the proposed setting even it is based on evidence-based research. Nevertheless, the organization climate and the nurses in the administrative level are very supportive to evidence-based practice and new innovation. For instance the clinical guideline for patients with pituitary tumor undergoing transspheniodial hypophysectomy has been implemented by the nurse specialists since 2006. Nurses have the autonomy to develop evidence-based guidelines in the researcher’s ward setting and the guidelines are highly appreciated by the management level and the frontline staffs.
As the training of the nurses about the proposed innovation will be taught by speech therapist, the orientation of the innovation must be introduced to the key stakeholders of the Department of Speech therapy in order to gain their collaboration. Speech therapist will be invited to conduct the training to the nurses.

Moreover, consensus should be made between nursing staffs and the administrators in order to gain their support and co-operation. It is easily achieved in the proposed setting because the nurses always show positive attitude towards evidence-based practice and are always willing to do for the patients’ benefits.

3.4.3 Availability of Staffs

In the proposed setting, there are around twenty registered nurses in the ward who are dedicated and supportive to new innovations that are beneficial to patients. The proposed innovation will be done by them after training and no extra manpower is required to perform the proposed innovation.

3.4.4 Availability of Equipment, Facilities and other Resources

In the proposed setting, there is a meeting room which can be used to train the nurses for the innovation. The meeting room is already equipped with a computer with
powerpoint software installed. A projector can be used for delivering the lectures to
the nurses during the training sessions. For printing of the pamphlets, guideline and
the assessment forms, a printer is already available in the proposed setting and the ink
cartilage and A4 paper are easily purchased. For the instruments and materials used in
the innovation, towels, plastic cups, the spoons, drinking water and biscuits or dry
bread are already available in the proposed setting and the thickener can be easily
purchased from the retailers or the medical suppliers.

3.4.5 Availability of Evaluation Tool

Aspiration pneumonia is defined as the inhalation of gastric contents into the airway
which causes inflammation of the lungs. As mentioned previously, 50% of dysphagic
stroke patients suffered from aspiration and pneumonia (Hinchey et al., 2005).
Therefore, the measure outcome of the innovation will be the incidence of pneumonia.
According to Lim and colleagues (2001), the signs and symptoms of pneumonia are
consolidation on the chest radiograph or having at least three of the following signs:
body temperature higher than 38 degree Celsius, productive cough, tachycardia
(which is heart rate higher than 100/minute), positive sputum culture or any clinical
sign of chest consolidation. In our evaluation, available formal reports of the chest
radiographs will also be included in our evaluation. All of the data we need to
evaluate the incidence of pneumonia is already readily available in patient’s record or the self-design patient assessment form (Appendix G). The predictive value of detecting dysphagia will be calculated and recorded for further use.

Nurse’s compliance with the proposed innovation will be assessed by the nursing members of the steering committee with the use of self-designed assessment form. Their knowledge about the dysphagia, swallowing assessment and pneumonia will also be assessed by the self-designed test (Appendix J).

3.4.6 Skills Requirement of Nurses

As the proposed innovation is new to the nurses, training is required before they implement the innovation. Lectures will be provided to nurses via powerpoint presentation, which will include the anatomy and physiology of swallowing, swallowing assessment of patients, details of the innovation, benefits and risks of the innovation. Also, speech therapist will perform the demonstration to the nurses in the workshops. Return demonstration is required and will be assessed by the speech therapist till the nurse’s performance is graded pass by the speech therapist. Furthermore, pamphlets will also be provided to the nurses in order to reinforce their skills of performing the innovation and can act as a reminder and encouragement for
them to perform the innovation in their daily nursing practice.

3.4.7 Potential Interference of Staffs Functions and Potential Friction during the Implementation of the Innovation

To implement a new innovation requires extra efforts paid by all staffs especially the frontline nurses. As nurses already work in a busy working environment, they may feel that performing the innovation will increase their daily workload. Moreover, training is required beforehand and nurses need to spend extra time to learn new skills and change their usual practice and thereby it brings interference to their daily routine schedule. Furthermore, the doctors may have concerns about the outcome if the swallow screen is done by nurses.

Therefore, orientation of the innovation and the benefits of the innovation must be addressed to both the nurses and the doctors in order to gain their understanding and support. Also, training should be provided to nurses in order to boost up their knowledge and confidence to implement the innovation. Taking their comments and opinions into consideration in the internal meeting during the process evaluation can help to implement the innovation. Official time relief will be offered to the nurses to attend the workshops and the lectures after the approval from Department of
Management (DOM). Staffs are willing to do good to patients as they know that the innovation brings benefits to patients. Also, providing sufficient time for the nurses to adapt to the new innovation will make the innovation easier to implement.

3.4.8 Process Evaluation and Outcome Evaluation

Process evaluation can help to understand the effectiveness of the proposed innovation progress and also help to assess the need for any changes or amendment of the proposed innovation. As the implementation period of the pilot test lasts for four weeks, the process evaluation will be performed afterwards. Process evaluation will include an internal meeting. The internal meeting will be held as an opportunity for nurses to receive feedbacks and express opinions about the proposed innovation. Modification of the innovation may be required to improve the smoothness of the implementation.

Outcome evaluation is used to determine whether the innovation is well-designed or well-implemented and to evaluate the effectiveness of the implementation of the innovation. After the process evaluation, the implementation of the proposed innovation will start and will last for sixteen weeks. After that, the outcome evaluation will begin. Patient’s data will be retrieved from patient’s medical record and the
results obtained from the innovation will be recorded with the use of the self-designed form (Appendix G).
3.5 COST-BENEFIT RATION OF THE INNOVATION

3.5.1 Introduction

Costs, benefits and risks of the innovation should be assessed before implementation in order to evaluate whether the innovation is suitable or worthwhile to implement.

3.5.2 Potential Risks of the Current Practice

As there is no swallow screen done by nurses previously in the proposed setting, patients may need to wait for the assessment from speech therapist to resume oral feeding and drinking. However, patients sometimes need to wait for two days or more to resume eating and drinking as the speech therapists only provide services during office hours in the weekdays. Patients always have to endure the feeling of hunger and thirst and sometimes they feel socially isolated when they have nothing to eat. Occasionally, it will lead to dehydration and malnutrition as well. Moreover, patients will have a higher chance of getting aspirated or pneumonia if the swallow screen is delayed. However, nurses may not know that a swallow screen that can be done by trained nurses is already available in some countries and has been shown to reduce the incidence of aspiration and pneumonia.
3.5.3 Potential Benefits to Patients

The proposed innovation can bring benefits to the patients. As the nursing swallow screen can be performed on the target patients immediately after the patient’s admission to the proposed setting, incidence of aspiration and pneumonia can be reduced. Besides, the length of stay in the hospital can also be shortened as early detection of dysphagia via swallow screen can prevent aspiration pneumonia (Hinchey et al., 2005). Also, patients may have good hydration and nutrition. Oral medications can be provided to patients as early as possible and thereby it may speed up cure. Patients may feel happy and satisfied when there is something to eat and drink and no more feelings of hunger and thirst. Moreover, further dysphagia assessment and interventions may be initiated at an earlier stage if the patient fails the swallow screen.

3.5.4 Potential Benefits to Nurses

As training for nurses is required before performing the swallow screen, it can increase their knowledge about dysphagia screening. With the guideline of the nursing swallow screen, nurses can follow the guideline to perform the dysphagia screening and they will have more confidence in providing food and drinks to the patients. Confidence, autonomy and satisfaction of the nurses will be increased as they are
providing a good quality and standardized care to the patients. Recognition will also be gained and good image can be built as the nurses are performing a new and effective innovation. Also, the early swallow screen can reduce the chance of getting aspirated by patients and thereby reduce the incidence of pneumonia. Workload of nurses will also be reduced as there will be fewer patients having pneumonia who required intense nursing care and thereby morale of nurses will also be improved.

3.5.5 Potential Benefits to the Hospital and the Institution

The proposed innovation does not only bring benefits to the patients and the nurses, it also brings benefits to the hospitals and the institutions. In the study of Martino et al. (2009), he stated that the chance of getting pneumonia is 11 times higher in the patients with dysphagia. As the swallow screen will be done by nurses at the beginning of the patient’s admission, dysphagia can be detected at an earlier stage. Therefore, it reduces the chance for patients to get aspirated and prevents the incidence of pneumonia. If the incidence of pneumonia is reduced, the hospital costs will also be reduced. The potential costs and the benefits include reducing the costs for the daily provision of chest physiotherapy service by physiotherapists daily, chest radiography taking, taking of sputum for culture two times weekly, daily checking of blood specimens for complete blood picture and the use of antibiotics of
approximately one week time. The potential costs and the benefits are stated in Table
1. It is estimated that a total of around $32251 will be saved for each patient in one
week. From the patients’ prospective, length of stay in the hospital and thus the
medical costs will be decreased. The mortality rate will also be reduced and this
brings to better health outcome to patients. From the hospitals’ prospective, utilization
of health care resources and the hospitals’ expenditures will be reduced. Besides, the
hospital can establish a professional and good image to the public when patients have
good health outcomes and fewer complications from the acquired diseases.
3.5.6 Potential Risks of the Proposed Innovation

Although the proposed innovation can help prevent aspiration, improper screening may lead to aspiration. In this connection, return demonstration is required during the training sessions. The techniques must be assessed by the speech therapist until graded pass to make sure the nurses can apply the swallow screen appropriately after the training. Nurses are welcome to voice their enquires when they have difficulties and can stop the innovation if they feel uncertain.

3.5.7 Material Costs of Implementation of the Proposed Innovation

Material costs for the implementation of the innovation include the training costs and the running costs of the innovation. Regarding the training costs of the innovation, a speech therapist will be responsible for teaching twenty nurses in two identical four-hour training sessions. In the training sessions, information of the anatomy and physiology of swallowing will be taught with the use of powerpoint presentation, and the demonstration of the innovation will be done by the speech therapist with the use of apparatus like a glass, towels, water, spoons, thickener and biscuits and dry breads. Pamphlets, the guideline (Appendix H) and the assessment form (Appendix G) of the proposed innovation will be given to the nurses for information and references in the training sessions. The manpower costs is around $10848 and the total material costs
for the training is estimated to be around $500. Total cost for the training will be
around $11348 and the details are listed in Table 2 and Table 3.

For the implementation of the innovation, the proposed innovation will be done by
nurses and probably will spend fifteen minutes out of the nurse’s working time for
each patient. The manpower costs for running the innovation for one week will be
around $360 and the material costs for running the innovation for one week is
estimated to be around $ 200. The details of the manpower and material costs for
running the innovation and are shown in Table 4 and Table 5.

The total costs of implementation the innovation will be $11348 + $ 590 = $11938
and the monthly expenses to maintain the innovation is only $ 590.

3.5.8 Non-Material Costs of Implementation of the Proposed Innovation

For the non-material costs, it includes increased workload and stress of the nurses.
During the implementation of the innovation, nursing time is required for the pilot
study, process evaluation and the outcome evaluation. The nurses may perceive the
innovation as time-consuming. Moreover, some of the nurses may feel that they need
to do more jobs than before and may feel stressful and have a sense of resentment.
Nurse’s morale may be reduced and this may lead to increased turnover of the nurses if it is not handled properly. Therefore, a comprehensive training program and the process evaluation are important. It provides chance for the nurses to give comments and share their opinions and ventilating their feelings about the implementation of the innovation. These would help to allay their anxiety and worries during the implementation of the innovation. The benefits of the innovation should be emphasized in order to let the nurses know that they are working for the well-beings of the patients so as to enhance their job satisfaction.

To conclude, the benefits of the proposed innovation are greater than that of the existing practice. The costs to implement the proposed innovation (HKD $11938) is less than the risks and expenses (HKD $32251) of the current practice. Moreover, the transferability and feasibility of the findings from the reviewed studies are high. Therefore, the implementation potential of the proposed innovation is high and the proposed innovation is achievable in the proposed setting.
CHAPTER 4

DEVELOPING AN EVIDENCE BASE GUIDELINE

4.1 INTRODUCTION

The previous chapter described the transferability, feasibility and the cost-benefit ratio of the nursing swallow screen and the evidence-based guideline is developed and reported in this section.

4.2 TITLE OF THE GUIDELINE

The title of the guideline is “evidence-based bedside swallowing assessment by nurses for patients with stroke”.

4.3 PURPOSE OF THE GUIDELINE

The purpose of the guideline is to provide a written evidence based guideline for nurses to perform a bedside swallow assessment for patients with acute stroke. This guideline helps nurses to identify dysphagia and the risk of aspiration and therefore may reduce the incidence of pneumonia due to aspiration. Moreover, the nursing bedside swallow assessments can also help to reduce patient’s time for waiting the assessment by speech therapist. Patients can resume their oral feeding and drinking
and also their oral medication on time, which in turn promotes early cure and better health outcomes.

4.4 OBJECTIVE OF THE GUIDELINE

The objectives of the guideline are:

1) To detect dysphagia and the risk of aspiration in acute stroke patients and thereby prevent aspiration and pneumonia

2) To provide a practical and systematic approach to perform the dysphagia assessment based on the best available evidence.

3) To reduce the medical cost of treating dysphagia related complications and stroke related aspiration

4.5 TARGET PATIENTS OF THE GUIDELINE

The target patients of the guideline are the acute stroke patients who aged 18 or above, are admitted to an acute hospital and are conscious and alert.

4.6 MAJOR OUTCOME OF THE GUIDELINE

The major outcome of the guideline is the detection of dysphagia and the aspiration risk and the reduction of the incidence of aspiration and pneumonia in stroke patients.
4.7 RATING SCHEME FOR THE STRENGTH OF THE RECOMMENDATIONS

The level of evidence (Appendix D) and the grades of the recommendations (Appendix I) are rated according to the Scottish Intercollegiate Guidelines Network 2008 and 2011 respectively. The recommendations are listed in the following section.

4.8 RECOMMENDATIONS

In total six recommendations are developed from the identified studies. Combining all the recommendations with the reference of the national clinical guideline from the Scottish Intercollegiate Guidelines Network, a flowchart of the clinical guideline is developed.

Recommendation 1.0

The bedside swallow screening should only be conducted with patients who are alert and able. [B]

(2++ Lim et al., 2001, 2++ Trapl et al., 2007, 2+ Martino et al., 2008, 2+ Edmiaston et al., & 2- Massey, 2002).
Rationale: Edmiaston et al. (2010) described that level of consciousness should be assessed before conducting the dysphagia screening. Massey (2002) stated that alertness is an essential condition for detecting dysphagia. Moreover, in Martino et al.’s study (2008), he stated that screening for dysphagia should only conducted with patients who are alert. Patients with reduced alertness should be considered to have dysphagia clinically and hence do not require screening. (Martino et al., 2007).

**Recommendation 2.0**

**Patients should be able to sit upright during the swallow screen.**

(2++ Trapl et al. 2007)

Rationale: Trapl et al. (2007) described that, when performing the screening, patients should be able to sit at least 60 degree upright. This is because neglect and apraxia can bias the swallowing test and it is also important to ensure that patient is able to perceive the tester’s face, the spoon and the textures in front of the screeners.

**Recommendation 3.0:**

**Swallow screen should be used on a daily basis.**

(2++ Trapl et al. 2007)
Rationale: Trapl et al. (2007) recommended that, in order to identify false-positive patients, the patient’s swallowing status should be evaluated daily with the use of swallow screen. Also, Smithard, et al. (1997) indicated that many patients with dysphagia will recover within the first week. Therefore, patients should be screened daily in order to avoid unnecessary restrictions on oral intake.

Recommendation 4.0

**Water swallowing test should be used as a part of the swallow screen.**


Rationale: Martino et al. (2008) illustrated that water swallow is one of the items that cannot be eliminated in the dysphagia screening. Water swallow test have been reported with a high sensitivity for predicting aspiration risk (Perry, 2001) and it is known to be a useful and a sensitive screening test.

Recommendation 5.0

**Patients should be keeping nil of mouth if they fail the swallow screen and should**
be referred for further assessment and management.


Rationale: Massey (2002) advocated that patients should be kept nil of mouth and refer to speech therapy if they cannot pass any parts of the swallow screen. Edmiaston et al. (2010) stated that patients should be referred to speech therapy if there is any abnormal symptom after the water swallow test. In Lim et al.’s study (2012), the authors stated that withholding oral feeding in patients who fail the swallow test is a form of indirect therapy for dysphagia management and the results of the swallow screening test should help in identifying patients who need or will be benefited from further investigation of their swallow.

Recommendation 6.0

Swallow screen should be done by trained staffs.  

(2+ Edmiaston et al. 2010, 2+ Martino et al. 2008)

Rationale: In Edmiaston et al’s study. (2010), all nurses in the stroke service were trained by a licensed speech language pathologist before the administration of the
swallow screen to patients and nurses (dysphagia screeners) who work in the stroke units should complete the didactic training about dysphagia screening (Martino et al., 2008). Otherwise, it will advertently cause patients to aspirate.

Since nowadays we have yet had a unique swallow test in the world, Trapl et al., (2007), from one of the identified studies (2++ evidence), stated that GUSS is the quick and reliable method to identify stroke patients with dysphagia and aspiration risk. Also, GUSS is a validated swallow screen that can be used by nurses and can let stroke patients to resume oral feeding. Moreover, the speech therapists in the researcher’s settings are also using this GUSS for preliminary swallowing assessment of stroke patients. Therefore, GUSS is suitable and applicable to the researcher’s settings. The formulated guideline and the recommendations are shown in appendix H.
CHAPTER 5
IMPLEMENTATION PLAN

5.1 INTRODUCTION

In the study of Hinchey et al. (2005), she described that early detection of dysphagia with the use of a formal dysphagia screening protocol can prevent pneumonia. Nurses not only have an important role in caring and identifying swallowing difficulties of patients, they also has play a crucial role in advocating necessary services for patients who are diagnosed with dysphagia (Barnard, 2011). Therefore, implementation of the dysphagia swallow screening and assessment is crucial in the clinical setting. In the previous section, transferability, feasibility and the cost-benefit ratio of the swallow screening and assessment are discussed. In this section, the communication plan, the plan of pilot testing and the evaluation plan are illustrated in details.

5.2 COMMUNICATION PLAN

A communication plan is a plan that used for communicating with the stakeholders. Its purposes are to keep everyone who are involved in the proposed innovation well informed and also to gain support from them for a successful implementation of the innovation.
5.2.1 Identification of Stakeholders

The first step of the communication plan is to identify the stakeholders of the implementation of the proposed innovation. Stakeholders are those who at any levels will influence or be influenced directly or indirectly by the implementation of the innovation. In the proposed innovation, the stakeholders include the Department Operating Manager (DOM), Ward Manager (WM), one Nurse Specialist (NS), One Nursing Officer (NO) or two Advanced Practice Nurses (APNs), sixteen Registered Nurses (RNs), Chief of Service (COS), four Doctors of the neurosurgical department and the Speech Therapist (ST) and the Head of the Department of Speech Therapy.

5.2.2 Communication Plan with Administrators

In order to obtain support and approval from the administrators for the proposed innovation, the NS will be first consulted because she is experienced in implementing the guidelines and also has frequent communication with the managerial levels. Details of the implementation of the proposed innovation will be discussed with her and refinement of the innovation will be made afterward if necessary. The NS will be invited to communicate with the DOM about the implementation of the proposed innovation and she will help to arrange meeting with DOM and the proposer of the
DOM is the head of the department who manage all the nursing and supporting staffs in the department, she therefore can provide expert opinions of the administration and the implementation of the innovation in the designated department. Moreover, she can also provide sufficient resources and support during the entire process of the implementation.

In the meeting with DOM arranged by the NS, a brief presentation will be given to her to introduce the aims, content, benefits, risks and the costs of the innovation with supporting evidence. Formation of a steering committee and the job description of the committee will be illustrated and questions raised out by DOM will be answered based on the evidences identified from the research. If needed, the implementation of the innovation will be refined and amended accordingly. The time compensation for the training of the frontline staff about the proposed innovation will be asked from the DOM. DOM will be invited to communicate with COS and the Head of ST about the innovation and help to arrange meetings with them.

As the proposed innovation is a swallowing screen and the assessment will be
performed by nurses, head of ST and COS will therefore be invited to participate in
the meeting for providing professional opinions to safeguard the patients. This also
helps to gain cooperation between multi-disciplinary teams and to improve the
smoothness of the implementation of the innovation. In order to gain support and
authorization of the implementation of the innovation, a meeting with NS, DOM,
head of ST and the COS will be arranged. The powerpoint presentation will be used
for illustrating the aims, objectives and content of the proposed innovation. The needs
for the change in the current practice, the benefits for the patients, health care
professionals and the service as well as the risks will be discussed. Resources,
facilities and the costs of the innovation will also be discussed and the implementation
potential, feasibility and the cost-benefit ratio of the proposed innovation will be
described. Moreover, an introduction of the Steering Committee and their job
description will be explained. Questions that arise from the administrators will be
answered based on the identified literatures. If necessary, refinement of the proposed
innovation will be made after the expressions of alternative views from the
administrators. This is to increase the feasibility of the innovation. Administrators will
be communicated and updated for any amendment of the proposed innovation
throughout the process of the implementation. And the head of ST and the COS will
be invited to disseminate the details of the innovation to their subordinates via emails.
5.2.3 Communicate with Speech Therapist and Doctors

As the proposed innovation is a swallowing screen and assessment performed by nurses to the patients, the head of ST should therefore disseminate the message to the appointed ST. The ST will be invited to provide training to the frontline nurses. Details of the proposed innovation will be explained to her via emails. The function of the Steering Committee will be introduced and she will be invited to become a member of the committee. Details of the training sessions will be discussed and the training time will be arranged with ST.

Moreover, the COS will disseminate the message to the ward doctors about the proposed innovation. Details of the proposed innovation will be explained to them via emails. One of the ward doctors will be invited to join the Steering Committee after the illustration of the function of the Steering Committee.

5.2.4 Setting up a Steering Committee

After obtaining the approval from the administrators, a Steering Committee will be formed. The proposer will act as the coordinator to help facilitating the internal meeting of the Steering Committee. The Steering Committee will include two
experienced nurses, one NS, one doctor, one ST and the proposer. Two experienced nurses who had completed the certificate course of neurological nursing held by Institute of advanced nursing studies (IANS) will be recruited and they can help answering questions raised by the frontline staffs, despite irregular working shifts and act as a channel to communicate between frontline staffs and the committee. They can also provide opinions and suggestions to the frontline staffs during the implementation. One NS will be invited to join the committee because she has the authority in management and leadership attributes to facilitate the entire process of the implementation. She can also provide guidance and share experiences to the nurses, frontline staff as well as and the committee. One doctor will be invited to join and he can help in monitoring any complications of the patients and provide treatment accordingly. One ST, who will be appointed by the head of speech therapy, will be invited to join the committee to provide professional opinions about the innovation and the training. WM will be invited to be the advisory committee in order to help in facilitating the pilot testing and implementing the innovation in the clinical setting. The steering committee will meet every week and the meeting will be coordinated by the proposer and all of the members within the Steering Committee will be informed via phone and emails by the proposer. The Steering Committee is responsible for planning the details and the timeline (Appendix F) of the proposed innovation,
discussing issues raised up by the frontline staffs, and brainstorming the solutions.

They are also responsible for monitoring the safety, progress, efficacy and compliance of the proposed innovation and to evaluate the results of it and make necessary refinement accordingly. Two experienced nurses, the NS and the proposer of the innovation will communicate and disseminate messages to the frontline staffs, offering help and answering questions raised by the frontline staffs and they will also perform audits to check for the compliance of the staffs about the proposed innovation. The results of the audits will be informed to the administrators via emails. Also, they will hold a meeting with the frontline staffs after the pilot testing to discuss issues and difficulties throughout the implementation.

5.2.5 Communicate with Nurses

After obtaining the approval from the administrators and the establishment of the steering committee, information about the implementation of the proposed innovation and the members of the Steering Committee will be announced to the frontline staffs during the handover time and informed them via emails. Frontline staffs will be told that they will be arranged for attending the training sessions about the proposed innovation with time compensation granted from DOM. Frontline staffs will be encouraged to give their opinions and feedbacks and ask questions to the nurse
members or the ST anytime or during the meetings after pilot testing. Also, the frontline staffs will be informed about the information file that includes the guideline and the written training materials of the proposed innovation. The information file will be kept in the cupboard of the nursing station. They can also find the information on the intranet. The adherence to the innovation will be emphasized and auditing will be performed to assess their compliance about performing the innovation. They will be told about this arrangement. Posters will be posted in the ward in order to remind frontline staffs to perform the innovation and to document the results in the patient’s record. Emails will be sent out by the proposer to remind frontline staffs to perform the innovation.

5.2.6 Communicate with Patients

As the proposed innovation is applied on patients, patients must understand the aims, the uses, benefits and the risks of the proposed innovation. Verbal consent should be obtained from the patients before their participation in the innovation.

5.2.7 Initiating the Change

As the proposed innovation is not included in the standard nursing training, frontline staffs may feel unsecured and uncertain about the implementation of the innovation.
Two identical four-hour teaching sessions will be held for two weeks time prior to the pilot testing. The training sessions will be provided by the ST. The training sessions for the frontline staff will include lectures using powerpoint slides, interactive workshops, and the pre- and post-training test for evaluating their skills and knowledge of the swallowing and the proposed innovation. In the lectures, the anatomy and physiology of swallowing, details of the innovation including objectives, benefits and risk of the innovations, inclusion and exclusion criteria of the participants, signs and symptoms of choking, aspiration and pneumonia, will be taught by the ST. The teaching materials from the lectures will be delivered to the frontline staffs in hard copies. They can also download it from the intranet. In the interactive workshops, demonstration and re-demonstration of the innovation and the post-training practical assessment will be performed by the ST. The lectures and the demonstration of the training session will be recorded digitally in order to let frontline staffs to obtain it via intranet. Pre and post training written test (Appendix J) will be offered to the staffs in order to evaluate their knowledge after the training session. After the two training sessions, sixteen frontline staffs will be trained.

5.2.8 Sustaining the Change

For the sustainability of the changes in practice, the nursing members of the Steering
Committee will stress the adherence of performing the innovation during handover time in daily basis, in order to arouse the attention of the frontline staffs and to monitor the efficacy and compliance. Audits will be performed by them and the results of the audit and suggestions for improvement will be posted in the nursing station and will be sent to the administrators and the frontline staffs via emails. Thank you card will be sent to frontline staffs individually via emails to express appreciation for their participations and efforts. New staffs will be guided by the nursing members of the steering committee. Training materials, including guideline and the video clips will be provided to them in order to guide the implementation of the innovation.
CHAPTER 6
PILOT TESTING PLAN

6.1 INTRODUCTION
A pilot study is a small scale study that is conducted before a full scale study. The purposes of a pilot study include examining the feasibility of the study, identifying barriers tackled, and checking for potential revisions for the study.

6.2 OBJECTIVE OF THE PILOT TESTING
The objectives of the pilot testing of this innovation include:

1. To examine the transferability and the feasibility of the innovation;

2. To examine the method for recruiting participants and the workflow of the implementation of the innovation;

3. To examine the level of acceptance from the staff towards the change in practice;

4. To identify unexpected difficulties and logistic problems occurred during the implementation of the innovation;

5. To evaluate the effectiveness of the innovation and to identify potential amendment.
6.3 RECRUITMENT OF THE SAMPLES

The pilot study utilizes a quasi-experimental study design. It has two phases (i.e. pre-test and post-test) and it has no control group. Convenience sampling will be used for the sampling method. The pilot study will be performed in a neurological and neurosurgical ward in a public hospital. From the previous admission record in the ward, around fifty patients are admitted in the designated ward in each month. Therefore, the period for recruiting participants will last around one month and the total sample size of the pilot study is expected to be fifty.

The inclusion and exclusion criteria of the participants of the pilot study are the identical with the actual recruitment of the proposed innovation. All recruited participants are aged above eighteen years old and are admitted to the proposed settings within twenty-four hours. They should have diagnosed with stroke and can follow simple commands. Patients who have pre-existing dysphagia, dementia or with current respiratory compromise will be excluded in the study.

Trained nurses will be responsible for the implementation. They will assess patient’s condition and review their medical records before the recruitment. This is to ensure the appropriateness of the candidates in participating in the pilot test. Benefits and
risks of the innovation and rights to withdrawal will be explained to the participants and their caregivers. Verbal consent will be obtained from them before the implementation of the innovation.

6.4 WORKFLOW OF THE PILOT TESTING

Prior to the start of the pilot test, the frontline nurses will undergo training by the ST and get pass for the practical assessment and the written test. All the equipments, written notes and assessment forms will be prepared by the proposer. Posters will be posted in ward and nurses from the steering committee will remind staff to perform the innovation everyday during the hand over time. The innovation performed in the pilot test will be identical with the actual implementation but the duration of the pilot study will be shorter, which is around one month only. Patients will be recruited by the trained nurses if they meet the inclusion criteria. Verbal consent will be obtained from them and their caregivers. Also, the trained nurses will record their consent in the patient’s record. The innovation will be performed to the participants according to the guideline and as early as possible (e.g. when the patient is admitted to designated ward.) The results obtained from the innovation will be recorded in the assessment form and also the patient’s record. The workflow is shown in the appendix K.
6.5 PROCESS EVALUATION

After the implementation of the pilot test, process evaluation will be performed. Nurses in the Steering Committee will arrange meeting with the frontline nurses after the start of the pilot test in order to provide chances for them to express their feelings and share the difficulties during the implementation of the pilot test. Nurses will also be encouraged to express themselves to the nurse members of the Steering Committee via emails and provide feedbacks about the logistic flow of the innovation during and after the pilot test. Also, audit will be performed by the nursing members of the Steering Committee in order to check the compliance of the nurses towards performing the innovation. Results of the audits will be discussed in the meeting. It will also be posted in the station and will be sent to each nurse and the members of Steering Committee via emails. The steering committee will meet in each week to discuss the problems they are raised by the nurses and they will seek for solutions to solve the problems out and to evaluate the results of the process evaluation for the pilot test. Potential refinement will be made accordingly. Results of the process evaluation and the potential amendments of the innovation will be reported to the administrators.
CHAPTER 7
EVALUATION PLAN

7.1 INTRODUCTION

The evaluation plan is used for assessing whether the innovation is effective. There are three types of outcomes that will be identified after the implementation of innovation. There are the patient outcome, the healthcare provider outcome and the system outcome. Details of the implementation and the evaluation plan are described as follow.

7.2 OUTCOME MEASURES

7.2.1 Patient Outcomes

Patient’s benefits will be regarded as patient outcomes. Patient outcomes are differentiated into primary outcome and secondary outcome. The primary outcome is the positive predictive value of detecting dysphagia. The secondary outcome is the time lag difference between the swallow screening and the usual practice and the incidence rate of aspiration and pneumonia.

The results of the swallow screening will be recorded immediately after the screening.
The positive predictive value will be measured at the end of the implementation period. The time of performing the swallow assessment will be recorded in the assessment form. And the occurrence of aspiration and pneumonia will be checked by using the patient’s medical record at the end of the implementation.

7.2.2 Healthcare Provider Outcomes

Healthcare provider outcomes include the level of knowledge about the innovation and the compliance rate of the innovation.

1) Knowledge about dysphagia, swallowing assessment and the pneumonia

Knowledge about dysphagia, swallowing assessment and the pneumonia will be assessed at the beginning and after the training sessions that are taught by the ST. A self-designed test will be used for the assessment. The self-designed test is designed by the steering committee. It includes five questions. Each question scores 20 points. The higher the scores, the better the knowledge the nurse has acquired. Before using this test, one medical officer who works in the neurosurgical department and one speech therapist will be invited to assess the content validity of the test.

2) Staff’s compliance on performing the innovation
Staff’s compliance on performing the innovation will be assessed after the pilot study and after the actual implementation. The assessment criteria of the audit will be introduced in the training sessions and the compliance will be checked by the nursing members of the Steering Committee.

7.2.3 System Outcome

The material costs (e.g. the thickener and training materials), and non-material costs (e.g. manpower cost) will be calculated. The cost for running the proposed innovation will be calculated at the end of the implementation and will be used for making a comparison with the costs of running the usual practice.

7.3 PARTICIPANTS

The nature of the participants will be same as the pilot study. The demographic data such as age, gender, diagnosis will be collected at the beginning of the innovation. The number of participants is calculated based on the primary outcome of the innovation. The primary outcome of the study is the positive predictive value of detecting dysphagia. In order to achieve a 5 % level of significance and a power of 80%, CI for one proportion test were used for the calculation of sample size. With the use of the software of Java applets for power and sample size calculation, the
calculated sample size is 241. As the monthly admission rate is around fifty in the targeted ward, the recruitment time therefore will require twenty weeks. As we need to assess the occurrence of aspiration and pneumonia, evaluation will be done within patient’s hospitalization (i.e. usually around 2 – 10 weeks.) Therefore, the evaluation will be done at thirty weeks.

7.4 PROCEDURE

In the proposed innovation, training sessions are provided to the frontline nurses. Written questions are given to them at the beginning and after the training. This is to investigate their knowledge level after the training. Demographic data of the participants will be collected at the beginning of the innovation. Assessment will be done by trained nurses and the results and the starting time of the innovation will be recorded on the assessment form and also the patient’s record. Compliance of the trained nurses will be measured at the end of the pilot test as well as the actual study. Incidence of pneumonia will be measured in the evaluation period and within patient’s hospitalization and the measurement of the costs will be collected and calculated in the evaluation period.
7.5 DATA ANALYSIS

The statistical analyses will be conducted with the Statistical Package for the Social Science (SPSS) for Windows. Descriptive statistic tables will be used for reporting the demographic data of the participants. CI for one proportion will be used for estimating the positive predictive value. To compare the mean waiting time with the usual practice, t test will be used. Paired t test will be used for the comparison of the occurrence of pneumonia with the usual practice. Descriptive statistics is used to show the mean score of the test and the paired t test will be used to compare the difference of the knowledge score before and after the training. Compliance rate of the frontline nurses in performing the innovation will be calculated by the researcher.

7.6 ON WHAT BASIS WILL THE GUIDELINE OR PROTOCOL BE CONSIDERATE AS EFFECTIVE?

The effectiveness of the proposed innovation is determined by whether the proposed innovation can successfully achieve the set objectives.

7.6.1 Patient Outcomes

The predictive value of dysphagia and aspiration detection will increase to 95% or above.
The innovation will be regarded as effective when the detection time for the dysphagia or aspiration risk is shorter (i.e. four hours) than the usual practice.

The innovation will be regarded as effective if the incidence of aspiration and pneumonia are significantly reduced (i.e. $p \leq 0.05$) when comparing to the usual practice.

7.6.2 Healthcare Provider Outcomes

Based on the self-designed test, trained nurses will achieve 80% or more in the score of the post training written test comparing to the results before the training.

The innovation will be regarded as successful if the compliance rate achieves 90% or higher.

7.6.3 System Outcome

The innovation will be regarded as successful if the cost of running the innovation is 30% lower than the cost of the current practice.
CHAPTER 8
CONCLUSION

8.1 CONCLUSION

Dysphagia is a common morbidity related to stroke. Approximately, 50% of stroke patients with dysphagia are suffered with aspiration and aspiration pneumonia which may lead to increased length of stay in hospitals, mortality rate and medical costs. An early nursing dysphagic screening and assessment protocol can help in early detect of dysphagia and therefore help to reduce incidence of aspiration and pneumonia. Therefore, a systematic review was done for this purpose in order to develop a guideline of nursing bedside swallow screening and assessment for the acute stroke patients.

In this thesis, five identified studies were reviewed. Quality and validity assessment of each study were assessed. Key components about the bedside swallowing assessment were summarized. Implementation potential in terms of transferability, feasibility and the cost benefit ratio of the proposed innovation were analyzed and discussed in order to ensure the guideline is workable in Hong Kong. The implementation plan, communication plan, the pilot testing plan and the evaluation plan were also included.
in this thesis. It is expected that the proposed bedside nursing swallow screening and assessment can reduce the incidence of aspiration and pneumonia.

Early assessment of dysphagia and aspiration risk in acute stroke patients can help to prevent patients from aspirated and acquire pneumonia. Identifying swallowing difficulties in stroke patients is an important task in nursing care (Westergren et.al., 1999) and in the study of Werner, (2006), she described that nurses have a key role to play in identifying, assessing, managing and preventing complications related to dysphagia. However, the researchers in this study found some limitations.

Firstly, in Sweden and other foreign countries, the nursing bedside swallow screening and assessment has already been well established and in the U.S, and they already have dysphagic clinical nurse specialist working in the clinical area. Nevertheless, the swallow screening and assessment performed by nurses is still not established in Hong Kong. Secondly, there are not many journal papers documenting the swallow screen, which makes the formulation of the guideline difficult. Therefore, it is recommended to perform more research on this area in Hong Kong in order to promote the importance of nursing swallow screening and assessment.
8.2 REFERENCES


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Trapl, M., Enderle, P., Nowotny, M., Teuschl, Y., Matz, K., Dachenhausen, A., &
Brainin, M. (2007). Dysphagia bedside screening for acute-stroke patients: the
Gugging Swallowing Screen. Stroke, 38; 2948-2952.


### 8.3 ILLUSTRATIONS

Table 1: The potential benefits for one patient in a week

<table>
<thead>
<tr>
<th>Medical Expenditures</th>
<th>Estimated Cost for One Time</th>
<th>Estimated Cost for One Week</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chest Radiography (daily)</td>
<td>Around $300</td>
<td>$2100</td>
</tr>
<tr>
<td>Intravenous Antibiotics</td>
<td>Can be range from $ 40-1400</td>
<td>$ 4900</td>
</tr>
<tr>
<td>(Around 1 week)</td>
<td>Approximately Mean</td>
<td>Cost:$720</td>
</tr>
<tr>
<td>Service of Chest Physiotherapy provided by</td>
<td>Mean Monthly Salary: $27697</td>
<td>$201</td>
</tr>
<tr>
<td>Physiotherapist (15 minutes)</td>
<td>Hourly Salary : $ 114</td>
<td></td>
</tr>
<tr>
<td>Sputum Culture (2 times/week)</td>
<td>$450</td>
<td>$ 900</td>
</tr>
<tr>
<td>Blood Specimen for White Blood Cell count (daily)</td>
<td>$150</td>
<td>$ 1050</td>
</tr>
<tr>
<td>Length of Stay in Hospital (one week)</td>
<td>$ 3300</td>
<td>$ 23100</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>$ 32251</td>
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Table 2: The Manpower Costs for Training

<table>
<thead>
<tr>
<th>Personnel</th>
<th>Mean Monthly Salary Each Person</th>
<th>Mean Hourly Salary</th>
<th>Training Time</th>
<th>Costs</th>
</tr>
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<tbody>
<tr>
<td>Speech Therapist X 1</td>
<td>$37515</td>
<td>$156</td>
<td>8 hours for total 2 sessions</td>
<td>$1248</td>
</tr>
<tr>
<td>Registered Nurse X 20</td>
<td>$29012</td>
<td>$120</td>
<td>4 hours</td>
<td>$9600</td>
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Total: $10848
<table>
<thead>
<tr>
<th>Item</th>
<th>Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equipment used in demonstrations: (e.g. towels, water, spoons, cups,</td>
<td>No extra costs (already available in the</td>
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<tr>
<td>dry bread)</td>
<td>proposed setting)</td>
</tr>
<tr>
<td>Equipment used in the lecture: (e.g. a room, computer, projectors</td>
<td>No extra costs (already available in the</td>
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<tr>
<td>and printers)</td>
<td>proposed setting)</td>
</tr>
<tr>
<td>Equipment used in lecture: (e.g. A4 paper, ink cartilages for</td>
<td>Approximately $200</td>
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<tr>
<td>printing)</td>
<td></td>
</tr>
<tr>
<td>Equipment used in demonstration (e.g. thickener)</td>
<td>Approximately $300</td>
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<tr>
<td>Total</td>
<td>$500</td>
</tr>
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</table>
Table 4: The Manpower Cost for running the innovation for a week

<table>
<thead>
<tr>
<th>Personnel</th>
<th>Mean Monthly Salary Each Person</th>
<th>Mean Hourly Salary</th>
<th>Costs for One Time</th>
<th>Cost for One Week (around 12 patients)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Registered Nurses X</td>
<td>$29012</td>
<td>$120</td>
<td>$30</td>
<td>$360</td>
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</table>

20 (for 15 minutes for each patient)

Total $360
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<tr>
<th>Item</th>
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</tr>
</thead>
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<td>Equipment used in demonstrations: (e.g. towels, water, spoons, cups, dry bread)</td>
<td>No extra costs (already available in the proposed setting)</td>
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<tr>
<td>Equipment used in lecture: (e.g. A4 paper, ink cartilages for printing)</td>
<td>Around $30</td>
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<tr>
<td>Equipment used in the innovation(e.g. thickener)</td>
<td>Around $200</td>
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<td>Total</td>
<td>$230</td>
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## Appendix A (1): Search Strategy Records (Ovid Medline)

Database: Ovid Medline (Year 1946- July Week 1 2012)

Retrieved on: 14/7/2012

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<tr>
<td>2</td>
<td>CVA.mp</td>
<td>1561</td>
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<tr>
<td>3</td>
<td>cerebrovascular accident.mp</td>
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</tr>
<tr>
<td>4</td>
<td>cerebrovascular disorder.mp or cerebrovascular disorder</td>
<td>42264</td>
</tr>
<tr>
<td>5</td>
<td>cerebral infarction.mp or cerebral infarction</td>
<td>22050</td>
</tr>
<tr>
<td>6</td>
<td>cerebral hemorrhage.mp or cerebral hemorrhage</td>
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<td>7</td>
<td>intracerebral hemorrhage.mp</td>
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<td>11</td>
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## Appendix A (2): Search Strategy Records (CINAHL Plus)

Database: CINAHL Plus(Year 1971-2012)

Retrieved on: 14/7/2012

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<tr>
<td>S2</td>
<td>dysphagia</td>
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<td>S3</td>
<td>screen or screening or assessment</td>
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<td>S4</td>
<td>S1+S2+S3</td>
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Appendix A (3): Search Strategy Records (Pubmed)

Database: Pubmed (Any date)

Retrieved on: 14/7/2012

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<td>#7</td>
<td>intracerebral hemorrhage</td>
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<td>#8</td>
<td>cerebrovascular disease</td>
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<td>dysphagia</td>
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Appendix A (4): Search Strategy Records (China Journal Net)

Database: China Journal Net (中國期刊網) (Year 1912-2012)

Retrieved on: 14/7/2012

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<td>China Proceedings of Conference Full-Text Database (中國重要會議論文全文數據庫)</td>
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<td></td>
<td>Century Journals Social Sciences (世紀期刊人文社科精品數據庫)</td>
<td>1911-1979</td>
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</tbody>
</table>
### Appendix B: Summary of Search Strategy Record

Summary of search strategy and its result

<table>
<thead>
<tr>
<th>Search Item</th>
<th>Ovid MEDLINE</th>
<th>CINHAL Plus</th>
<th>Pubmed</th>
<th>China Journal Full-text database</th>
</tr>
</thead>
<tbody>
<tr>
<td>Search Date</td>
<td>14/7/2012</td>
<td>14/7/2012</td>
<td>14/7/2012</td>
<td>14/7/2012</td>
</tr>
<tr>
<td>1. Stroke/CVA/cerebrovascular accident/cerebrovascular disorder/cerebral infarction/cerebral hemorrhage/intracerebral hemorrhage/cerebrovascular disease</td>
<td>212408</td>
<td>49950</td>
<td>353667</td>
<td>N/A</td>
</tr>
<tr>
<td>2. Dysphagia</td>
<td>21400</td>
<td>2831</td>
<td>45863</td>
<td>N/A</td>
</tr>
<tr>
<td>3. Screen/screening/assessment</td>
<td>1032770</td>
<td>311330</td>
<td>5036774</td>
<td>N/A</td>
</tr>
<tr>
<td>1+2+3</td>
<td>283</td>
<td>205</td>
<td>877</td>
<td>N/A</td>
</tr>
<tr>
<td>4. 脳卒中/中風</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>5. 吞咽困難/吞咽障礙</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>6. 測試/評估</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>4+5+6</td>
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<td>N/A</td>
<td>48</td>
</tr>
<tr>
<td>Topic screened and abstract read</td>
<td>283</td>
<td>205</td>
<td>877</td>
<td>48</td>
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<tr>
<td>Time of journals</td>
<td>1946-2012</td>
<td>1971-2012</td>
<td>All years</td>
<td>1912-2012</td>
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<tr>
<td>Number of selected articles</td>
<td>4 (all duplicate with Pubmed)</td>
<td>1 (4 is duplicate)</td>
<td>4 (all duplicate with Ovid MEDLINE)</td>
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<tr>
<td>Final selected articles</td>
<td>5</td>
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</table>
### Appendix C: Table of Evidence

<table>
<thead>
<tr>
<th>Bibliographic Citation</th>
<th>Study Type</th>
<th>Evidence level</th>
<th>Purpose</th>
<th>Number of Patients</th>
<th>Patient Characteristics</th>
<th>Details of the screen:</th>
<th>Outcome Measures</th>
<th>Gold Standard</th>
<th>Results:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Massey and Jedlicka (2007)</td>
<td>Prospective, one group, non-experimental design</td>
<td>2 -</td>
<td>To establish reliability and validity of the Massey bedside swallowing screen</td>
<td>N = 25</td>
<td>- Stroke patients admitted to the hospital in 48 hours. - awake and able to follow 1-step commands - Age: Mean: 75 years old - Male=16 - LOS: Mean: 4 days</td>
<td>alertness, presence of dysarthria, aphasia, facial symmetry, tongue midline, uvula midline, gag reflex, voluntary cough, swallow reflex; - ability to clench teeth, close lips, swallow secretions - tolerance of teaspoon and tablespoon of water and a glass of water</td>
<td>-Presence of dysphagia showed on medical records (any consultati on with ST, special diet offered, clinical symptoms of aspiration pneumoni a or performance of MBS/VFSS if any)</td>
<td>VFSS/ MBS</td>
<td>-Content validity: (by 6 experts) with good agreement - Interrater reliability: (by 2 research assistants) high (&gt;90%) - Sensitivity: 100% - Specificity: 100%</td>
</tr>
</tbody>
</table>
| Trapl, Enderle, Nowotny, Teuschl, Matz, Dachenhausen & Brainin (2007) | Prospective two groups cohort study | 2 ++ | To evaluate a new quick screening tool for detecting aspiration risk in acute stroke patient | N= 50 | - first-ever stroke patients  
-First group: mean age: 74.6+/−2.4 (SE)  
-Second group: mean age: 76.8+/−1.85 (SE)  
-First group: (for interrater reliability: N=20, Male=9)  
-Second group: (for external validation: N=30, Male=16) | -Indirect swallowing test: (saliva swallow) and assess vigilance, voluntary cough, throat clearing  
-Direct swallowing test: (semisolid->liquid->solid: assess deglutition, cough, drooling and voice changes) | GUSS scores  
PAS (results of FEES) | FEES | -Interrater reliability: excellent agreement between raters (k=0.835, p<0.001, proportion of overall agreement: 0.90)  
-Content validity: (median scores for semisolid: 3; and 6 for liquid in first group) and (median scores for semisolid: 2 and 3.5 for liquid in second group) indicated significantly high risk with liquid compared with semisolid texture in both groups  
In first group,  
-Sensitivity: 100%  
-Specificity: 50%
| Martino, Silver, Teasell, Bayley, Nicholson, Streiner & Diamant. (2008) | Prospective diagnostic study design | 2+ | To develop and validate the TOR-BBST and identify stroke patients with dysphagia regardless of severity and settings | N=311 | Stroke patients with a NIHSS score $\geq$4 | -voice before swallow | Results of VFSS | VFSS by 4 separate blinded SLT with the use of 3 standardized scales to establish validity. |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | In all settings: Mean age: 68.6 +/- 14.3 (SD); Male: 58.2%; History of stroke: 19.9% | -tongue movement | Results of TOR-BBST | Interrater reliability: by trained nurse screeners was high (ICC 0.92) (95%CI, 0.85-0.96) | In all settings: Sensitivity: 91.3% (71.9-98.7), Specificity: 66.7%, (49.0-81.4) +LR: 2.7(1.7-4.4), -LR: 0.1(0-0.5) |
| | | | | | In acute settings: | -water swallow | | | In second group, | -Sensitivity: 100%  
-Specificity: 69%  
-PPV: 74%  
-NPV: 100%; k value=0.672(p<0.001) |
<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Study Type</th>
<th>Design</th>
<th>N=50</th>
<th>Acute stroke patients</th>
<th>FEES Water swallowing test: Sensitivity: 84.6%, specificity: 75%, PPV: 78.6%, NPV: 81.8% (X2=18.001, p=0.00002), moderate agreement of</th>
</tr>
</thead>
</table>
| Lim, Lieu, Phua, Seshadri, Venketasubramanian, Lee & Choo. (2001) | Prospective observational study | 2 ++   | To determine the accuracy of bedside clinical methods compared with the FEES for detecting | - 50 ml water swallow test  
- oxygen saturation water test  
-50ml water swallow test + oxygen saturation test (bedside aspiration combine  
-Oxygen desaturati on test (desaturati on >2%)  
-Signs of aspiration (cough, choke, voice  
FEES Water swallowing test: Sensitivity: 84.6%, specificity: 75%, PPV: 78.6%, NPV: 81.8%(X2=18.001, p=0.00002), moderate agreement of |

N=103;  
Mean age: 67.7 +/- 13.9 (SD); Male: 56.3%;  
History of stroke: 16.5%  

In rehabilitation settings:  
N=208;  
Mean age: 69 +/- 14.5 (SD); Male: 59.1%;  
History of stroke: 21.6%  

In acute settings:  
Sensitivity: 96.3%(72.5-99.6), Specificity: 63.6%(35.4-84.8), +LR: 2.6(1.2-5.8), -LR: 0.1(0-0.9), PPV: 76.5%, NPV: 93.3%  

In rehabilitation settings:  
Sensitivity: 80% (49-94.3), specificity: 68% (48.4-82.8), +LR: 2.5(1.3-4.8), -LR: 0.3(0.1-1), PPV: 50%. NPV: 89.5%
<table>
<thead>
<tr>
<th>Study</th>
<th>Design</th>
<th>N</th>
<th>Patients</th>
<th>Tests</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aspiration in acute stroke patients</td>
<td>Prospective study</td>
<td>300</td>
<td>Patients admitted to stroke service of the Barnes</td>
<td>FEES</td>
<td>Sensitivity: 76.9%, specificity: 83.3%, PPV: 83.3%, NPV: 76.9% (X2: 18.154, p=0.00002), good agreement with FEES</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Oxygen desaturation:</td>
<td>Sensitivity: 100%, specificity: 70.8%, PPV: 78.8%, NPV: 100% (X2=27.904, p=0.000001), highest agreement with FEES</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Bedside aspiration: Combined test:</td>
<td></td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Interrater reliability for ASDS: Cohen kappa: 93.6% (high)</td>
<td></td>
</tr>
</tbody>
</table>

Mean length of in-hospital follow up: 12.7 +/- 11.5 (SD) days

Test:

- Results of FEES
- Sign(s) of aspiration pneumonia (from record)
<table>
<thead>
<tr>
<th>Screening too to be used by health care professionals who are not SLT in order to identify dysphagia and aspiration risk in acute stroke patients</th>
<th>Jewish hospital</th>
<th>checking facial, lingual and palatal symmetry)</th>
<th>3 ounce water swallow</th>
<th>had been validated against the MBS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test-retest reliability: 92.5% For dysphagia: -Sensitivity: 91% (95%CI, 82%-95%) -Specificity: 74% (95%CI, 64%-80%) -PPV: 54% -NPV: 95% For aspiration: -Sensitivity: 95% (95%CI, 85%-95%) -Specificity: 68% (95%CI, 62%-74%) -PPV: 44% -NPV: 98%</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>
## Appendix D: Level of evidence

<table>
<thead>
<tr>
<th>Level of Evidence by Scottish Intercollegiate Guidelines Network (2008)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1++</td>
</tr>
<tr>
<td>1+</td>
</tr>
<tr>
<td>1-</td>
</tr>
<tr>
<td>2++</td>
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<td>2-</td>
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<tr>
<td>3</td>
</tr>
<tr>
<td>4</td>
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</table>
## Appendix E: Summary Table of the Quality Assessment of the 5 studies (Section 1)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The spectrum of patients is representative of the patients who will receive the test in practice.</td>
<td>AA</td>
<td>WC</td>
<td>WC</td>
<td>WC</td>
<td>AA</td>
</tr>
<tr>
<td>2. Selection criteria are clearly described.</td>
<td>WC</td>
<td>WC</td>
<td>WC</td>
<td>WC</td>
<td>WC</td>
</tr>
<tr>
<td>3. The reference standard is likely to classify the condition correctly.</td>
<td>AA</td>
<td>WC</td>
<td>WC</td>
<td>WC</td>
<td>AA</td>
</tr>
<tr>
<td>4. The period between reference standard and index test is short enough to be reasonably sure that the target condition did not change between the two tests.</td>
<td>PA</td>
<td>WC</td>
<td>WC</td>
<td>WC</td>
<td>WC</td>
</tr>
<tr>
<td>5. The whole sample or a random selection of the sample received verification using a reference standard of diagnosis.</td>
<td>PA</td>
<td>WC</td>
<td>PA</td>
<td>WC</td>
<td>WC</td>
</tr>
<tr>
<td>6. Patients received the same reference standard regardless of the index test result.</td>
<td>PA</td>
<td>WC</td>
<td>PA</td>
<td>WC</td>
<td>NA</td>
</tr>
<tr>
<td>7. The reference standard was independent of the index test (i.e. the index test did not form part of the reference standard).</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>WC</td>
<td>NA</td>
</tr>
<tr>
<td>8. The execution of the index test was described in sufficient detail to permit replication of the test.</td>
<td>WC</td>
<td>WC</td>
<td>AA</td>
<td>WC</td>
<td>NR</td>
</tr>
<tr>
<td>9. The execution of the reference standard was described in sufficient detail to permit replication of the test.</td>
<td>N/A</td>
<td>NR</td>
<td>NR</td>
<td>WC</td>
<td>NR</td>
</tr>
<tr>
<td>10. Index test results were interpreted without knowledge of the results of the reference standard.</td>
<td>AA</td>
<td>WC</td>
<td>AA</td>
<td>WC</td>
<td>AA</td>
</tr>
<tr>
<td>11. Reference standard results were interpreted without knowledge of the results of the index test.</td>
<td>AA</td>
<td>WC</td>
<td>AA</td>
<td>WC</td>
<td>AA</td>
</tr>
<tr>
<td>12. Uninterpretable or intermediate test results are reported.</td>
<td>PA</td>
<td>WC</td>
<td>WC</td>
<td>WC</td>
<td>WC</td>
</tr>
<tr>
<td>13. An explanation is provided for withdrawals from the study.</td>
<td>N/A</td>
<td>WC</td>
<td>WC</td>
<td>WC</td>
<td>N/A</td>
</tr>
</tbody>
</table>

WC: Well covered, AA: Adequately addressed, PA: Poorly addressed, NAD: Not Addressed, NR: Not reported, N/A: Not Applicable
# Appendix E: Summary Table of the Quality Assessment of the 5 studies (Section 2)

<table>
<thead>
<tr>
<th>Study</th>
<th>1. How reliable are the conclusions of this study?</th>
<th>2. Were the same clinical data available when test results were interpreted as would be available when the test is used in practice?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Massey and Jedlicka (2007)</td>
<td>++</td>
<td>No</td>
</tr>
<tr>
<td>Trapl, Enderle, Nowotny, Teuschl, Matz, Dachenhausen &amp; Brainin (2007)</td>
<td>++</td>
<td>Yes</td>
</tr>
<tr>
<td>Lim, Lieu, Phua, Seshadri, Venketasubramanian, Lee &amp; Choo. (2001)</td>
<td>++</td>
<td>Yes</td>
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</tbody>
</table>
Appendix E: Summary Table of the Quality Assessment of the 5 studies (Section 3)

<table>
<thead>
<tr>
<th>Study Details</th>
<th>Inclusion Criteria</th>
<th>Exclusion Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Massey and Jedlicka (2007)</td>
<td>25 patients are included. Inclusion criteria: a) at least 21 years old with admitting diagnosis of stroke in an acute care hospital or who experienced a stroke following a procedure during hospitalization. b) patients who are able to follow verbal or visual 1-step commands. c) patients who were awake and able to respond to verbal or nonverbal cues. No exclusion criterion is addressed.</td>
<td>No exclusion criterion is addressed.</td>
</tr>
<tr>
<td>Trapl, Enderle, Nowotny, Teuschl, Matz, Dachenhausen &amp; Brainin (2007)</td>
<td>50 consecutive patients with first-ever stroke and suspected dysphagia are included from the acute stroke unit on weekdays between Monday and Thursday in May to October of year 2005. Exclusion criteria: patients with multiple infarcts which is visible on the computed tomography or magnetic resonance imaging scans, dysphagia of other known cause, and somnolence or coma within 24 hours.</td>
<td>Exclusion criteria: patients with severe peripheral vascular disease, a consciousness level not sufficient to give informed consent, no CT evidence of a stroke or no significant neurological deficit (e.g. new hemiplegia) lasting more than 24 hours, insufficient lip seal to retain 10 ml of water in the mouth.</td>
</tr>
<tr>
<td>Martino, Silver, Teasell, Bayley, Nicholson, Streiner &amp; Diamant (2008)</td>
<td>N=311 Inclusion criteria: confirm brainstem or cerebellar stroke and stroke patients with a National Institutes of Health Stroke Scale (NIH-SS) score greater than or equal to 4; strokes was confirmed by physician clinical note or from CT scan or MRI findings. Exclusion criteria: Nonbrainstem and noncerebellar stroke patient with low NIH-SS scores considered by stroke neurologist to have no swallowing difficulties; patients with</td>
<td>Exclusion criteria: patients with severe peripheral vascular disease, a consciousness level not sufficient to give informed consent, no CT evidence of a stroke or no significant neurological deficit (e.g. new hemiplegia) lasting more than 24 hours, insufficient lip seal to retain 10 ml of water in the mouth.</td>
</tr>
<tr>
<td>Lim, Lieu, Phua, Seshadri, Venkatasthramanian, Lee &amp; Choo. (2001)</td>
<td>N=50 Inclusion: all acute stroke patients admitted to the stroke unit of Tan Tock Seng hospital from October 1997 to February 1998. Exclusion criteria: patients with severe peripheral vascular disease, a consciousness level not sufficient to give informed consent, no CT evidence of a stroke or no significant neurological deficit (e.g. new hemiplegia) lasting more than 24 hours, insufficient lip seal to retain 10 ml of water in the mouth.</td>
<td>Exclusion: not reported</td>
</tr>
<tr>
<td>Edmiaston, Connor, Loehr &amp; Nassief. (2010)</td>
<td>N=300 Inclusion: stroke patients that admitted to the stroke service at an urban tertiary care hospital. Exclusion: not reported.</td>
<td>Exclusion: not reported</td>
</tr>
</tbody>
</table>
1. Patients cannot have current respiratory compromise, patients on nonoral feeding regime, or a history of one or more of the following: nonstroke neurological disorder, surgery to the head or neck, a history of previous oropharyngeal dysphagia, dementia or decreased level of consciousness.

2. What is the prevalence in the population from which patients were selected?

<table>
<thead>
<tr>
<th>First group</th>
<th>Second group</th>
<th>Not addressed</th>
<th>62%</th>
<th>Not addressed</th>
</tr>
</thead>
<tbody>
<tr>
<td>68%</td>
<td>10%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3. What are the main characteristics of the patient population?

<p>| All patients are recruited from the central Ohio acute care hospitals. Gender: 16 are males and 9 are females. Age: 39-78 years old (mean age: 75) | Sex: First group: 11 female, 9 men Second group: 14 female, 16 men Age: First group: 74.6 +/- 2.4 (Standard Error) Second group: | Mean age: 68.6 +/- 14.3 (standard deviation) Sex: Male: 58.2%, female: 41.8% Ethnic origin and comorbidity: not reported | Gender: Male 31, Female: 19 Age: Mean: 67.5 +/- 11.73 (Standard deviation) Ethnic origin: not addressed Pre-existing condition: | Age, Sex, ethnic origin, comorbidity and disease status are not reported | All the participants are from urban tertiary care hospital |</p>
<table>
<thead>
<tr>
<th>4. What test is being evaluated in this study?</th>
<th>Massey bedside swallowing screen</th>
<th>The Gugging swallowing screen (GUSS)</th>
<th>The Toronto Bedside Swallowing Screening Test (TOR-BSST)</th>
<th>50 ml water swallow test and oxygen desaturation test and its combined test (50ml water swallow test and oxygen desaturation test)</th>
<th>The Acute Stroke Dysphagia Screen</th>
</tr>
</thead>
<tbody>
<tr>
<td>5. What is the reference standard with which the test being evaluated is compared?</td>
<td>Reference Standard in this study: tracking medical record for 5 days for any consultation with speech therapy, performance of MBS, any special diet is taken or any signs of pulmonary infections</td>
<td>Fiberoptic endoscopic evaluation of swallowing (FEES)</td>
<td>Videofluoroscopic assessment of swallowing (VFSS)</td>
<td>Fiberoptic Endoscopic Examination of Swallowing (FEES)</td>
<td>The Mann Assessment of Swallowing Ability (MASA), which had been validated against the modified barium swallow</td>
</tr>
</tbody>
</table>
Suggested Golden Standard: Modified Barium Swallow (MBS) and also known as Videofluoroscopy swallowing of study (VFSS)

| 6. What is the estimated sensitivity of the test being evaluated? (state 95% CI) | 100% | First group: Sensitivity: 100%  
Second group: Sensitivity: 100% | In all settings: Sensitivity: 91.3%  
In acute settings: Sensitivity: 96.3%  
In rehabilitation settings: Sensitivity: 81% | 50-ml water swallow test: Sensitivity: 84.6%  
Oxygen desaturation test: Sensitivity: 76.9%  
Combined test (50-ml water swallow test and Oxygen desaturation test): Sensitivity: 100% | For aspiration: Sensitivity: 95% (95% CI, 85%-95%)  
For dysphagia: Sensitivity: 91% (95% CI, 82%-95%) |
<table>
<thead>
<tr>
<th>Question</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>7. What is the estimated specificity of the test being evaluated?</td>
<td>100%</td>
</tr>
<tr>
<td>First group: Specificity:</td>
<td></td>
</tr>
<tr>
<td>50%</td>
<td></td>
</tr>
<tr>
<td>Second group: Specificity:</td>
<td></td>
</tr>
<tr>
<td>69%</td>
<td></td>
</tr>
<tr>
<td>In all settings: Specificity:</td>
<td></td>
</tr>
<tr>
<td>66.7%</td>
<td></td>
</tr>
<tr>
<td>In acute settings: Specificity:</td>
<td></td>
</tr>
<tr>
<td>63.6%</td>
<td></td>
</tr>
<tr>
<td>In rehabilitation settings: Specificity:</td>
<td></td>
</tr>
<tr>
<td>68%</td>
<td></td>
</tr>
<tr>
<td>50-ml water swallow test: Specificity:</td>
<td></td>
</tr>
<tr>
<td>83.3%</td>
<td></td>
</tr>
<tr>
<td>Oxygen desaturation test: Specificity:</td>
<td></td>
</tr>
<tr>
<td>70.8%</td>
<td></td>
</tr>
<tr>
<td>Combined test (50-ml water swallow test and Oxygen desaturation test):</td>
<td></td>
</tr>
<tr>
<td>Specificity:</td>
<td></td>
</tr>
<tr>
<td>63.6%</td>
<td></td>
</tr>
<tr>
<td>For aspiration: Specificity:</td>
<td></td>
</tr>
<tr>
<td>68% (95% CI, 62%-74%)</td>
<td></td>
</tr>
<tr>
<td>For dysphagia: Specificity:</td>
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</tr>
<tr>
<td>74% (95% CI, 64%-80%)</td>
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<tr>
<td>8. What is the positive predictive value of the test being evaluated?</td>
<td>Not addressed</td>
</tr>
<tr>
<td>First group: Positive predictive value:</td>
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<tr>
<td>81%</td>
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<tr>
<td>Second group: Positive predictive value:</td>
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<tr>
<td>74%</td>
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<tr>
<td>In acute settings: Positive predictive value:</td>
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<td>76.5%</td>
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<tr>
<td>In rehabilitation settings: Positive predictive value:</td>
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<td>50%</td>
<td></td>
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<tr>
<td>50-ml water swallow test: Positive predictive value:</td>
<td></td>
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<tr>
<td>78.6%</td>
<td></td>
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<tr>
<td>Oxygen desaturation test: Positive predictive value:</td>
<td></td>
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<tr>
<td>83.3%</td>
<td></td>
</tr>
<tr>
<td>Combined test (50-ml water swallow test and Oxygen desaturation test):</td>
<td></td>
</tr>
<tr>
<td>Positive predictive value:</td>
<td></td>
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<tr>
<td>78.8%</td>
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<tr>
<td>For aspiration: Positive predictive value:</td>
<td></td>
</tr>
<tr>
<td>44%</td>
<td></td>
</tr>
<tr>
<td>For dysphagia: Positive predictive value:</td>
<td></td>
</tr>
<tr>
<td>54%</td>
<td></td>
</tr>
<tr>
<td>9. What is the negative predictive value of the test being evaluated?</td>
<td>Not addressed</td>
</tr>
<tr>
<td>First group: Negative predictive value:</td>
<td></td>
</tr>
<tr>
<td>100%</td>
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<tr>
<td>Second group: Negative predictive value:</td>
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</tr>
<tr>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>In acute settings: Negative predictive value:</td>
<td></td>
</tr>
<tr>
<td>93.3%</td>
<td></td>
</tr>
<tr>
<td>In rehabilitation settings: Negative predictive value:</td>
<td></td>
</tr>
<tr>
<td>81.8%</td>
<td></td>
</tr>
<tr>
<td>50-ml water swallow test: Negative predictive value:</td>
<td></td>
</tr>
<tr>
<td>98%</td>
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<tr>
<td>Oxygen desaturation test:</td>
<td></td>
</tr>
<tr>
<td>Negative</td>
<td></td>
</tr>
<tr>
<td>For aspiration: Negative predictive value:</td>
<td></td>
</tr>
<tr>
<td>98%</td>
<td></td>
</tr>
<tr>
<td>For dysphagia: Negative</td>
<td></td>
</tr>
</tbody>
</table>
89.5%
negative predictive value: 76.9%
Combined test (50-ml water swallow test and Oxygen desaturation test):
  negative predictive value: 100%
  predictive value: 95%

10. What are the likelihood ratios for the test being evaluated?

   Positive likelihood ratio: Sensitivity/(1-specificity) = 1/0.5 = 2
   Negative likelihood ratio: (1-Sensitivity)/specificity = 0/0.5 = 0

   First group: Positive likelihood ratio:
   Sensitivity/(1-specificity) = 1/0.5 = 2
   Negative likelihood ratio: 0.1

   In all settings: Positive likelihood ratios: 2.7
   Negative likelihood ratios: 0.1

   In acute settings: Positive likelihood ratios: 2.6
   Negative likelihood ratios: 0.1

   In rehabilitation settings: Positive likelihood ratios: 2.5
   Negative likelihood ratios: 0.3

   For 50-ml water swallow test: positive likelihood ratios:
   Sensitivity/(1-specificity) = 0.846/(1-0.75) = 3.4
   Negative likelihood ratios: (1-Sensitivity)/specificity = (1-0.846)/0.75 = 0.2

   For Oxygen desaturation test: positive likelihood ratios:
   Sensitivity/(1-specificity) = 0.769/(1-0.833) = 4.6
   Negative likelihood ratios: (1-Sensitivity)/specificity = 0.09/0.74 = 0.1

   For aspiration: the positive likelihood ratios:
   Sensitivity/(1-specificity) = 0.95/ (1-0.68) = 3
   For aspiration: the negative likelihood ratios:
   (1-sensitivity)/specificity = 0.05/0.68 = 0.1

   For dysphagia: the positive likelihood ratios:
   Sensitivity/(1-specificity) = 0.91/(1-0.74) = 3.5
   For dysphagia: the negative likelihood ratios:
   (1-sensitivity)/specificity = 0.09/0.74 = 0.1
Second group: Negative likelihood ratio:
(1-Sensitivity)/specificity = 0/0.69 = 0

ratios:
(1-Sensitivity)/specificity = (1-0.769)/0.833 = 0.3
For Combined test (50-ml water swallow test and Oxygen desaturation test):
positive likelihood ratios:
Sensitivity/(1-specificity) = 1/(1-0.708) = 3.4
For Combined test (50-ml water swallow test and Oxygen desaturation test):
negative likelihood ratios:
(1-Sensitivity)/specificity = (1-1)/0.708 = 0

<table>
<thead>
<tr>
<th>11. How was this study funded?</th>
<th>Not addressed</th>
<th>Not addressed</th>
<th>Financial support: Canadian Stroke Network (CSN), Canadian Institute of Health Research Funding: Toronto Rehabilitation Institute</th>
<th>Not addressed</th>
<th>Not addressed</th>
</tr>
</thead>
<tbody>
<tr>
<td>12. Are there any specific issues raised by this study?</td>
<td>Massey bedside swallow screen is an accurate swallowing screen for</td>
<td>No</td>
<td>TOR-BSST offers an accurate method to identify stroke patients</td>
<td>The use of both the 50 ml water swallow test and oxygen desaturation test</td>
<td>The Acute Stroke Dysphagia Screen requires minimal training</td>
</tr>
<tr>
<td>Nurses to use daily as suggested by the authors. However, it has small sample sizes and not mentioned construct validity. Further recommendations are perform the screening on more patients and can include patients with other disease which is prone to dysphagia.</td>
<td>With dysphagia in the acute and rehabilitation setting with confidence that patients with a negative screen will not have dysphagia.</td>
<td>Is a sensitive screening instrument for identify patients at risk for clinically significant aspiration.</td>
<td>And can be administered in less than 2 minutes and it had high interrater reliability and has high sensitivity and reliability.</td>
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</table>
### Appendix F:
**Timeline of the Implementation and the Evaluation of the Innovation**

<table>
<thead>
<tr>
<th>Month</th>
<th>1</th>
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<td>Identify problem</td>
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<td>Perform systematic review</td>
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<tr>
<td>Identify and communicate with stakeholders</td>
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<td>Set up a steering committee</td>
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<td>Communicate with staffs</td>
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<td>Develop a pilot plan</td>
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<td>Arrange training sessions</td>
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<td>Modifications of pilot test</td>
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<td>Implementation of innovation</td>
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<td>Evaluation of whole implementation</td>
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</table>
Appendix G: Patient’s Assessment and Evaluation Form of Swallowing

Admission time & date: __________________
Initial assessment date and time (nurses): ______________

Part A: Inclusion Criteria: (Perform at first time only)

1. Patient is diagnosis to have stroke? Yes☐ No☐
2. Age is > 18 years old? Yes☐ No☐
3. Patient is alert and conscious? Yes☐ No☐
4. Patient is conscious and can obey simple command?: Yes☐ No☐
5. Is patient can sit upright? Yes☐ No☐
6. Any. Preexisting disease: Dyphagia? Yes☐ No☐
   Dementia? Yes☐ No☐
   Pneumonia? Yes☐ No☐
   Other respiratory disease? Yes☐ No☐
7. Is patient verbal consent to the nursing swallowing assessment? Yes☐ No☐

If there is any No on question 1-5, and question 7 or any Yes on question 6, swallow screen should not be performed by nurses and referred to the speech therapist for assessment.

8. Is patient fit to perform nursing swallow assessment? ………..Yes☐ No☐
If yes, proceed to part B of the patient’s swallowing assessment.

Remarks: Assessment of swallowing should be done within 24hours since admission to ward.
## Part B: Assessment and Evaluation of Patient (Done on daily basis)

<table>
<thead>
<tr>
<th>Patients’ condition</th>
<th>Date</th>
<th>Date</th>
<th>Date</th>
<th>Date</th>
<th>Date</th>
<th>Date</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Can patient sit upright?</td>
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<td>(Yes: √ /No: x)</td>
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<tr>
<td>Can patient alert and obey simple command?</td>
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<tr>
<td>Blood pressure (mmHg)</td>
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<td>Pulse rate (beats/minute)</td>
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<tr>
<td>Respiration rate (rate/minute)</td>
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<tr>
<td>Oxygen saturation (%)</td>
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<tr>
<td>Body temperature (degree Celsius)</td>
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<tr>
<td>Any cough</td>
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<td>(Yes: √ /No: x)</td>
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<tr>
<td>Any sputum</td>
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<td>(Yes: √ /No: x)</td>
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<tr>
<td>Any facial/tongue/palatal weakness or asymmetry</td>
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<td>(Yes: √ /No: x)</td>
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<tr>
<td>Any drooling of saliva</td>
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<td>(Yes: √ /No: x)</td>
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<tr>
<td>Any chest consolidation or haziness on chest radiography?</td>
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<td>(Yes: √ /No: x)</td>
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<tr>
<td>Is the white blood cells count in normal range?</td>
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<td>(Yes: √ /No: x)</td>
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</table>
### Part C: Preliminary Assessment/Indirect Swallowing Test

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Vigilance</strong></td>
<td>1 □</td>
<td>0 □</td>
</tr>
<tr>
<td>(patient can be alert at least for 15 minutes)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Cough and/or throat clearing (voluntary cough)</strong></td>
<td>1 □</td>
<td>0 □</td>
</tr>
<tr>
<td>(Patient can cough or clear his/her throat twice)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Saliva Swallow</strong></td>
<td>1 □</td>
<td>0 □</td>
</tr>
<tr>
<td>(swallowing is successful)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Drooling</strong></td>
<td>0 □</td>
<td>1 □</td>
</tr>
<tr>
<td><strong>Voice Change</strong></td>
<td>0 □</td>
<td>1 □</td>
</tr>
<tr>
<td>(hoarse, gurgly, coated, weak)</td>
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</tbody>
</table>

**Total Marks: (5)**

Marks 1-4: Keep NPO and refer to speech therapist for further assessment and management

Marks 5: Continue part D
Part D: Patient’s condition during swallow screen and results of the swallow screen:

<table>
<thead>
<tr>
<th>Part D: Patient’s condition during swallow screen and results of the swallow screen:</th>
<th>Semisolid</th>
<th>Liquid</th>
<th>Solid Food</th>
</tr>
</thead>
</table>
| 1. Swallowing:  
  \(\text{swallowing not possible}\)  
  \(\text{delay swallow (}>2\text{second})\) (Solid texture>10 second)  
  \(\text{successful swallowing}\) | 0 □ | 0 □ | 0 □ |
| 2. Any cough before, during or after swallow? (until 3 minutes later)  
  \(\text{Yes}\)  
  \(\text{No}\) | 1 □ | 1 □ | 1 □ |
| 3. Any drooling during or after swallow?  
  \(\text{Yes}\)  
  \(\text{No}\) | 2 □ | 2 □ | 2 □ |
| 4. Any voice change before, during or after swallow? (patient can speak “O”)  
  \(\text{Yes}\)  
  \(\text{No}\) | 0 □ | 0 □ | 0 □ |
| Total Marks: (20) (Part C + Part D) |  |  |  |
| Mark 1-4 Keep NPO & reassess daily & refer to speech therapy | Mark 1-4 Keep NPO & reassess daily & refer to speech therapy | Mark 1-4 Keep NPO & reassess daily & refer to speech therapy |
| Mark 5: Continue liquid | Mark 5: Continue solid diet | Mark 5: can resume normal diet |

Signature of staff  
Put a “✓” in the appropriate box.
Part E: Results and suggestions after the swallow screen

1. What diet is suggested: ____________
2. Necessity of referral to speech therapist? (Yes/No)
Appendix H
The Protocol of the Nursing Swallow Screen and Assessment

(Should be performed by trained staff & perform on daily basis)

Is patient fit the inclusion criteria (e.g. Age>18 years old) and excluded with the exclusion criteria (e.g. with respiratory compromise/with pre-existing dysphagia/dementia?

Yes

Is patient conscious and able to follow commands?

Yes

Is patient can sit upright?

Yes

Perform preliminary assessment
Ask patient to perform a simple saliva swallow

Mark 5

Semisolid swallowing trial
Give 1/3 to 1/2 teaspoon water with thickener and make up to pudding consistency & up to 3-5 teaspoons. Assess after the 5th spoonful

Mark 1-4

Liquid swallowing trial
Give 3ml->5ml-> 10ml->20ml->50ml water & drink it as fast as he/she can. Assess. Stop when one criterion observed. (E.g. delay swallow/drooling/voice change/cough)

Mark 5

Solid swallowing trial
Give small piece of dry bread for 5 times. 10second as set the time limit for a small solid bolus.

Mark 5

Allow normal diet

Excluded in this protocol

Keep NPO and refer to ST for further assessment and management
## Appendix I:
### Grades of Recommendation by Scottish Intercollegiate Guidelines Network (SIGN) 2011

Grades of Recommendations from Scottish Intercollegiate Guidelines Network 2011

<table>
<thead>
<tr>
<th>Grades of Recommendations:</th>
<th>Note: The grades of recommendations relates to the strength of the evidence on which the recommendation is based. It does not reflect the clinical importance of the recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>At least one meta-analysis, systematic review or RCT rated as 1++, and directly applicable to the target population or a body of evidence consisting principally of studies rated as 1+, directly applicable to the target population and demonstrating overall consistency of results</td>
</tr>
<tr>
<td>B</td>
<td>A body of evidence including studies rated as 2++ directly applicable to the target population and demonstrating overall consistency of results or Extrapolated evidence from studies rates as 1++ or 1+</td>
</tr>
<tr>
<td>C</td>
<td>A body of evidence including studies rated as 2+ directly applicable to the target population and demonstrating overall consistency of results or Extrapolated evidence from studies rated as 2++</td>
</tr>
<tr>
<td>D</td>
<td>Evidence level 3 or 4 or Extrapolated evidence from studies rated as 2+</td>
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</tbody>
</table>

**Good Practice Points:** Recommended best practice based on the clinical experience of guideline development group
Appendix J: Written Test for the Frontline Nurses about Proposed Innovation

Each question carries 20 score, total score is 100

Name: ___________________
Date: ____________________

Question 1: If the participants drooling after drinking should the swallowing assessment continue? (Yes/No)

Question 2: If the participants coughing after drinking should the swallowing assessment continue? (Yes/No)

Question 3: If the participants have voice change after drinking, should the swallowing assessment continue? (Yes/No)

Question 4: What amount of water should be given to participants in the initial step? (1ml /10ml)

Question 5: What should you do if participants fail the swallow assessment? (Notify the doctor and suggest for refer to speech therapy / Refer to the speech therapy by your own)

Total score: _____________
Checked by: ____________
Appendix K: Workflow of the Pilot Testing

- Trained nurses recruitment patients who fit the inclusion criteria of the proposed innovation
- Obtain verbal consent from the participants and the caregivers
- Recruited participants undergo proposed innovation
- Process evaluation