Towards Earlier and Improved Detection of Oropharyngeal Swallowing Disorders in the Acute Care Setting

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Abstract

Oropharyngeal swallow disorders are common in the acute general hospital population. However, many patients with these disorders remain undetected by medical and nursing personnel and risk developing associated complications which lead to increased morbidity and mortality. Speech and language therapists often get several inappropriate requests for swallow assessments and detection of swallow disorders at the bedside is difficult. This has significant service implications. This research examines the reliability of a swallow screening test and training programme for nursing staff. Furthermore it examines the diagnostic significance of cervical auscultation as a bedside clinical assessment tool. Ninety seven consecutive subjects were screened by nursing staff on admission to hospital over a five month period. Subjects who screened positively for dysphagia underwent a full clinical swallow assessment with cervical auscultation (N = 50) Twenty nine subjects underwent a videofluoroscopic evaluation of swallow function . The screening test displayed a moderate inter-rater reliability rating (Kappa = 0.53), sensitivity 83% and specificity 72.5%. Trained staff were significantly better at detecting swallow disorders than untrained staff. Inappropriate referral rates to speech and language therapy dropped by a significant 21.28% (chi-square with Yates correction 23.83, $p < 0.001$) during the study period. The study also demonstrates that cervical auscultation has good reliability (Kappa 0.8) and gives additional information to a bedside clinical assessment thus further improving accuracy beyond current measures. A recommended model of practice for screening and assessment of swallow disorders in the acute care setting is presented. Study limitations and implications for future research are also discussed.

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Declaration

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Summary

Oropharyngeal swallowing disorders (OPSD) leading to aspiration and reduced swallow efficiency are common in the acute care setting. Patients presenting with swallow disorders are at a significant risk of developing medical complications such as pneumonia, malnutrition, dehydration and weight loss. Such complications are known to contribute significantly to patient morbidity and mortality. If swallow disorders are detected early there are many different strategies which can be used to treat the problem effectively and minimise, or in many cases, eliminate the aspiration and improve overall swallow efficiency. This allows the patient to eat a regular diet safely.

The importance of swallowing disorders has received greater recongition in recent years as the complications arising have significant implications in terms of cost of care and patient morbidity and mortality. In the acute care setting, speech and language therapists (SLTs) work in conjunction with a multidisciplinary team to manage swallow disorders effectively. However several problems exist such as;

(a) inappropriate referrals for swallow assessments
(b) at risk patients are not identified on admission
(c) inappropriate methods of detection are used by medical/nursing personnel to identify dysphagia e.g. 'gag' reflex
(d) inappropriate management of a patient in the early part of an admission.

Another problem facing SLTs is that detection of swallow disorders at the bedside, whilst improving, is still not wholly accurate. Many objective means of assessment exist but often remain inaccessible, invasive or not diagnostic enough. This can result in delays in decision making which affects service efficiency. Cervical auscultation is a technique which shows promise as a clinical bedside tool and previous studies show that it further increases

accuracy at the bedside. This research attempted to quantify the number of people at risk of swallow disorders in an acute setting as well as addressing the concerns of under identification of swallow disorders on admission to hospital, and under-detection of swallow disorders by speech and language therapists at the bedside.

A swallow screening tool was developed for nursing staff to aid in the identification of patients at risk of swallowing disorders on admission to an acute care hospital. Thirty staff nurses were trained and participated in an inter-rater reliability trial over a five month period. A total of ninety seven subjects were screened. All those who screened positive for dysphagia had a full SLT swallow assessment with cervical ausculation using a customised recording system (N = 50). Twenty nine subjects underwent a videofluoroscopic swallow evaluation. Overall, good agreement between nursing and SLT was demonstrated (87% agreement/Kappa rating 0.53). The screening test showed good sensitivity (83%) and specificity (72.5%) for detecting swallow disorders. Trained staff displayed better ability to detect swallow disorders than their untrained counterparts. Examination of speech and language therapy referral rates before and after the trial indicated that there was a significant drop (21.28%; $p < 0.001$) in inappropriate swallowing referrals once the swallow screening training programme was instigated.

Despite some limitations of the recording equipment and sample size, the study also demonstrates that cervical auscultation has good reliability and adds additional information to a bedside clinical examination. A model of practice incorporating initial screening procedures and thorough clinical assessment is presented based on the findings of this study. If such a model is adopted by therapists in practice, it should lead to more effective and efficient services for all patients who need them.

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Chapter 1

Introduction and Literature Review

1. Introduction

In 1994, the Department of Health in Ireland launched a document entitled 'Shaping a Healthier Future'. This document grasped the essence of the current health care climate. More than ever, emphasis is being placed on health gain, social gain and early intervention programmes to prevent and minimise disability (Towards an Independent Future 1996). According to the World Health Organisation quality of life committee (WHOQOL 1995) health in general is defined as

> *'not only the absence of infirmity and disease, but also as a state of physical, mental and social well being'* .

However, it is only recently that the medical profession has begun to recognise its responsibility for the welfare of the whole patient (Ebbs, Fallowfield, Baum 1989 cited in Farquhar 1995). In the current health care climate the person, their illness and how it affects them in their own context are now considered in a more holistic approach. Even though 'quality of life' is difficult to define and determine succinctly (Zhan 1992; Bowling 1995; Bowling and Brazier 1995; Farquhar 1995; WHOQOL 1995) health professionals are increasingly expected to contribute significantly to this dimension of patient care. It is within this context that speech and language therapists (SLTs) must exist and develop services, with the well-being and quality of life of the patient clearly in mind.

Ever since the 1930's, speech and language therapists have been involved in the identification and rehabilitation of oropharyngeal swallowing disorders (oropharyngeal dysphagia) in adults and children (Miller & Groher 1993). Since that time, and particularly during the 1970's and 1980's, knowledge about the identification and causes of swallowing disorders has burgeoned, appropriate and more objective means of physiological assessment have been pioneered, particularly by Jeri Logemann and colleagues (1983). In addition, the effects of the consequences of swallowing disorders on the lives of patients as well as treatment methods have been widely studied (DePippo, Holas, Reding, Mandel, Lesser 1994; Neumann 1993, 1995; Odderson, Keaton & McKenna 1995; Rosenbeck 1995; Park, Wyatt, O'Neill 1997;

Huckabee, Cannito 1999). Various techniques have been developed for both assessment and treatment purposes. Whilst still a source of controversy for some clinicians, speech and language therapists have been largely responsible for establishing and maintaining these services. As always, the delivery of services depends on the population to be served. As that population evolves, so too must the service. With an increasing awareness of the prevalence and incidence of swallowing disorders, their implications and effects, and also of the difference that intervention by trained speech and language therapists can make, demand for such services has ultimately grown.

Several medical conditions are now recognised as having oropharyngeal dysphagia as a secondary complication e.g. stroke, progressive neurological diseases, systemic disease, respiratory disease, critical care illness, dementia, as well as iatrogenic causes (Kirshner 1989; Kaatzke 1992; Kulheimeier 1994; Buchholz 1994; Collins, Farrell, Murphy, O'Neill, Fitzpatrick 1996; Chouinard, Lavigne, Villeneuve 1998; Lee, Hwang, Chang 1999). In particular, several authors (Feinberg, Knebl, Tully, Segall 1990; Kaatzke 1992; Feinberg 1996; Butt 1997) describe how the elderly population are more susceptible to such diseases which are prevalent in this population. In this country, the Government has singled out the elderly population as the one increasing most rapidly (Shaping a Healthier Future 1994). The Central Statistics Office (1988 cited by O'Shea 1993) predicts that by the year 2011, the percentage of elderly people in the Irish population will have increased by 14%. In the Dublin Health Board area, it has been estimated that the population aged 65 and over will have increased by 35% by the year 2008 (Eastern Health Board 1998). This ageing population is reflected not only in the growth of the population aged 65 and over, but also secondary ageing i.e. the growth of the numbers of elderly people aged 80 and over. This poses a special challenge to health services as they will have to be responsive to the increasing demand which this growing population is likely to bring.

As awareness and prevalence of oropharyngeal dysphagia increases, disorders of deglutition and feeding are becoming recognised as major health care problems which need to be addressed (Miller & Groher 1993). Several authors outline the complications of swallow disorders e.g. aspiration, altered consistency diets and rigid eating regimes, and the significant impact they have on a patient's morbidity and mortality (Smithard, O'Neill, Parks, Morris 1996; Schmidt, Holas, Halvorsonk, Reding 1994; Feinberg et al 1990) as well as on his/her quality of life. One study in the United States estimated that 40-60% of institutionalised elderly have identifiable signs and symptoms of oropharyngeal dysphagia (Steele, Greenwood, Erns, Robertson, Seidman-Carlson 1997). In fact, Splaingard (1988) observed that being over sixty years old is one factor identified as statistically significant for the presence of silent aspiration in stroke patients. Studies in the United Kingdom have estimated that up to 33% of nursing home residents are likely to have a swallow disorder (Smithard 1995; Shield and Hughes 1998)

In Ireland, services to people with swallowing disorders are relatively recent but have increased steadily since first instituted here in 1989 (Gilchrist, Ni Loingsigh 1997; Murphy 1996; O'Donoghue, Jordan, O'Regan, Gilchrist, Duffy 1994). These services are however, still seriously lacking both in the United Kingdom and Ireland with clinicians reporting an increasing demand for services to patients with dysphagia. The Royal College of Speech and Language Therapists (RCSLT 1992, 1998), the Irish Association of Speech and Language Therapists (IASLT 1993, 1996) and other authors (Smithard and Crockford 1995, 1997; RCSLT 1998) have reported increased referral rates to speech and language therapy departments. These demands have many implications for service managers e.g. increased referrals (both appropriate and inappropriate), and increases in cost and resources by accessing specialist equipment and specialist training. Developing services for patients with dysphagia can be a difficult undertaking for already understaffed and under-budgeted departments (Smithard et al 1995). However, such demands will continue to increase as the awareness of swallowing disorders and their consequences grow, as well as demands to

provide more equitable and quality services. Clinicians must look closely at service demands and service provision and ways of carefully balancing the two.

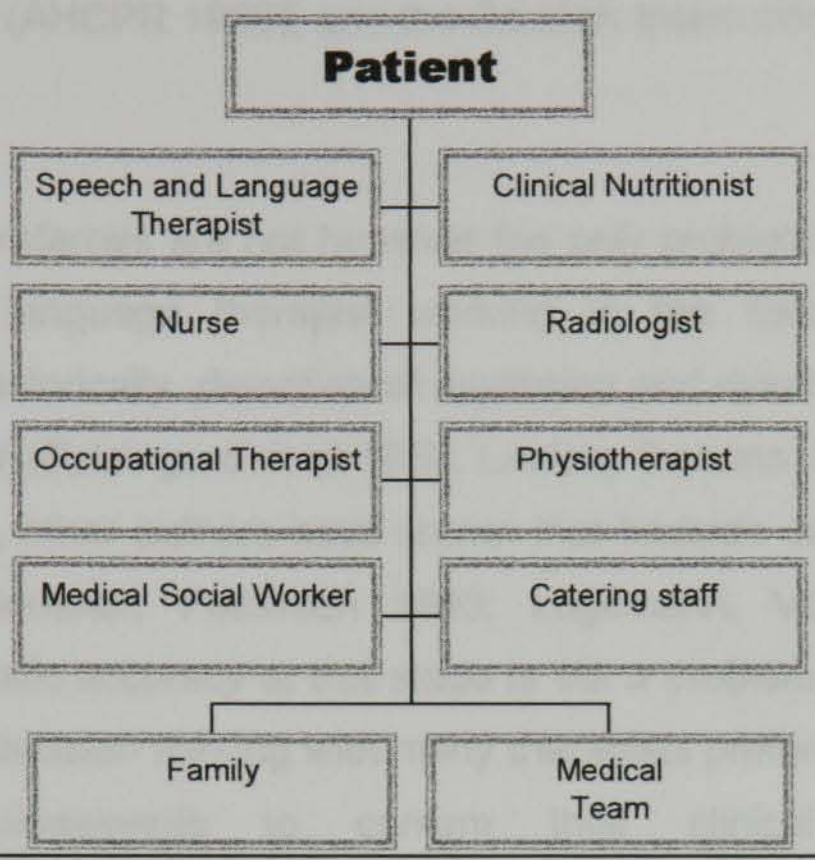
In certain client groups e.g. stroke where dysphagia is often suspected, all patients presenting with this diagnosis may be automatically referred to the speech and language therapist for a swallow evaluation. Several studies (Barer 1989; Kidd, Lawson 1993; Logemann, Shanahan, Rademaker, Kahrilas, Lazar, Harper 1993; Holas, DePippo, Reding 1994; Robbins, Levine 1993; Teasall, Fuller 1994; Teasell, Bach, Mc Rae 1994; Daniels, Bailey, Priestly, Herrington, Weisberg, Foundas 1998) have shown that up to 50% of stroke patients are at risk for dysphagia. This means that 50% are not at risk. Thus, many of these referrals may be inappropriate. Assessing a patient who does not have a problem is essentially a waste of valuable clinical time, especially when many services are already over stretched (Smithard et al 1995, 1997). It is necessary that services are streamlined so that patients who need comprehensive assessment and treatment for dysphagia get it. It is just as important that patients who *don't* need speech and language therapy intervention are not referred thus wasting already valuable clinical time. However, whilst it is evident that a substantial number of patients, especially the elderly presenting in an acute care setting are likely to have dysphagia to some degree, this is not always recognised by medical and/or nursing staff.

Often the medical team are heavily dependant on the speech and language therapist to make decisions regarding feeding. This can give rise to problems if the therapist is unavailable to do an assessment e.g. at weekends. In such an instance patients may be kept fasting unnecessarily by medical staff until an assessment can be done. Alternatively, feeding tubes may be inserted unnecessarily causing significant patient discomfort. This may lead to patient distress and a loss of vital nutrition in the acute phases of an illness, possibly increasing morbidity, as well as creating staff frustration due to delayed decision making regarding feeding and management. In addition, as many referral agents are largely unaware of what constitutes a swallow disorder and how it may be manifested, patients who may not be readily identifiable as

being at risk of oropharyngeal dysphagia e.g. those presenting with recurrent chest infections, Parkinson's disease, significant weight loss, are generally not suspected (by medical staff) of having a swallow disorder. Such patients are fed normally until a pneumonia or some other complication develops. This, as several studies have shown, is costly to treat, prolongs hospital stay and ultimately puts patients at risk (Martin, Corlew, Wood, Olson, Lawrence, Golopol, Wingo, Kirmani 1994; Schmidt et al 1994, Carter Young & Durant Jones 1990; Smithard, O'Neill, Park, Morris, Wyatt, Martin 1996; Lundy, Smith, Colangelo, Sullivan, Logemann, Lazarus, Neumann, Murry, Lombard, Gaziano 1999).

Speech and language therapists are dependant on referral sources to detect possible disorders which need a more in-depth clinical evaluation. However, therapists do not exist in isolation. As there is a closer move towards a holistic model of health care, patients are viewed as having multifaceted problems requiring input from multiple health care professionals. These professionals work together for a common aim and often, in the acute setting there are many members of such a team as outlined below (figure 1 page 6).

Figure1 **Multidisciplinary team involved in management of oropharyngeal dysphagia**



If speech and language therapists are to work effectively as part of a 'team' they must be prepared to share core skills with other team members to facilitate development of a more flexible and streamlined service for patients. In particular it is important to work closely with professionals who are most aware of patient's day to day needs e.g. nursing staff. Speech and language therapists need to improve awareness of the signs and symptoms of oropharyngeal dysphagia through training and education programmes, and thereby facilitate appropriate detection within the general team setting. Once a team 'talks the same language' there should be little room for confusion.

The prevention of disability or limitation of its effects, through early intervention programmes, is an objective of health services. In line with this there is clearly a place for appropriate screening procedures to identify patients who are at risk for dysphagia, associated aspiration and its complications, and those who are not. Once more appropriate referrals are received, patients who need speech and language therapy intervention should get a timely and improved assessment and treatment service (both communication and dysphagic patients), as time will not be wasted by

therapists seeing inappropriate swallowing referrals. Other professionals are involved in the identification of dysphagia and initial screening on admission to hospital is recommended by groups such as the American Health Care and Policy Review (AHCPR 1996), and the Scottish Intercollegiate Group Network (SIGN 1997).

Inappropriate referrals are not however the only problem currently facing the speech and language therapist working in the field of oropharyngeal dysphagia. Historically, detection of aspiration and dysphagia at the bedside has been poor (Splaingard et al 1988; Linden, Siebens 1983). Even though more recently, other authors have shown that bedside detection is improving (Linden, Kuhlemeier, Patterson 1993; Logemann, Veis, Colangelo1999) limited diagnostic accuracy at this stage is still a problem. This can, at times, further delay decision making with many therapists preferring to wait for more objective assessments to confirm their clinical suspicions e.g. videofluoroscopy. Such objective assessments may be unnecessary. The primary use of videofluoroscopy is in establishing the etiology of aspiration as well as identifying what treatment strategies can be used to minimise or eliminate it (Logemann 1993). It should not be used only to confirm presence or absence of aspiration, although this is necessary in certain cases. Otherwise inappropriate use of already overstretched resources and delays in implementing full management programmes occurs.

Clinical accuracy at the bedside needs to improve beyond its current standing to identify at risk patients properly if procedures such as videofluoroscopy are to be used effectively. Performing such a procedure on a patient who does not really need it is timely and an inefficient use of resources. In effect, there is little room for delays resulting from clinical inaccuracy in an already pressurised clinical environment. This ultimately has important implications for service provision in general. If clinical accuracy at the bedside can be improved, speech and language therapists will be able to deal more effectively with what needs to be dealt with, while medical/nursing staff can make earlier decisions regarding the feeding status of a patient without wholly depending on the speech and language therapist in the initial stages after

admission. By streamlining services thus, therapists can strive to provide a service of improved quality to those who need it in a climate where equity, quality and accountability of services are necessary. In order to develop this, a clear understanding of oropharyngeal swallow function, dysfunction and current assessment and service options is necessary if 'gaps' in existing services are to be addressed and altered.

1.1 The Normal Swallowing Mechanism

Swallowing is a most complex act involving discrete co-ordination of very complicated systems including neurology, neuroanatomy, physiology and respiration (Miller 1989; Bass, Morrell 1992; Takahashi 1990, 1994; Shaker, Li, Ren, Townsend, Dodds, Martin, Kern, Rynders 1992; Selley, Ellis, Flack, Bayliss, Chir, Pearce 1994; Martin, Logemann, Shaker, Dodds 1996; Sessle 1997; Hamdy 1997; Hamdy, Power 1997; Leopold 1997; Jean 1997; Tuite 1998; Logemann, Rademaker, Pauloski, Ohmae, Kahrilas 1998). It involves motor and sensory components of cranial nerves V, VII, IX, X, XII as well as all the muscles of mastication and the pharyngeal, laryngeal and oesophageal musculature. With so many systems involved, it is easy for something to go wrong with serious and life-threatening consequences.

As several of the above authors describe, the act of swallowing can be divided into four phases. In the first *Preparatory phase,* the food is manipulated and masticated in the mouth to form a cohesive food bolus. The second, *Oral phase* follows as the tongue propels the food bolus posteriorly between the anterior faucial arches at which point the third stage is initiated. This phase, the *Pharyngeal* phase, occurs as the bolus is propelled through the pharynx. There is a simultaneous closing of the larynx/airway/vocal folds and an upward and forward movement of the larynx and hyoid bone. This, probably the most vital stage, is to ensure airway protection as the bolus is propelled towards the oesophagus. Several sensory and motor components of the cranial nerve system are at work simultaneously to ensure safe food propulsion. The final, oesophageal phase, begins as the upward and forward motion of the larynx allows the upper oesophageal sphincter (UES) to relax and open. Once the food passes the safely closed airway it enters the oesophagus. After the tail of the bolus passes the UES, it closes again with simultaneous lowering of the larynx and subsequent airway reopening. The food should then be propelled to the stomach by oesophageal peristaltic action. No food enters the airway and no food is left behind in the pharynx or upper oesophagus after the swallow occurs. Swallowing does not however, rely solely on cranial nerve and oropharyngeal muscle functions alone.

As eating and drinking involve the presence of a foreign body in the upper airway, discrete and timely co-ordination is required between the activities of mastication, deglutition and respiration to prevent aspiration (Smith, Wolklove, Clalcone, Kreisman 1989). Normally, resting ventilation is influenced by feedback from a variety of mechanoreceptors and chemoreceptors and by information from the cortex (Lahiri and Gelfand 1989 cited by Smith et al 1989). Obviously, respiratory airflow and the passing bolus must be regulated during the pharyngeal stage of swallowing, in such a way that the lungs are protected from aspiration. This vital stage of swallowing is controlled by a reflex arc with the afferent sensory receptors situated in the region of the mouth between the pillars of the fauces, conveying stimuli to the swallow centres and then to the respiratory centres. Sensory disruption in that region, typically associated with respiratory disease, results in delays in sensory transmission and motor response. A delicate balance therefore exists between respiration and deglutition. If disruption occurs in either area, problems will arise. Knowledge about normal respiratory patterns during swallowing can significantly add to a swallow evaluation. Such information can help further identify patterns of abnormality and thus possibly improve detection accuracy at the bedside

A consensus has generally been reached about the normal respiratory pattern that occurs during swallowing, work that has been pioneered by Selley and colleagues since the late eighties (Selley, Flack Ellis,Brooks,1989; Selley, Flack, Ellis, Brooks 1990). Typically at spoon contact the individual inhales, a small expiration occurs just before the swallow, swallowing occurs during deglutition apnoea, then a large exhalation occurs. It is generally acknowledged that swallowing usually occurs in the expiration phase. Other studies generally concur that up to 95% of swallows are followed by exhalation (Nishino, Yonezawa,Honda 1985; Selley et al 1989; Martin,Logemann, Shaker, Dodds, 1994; Uyama, Takahashi Groher, Yokoyama, Hirano, Michi 1997).

Generally it has been observed that at spoon contact, respiration varies depending on the individual but tends to stay constant for that individual. For

example, whilst the majority of individuals appear to exhale after the swallow apnoea, at spoon contact (i.e. prior to swallow initiation) some may inhale, swallow then exhale, whilst others may inhale, begin exhalation, suspend exhalation during swallowing and then resume exhalation. The apnoea which occurs during a swallow has been recorded to range from 0.3-1.4 seconds and appears to be slightly longer in older normal individuals (Selley et al 1989).

In short, characteristic findings of breathing patterns during swallowing for normal individuals may be summarised as follows (Selley et al 1989):

- For an individual's preferred pattern of respiration at spoon contact, either an inspiration or an inspiration/expiration combination occurs
- The majority of swallows are followed by a large expiration
- Deglutition apnoea is consistent for each individual and ranges from 0.3 sec - 1.4 sec
- Only one swallow takes place per teaspoonful
- Usually, each swallow sound has no other associated noise relating to coughing or spluttering

The fact that the majority of 'normal' swallows occur in the expiratory phase, and that the preferential resumption of respiration with expiration after the completion of swallow must have some physiological advantage. Authors are generally in agreement about the significance of this (Selley, Ellis,Flack, Bayliss, Chir, Pearce 1994; Shaker et al 1992; Smith et al 1989). It is suggested that this particular arrangement provides an airflow direction opposite to the direction of the swallowed material at the onset of the pharyngeal stage of swallowing. In cases where some residue might have been left behind in the hypopharynx after the completion of the swallow, resumption of respiration with expiration may help prevent aspiration of the hypopharyngeal residue. In effect, the large exhalation after the swallow produces an effective means of completely clearing the pharynx before the next inhalation.

If this pattern is disrupted, as it appears to be in individuals with respiratory disease and sensori-motor disorders, then material is much more likely to be inhaled from the pharynx into the airways, predisposing the subject to aspiration. As the pattern of breathing is set so that a given minute ventilation can be achieved with the lowest possible workout or energy expenditure, deviation from this optimal pattern causes an increase in the work of breathing. Whilst increased work of breathing is unlikely to have any consequence for normal subjects, it is likely to be more significant in subjects with lung disease and contribute to the dyspnoea with eating experienced by some subjects with COPD (Smith et al 1989; Curtis, Langmore 1997). Therefore, knowing what constitutes a normal respiratory pattern during the act of deglutition should readily help clinicians discriminate between normal and abnormal swallow respiratory patterns.

Typically, the whole swallowing act takes less than one second once the pharyngeal phase is initiated. However, this is not simply a motor process. During the course of a normal meal the swallow system must constantly adapt and adjust itself quickly and finitely in order to accommodate the vast range of quantities and various consistencies ingested at different rates at different times. Several studies (Lazarus, Logemann, Rademaker, Kahrilas, Pajak, Lazar, Halper 1993; Reimers-Neil, Logemann, Lawson 1994; Bisch, Logemann, Rademaker, Kahrilas, Lazarus 1994; Cook, Dodds, Dantas, Kern, Massey, Shaker, Hogan 1989; Kahrilas & Logemann 1993) indicate how, In normal individuals, increases in bolus viscosity and bolus volume change the timing of the swallow. Increased bolus viscosity significantly increases swallow duration across consistency categories. In addition, increases in bolus volume prolong laryngeal closure and cricopharyngeal opening durations, as well as reducing tongue base contact to the posterior pharyngeal wall. These constant adaptations rely on intact structures and well regulated systems to cope with the demands which are placed on them every day.

It is obvious that swallowing is by no means a simple process. The correct sensory information must be delivered at the right times to initiate the right

motor responses which promote adequate airway protection and ensure full bolus clearance from the oropharyngeal and upper oesophageal areas. Striking the delicate balance for an individual with a normal swallow involves complex co-ordination of several systems. Nevertheless, even in normal individuals it does 'go wrong' occasionally. When the ability to sense or control certain parts of these combined systems has been lost through neurological, respiratory or structural damage, this efficient swallow system can be badly affected with serious consequences. Given the complex nature of normal swallowing, it is easy to speculate that oropharyngeal dysphagia is present in a wide range of medical disorders where one or more of these systems are affected, indeed a wider range than expected.

1.2 Dysphagia - The Consequences of Dysfunctional Oropharyngeal Swallowing

Robbins in 1985 broadly defined dysphagia as a swallowing disorder characterised by difficulty in oral preparation for swallowing and/or moving material from the mouth to the stomach. Such a disorder may result from structural damage to the oropharyngeal/laryngeal area or neurological change leading to impaired oropharyngeal and/or laryngeal function, as well as disrupted respiratory function. This can result in inefficient transport of the food bolus and/or reduced airway protection before/during/after swallowing causing entry of food or liquid into the airway (i.e. aspiration/penetration) which may be potentially fatal (Martin et al 1994; Loughlin 1989; Schmidt, et al 1994; Terry et al 1994; Feinberg et al 1990; Feinberg 1996; Smithard et al 1996; Lundy et al 1999).

Despite an increase in awareness of dysphagia, its consequences and its prevalence, the epidemiology of dysphagia is unexplored. Kuhlemeier (1994) reports a steady increase in the number of articles about dysphagia in the literature surveyed in Index Medicus over thirteen years i.e. 1981-1994. This indicates an increased interest in, and awareness of, the presence and importance of dysphagia by health care professionals. For one local hospital in the United States, according to Kuhlemeier, the incidence of reported

dysphagia rose from 3/1,000 to 10/1,000 over a decade. Whilst no official incidence or prevalence figures exist for this country, clinicians in Ireland have reported an increase in demand for services to this particular population (Gilchrist et al 1997), as have clinicians in the United Kingdom (RCSLT 1992, 1996, 1998). This obviously has service implications as clinicians try to keep up with the demand. Unfortunately, even though general awareness of oropharyngeal dysphagia is slowly increasing, it often goes undiagnosed/unsuspected, particularly in a busy acute setting and patients are often placed unnecessarily at risk until complications develop. There are many ways in which dysphagia can affect the life of the person who presents with it. Some consequences are life threatening e.g. aspiration.

Aspiration is a serious and potentially fatal consequence of oropharyngeal dysphagia. It can be defined broadly as the misdirection of oropharyngeal contents (saliva, food, liquids) into the larynx (Feinberg et al 1990, Logemann 1983). Materials that enter the larynx may pass further into the trachea and lungs depending on their physical or rheologic characteristics, the functional status of the cough reflex and the efficiency of the mucociliary action of the respiratory epithelium. Whilst the terms 'aspiration' and 'penetration' are used varyingly by different authors, as a working definition the term 'penetration' describes the entry of food/fluids into the larynx to the level of the vocal folds (i.e. above the vocal folds), whilst aspiration describes the entry of food/fluids to the larynx but travelling below the level of the vocal folds (Logemann 1983; Feinberg 1990; Ekberg 1992; Linden et al 1993; Rosenbek, Robbins, Roecker, Coyle, Wood 1996).

For the person with dysphagia, it is ideal if swallow problems are detected early and, their consequences prevented or minimised. The pulmonary consequences of aspiration can potentially have serious implications for both patients and service providers. Pneumonia, pulmonary abscess, airways obstruction (mechanical or physiologic), fibrosis, Adult Respiratory Distress Syndrome (ARDS), apnoea and bradycardia are all known consequences of entry of foreign material into the lungs (Feinberg et al 1990; Terry et al 1989; Loughlin 1989). This has implications for health care managers as

oropharyngeal swallow dysfunction resulting in aspiration is known to be associated with the development of aspiration pneumonia as well as leading to significant length of stay in hospital and increased morbidity and mortality (Martin et al 1994; Schmidt et al 1994, Carter Young et al 1990; Smithard et al 1996; Lundy et al 1999). These factors lead to increased cost of care especially with increased length of stay in hospital and if extra medications are used in treatment (e.g. antibiotics prescribed to treat lung infection). It has been demonstrated that aspiration and its effects can be minimised once detected (AHCPR 1999; Langmore 1991, 1995; Martens, Cameron, Simonsen 1990; Crary 1995; Selley, Roche, Pearce, Flack 1995; DePippo et al 1994; Neumann 1993,1995; Logemann & Kahrilas 1990; Palmer, DuChane 1991). The issue of earliest possible detection remains. Patients at risk of aspiration must be detected early enough before full complications set in.

Pulmonary problems are not the only complications associated with dysphagia. Other complications have implications for both the person's nutritional status and quality of life. Treatment for dysphagia involves a change in eating habits and maybe altered food consistencies, which may detract from the social enjoyment of eating and drinking (Martin 1991). Nutritional issues arising have significant implications for patients and service managers alike. The myriad of potential problems which can arise often result in hospital admissions or even mortality if untreated. (Hendrix 1993; Logemann 1997). Several studies (Smithard et al 1996; Lundy et al 1999; Schmidt, Holas, Reding 1994; Feinberg et al 1990) have associated the presence of dysphagia with poor nutritional state, increased chest infection and mortality. Indeed, other authors, cited by Elmstahl, Bulow, Ekberg, Petersson, Tegner (1999) agree that prolonged conditions with protein-energy malnutrition (PEM) can deprive immune functions and increase morbidity from infectious diseases and mortality. Valdee and Peth (1992) also suggest that PEM may alter muscle and nerve function and thereby increase swallowing impairment. As McWhirter (1996) points out, nutritional depletion has been linked with impaired muscle and immune function, as well as increased risk of pressure sores, potentially resulting in longer hospital stays and increased morbidity and mortality. Another study has identified protein energy

malnutrition after acute stroke as a risk factor for poor outcome generally, thus possibly affecting rehabilitation (Davalos, Ricart, Gonzalez-Huix, Soler, Marrugat, Molins, Suner, Genis 1996). People with oropharyngeal dysphagia who have not been diagnosed as thus often present with signs and symptoms which cause a lot of distress e.g. weight loss, recurrent chest infections, and have often made their own adaptations in eating habits. Generally such symptoms are commonly associated with 'growing old' and are accepted by people despite the distress it may cause.

For many of those patients caught in the 'swallow management' net, oropharyngeal dysphagia ultimately means that taking normal food and drink becomes a trial, with many foods denied to them, particularly in the early stages of their rehabilitation. Fluids may need to be thickened to a certain consistency to promote safer swallowing and prevent aspiration. Foods will often have to be prepared to smoother consistencies to improve swallowing efficiency. Such foods tend to be bland and unappetising. Solid foods may be eliminated completely from their diet. Certain swallowing techniques or manoeuvres may have to be remembered and used for every mouthful at every mealtime. (Logemann 1993; Langmore 1991; Martens et al 1990; Langmore 1995; Crary 1995; Selley et al 1995; DePippo et al 1994; Neumann 1995; Logemann, Kahrilas 1990; Palmer et al 1991; Rasley, Logemann, Kahrilas, Rademaker, Pauloski, Dodds 1993). In effect, mealtimes often become an unpleasant chore for the person and their caregivers.

As discussed by Feinberg et al (1990) and several other authors (Feinberg 1996; Jaradeh 1994; Croghan, Burke, Caplan, Denman 1994; Feinberg, Knebl, Tully 1996, Shaker & Lang 1994), olfactory dysfunction may be significantly altered thus reducing the sensory pleasures of eating, particularly in the elderly population. Therefore patients who are prescribed altered consistency diets because of swallowing disorders can also have great difficulty distinguishing between flavours and taste. Poor oral hygiene in addition, may affect the person's appetite and taste but also has significant associated risks as it is considered a high risk variable for the development of aspiration pneumonia (Langmore,Terpenning, Schork, Chen,Murray, Lopatin,

Loesche 1998). The combination of colonization of the oropharynx with bacterial pathogens and microaspiartion of saliva containing these bacteria appears to be the most common source of aspiration pneumonia. This culmination of factors can result in patient distress and discomfort as well as reduced nutritional consumption resulting in malnutrition and dehydration.

Whilst it is difficult to quantify 'quality of life' specifically people frequently measure this concept in terms of several dimensions such as family, social contacts, health, mobility/ability, home environment, happiness etc. (Farquhar 1995; Bowling, Brazier 1995; Zhan 1992). According to one study (Farquhar 1995), older people tend to define quality of life mostly in terms of family relationships and social contacts and activities. If one considers the potential implications that oropharyngeal dysphagia will have on a person in terms of social contacts and activities, one may expect significant changes in that person's lifestyle. They may be limited in participating in many social activities i.e. dining with friends or family, eating out and generally participating in a social scene. Such limitations could dramatically alter how a person and their family live within their environment and how they experience that environment. If swallowing disorders, which may predispose people to such complications, can be managed early in the disease process by trained Speech and language therapists working with a multidisciplinary team, then these effects can be minimised and eventually eliminated in many patients, with a minimum of distress. In cases where little recovery is expected e.g. progressive neurological diseases, early support must be provided for the patient and their carers to maintain safe oral feeding for as long as is possible (Cherney 1996; Martens et al 1990). In general effective management means that patients can ultimately enjoy an oral diet with certain compensations, knowing that the risk of aspiration and developing associated complications is reduced.

If at risk patients are identified at the right time, then complications can in most instances be minimised. Often, however, many patients are not identified as being 'at risk' of a swallow disorder. In this country, where awareness of dysphagia is growing slowly, it is often not considered as a

complication or a cause of many presenting disorders. Therefore speech and language therapists are not aware of patients in their setting who may need their services and advice. As the root cause of arising medical complications is not identified, this contributes to increases in cost of care, length of hospital stay and most significantly, patient morbidity and mortality as previously discussed. If patients are to get a fair service, good awareness programs to aid identification of at risk groups is paramount.

1.3 Groups at Risk of Oropharyngeal Dysphagia in the Acute Care Setting

(1) The elderly population

Particularly in the general hospital setting there are a significant number of different groups who are specifically at risk of oropharyngeal dysphagia. People over the age of sixty-five often form a large part of an acute care hospital caseload particularly as the general population is now ageing. Feinberg (1997) defines ageing as the

> *'progressive loss of dynamic range in physiologic function that reduces the ability to successfully respond to internal or external stress and maintain a constant homeostasis'.*

Many studies describe how healthy elderly adults have changes in their swallow mechanism when compared with younger individuals (Nilsson, Ekberg, Olsson, Hindfelt 1996; Jaradeh 1994; Dejaeger, Pelemans, Bibau, Ponette 1994; Shaker et al 1994; Logemann 1993). This altered swallow is generally efficient and safe. If a disease process is introduced to this already altered system, as is often the case on a hospital admission, this 'homeostasis' can be significantly disturbed as the elderly person has less reserve to compensate if an external stress is placed on their system. Diseases known to have dysphagia as a secondary complication such as stroke, cerebrovascular disease, chronic systemic disease, progressive neurological illnesses, severe respiratory illnesses, critical illness and

dementia, are all more prevalent in the elderly population (Feinberg 1996; Collins et al 1996; Kaatzke 1992). These disease processes coupled with changes in dentition, reduced muscular tonicity, reduced reflexes and sensorimotor abilities, alterations in cognition, affect or alertness, means that the elderly person on admission to hospital is at increased risk for dysphagia, particularly with excessively large boluses or rapid ingestion rates (Feinberg et al 1990).

Ultimately, this group are most likely to have multiple medical problems, requiring sophisticated medical intervention and/or institutional care (Kaatzke 1992). Unfortunately more often than not, the elderly population are not identified as being 'at risk' by many referral agents. Signs such as repeated pneumonia, weight loss, altered eating habits etc. are not immediately associated with dysphagia on admission. Earlier awareness of and identification of dysphagia in the elderly and its effects would help improve their quality of life and make them more comfortable. It would also allow for close monitoring of their nutritional status and general well being as they get older still. Morbidity and mortality, as well as the costly disability and dependence that result from impairment in oral intake, are now becoming recognised as major geriatric health problems (Feinberg et al 1990; Miller & Groher 1993). With a fast growing elderly population, it is important that such patients are channelled towards more appropriate and timely intervention programs by trained professionals early in their hospital admission to address swallow and nutritional problems.

(2) Stroke

Wade and colleagues (Wade, Hewer, Skilbeck, Devid 1985 cited by Gottlieb, Kipnis, Sister, Nardi, Brill 1996) identified stroke as the third leading cause of mortality in the general population and the most frequent cause of disability in the elderly. Whilst it is particularly common in this population (Barker, Mullooly 1997; Mann, Hankey 1999), like other diseases it also affects the under sixty-five population and can have equally devastating consequences for them. In the early post stroke phase swallowing dysfunction is an expected

complication. Gottlieb et al (1996) point out that pneumonia is the major cause of morbidity and mortality after stroke. Another study has identified dysphagia as an independent predictor of mortality in stroke (Smithard et al 1996). Generally it is accepted that up to 50% of stroke patients will present with some degree of dysphagia with/without aspiration in the initial acute stroke phase. Early studies in swallowing disorders in stroke revealed that dysphagia is present in 40% of patients with hemispheric stroke, 67% of brainstem infarcts, 56% of strokes including both hemispheres and 85% of combined infarcts of brainstem and hemisphere (Horner, Massey, Riski, Lathrop 1988). Whilst this dysphagia does tend to resolve in many cases (AHCPR 1999; Gottlieb et al 1996; Teasell et al 1994), patients with initial problems need to be identified on admission to prevent inappropriate feeding methods which might lead to pneumonia or compromised nutritional status. Those who do *not* have a swallow disorder also need to be identified so that they may start feeding as soon as possible, instead of having nasogastric tubes inserted unnecessarily or kept fasting whilst waiting for the SLT to assess them formally.

(3) Parkinson's Disease (PD)

PD is prevalent in the elderly population but also affects younger people. Given the nature of the disease as an extrapyramidal syndrome, rigidity and bradykinesia contribute to disorders of movement of the oral, pharyngeal, epiglottic and laryngeal musculature, resulting in inefficient bolus transfer and/or aspiration into the airway. Up to 95% of patients can have cineradiographic/videofluoroscopic disturbances of deglutition (Leopold et al 1996; Fonda & Schwartz 1995;Tuite 1998; Quigley 1998). Despite this, as many of these studies reveal, there appears to be a significant lack of awareness of dysphagia among these patients with the majority denying symptoms.

Typically, patients with Parkinson's disease are likely to be silent aspirators with reduced cough reflexes as well as having this lack of awareness of

dysphagia (Tuite 1998; Quigley 1998; Leopold 1997). This lack of awareness on the part of the patient may lead to lack of detection by medical personnel as the patient is unlikely to complain of, or agree to, symptoms on questioning. Therefore the patient with Parkinson's disease is, again, largely at risk of developing complications e.g. pneumonia or significant weight loss. It is often at this stage of a hospital stay (usually weeks after initial admission) that patients are eventually referred for swallowing investigations, the 'all else has failed' last resort. These problems could have been minimised if detected and managed earlier by trained professionals. With such a large percentage of PD patients likely to have dysphagia to some degree, it is crucial that staff are aware of this so patients are channelled in the right direction at the right time for the right management and prevention.

(4) Alzheimer's Disease/Dementia

In line with this rapidly ageing population, the incidence of dementia/Alzheimer's disease is also rising. It is estimated that between 1-6% of those over age 65 (in the US) have severe dementia and another 2-15% mild dementia (Gray 1989 cited by Kaatzke 1992). In Ireland, Swannick (1996) estimated that 5% of people over the age of 65 present with dementia. These patients often present with a multiplicity of behavioural, cognitive and physiological problems, and can often pose moral dilemmas in treatment (Carnes 1998). Nutritional problems are often most pronounced in the final stages of illness when roughly half of these patients are unable to feed themselves (Chouinard et al 1998). The main issues of concern for speech and language therapists are to establish whether or not there is an underlying dysphagia and to help the multidisciplinary team ensure that the patient's nutritional needs are met. Many patients with dementia forget to eat or stop eating certain foods because they have difficulty swallowing them e.g. solids. Due to language problems and cognitive impairment, they are often unable to verbalise this to carers so it is important that this group are screened for eating problems from an early stage. It is evident from clinical practice however, like patient's with Parkinson's disease, many are referred too late after a pneumonia or significant weight loss occurs. Again, problems arising

are often viewed as part of 'getting old' and may not yet be taken seriously by many health care providers as real issues that are preventable and manageable given the right resources.

(5) Systemic Disease

Stroke, dementia and progressive neurological diseases are some of the most obvious causes of oropharyngeal dysphagia but there are several other causes of neurogenic dysphagia which often go unrecognised by medical or nursing staff but which commonly present in the acute setting. Buchholz (1994) outlines some of these 'hidden' causes such as neuropathies (peripheral or cranial) arising from dyptheria, diabetes and neurotoxins can lead to dysphagic symptoms. Myopathies such as polyomyositis and dermatomyocitis can affect the bulbar muscles directly. Inflammatory myopathies and muscular dystrophies as well as endocrine disorders e.g. hypothyroidism, can cause pharyngeal muscle weakness. In addition, systemic diseases can contribute to oropharyngeal dysphagia (Jones, Ravich, Donner 1993). Skin diseases can result in the formation of webs, strictures, inflammatory changes, adhesions, ulcerations, fistulae and perforations in the oropharyngeal area. Gastroenterologic diseases are associated with oesophagitis and ulceration which can result in reflux aspiration due to regurgitation of food from the oesophagus to the oropharyngeal area (Murray, Rao, Schulze-Delrieu1997). Certain haematologic diseases e.g. amyloid, can result in reduced oropharyngeal and possibly laryngeal muscle movement. Iron deficiency anaemia has also been linked to the formation of webs, resulting in the patient complaining of dysphagia for solids as food will get stuck either in the oesophagus or in the oropharyngeal area (Kirshner 1989, Buchholz 1994, Jones et al 1993). Rheumatologic diseases and connective tissue disorders are also known to contribute to dysphagia. Jones et al (1993) describe how rheumatoid arthritis can cause bulbar pharyngeal paresis as a result of medullary compression by the odontoid process. Local factors can interfere with the normal suspension of the pharynx and the ability of the larynx to elevate during swallowing. Mobility of the cricothyroid and arytenoid joints can also be affected.

(6) Iatrogenic factors

Dysphagia arising after critical illness, possibly arising from neurological complications of sepsis in intensive care, has been recently reported (Collins et al 1996). Iatrogenic causes of dysphagia also occur secondary to the neurological side effects of medications or to neurological complications of surgery involving the structures of the head and neck (Stoschus, Allescher 1993; Jones et al 1993; Buchholz 1994). Such patients will often present with an array of symptoms e.g. weight loss, nausea and vomiting, oesophageal problems and while speech and language therapists are aware of risks to these patient groups, general medical, surgical and nursing staff typically aren't. The symptoms are treated but, consequently, will not resolve because the root cause has not been treated properly. Therefore at risk patients are not referred for timely investigation unless serious complications develop or as an 'all else has failed' tactic.

(7) Respiratory disease

More evidence is now coming to the fore which indicates that patients presenting with severe respiratory illness also present with dysphagia, probably due to the very close relationship between swallowing and respiration as previously alluded to (Curtis, Langmore 1997; Martin, Logemann, Shaker & Dodds 1995; Takahashi 1990, 1994; Shaker et al 1992; Selley et al 1994). In essence, the upper digestive and respiratory systems are physiologically conditioned so that deglutition and respiration are accomplished with ease. If anything disrupts the ease with which this intricate act occurs e.g. disrupted respiratory patterns, then the system becomes unbalanced. According to Martin et al (1996) 45% of the COAD (Chronic Obstructive Airways Disease) population are estimated to have disrupted oropharyngeal swallowing patterns leading to aspiration and reduced oropharyngeal swallow efficiency. A Spanish study has looked at community acquired pneumonia in the elderly (Riquelme, Torres, El-Ebiary, Puig De La Bellacasa, Estruch Mensa, Fernandez-Sola, Hernandez, Rodriguez-Roisin

1996). The authors found that the presence of suspicion of large volume aspiration or swallowing disorders were statistically significant as causes of pneumonia in the studied population. They also discovered that large volume aspiration and a poor nutritional status were independent risk factors for developing pneumonia. Swallowing disorders in this elderly group were associated with poorer prognosis and outcome. The study agrees with one conducted by Japanese authors Kikuchi, Watabe, Konno, Mishina, Sekizawa, Sasaki (1994). These researchers found a high incidence of silent aspiration in 14 elderly patients with community acquired pneumonia. Seventy one per cent of a series of elderly individuals with acute pneumonia had silent aspiration. It was not clear from this study if the aspiration was oropharyngeal or gastric related.

Oropharyngeal dysphagia has also been observed in 50% of a group of 23 patients with diffuse aspiration bronchiolitis (DAB) as described by other Japanese authors Matsuse, Oka, kida, Fukuchi (1996). The authors have proposed that the phrase 'Diffuse Aspiration Bronchiolitis' should be used to define the disease entity characterised by a chronic inflammatory reaction to recurrent aspirated foreign particles in the bronchioles. They further stress that DAB should be suspected in any elderly patient with recurrent episodes of bronchorrhea, bronchospasm and dyspnea and recommend speech and language therapy evaluation and follow up in this instance. A retrospective study of oropharyngeal swallow disorder in chronic obstructive airways disease in an Irish population studied 50 subjects with a primary diagnosis of exacerbation of COPD on admission to hospital (Gerrard- Dunne, Farrell, O'Neill in press). Sixty two per cent of subjects had confirmed swallow disorders and over half of the total sample displayed relevant co-morbidities such as dementia, stroke disease, and parkinsonism. However, despite what these studies prove, typically many of these patients will have multiple admissions to hospital before finally being channelled in the appropriate direction for management of swallowing disorders, if channelled there at all. This group of patients are probably least suspected of having a swallow disorder due to poor awareness among medical and nursing staff of the interplay between respiration and swallowing. Such a group need to be

identified early and dealt with appropriately in a bid to reduce length of hospital stay, number of admissions and cost of care generally.

1.4 Management of Oropharyngeal Dysphagia - Issues and Implications

The management of oropharyngeal dysphagia is a complex process from the very beginning i.e. identification of a problem, through to the assessment, diagnostic and treatment phases. As oropharyngeal dysphagia affects the person in many ways it can only be managed effectively within the confines of a full multidisciplinary setting. After a detailed assessment process, the speech and language therapist will make a set of recommendations which are generally aimed at minimizing aspiration/dysphagia and maximising nutritional intake. Essentially it must be decided if it is safe for the individual to feed orally and how safe it is. Recommendations and treatment often involve both direct and indirect strategies for overall swallow rehabilitation. Direct therapy involves practising swallowing with food/fluids following specified instructions i.e. using certain head postures such as chin down, head turning, or using specific swallow techniques such as supraglottic swallow or mendelsohn manoeuvre (Rasley et al 1993; Logemann 1993; Shanahan, Logemann, Rademaker, Pauloski, Kahrilas 1993; Logemann et al 1990). Indirect therapy includes instruction in exercises to improve oromotor control i.e. range of tongue motion exercises, resistance exercises, bolus control exercises, exercises to increase gross oral manipulation of material, exercises to hold a cohesive bolus and bolus propulsion exercises (Lazarus, Song, Logan, Rademaker, Kahrilas 1998; Miller, Groher 1992). Indirect therapy also includes direct stimulation of the swallow reflex using thermal stimulation (Rosenbek, Roecker, Wood, Robbins 1996; Rosenbek, Robbins, Fishback, Levine 1991) although the effectiveness of the technique has been disputed (Bove, Mansson, Eliasson 1998). Laryngeal exercises are also incorporated into therapy programmes to improve adduction of tissues at the top of the airway and laryngeal elevation (Shaker, Kern, Barden, Taylor, Stewart, Hoffmann, Bounevier 1997; Shaker, Kern, Barden, Arndorfer, Easterling 1997).

Whilst these techniques involve working directly with the individual, management extends beyond this. The multidisciplinary team must be informed regarding feeding recommendations and compensatory strategies. The medical team must observe for and treat complications of aspiration, the physiotherapist will advise regarding correct positioning for feeding and also monitor chest status, the clinical nutritionist will ensure the nutritional needs of the person are met appropriately, the occupational therapist will adapt the feeding environment to make self feeding easier for the person, the catering department will prepare foods of specified consistencies which are safe to swallow, and nursing staff will assist and supervise the patient at mealtimes to ensure all recommendations are being followed. In fact, the nurse is a most valuable link for the rest of the team as s/he is in contact with the patient all day and night and is generally aware of any specific difficulties the patient might have. Social workers or psychologists, where available, provide support for the person who may find the whole process distressing. Another vital part of the team are carers who must also be informed and in many cases educated regarding swallow exercises, special techniques and food/fluid preparation so they become an active part of the rehabilitation process. In general, the speech and language therapist must take the time to liaise with and educate all these professionals in order to establish a comprehensive swallow rehabilitation process and follow the progress of the patient closely on a regular basis.

In short, direct treatment of swallowing and its overall management takes a lot of time to implement and complete. In an ideal setting a patient will need daily therapy sessions and families/carers need a lot of support initially if treatment is to be effective. The speech and language therapist needs to spend time educating the team and carers alike for treatment to be successful. However, as referral rates and assessment demands increase, treatment time typically suffers. Often, as mentioned, increased referrals rates include a significant number of inappropriate referrals which waste valuable clinical time. If this number of inappropriate referrals could be minimised this would reduce time wasting and lead to increased clinical treatment time.

Currently demands are increasing for quality and effective healthcare services (Department of Health 1994; Towards Independent Living 1996; RCSLT 1996). If appropriate therapy time is not available to therapists it is very difficult to achieve this. Clinicians are expected to make the best use of the facilities and resources they have to streamline existing services thus improving the quality of service delivery and overall care. As previously stated, limited diagnostic accuracy at the bedside clinical examination can further delay decision making as therapists may prefer to wait for an objective assessment e.g. videofluoroscopy. More effective use of expensive, objective techniques should minimise the amount of clinical time a therapist spends inappropriately, as well as improving service delivery to patients who need improved access to specialist assessment and treatment techniques. By educating the members of the multidisciplinary team and by increasing general awareness of oropharyngeal dysphagia, its signs, symptoms and consequences, one should expect to reduce the numbers of inappropriate referrals. In addition, if clinicians strive to adopt more objective and reliable bedside assessment methods which improve clinical accuracy and detection ability, then this will reduce numbers of unnecessary videofluoroscopies and should ultimately help streamline hospital throughput.

In general it is acceptable that speech and language therapists are not readily accessible twenty-four hours a day seven days a week. Furthermore, therapists are not available to assess every patient on admission to acute care wards on a daily basis. All patients are admitted to wards by nursing staff following a standard admission nursing protocol which assesses an individual's ability to perform certain activities of living e.g. the Roper Logan Tierney Model (Roper, Logan, Tierney 1996) currently used in this centre (Table 1 page 28).

Table 1 Roper Logan Tierney Model Of Nursing Practice

Subsections: Activities of Living
1. Maintaining a safe environment
2. Communicating
3. Breathing
4. Eating and Drinking
5. Eliminating
6. Personal Cleansing and Dressing
7. Controlling body temperature
8. Mobilizing
9. Working and playing
10. Expressing sexuality
11. Sleeping
12 Dying

According to several agencies including the Scottish Intercollegiate Guidelines Network (SIGN 1997), it is at this point that determination of risk for dysphagia should be made. If equipped with a simple screening tool as part of their admission procedures, nursing staff are the ideal group to use such a tool as part of their 'eating and drinking' assessment. In addition, nursing staff monitor patients on an ongoing basis after admission and are the first to detect changes in patient status and any problems which arise. A recent study by Farrell, O'Neill, McMenamin, Mannion (1998) indicates that nursing staff are favourable towards using a simple screening tool as it allows earlier and more flexible decision making regarding patient feeding status and does not make the team wholly dependant on the speech and language therapist. If nursing staff are willing and reliably equipped to identify whether it is safe to feed or not to feed a patient, then almost certainly the complications associated with aspiration and reduced oropharyngeal swallowing efficiency should be readily minimised.

1.5 Bedside Clinical Assessment

Before any swallowing disorder can be managed a thorough clinical assessment must be undertaken. In order to extend core skills to other team members, core identification factors must be fully explored and those

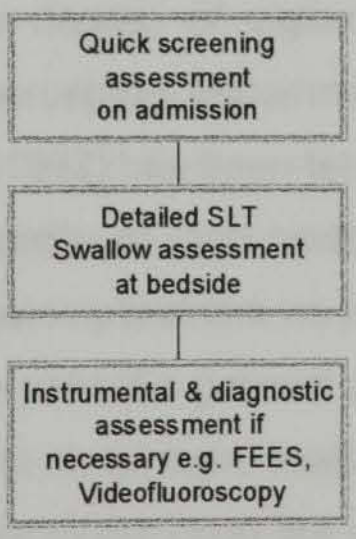
essential to a screening procedure should be selected. There are many components of the dysphagia evaluation (Logemann 1983; Miller 1992; Cherney et al 1996; Baker 1993; Schulze-Delrieu, Miller 1997) which must be included in any assessment if holistic decisions are to be made.

Indeed the swallow assessment process may be described as a three tiered assessment cascade with initial screening being an important first component (figure 2 below). It is important here to differentiate between screening tests and diagnostic tests. Logemann, Veis and Colangelo (1999) explain the difference as follows;

> *'A screening procedure is generally designed to identify patients at high risk for a particular problem.....whereas a diagnostic procedure is designed to identify the abnormal anatomy or physiology causing the problem'.*

In essence, screening procedures look at symptoms and diagnostic procedures look at anatomy and physiology causing these symptoms.

Figure 2 Components of Swallow Assessment Process



Past medical history is crucial in identifying patients who are at risk for dysphagia. Referral sources must become increasingly aware of signs, symptoms and disease processes that indicate risk if accurate diagnosis is to

be reached. It is vital to identify patients who are at risk of dysphagia and why they may be at risk. This, ideally, should be done on admission to hospital. Thus the person's previous and present medical history must be studied for evidence of any neurological disease/trauma, chronic respiratory disease, gastrointestinal disease, systemic disease, head and neck surgery or medications which are known to contribute to dysphagia. Several factors in a person's history which typically indicate the presence of dysphagia include complaints of obstruction, mouth or throat pain, nasal regurgitation, mouth odour, choking/coughing with food, history of pnuemonia/ other respiratory symptoms, gastroesophageal reflux, chest pain, weight loss, change in eating habits, alterations of taste, mucosal changes/dryness, salivary consistency changes, sleep disturbance, and speech/vocal changes (Miller 1992; Hendrix 1993; Schulze-Delrieu et al 1997). In addition, Miller (1992) warns that changes in speech or voice may parallel the development of swallowing difficulties since speech and swallowing are dependent on certain common neurologic, muscular and anatomic factors. There does appear to be a significant correlation between wet-hoarse voice quality and subsequent laryngeal penetration/aspiration as Linden, Kuhlemeier, Patterson (1993) have observed.

As eating requires some degree of vigilance and planning, patients who exhibit poor judgement, perceptual impairments, or motor planning disorders are at risk for what Miller (1992) has been termed 'swallowing catastrophe'. In addition, the person's appetite or food preference may be affected and this can have serious nutritional implications as previously discussed. Therefore it is also necessary that the patient's general psychologic and cognitive/mental status is considered in the dysphagia evaluation. Patients presenting with dementia or other cognitive dysfunction are at risk for these reasons. Any or a combination of the above factors are significant indicators for dysphagia and patients presenting as such need identification and full clinical investigation. Some mechanism for training and increasing awareness of these factors among referral sources are necessary to facilitate appropriate referral and should be part of any screening programme.

Once the medical diagnosis and past history have been established and a history of the person's feeding and nutritional status taken, a number of clinical observations must be made before direct assessment of the swallow can take place. Cherney and colleagues (1996) termed this part of the assessment 'Pre-Feeding Skills'. These 'Pre Feeding Skills' are important in deciding readiness for assessment, which should be another important element of any screening procedure for dysphagia. The evaluation of such skills involves considering level of responsiveness and cooperation, cough, gag reflex, presence/absence of tracheostomy tube, general positioning, oral-motor and laryngeal functioning, dentition, and pathologic reflexes. A standard assessment should involve examination of the oral anatomy, oral motor control, oral sensitivity exam and laryngeal function exam.

There are several well documented warning signs that should alert health professionals to the likelihood of dysphagia during a clinical examination, even before direct assessment takes place. These include presence of a confused mental state or dysarthric speech in patients with neurologic disease, excessive drooling/difficulty handling oral secretions/excessive copius secretions, prolongation of meals, unexplained weight loss, complaints of obstruction and/or pain during swallowing, coughing and choking on food/sputum, moist wet gurgly voice quality, absence of gag, cough, swallow reflexes, decreased tongue and mouth movements (Logemann 1983; Groher 1992: Baker 1993; Linden, Kuhlemeier, Patterson 1993). Such clinical observations allow for the assessment of behaviours that may interfere with or compensate for a patient's swallowing skills. Disturbances in any or a combination of the above factors are known to contribute to dysphagia. Referral sources must become more aware of these warning signs if appropriate identification and referral are to be initiated.

Once these factors have been evaluated, the best posture for the patient, best food position in the mouth and best food consistency can be selected before trial swallows commence. For this 'direct assessment' of the swallow, the person must be alert, co-operative, ideally sitting upright with chin flexed. If deemed appropriate for assessment, foods of graded consistency are

presented to the patient whilst the larynx is palpated by the clinician to feel laryngeal elevation as the swallow is triggered, observing for any of the above signs (Logemann 1983). Generally it is agreed that signs such as pocketing of food in lateral sulci/collection of food in mouth generally, spitting food out of mouth, slowed oral transit times, excessive lingual movement, delayed/absent elevation of hyoid bone and thyroid cartilage on laryngeal palpation of swallow, coughing and choking before/during/after reflexive swallow, expectoration or regurgitation of material through the mouth or nose, changes in respiration, change in vocal quality, fatigue, eye-tearing, throat clearing do indicate reduced oropharyngeal swallow efficiency with or without aspiration (Hendrix 1993; Schulze-Delrieu et al 1997; Logemann et al 1999).

Relying on coughing alone is not enough. In detecting aspiration the clinician must take the whole assessment into account before making a decision. In several patient groups sensitivity to aspiration may be significantly reduced as many neurological and respiratory conditions affect sensory feedback about position of food in the vocal tract and entry of food into the airway. Many patients, particularly in the acute phases of an illness, may have significantly reduced sensitivity in the oropharyngeal/laryngeal area. In addition, the cough compression phase duration may have been affected, particularly in stroke (Smith, Hammond, Bolser, Davenport, Hiss, Zafac 1998). This leaves little protection against aspiration if it occurs and, also, makes detection of aspiration difficult, particularly if the clinician is relying on the person to cough reflexively and they do not do so i. e. the patient may have 'silent aspiration'. Generally it is accepted that occurrences at the pharyngeal phase of swallowing are difficult to observe from the bedside, making detection of silent aspiration even more difficult.

Historically, detection rates of aspiration at a bedside clinical assessment by Speech and language therapists have been relatively low with approximately 40% of at risk patients being detected by therapists (Logemann 1983; Splaingard, Hutchins, Sulton, Chadhuri 1988; Linden & Siebens 1983; Horner

& Massey 1988). However, more recent studies have shed light on factors which, if present during a swallow assessment, are significantly correlated with the presence of aspiration on videofluoroscopy. Linden and colleagues (Linden et al 1993) identified nine clinical indicators which have been shown to have significant relationships with aspiration as shown by videofluoroscopy. These include;

1. Reclining or lying posture
2. Moderate, or severe dysphonia, aphonia, or inability to test for dysphonia
3. Wet phonation or inability to test for wet phonation
4. Abnormal or absent laryngeal elevation or inability to test for laryngeal elevation
5. Wet spontaneous cough
6. Abnormal palatal gag on either or both sides
7. Some or no swallowing of secretions (i.e. poor ability to control secretions)
8. Harsh phonation or the inability to test for harsh phonation
9. Breathy phonation or the inability to test for breathy phonation.

Identification of any of these nine clinical factors accurately predicted aspiration 66% of the time i.e. in two thirds of the studied population. The absence of subglottic penetration could be predicted 67% of the time. Another study evaluating aspiration in patients with acute stroke (Daniels, Brailey, Priestly, Herrington, Weisberg, Foundas 1998) identified dysphonia, dysarthria, absent gag reflex, absent volitional cough, cough after swallow and voice change after swallow as significant indicators of dysphagia. This study showed that the co-existence of abnormal volitional cough and cough with swallow predicted aspiration with 78% accuracy.

Further reinforcing these findings, Logemann et al (1999) presented the sensitivity and specificity of a 28 item screening test in identifying patients who aspirate, have an oral stage disorder, a pharyngeal delay, or a pharyngeal disorder. Overall their 28-item screening test achieved 70% accuracy in detecting presence or absence of oropharyngeal dysphagia. The study showed that the best single predictor or aspiration was a cough or throat clear during trial swallows. This meant that 69% of subjects were

classified correctly with 78% sensitivity and 58% specificity. If reduced laryngeal elevation or history of recurrent pneumonias was also present, detection increased to 71%. The best single predictor of oral stage problems was dysarthria (69% of patients correctly classified). The best single predictor of pharyngeal stage problems was reduced laryngeal elevation on trial swallows. Seventy percent of patients were correctly classified thus, with 72% sensitivity and 67% specificity. Facial weakness and observation of delay on trial swallows also identified pharyngeal stage problems.

In a multi-centre study reported by Lundy, Smith, Colangelo, Sullivan, Logemann, Lazarus, Newman, Murry, Lombard, Gaziano 1999) decreased laryngeal elevation and delayed triggering of the pharyngeal motor response were the most common causes of aspiration observed. A history of aspiration pneumonia was also significantly associated with the presence of aspiration on videofluoroscopy. This reinforces what other recent studies have found and proves that detection of dysphagia at the bedside by trained professionals is improving. In fact, the Agency for Health Care Policy Review (1999) have also recognised this, particularly in relation to stroke when they conducted a review of detection methods and procedures;

> *'Full bedside exams can have sensitivities for aspiration near 80% with specificities near 70%. Epidemiologic evidence indicates that about half of the patients with dysphagia who aspirate do so silently. These two points taken with very low pneumonia rates observed in dysphagia management programmes that used full bedside exams indicate that these exams are capable of detecting most aspiration even silent aspiration'*
>
> *AHCPR, USA, 1999*

Such results are encouraging and indicate that as research and experience continue, clinicians are becoming better at detecting aspiration at the bedside. The factors outlined above have been significantly correlated with aspiration on videofluoroscopy and should be incorporated into any bedside screening procedure, if oropharyngeal dysphagia is to be identified accurately.

It is unlikely in an acute setting that referral agents will have time to do such a detailed assessment which is usually done by speech and language therapists. There is evidently room however for some quick and easy measure to identify at risk patients and quickly screen for problems by looking for the factors already mentioned. Ideally a screening test should be

- quick and easy to use
- require minimal training
- require minimal equipment
- must be sensitive
- must be specific enough to avoid inappropriate referrals. (Smithard et al 1995, 1997)

1.6 Existing Swallow Screening Measures

Different screening procedures for dysphagia have been previously described but only one to date is specifically tailored for use in the general acute care setting. The Burke Dysphagia Screening Test - BDST (De Pippo et al 1992, 1994) was developed for a stroke population. Once any one of seven key features (which are associated with an increased risk of dysphagia) is identified i.e.

1. Bilateral hemisphere stroke
2. Brainstem stroke
3. History of pneumonia during the acute stroke phase
4. Coughing associated with feeding
5. Failure to consume half of meals
6. Prolonged time for feeding
7. Non-oral feeding program in progress.

a 3oz water swallow test is automatically done (i.e. drink 3oz of water from a cup without interruption). Coughing with associated feeding is shown to correlate significantly with development of pneumonia, recurrent upper airway obstruction or death. The test identified 80% of patients aspirating during

subsequent videofluoroscopies with 92% of patients developing these complications during their inpatient rehabilitation stay.

In conclusion, the authors deem this water swallow test a sensitive screening tool for aspiration during stroke, useful as a screening tool for videofluoroscopic examination referral as well as being effective in identifying patients at greater risk for medical complications associated with aspiration and dysphagia. The tool, however, has only been validated on a stroke population by the authors who are experts in the field of dysphagia and takes fifteen minutes to administer. It is doubtful in an acute care setting that speech and language therapists will be available on every ward to assess every new admission. Whilst it may be useful in a specialised stroke unit, it does not apply to the wider population of patients who may have oropharyngeal dysphagia and who may well demonstrate silent aspiration. Even though the authors mention the observation of the presence of post swallow 'wet-hoarse voice quality', the criteria stated on the screening form does not include this factor. Linden et al (1983) demonstrated in fifteen subjects that wet-hoarse voice quality is strongly correlated with the presence of aspiration on videofluoroscopy. Such a factor should be included on any screening form for dysphagia. Certainly, elements of this screening tool may be useful in a more generalised screening tool for a wider patient population. Whilst it is stated that an admitting physician, nurse or health professional can administer the test, no interrater reliability data is presented. In addition, in a busy acute care ward, fifteen minutes is likely to be too long for such a screening test to be administered by ward staff.

A timed test for swallowing in neurological outpatients has been described (Nathadwarawala, McGroary, and Wiles 1994). The study concludes that swallowing speed is significantly slower in patients who perceived a swallowing problem or who had abnormal symptoms/signs on clinical examination. A swallow speed of >10ml/sec was considered fast, whilst a speed of < 10ml/sec was considered slow. Previous research by the authors had indicated that no individual in a control population drank at <10ml/sec (Nathadwarawala, Nicklin, Wiles 1992). Whilst swallowing speed was

significantly slower in patients who perceived a swallowing problem or who had abnormal symptoms or signs compared with those who did not, no correlation/comparison was made with time as measured by videofluoroscopy/time frame analysis. In a later study, Hinds And Wiles (1998) showed the swallowing test had 100% sensitivity and 52% specificity for patients with acute stroke. In addition to the timed swallow test, all patients in these studies underwent a detailed neurological examination and swallow history questionnaire. Again, on a busy acute care ward this is likely to be deemed too time consuming to include as part of a 'simple' screening procedure. In the first study (Nathadwarawala et al 1994) only patients with neurological disease under age 70 years were included in the study. Patients over 70 years were excluded because of the known high prevalence of swallow disorder in the elderly and lack of control data for swallowing speed in this age group. Whilst, again, elements of this test may be useful in an overall screening tool for dysphagia e.g. a longer swallow time is likely to indicate dysphagia, findings are not representative of a more generalised elderly population.

One tool which involves medical and nursing staff screening has been described (Smithard et al 1995, 1997). The authors state many of the reasons already cited as the rationale for developing the screening tool e.g. large number of inappropriate referrals for swallow assessment leads to wasting of valuable clinical time. This screening test lists examples of groups of patients who are considered at high risk for aspiration and who should be screened. It would appear that in this instance, identification of the high risk patients depends on the vigilance of the nursing/medical staff to identify patients based on training and knowledge/experience. There is still a risk that some patients will still 'slip through the net' and not be screened. If all patients are screened on admission with a checklist of diagnoses, this may allow clearer identification of appropriate patients to be singled out for further swallow assessment. The likelihood of patients being 'missed' should therefore be reduced. The authors state that the high risk groups may need to be redefined for some patient populations. Furthermore, certain groups of patients are not included in this particular screening test. Patients with critical

illness after major surgery have been documented to have persisting dysphagia (Collins et al 1996). Patients with psychiatric history should also be screened as several drugs used to treat psychiatric conditions are known to cause neuromuscular side effects which can contribute to dysphagia (Bazemore, Tonkonogy, & Ananth 1991; Leopold et al 1996; Stoschus et al 1993, Buchholz 1994,1995).

A screening form to detect dysphagia in an acute care setting should channel the right patients in the right direction. In order to do so, the following criteria should be fulfilled;

- Should be quick and easy to use with minimal equipment
- All patients entering the ward should be screened and their diagnosis checked against an initial checklist on the test form
- All relevant diagnoses should be included
- All factors known to be strongly correlated with aspiration and dysphagia should be included on the form
- Good inter-rater reliability should be established

If such a tool could be implemented then the SLT could concentrate on ways of streamlining techniques for management of aspiration and dysphagia.

The very subjective nature of a bedside clinical examination, coupled with difficulty in identifying problems at the pharyngeal stage of the swallow can make patient management very difficult if it alone is to be relied upon. Even with experience, as clinicians are becoming increasingly accurate at predicting presence/absence of aspiration at the bedside as outlined previously, accuracy is not at 100% level and patients are still likely to slip through the net undetected even after a bedside assessment by a trained professional.

Whilst identification of oropharyngeal dysphagia is vital, pinpointing the origin of the dysphagia i.e. the cause is most difficult at the bedside. It is generally agreed that the bedside clinical examination remains largely subjective and non-diagnostic, and should be supplemented with some form of objective,

more diagnostic measure. Therapists have become increasingly reliant on objective means of assessment to determine cause and then lead the way to appropriate and specific treatment methods. There are many methods of objectively measuring swallow dysfunction and all have strengths and weaknesses. Therapists ideally need a relatively non-invasive, accessible and accurate diagnostic tool for prompt diagnosis at the bedside which will alter their management appropriately in a more timely fashion.

1.7 Objective Measurement of Swallowing

Videoflouroscopy (also known as modified barium swallow- MBS) is ultimately considered to be the 'gold standard' for measuring swallow dysfunction. Because swallowing is a dynamic and rapid process, fluoroscopy is particularly well suited to the study of this physiologic function (Logemann1993). Several Authors have described standard procedures for videofluoroscopy (Logemann 1993, Feinberg 1993, Palmer 1993). The focus of the fluoroscopic image involves the lips anteriorly, the hard palate superiorly, the posterior pharyngeal wall posteriorly and the bifurcation of the airway and the oesophagus. As the fluoroscopic image is recorded on videotape, voice recording can be made simultaneously. Frame by frame analysis of the swallow is also possible.

The primary rationale for performing videofluoroscopy is to define the etiology of aspiration. The procedure allows assessment of oral and pharyngeal transit times during deglutition and pinpoints the motility problems in the oral cavity and pharynx which may cause these times to be slow. It also allows viewing of the cricopharyngeal junction and the status of the upper oesophagus. More specifically, viewing the oropharynx in the lateral view permits identification of location of stasis of the bolus along the vocal tract from the anterior to the posterior; it allows analysis of patterns of lingual movement, estimation of pharyngeal residue and the amount of material aspirated per bolus as well as the reason for aspiration. Furthermore it permits accurate information about the duration/timing and latency of the swallow. Once the etiology of aspiration is established, treatment techniques

can be trialled during the procedure to try to eliminate/minimise aspiration (Logemann 1993; Logemann, Kahrilas, Kobara, Vakil 1989; Shanahan, Logemann, Rademaker, Pauloski, Kahrilas 1993; Logemann et al 1990; Palmer 1993). Positioning patients in the anteroposterior (AP) view allows assessment of asymmetries in function, especially of the vocal folds. Gross judgement can be made about the relative movement of the two cords on adduction and abduction, allowing the clinician to assess the patient's ability to close his/her vocal folds and protect the airway during swallowing. Bilateral or unilateral collection of residue can also be viewed and treatment strategies to minimise residue can be tried. Whilst videofluoroscopy is considered the 'gold standard ' in assessing swallowing disorders and directing treatment, Bastian (1993) outlines some limitations which may hinder its use in certain patients including;

1. Dependence upon the equipment, personnel and scheduling of the radiology suite tends to reduce the efficiency of diagnosis and management. This often leads to delays due to reduced availability and access to the appropriate equipment and setting.

2. The procedure is inaccessible to patients who are physically unable to come to the radiology suite, through grave illness or injury. Even though appropriate supportive seating is available on the market (Langmore in Kidder 1994; Logemann 1993), it tends to be costly and many departments may not have available funds. In addition, those who are critically ill and in need of urgent evaluation e.g. patients in intensive care are often too ill to transport to the radiology suite.

3. Reliance on ionising radiation is of concern for patients who need frequent reassessment of swallowing function.

4. Important information may remain hidden e.g. subtle neurological deficits of palate, pharynx, and larynx.

5. It is expensive and as a result, may not be available in many centres (RCSLT 1992; IASLT 1996)

Whilst it is the ideal assessment for swallow dysfunction, if videoflouroscopy is unavailable or inappropriate for the individual, the clinician must look at other objective ways of improving the accuracy of the clinical examination.

Many other techniques are being pioneered and are becoming increasingly useful at the bedside including Fibreoptic Endoscopic Examination of Swallowing, otherwise known as FEES. This procedure, first described by Langmore (1988), involves evaluation of structure and function of the palate, pharynx, and larynx as well as sensation of the laryngopharynx, using a fiberoptic nasolaryngoscope passed transnasally, often with some local anaesthetic spray. Then patients' swallowing abilities are assessed as they ingest various food consistencies. The equipment can be linked to a video recorder and television monitor. Some authors refer to this as 'videoendoscopic swallowing study' (Bastian 1991, 1993; Kidder et al 1994). More recently, equipment for sensory testing of laryngeal sensation using air pulses has been developed (Leder 1997)

FEES is documented to allow better assessment of palate mobility and closure, pharyngeal squeeze, vocal fold mobility and closure, sensation and more anatomic detail (Bastian 1993). It is portable, versatile, and can be used in many settings e.g. clinic, office, nursing home, intensive care unit, and hospital bedside. It provides immediate information to the examiner and does not expose the patient or examiner to ionising radiation (Kidder et al 1994; Bastian 1993). The examination can be recorded on a videotape, is easily repeatable to gauge progress in recovery of swallow function, and is a useful biofeedback tool for treatment.

In contrast, videofluoroscopy is acknowledged to provide better information about aspiration (extent and timing), duration/timing and latency of the swallow, the extent of laryngeal elevation/excursion, the oral phase of the swallow, as well as the oesophageal (upper) phase of swallowing (Bastian 1991, 1993; Kidder et al 1994; Langmore, Logemann 1991). As the view is obliterated during the swallow in FEES (by epiglottic closure), during swallow events are difficult to observe (Langmore 1991; Kidder et al 1994) Whilst both procedures have obvious advantages and disadvantages, it is accepted that FEES is generally useful only as an adjunct to the videofluoroscopic examination of swallowing, particularly as a bedside screening assessment i.e. it tells you that there is a problem but not fully why it is there or how it can

be treated. FEES primarily evaluates the pharyngeal phase of swallowing and does not provide as comprehensive picture of swallow function as contrast radiography (Kidder 1994; Logemann et al 1998). Its best use may be as a preliminary examination in a patient for whom videofluoroscopy is not feasible.

As it involves passing a scope transnasally into the pharynx, this is quite an invasive technique making it instantly inappropriate for some patient groups e.g. the confused elderly patient. In addition, anasthetic spray is often used to help make passage of the scope easier. Arising from these two factors are possible risks including vasovagal reaction, laryngospasm, nasal haemorrhage and adverse medication reaction (Kidder et al 1994) although these risks are relatively small. The influence of a nasendoscopic tube on the physiology of normal swallow mechanics has not, to date, been assessed in large samples of subjects (Martin in Kidder et al 1994). More recently the effects and administration of medication used to anaesthetise the nasal area have been questioned. Who administers the anaesthetic is often a source of controversy between clinicians in many centres, due to the potential side effects. However, recent indications are that many people tolerate the passage of the endoscope with no medication and minimal discomfort (Leder et al 1997). Furthermore, like videofluoroscopy, the equipment is costly and requires specific training in its use. For these reasons it is often not readily available in many centres (IASLT 1996; RCSLT 1992; Kidder et al 1994).

Another technique involves the use of manometery to assess swallow function objectively. First described by McConnel, Cerenko, Hersh, Mendelsohn & Jackson (1988), this procedure assesses pressure changes in the oropharynx during swallowing. Manometry involves placing a catheter like solid state manometer into the pharynx transnasally (Cerenko, McConnell & Jackson 1989). This measures intraluminal pressures but the amount of pressure applied to the bolus is difficult to determine i.e. it is difficult to assign pressures to specific pharyngeal structures and decide what role the pressures play in bolus transit (McConnel 1988; Cerenko et al 1988; McConnel, Cerenko, & Mendelsohn 1988). Further limitations of pharyngeal manometry in the evaluation of dysphagia include asymmetric pressure

generation, catheter movement, and rapid motion during the swallow (Cerenko et al 1988; McConnel et al 1988). In a more recent study, manometry has been shown to have important diagnostic and therapeutic implications as part of an overall swallow evaluation, which reveals nothing other than high UES resting pressures which, after dilatation, are reduced with resolution of the swallow problem (Hatlebakk, Castell, Spiegel, Paoletti, Katz, Castell 1998)

Taking the assessment a step further, manofluorography simultaneously records pressure, anatomic events, and bolus transit on a single videotape along with timing numbers (McConnell 1998; Brasseur 1998). Essentially, the procedure is a combination of videofluoroscopy and manometry. The fluoroscopic image and four channel pressure recordings are simultaneously recorded on videotape. The technique has important diagnostic implications but clinically as a therapeutic tool, it remains largely unexplored. The invasive nature of the procedure, as well as the expense of integrating all of the components (manometry, videofluoroscopy, computer/data analysis and printout systems) may make the procedure inaccessible to many centres. Furthermore, patients who are unsuitable for videofluoroscopy will also be unsuitable for this procedure, as discussed previously.

Pulse oximetery is another tool which therapists are using at the bedside to help detect aspiration. This technique is a means of providing accurate measurement of arterial oxygen saturation ($Sp0_2$) which can detect changes in $Sp0_2$. As aspiration causes hypoxemia to occur it follows that a drop in oxygen saturation after swallowing food indicates that hypoxemia has occurred i.e. aspiration has occurred. Several studies looking at the use of this technique in stroke patients demonstrate that it appears to be a reliable tool for this particular population (Collins, Bakheit 1997; Zaidi,Smith, King, Park, O'Neill 1995). However, more recent studies have expressed caution in using the technique, particularly in people with respiratory disease and neurologic disease affecting the respiratory centres in the brain e.g. brainstem stroke (Sellars, Dunnet,Carter 1998; Sherman, Nisenboum, Jesberger, Morrow, Jesberger 1999). Disruption to respiratory centre alone may cause

oxygen levels to fall intermittently which may at times be misinterpreted as aspiration during eating. However, all studies do support that respiratory function may be altered at mealtimes and suggest that pulse oximetery is a useful tool as an adjunct to the bedside assessment. It is not diagnostic, has little diagnostic potential and can only add information to an evaluation.

Clinicians have also employed surface EMG (electromyography) as an assessment and diagnostic tool. This provides a measure of the electrical events of the muscle and allows a measure of the composite of the activity of the underlying muscles. The pharyngeal stage of swallowing in a normal individual, is distinguished by a complex pattern of activity that once elicited proceeds in an all or nothing sequence through the groups of suprahyoid, tongue, pharyngeal, and laryngeal muscles (Gupta, Reddy, Canilag 1996 et al). Electrodes are placed under the chin, approximately two inches inferiolaterally and superiolaterally to the thyroid cartilage. (Reimers-Neils et al 1994, Gupta, Reddy, Canilag 1996). This technique is becoming increasingly popular with clinicians as a simple, non invasive means of objectively measuring swallow function (Gupta, Reddy, Canilag 1996). Surface EMG is preferable to needle EMG (i.e. intramuscular electrodes), bipolar suction electrodes or the PCA electrode (Gupta et al 1996; Cunningham & Basmajian 1969) because of its non invasive nature.

EMG has important diagnostic and therapeutic potential which has yet to be developed fully and made more accessible. One recent study describes the positive therapeutic benefits of EMG as a 'biofeedback' tool in chronic brainstem dysphagia (Huckabee et al 1999). Once equipment has become more refined and portable, and once norms have been established and compared to abnormal data, EMG may be effectively combined as part of ongoing, non-invasive assessment and treatment for patients who have swallowing disorders (Gupta et al 1996). However, it is likely that EMG may only be useful as an adjunct to videofluoroscopy and will not identify precisely timing of events and occurrence of aspiration or indeed, identify appropriate management strategies for aspiration.

All these objective techniques/alternatives to swallow assessment are either costly, impractical, invasive or under explored. There is clearly a need for a simple, non invasive diagnostic tool that gives instant information at the bedside and helps pinpoint the origin of dysphagia and thus direct treatment promptly. Cervical auscultation is another approach becoming increasingly useful as a clinical bedside tool and is showing definite promise in significantly improving accurate detection of dysphagia at the bedside (Zenner 1992). This assessment technique involves listening to and interpreting sounds of swallowing and respiration via a stethoscope or specific recording equipment.

As previously described, the relationship between breathing and swallowing and the effects one has on the other has been extensively investigated (Selley, Flack, Ellis and Brooks 1989, 1990, 1994, 1997; Nishino, Yonezawa, Honda 1985). This 'feeding respiratory pattern' is a complex rhythm which occurs or is initiated as food or drink approaches the lips, continues until the bolus has entered the oesophagus and includes a period of deglutition apnoea (Selley, Flack, Ellis, Brooks 1990). Several different techniques exist which can objectively measure swallowing and respiration simultaneously. Currently, the two main techniques for monitoring respiration are either direct airflow (oral, nasal, or both oral or nasal being monitored) or some type of measurement related to changes in inflation of the lung, often called respiratory effort focuses on movements of chest and abdomen, accessories to respiration (Tarrant, Ellis, Flack, Selley 1997). As oral air flow is difficult to measure during eating, most authors prefer to measure nasal airflow. However these techniques are invasive and uncomfortable.

When listening to the swallowing process, there are two elements which should be listened for i.e. the actual sounds of the swallow itself as well as the respiratory pattern which accompanies it. First identified in 1967 by two separate studies (Logan, Kavanagh, Warnall 1967; Mackowiak, Brenman, Friedman 1967), acoustically a normal swallow has been described as a crisp 'double click' i.e. there are two discreet bursts of audible sound which are also visible spectrographically. A third acoustic burst of short duration is also observed in most swallows using water. Coupled with the normal respiratory

pattern as previously described, a normal swallow then acoustically has a discrete evolution, is crisp, quick and clear with no extraneous noise. It has a specific respiratory pattern which remains constant for normal individuals and is easily identifiable. This is important as anything other than this is classed as 'abnormal' or dysphagic swallows.

As well as studying normal feeding respiratory patterns, abnormal respiratory feeding patterns have been explored and comparisons have been drawn between the two (Selley et al 1989;Shaker et al 1992). The hypothesis that swallowing and respiration are inextricably bound by sensory pathways appears to be reinforced when comparing respiratory patterns of subjects with Motor Neurone Disease (purely motor deficit) and subjects with more diffuse motor and sensory impairment e.g. stroke or Multiple Sclerosis. Identifiable differences are demonstrated between these groups and healthy subjects either in respiratory patterns or in timings of some stages of the swallowing sequence. All subjects with stroke and MS show variable respiratory patterns at spoon contact. Many subjects frequently inhale immediately after swallowing, suggesting lack of respiratory control due to reduced sensory input. In comparison, subjects with MND exhibit normal respiratory patterns that were apparently well controlled. These subjects (MND) are observed to make rapid repeated swallow actions per single teaspoonful, even if this was as little as 5ml. The authors note that this is likely to be due to inadequate swallowing mechanism as a result of motor nerve impairment, with little sensory involvement. It is re-emphasised that measurement of respiratory patterns associated with swallowing appear to help assess more reliably and with greater sensitivity, the degree of sensory loss associated with that region of the brain where the swallow centres are found.

Not to be excluded, subjects with respiratory disease, including tachypnea and chronic obstructive pulmonary disease (COPD) have also been observed for respiratory patterns during swallowing in comparison with the norm (Shaker, Li, Ren, Townsend, Dodds, Martin, Kern, Rynders 1992). This study observes the coordination of the phases of respiration and swallowing using

concurrent respirography and submental surface electromyography. Again, this study confirms that in healthy young volunteers there is a preferential coupling of subconscious swallowing with the expiratory phase of continuous respiration. In direct comparison, subjects with COPD during their disease exacerbation swallowed significantly more in the inspiratory phase and resumed their respiration significantly more with inspiration. Furthermore it is observed that the mean respiratory cycle in COPD patients during exacerbation of their disease and during the basal state was significantly shorter than duration of the respiratory cycle in both young and elderly volunteers.

Typically then, a dysphagic swallow has certain characteristics, namely;

- wet gurgly sounds
- indistinct 'clicks'
- absence of two 'clicks'
- respiratory bubbling
- throat clearing/blow-out
- vocal stridor
- inspiration following the swallow

It is clear that by listening to respiratory patterns during swallowing, subjects with normal patterns can be identified from those with dysfunctional patterns and the literature generally supports this (Cichero et al 1998; Selley et al 1989; Stroud 1998) .

Certainly this technique appears to be more useful at the bedside assessment. However, the methods previously described involve the placement of a nasal cannula in the subject's nose to measure airflow, which some subjects may find invasive and uncomfortable. On a more practical level, just as medical colleagues listen to heart and lung sounds, speech and language therapists are now using stethescopes at the bedside to listen to the sounds of swallowing and breathing and are finding very encouraging results in predicting the presence of aspiration (Abella, Formolo, Penney 1992;

Hamlet et al 1994; Stroud 1996). Stethescopes essentially detect sounds in different frequency ranges. This instrument has been used for years by physicians and medical staff to listen to heart and lung sounds as previously discussed and the technique has been adapted to listen to the cervical swallow. This is an ideal instrument as it detects sounds within certain frequency ranges to the exclusion of other, unnecessary sounds i.e. it narrows the spectral range of possible sounds to low frequency sounds, which swallow sounds typically tend to be. In addition, a stethoscope is portable, non-invasive, inexpensive in comparison with other equipment and easy to use, making it a 'friendly' piece of equipment.

With this additional information about what constitutes normal and abnormal swallow breath and sound patterns, therapists are finding that clinical accuracy is virtually doubling once a stethoscope is introduced to the clinical examination (Zenner 1995; Eicher 1996) Also, importantly, it appears to increase greatly the detection of patients who do *not* have dysphagia with 99% of such subjects detected in one study (Stroud 1996). The use of cervical auscultation (using a stethoscope) in the clinical dysphagia examination in long term care patients has been examined (Zenner 1995). In comparison with the previous studies which indicated that agreement between bedside clinical examination and videofluoroscopy in identifying true aspirators was aproximately 70%, this study found there was a significantly higher agreement between clinical examination and videofluoroscopy when cervical auscultation was used i.e. approximately 80% of aspirating patients were detected appropriately.

The impact of cervical auscultation in predicting aspiration in a paediatric population has also been investigated (Eicher 1996). Again it was discovered that the predicted result on the clinical checklist (including cervical auscultation) matched the actual result on videofluoroscopy 86% of the time. It appears that by incorporating cervical auscultation into the clinical dysphagia examination clinician accuracy in predicting aspiration at the bedside is further increased. It may be interesting to speculate that given improving bedside clinical skills with accurate prediction 66-80% of the time,

then maybe close to 100% accuracy is achievable when a stethoscope or some other recording of the respiratory and swallow patterns is introduced.

Finally, clinicians appear to have found a bedside tool which is non-invasive, very easily portable, inexpensive and easy to use which has been shown to increase clinical accuracy further. The stethoscope itself remains quite subjective, non-reproducible and is only as good as the listener. Ideally, recording information via a microphone/accelerometer attached directly to the neck or to a stethoscope head is instantly more objective and reproducible. Sounds recorded onto a recording device can then be channelled into computer programs for sound and wave form analyses, thus providing even more objective data for examination. As research continues to pinpoint the precise correlation of sounds with swallow events, this simple bedside technique has strong potential to ultimately become an important diagnostic and therapy tool (Cichero & Murdoch 1998). Such technology is easily portable and therefore more useful at the bedside. With this method however, the issue of reliability remains largely unexplored, especially interrater and intrarater reliability. This needs to be established if clinicians are to incorporate this apparently useful assessment tool into their bedside evaluations with confidence. The diagnostic significance of the technique is also largely unexplored as researchers endeavour to match swallow sounds with specific physiologic events during the swallow (Cichero et al 1998).

However, no matter what expensive or advanced technology speech and language therapists may have to conduct proper clinical evaluations of swallowing, if patients at risk of dysphagia are not referred in the first instance, then resources are wasted in seeing people who do not need to be seen. Patients who are not referred appropriately are increasingly at risk for complications of oropharyngealdysphagia as previously discussed. Therapists need to increase awareness of dysphagia amongst referral sources. Part of this will involve means of correct identification of at-risk groups and the development of reliable screening techniques to facilitate referral. Once patients are reliably screened and referred, therapists then must strive to find ways of managing these patients in an appropriate and

timely fashion given the current health care climate which demands streamlining services. By working as part of a team, sharing core skills and information and by striving to promote and improve earlier detection of swallowing disorders in the acute care setting, speech and language therapists can significantly contribute to patient care whilst at the same time promoting health and social gain. Timely, thorough diagnostic screening investigation is crucial for prompt and accurate decision making regarding appropriate referral and management of all at risk patient groups presenting with dysphagia.

1.8 Statement of the problem

If therapists are to streamline services and provide better quality care to patients who really need it, several issues must be examined.

1. The number of patients potentially at risk for swallowing disorders on admission to the acute care hospital

2. The reliability of a specially designed swallow screening tool aimed at improving sensitivity to detection of dysphagia in an acute setting and the correlation of assessment findings with videofluoroscopic examination of swallowing.

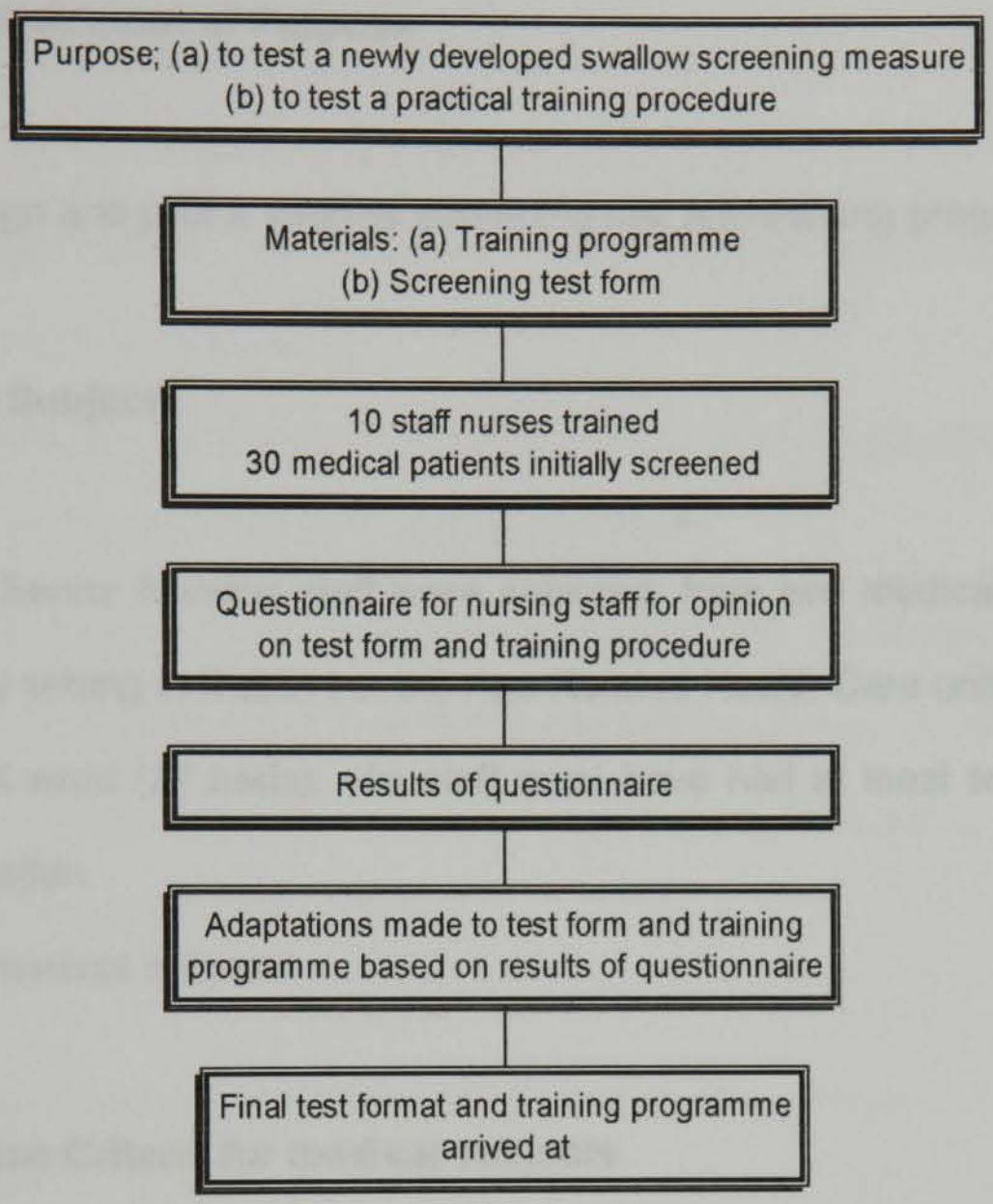
3. The effects of training nursing staff to use a swallow screening tool, comparing trained nursing staff with untrained nursing staff, observing referral trends to speech and language therapy before and after training and examining outcomes of all subjects screened.

4. The diagnostic significance of cervical auscultation.

Chapter 2

Methodology

Figure 3 **Swallow Screening Test and Training Programme Pilot study**



2.1 Pilot Study for Swallow Screening Test and Training Programme

2.1.(i) Statement of Purpose

To design and pilot a swallow screening test and training programme for nursing staff

2.1. (ii) Subjects

(a) 10 Senior Nursing staff were selected, from two medical wards in an acute care hospital setting in Dublin i.e. the Age Related Health Care unit (17 beds) and one acute medical ward (27 beds). All staff must have had at least two years experience post qualification.

(b) 30 medical subjects

Selection Criteria for medical subjects

(a) Diagnosis: All consecutive new admissions to the two wards with an acute presentation or a history of one or more of the following diagnoses/conditions were identified for inclusion in the study

- ***Stroke:*** acute as determined by CT scan and clinical presentation
- ***Previous stroke:*** as documented by previous clinical evidence and clinical presentation
- ***Dementia:*** as determined by history of acute and chronic confusion/cognitive impairment/delirium or dementia

- ***Respiratory disease*** including COPD/COAD/Emphysema/Asthma/Recurrent unexplained pneumonia's/RTIs
- ***Critical illness in post surgical subjects:*** including post intubation/head and neck surgery/upper GI or lung surgery.
- ***Neurodegenerative diseases:*** including Parkinson's Disease, MND, MS, Huntington's Chorea
- ***Significant unexplained weight loss:*** 10 -20% of pre-illness weight in last three months (British Dietetics Association 1997)
- ***Complaints of swallowing disorders***/difficulty swallowing.
- ***Psychiatric History:*** due to the side effects of many psychotrophic drugs used in this population which contribute to dysphagia (Bazemore, Tokonogy, Ananth 1991;Buchholz 1994/1995)

(b) Age: All adult subjects presenting, irrespective of age.

(c) Sex: Both male and female subjects were included.

(d) Co-operation: All subjects who are able to co-operate fully with assessment as determined by clinical medical or nursing opinion of assessibility.

Exclusion Criteria

(a) Previous known diagnosis of dysphagia: Any subjects transferred to the wards from other wards who were known to the Speech and language therapy service and were having current treatment for dysphagia /had treatment for dysphagia in the past.

(b) Subjects with tracheostomy tubes: all such subjects were automatically referred to the Speech and language therapy service for swallowing assessment on insertion of a tracheostomy tube, due to the complex issues involved in swallow assessment in this group (Dikemann & Kazandjian 1995)

2.1.(iii) Materials

The following materials were used during the training process.

(a) Handouts with definitions of normal swallowing and terms associated with oropharyngeal dysphagia

(b) Videofluoroscopy recordings depicting the following

- normal swallowing
- swallow reflex delay
- aspiration (both silent and non-silent)
- nasal regurgitation
- residue build up in the pharynx
- wet voice
- general reduced oropharyngeal efficiency

(c) A series of acetates including information on the following;

- normal anatomy of the oropharynx
- the normal swallow process
- the swallow reflex versus the gag reflex
- at risk disease groups
- signs and symptoms of dysphagia at the bedside
- signs of dysphagia in specific disease groups/risk considerations prior to assessment
- appropriate finger placement for laryngeal palpation
- picture of correct posture for eating and swallowing
- swallow screening procedure
- decision making process for the swallow screening test

(d) Glasses of water

(e) Teaspoons

(f) Pilot test form of Meath Hospital Swallow Screening Test

The pilot test form used (page 58) was adapted from that presented by Smithard and Crockford (1995). It involved a 'flow chart' progression through the assessment/screening procedure. Some changes were made to this original form for the pilot Meath Hospital Swallow Screening Test (MHSST) as follows;

- a picture showing a lateral view of the oropharynx with finger placement for laryngeal palpation was included.
- a separate category entitled 'general medical diagnoses' was included in the 'High Risk Patients' section. Disorders such as COAD, recurrent chest infection/pneumonia were listed separately under this category. These disorders had been listed in the 'other' category.
- the form stated that *'this swallow test will not detect patients who have difficulties swallowing solids. Observe for oral retention after meals'*

(g) Questionnaire to establish nurse opinion of screening test form and training procedure (overleaf)

2.1.(iv) Procedures

Setting of Training sessions

(a) Nursing staff were trained in groups of 1-3, depending on availability of staff on the ward. Training took place in the speech and language therapy department as well as on the wards.

(b) Each training session involved the staff nurses to be trained and the speech and language therapist conducting the research.

(d) The training sessions involved one hour of theory (held in speech and language therapy department) and 30 mins of practical training (both in speech and language therapy department and on wards)

Introduction to training sessions/background information

(a) Each session began with an explanation of the rationale for the research i.e. concerns of the speech and language therapy department in general that

- increased numbers of inappropriate referrals were being received, wasting valuable clinical time
- significantly delayed referrals for some patients due to lack of awareness of swallowing disorders, putting patients at increased risk of developing complications
- inappropriate management of patients in the absence of a speech and language therapist e.g. feeding tubes inserted inappropriately or patients kept fasting unnecessarily at weekends, because nursing/medical staff could not determine risk

of swallow disorder, or because inappropriate methods were being used to determine same i.e. use of 'gag' test

(b) It was explained that the aim of the study was to provide staff with a useful screening tool to facilitate earlier decision making regarding feeding and swallowing status in at risk patients on admission to the two wards.

(c) The need for a proper inter-rater reliability trial was stated, before the screening tool could be implemented fully hospital wide. Definitions of terms e.g. aspiration, penetration, videofluoroscopy were also outlined.

(d) Each staff nurse was provided with a copy of the pilot test form at the outset of the training session

Theory session

(a) Staff were initially asked for their opinion of what constituted a normal swallow and prerequisites for same before the above detail was introduced by the speech and language therapist. A description of the normal swallow process, including normal anatomy and physiology, the importance of respiration and cognition in eating and feeding was outlined. Diagrams and videofluoroscopic recordings of normal swallowing were used to reinforce the above visually.

(b) The differences between the swallow reflex and the gag reflex were then outlined by the speech and language therapist, reinforcing the idea that the gag reflex is not a reliable indicator of swallow reflex status as is traditionally viewed.

(c) The nurses were then asked what patients on admission to the wards would be considered at risk for swallowing disorder and why. The groups of patients who are typically at risk for swallow disorder were then outlined by the speech and language therapist and the reasons why were stated in each case. Attention was drawn to the high risk groups detailed at the bottom of the form.

(d) The group was then asked to state how a swallow disorder might be identified on feeding a patient. The signs and symptoms of aspiration/dysphagia were introduced by the Speech and language therapist and several videos of abnormal swallowing were shown to reinforce this.

(e) The general principals of assessment were then outlined. Determining candidacy for assessment (by reviewing medical diagnosis/reason for admission) and appropriateness for assessment (co-operation/level of responsiveness) were discussed.

Practical Training

(a) Manual assessment of the swallow was demonstrated by the speech and language therapist, using diagrams to show correct finger placement on the larynx and then by practice on themselves and each other using dry swallows, teaspoons and sips of water. The speech and language therapist advised regarding correct hand placement and any necessary adjustments.

(b) The signs and symptoms of aspiration as outlined on the test form were discussed. The speech and language therapist outlined how the test should proceed from start to finish and how information should be recorded.

Ward training

(a) Once these basic skills in screening had been demonstrated and practised, some training took place in the ward setting immediately.

(b) On returning to the ward, nursing notes were reviewed by the nurses, observed by the speech and language therapist, and appropriate patients for screening were selected, as per criteria on the test form.

(c) Each newly trained nurse assessed *at least one* patient immediately after the initial training session, with the speech and language therapist observing to advise about positioning and hand placement and answer any other queries.

Documentation

(a) For the pilot MHSST outcome was recorded on the back of the form by indicating date, time, outcome (NPO/SLT or Normal Diet), and nurses signature.

(b) The form was stored in the patient's nursing notes.

(c) A separate swallow screening register was kept in the Nurse's station so that the speech and language therapist could keep a record of who had been screened (page 63).

(d) Practice forms were filled in and fully completed by the newly trained nurses and checked by the speech and language therapist.

Evaluation of Test and Training Procedure

(a) Approximately 2 months following training, all trained nurses were given a questionnaire which asked their opinion about the adequacy of training and the usefulness of the screening test. Information from this questionnaire was noted by the speech and language therapist in evaluating the training procedure and screening test form.

(b) The pilot test format was also discussed with all the staff nurses involved and with other speech and language therapists working on the two wards.

2.1.(v) Results of pilot study

(a) 10 Staff nurses from two wards were trained in the use of this adapted form. All nurses were familiar with working with speech and language therapists on a daily basis.

(b) 30 patients were assessed on admission using the pilot test form, according to diagnostic criteria on the test form

(c) Eight of ten staff nurses completed the questionnaire to evaluate their opinion of the training procedure and test form.

The main factors arising were;

- Nursing staff reported there was too much documentation involved
- The use of a teaspoon often resulted in delays in the test being done as teaspoons were not readily available at the patient's bedside.

- Inadequate follow up supervision by the speech and language therapist was reported by nursing staff. Refresher and trouble shooting sessions would have been useful
- The speech and language therapist observed that not all relevant groups outlined on the test form were being screened
- Options at the end of the test were reported by nursing staff to be limited, particularly the NPO option. Whilst this option was appropriate for some patients e.g. acute severe stroke, it was not always appropriate for other groups of patients e.g. COAD patients who are generally well and mobile, who want to eat and who may have to wait 24 hours for a speech and language therapist assessment.
- Generally staff reported that they were happy to be involved in screening for swallow disorders as it allowed increased flexibility and earlier decision making regarding feeding of patients.
- Speech and language therapists reported that there appeared to be fewer but more appropriate referrals from both wards.

2.1.(vi) Adaptations to Screening Form and Training Procedure

As a result of the pilot study and discussion with nursing staff and speech and language therapy staff, recommendations were made in order to make the training procedure more thorough and to make the test format more practical and efficient.

Adaptations to Training Procedure

(a) Each newly trained nurse would have two additional follow up sessions with the speech and language therapist in the two weeks following the initial training period as required. These sessions would be used to check assessment technique and to solve any problems or queries that staff may have had regarding the test form or their assessment skills.

(b) A swallow screening folder would be compiled and kept on each ward containing basic theoretical information and terms and definitions associated with oropharyngeal dysphagia as presented in the training session, so that staff could clarify information as necessary.

Adaptations made to screening test form.

Adaptations were made as outlined in table 2 (page 66.)

Table 2 Adaptations made to Screening Test Form

Adaptation	Rationale
1. Checklist of all at risk groups at beginning of test form in 'tick-box' format	To facilitate identification of at risk subjects on admission
2. Use sips of water from glass instead of teaspoons	Easily available at bedside, no significant risk to swallow indicated and may promote safer swallowing (Lazarus et al 1993; Reimers Neils 1994; Bisch et al 1994: Dodds et al 1988)
3. Include extra indicators of aspiration i.e. drooling, increased respiratory rate, repeated laryngeal elevations, voice change	Positive predictors of aspiration according to literature (Linden & Kuhlemeier 1994; Logemann 1998)
4. Decision making options to be widened as follows; **'If *yes* to any of the above signs then;** ***(a) if status poor, keep NPO and refer to SLT*** **or** ***(b) if status good, refer to SLT/observe eating'***	Some patients are generally well (e.g. ambulant, alert and talking) and will demand food from nurses whilst waiting for SLT assessment. Once a referral is sent nurses can observe the subject for difficulties
5. Caution testers about observing subjects with difficulty swallowing solid foods, observe for coughing with food or development of a chest infection if oral feeding recommenced.	Not included on pilot screening test form, these are further indicators that dysphagia is present and should be thoroughly investigated
6. Outcome marked in tick-box format & all forms stored in centralised ward folder (swallow screening folder)	Minimises documentation/allows easier access for SLT and Nursing staff to screening tests

With these adaptations in place, a formal trial to determine how a swallow screening training and assessment programme would contribute to overall detection and assessment of swallow disorders in the acute care setting was implemented. A flow chart for the swallow screening and formal swallow assessment process was devised

2.2 Earlier and Improved Detection of Swallow Disorders in an Acute Care Setting

2.2.(i) Statement of Purpose

The aim of the study was to examine two critical areas of improvement in the screening and assessment of swallowing disorders, specifically;

1. The proportion of patients admitted to an acute care hospital who are potentially at risk of oropharyngeal dysphagia.

2. The reliability of a specially designed swallow screening tool aimed at improving sensitivity to detection of dysphagia in an acute care setting and the correlation of assessment findings with videofluoroscopic examination of swallowing.

3. The effects of training nursing staff to use a swallow screening tool, with particular regard to

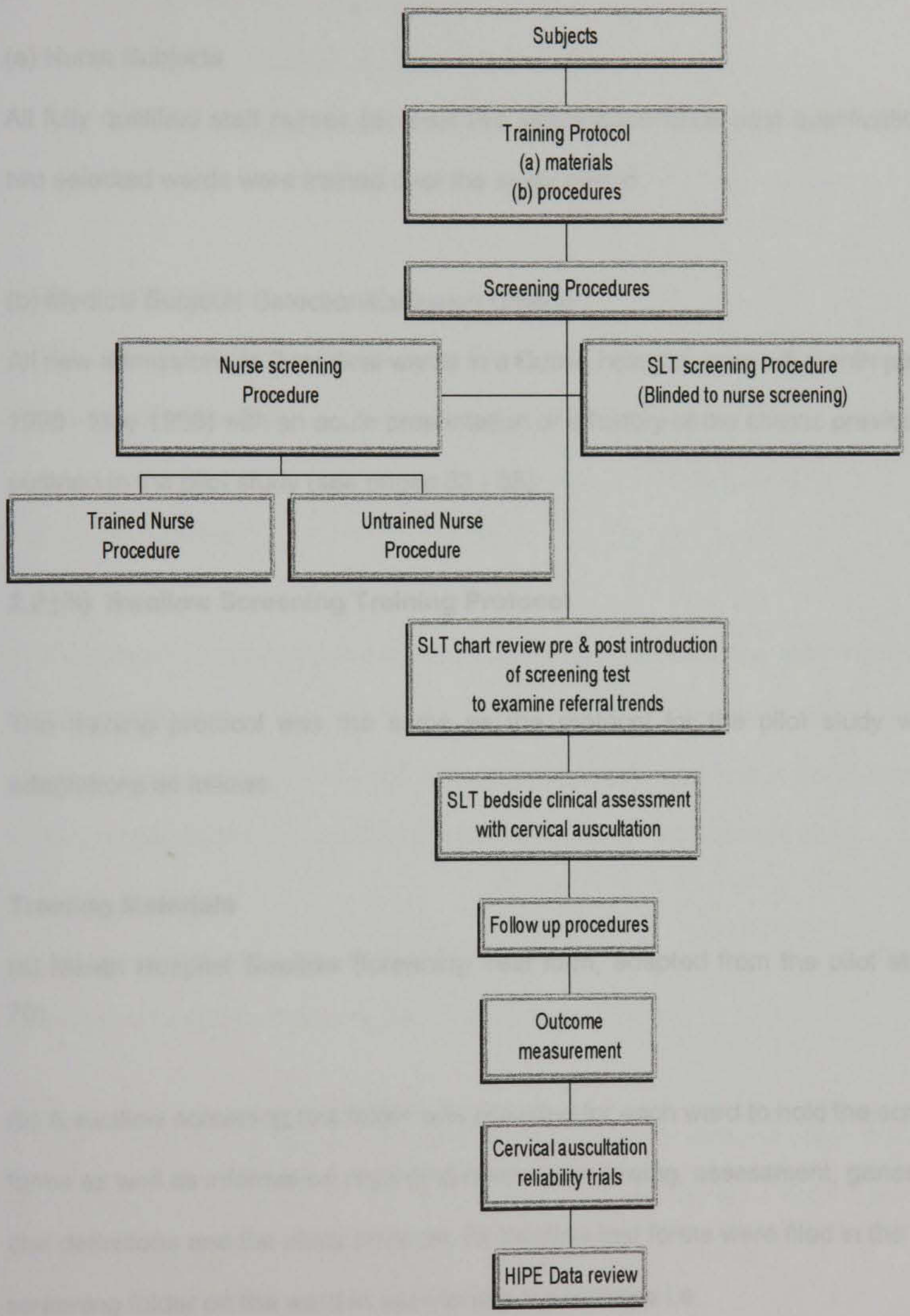
(a) comparing trained nursing staff with untrained nursing staff,

(b) observing referral trends to speech and language therapy before and after training,

(c) examining outcomes of all subjects screened.

4. The diagnostic significance of cervical auscultation as a bedside clinical assessment tool.

Figure 4 **Swallow Screening Training & Test Methodology**



2.2.(ii) Subjects

(a) Nurse Subjects

All fully qualified staff nurses (at least two years experience post qualification) on the two selected wards were trained over the study period.

(b) Medical Subjects Selection/Exclusion Criteria

All new admissions to 2 medical wards in a Dublin hospital over a 5 month period (Jan 1998 - May 1998) with an acute presentation or a history of the criteria previously outlined in the pilot study (see pages 53 - 55)

2.2.(iii) Swallow Screening Training Protocol

The training protocol was the same as the protocol for the pilot study with a few adaptations as follows.

Training Materials

(a) Meath Hospital Swallow Screening Test form; adapted from the pilot study (page 70)

(b) A swallow screening test folder was provided for each ward to hold the screening forms as well as information regarding normal swallowing, assessment, general terms and definitions and the study protocol. All swallow test forms were filed in the swallow screening folder on the ward in appropriate subsections i.e.

- Screening test unnecessary
- Problem detected - refer to Speech and language therapist
- No problem detected - start feeding
- Unable to assess/uncooperative

Training Procedures

There was no change in training procedure from that used in the pilot study except for the introduction of follow up training on the wards as follows;

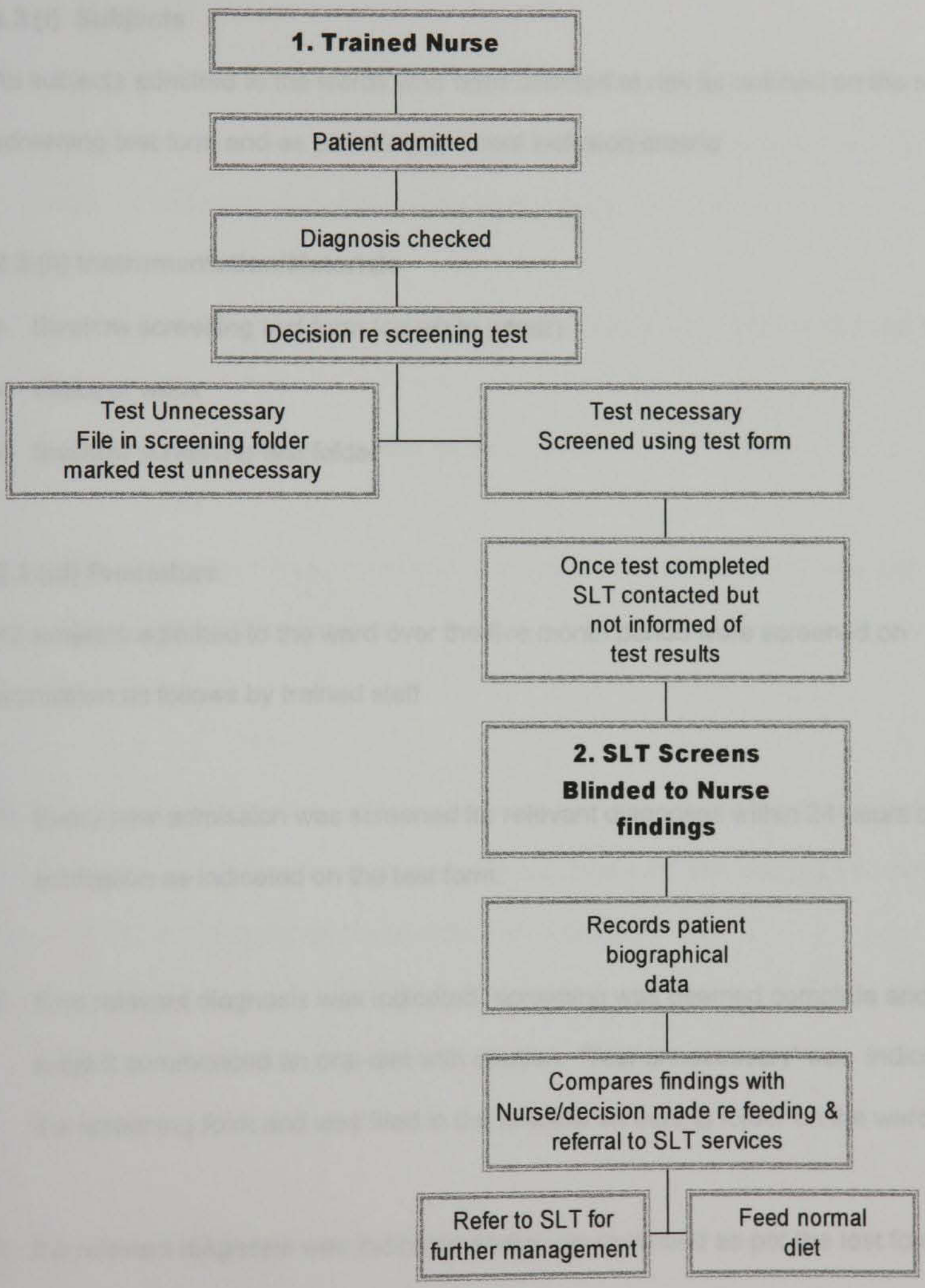
Follow up training

1. Each newly trained nurse had two more follow up sessions with the speech and language therapist in the two weeks following the initial training period as required. These sessions were used to check assessment technique and to solve any problems or queries that staff had regarding the test form or their assessment skills.

2. Once the staff were confident in their assessment technique, in agreement with the speech and language therapist, they were deemed trained.

3. The speech and language therapist outlined the study protocol again and staff were alerted to signs on the ward reminding them to ring the therapist once a test had been completed, but not to tell her the results as per the study protocol.

Figure 5 **Trained Nurse and SLT Swallow Screening Procedures**



2.3 Screening Procedure for Trained Nursing Staff

2.3.(i) Subjects

All subjects admitted to the wards who were deemed at risk as outlined on the swallow screening test form and as per study protocol inclusion criteria

2.3.(ii) Instrumentation/Materials

- Swallow screening test form (on white paper)
- Glass of water
- Swallow screening test folder

2.3.(iii) Procedure

All subjects admitted to the ward over the five month period were screened on admission as follows by trained staff.

1. Every new admission was screened for relevant diagnoses within 24 hours of admission as indicated on the test form.

2. If no relevant diagnosis was indicated, screening was deemed complete and the subject commenced an oral diet with caution. 'Test unnecessary' was indicated on the screening form and was filed in the swallow screening folder on the ward.

3. If a relevant diagnosis was indicated screening continued as per the test form.

4. The tester determined if the subject was *ready for assessment* as indicated on the test form.

5. If the subject was not ready for assessment the relevant box was ticked and 'repeat test later' was marked in the outcome section. If after 3-5 attempts the patient remained uncooperative, attempts at testing were discontinued.

6. If testing was appropriate, the 'water test' continued as indicated on the test form.

7. Outcome was marked in the appropriate section.

8. The screening form was signed and dated by the tester. The time was also noted. All forms were filed in the swallow screening folder on the ward in the appropriate subsection.

For the duration of the study, once a screening test was completed, the speech and language therapist was contacted immediately. However, she was <u>not</u> informed of the outcome of the screening test as determined by the first tester.

2.4 Screening procedure for the Speech and Language Therapist

2.4.(i) Subjects

All subjects who were initially screened by nursing staff.

2.4.(ii) Materials

- Swallow screening form (on pink paper)
- Glass of water
- Speech and language therapy subject information record sheet (page 76)

2.4.(iii) Procedures

1. Once informed by nursing staff that a screening test had been completed on a subject, the speech and language therapist screened that subject as soon as possible after the nursing assessment (within 3 hours)

2. The speech and language therapist was blinded to the results of the first screening test by nursing staff

3. The speech and language therapist used the same screening format (using a new test form) as the nursing staff

4. If there had been a change in the status of the subject since the first screening assessment then this was noted after consultation with nursing staff.

5. The time the speech and language therapist screening assessment took place was also noted on the speech and language therapist screening form.

6. To facilitate follow up 3 months later, a record was made on the subject information sheet of

- medical chart number
- GP name and details
- next of kin/carer details

7. Both wards were checked on a daily basis by the speech and language therapist to determine if new admissions were being appropriately screened. Subjects who were inappropriately excluded from further screening by nursing staff were brought to the attention of the nursing staff and were screened. These subjects were not included in the trial.

8. If the subject was deemed to have a swallowing disorder, he/she was referred to the speech and language therapy service as per current standard practice in the hospital, for follow up assessment and treatment.

9. This decision was based on the combined results of the swallow screening tests (the initial nurse screening assessment and the speech and language therapy screening assessment). If both parties strongly agreed that signs of aspiration were present, a full swallow evaluation occurred. If there was disagreement between the two raters i.e.

one identified signs of aspiration and one did not, then a decision was made taking into account the patient's current medical status and time lag between screening assessments during which the patient's condition may have improved or deteriorated/changed.

10. All new initial assessments arising from the screening test on both wards were conducted by the research speech and language therapist. After the initial assessment, the subject was transferred to the care of the speech and language therapist who usually looked after patients on these wards, if further intervention was indicated.

2.4 (iv) Data Entry and Storage

(a) Nursing staff stored the appropriately marked nursing screening forms in the ward folder in the appropriate subsection

(b) After the speech and language therapist completed the screening test on each subject, the nurse screening form for each subject was stored with the speech and language therapist screening form and the subject information sheet which had been completed.

2.4 (v) Statistical Analysis

(a) Determination of the percentage agreement between the speech and language therapist and the nursing staff was calculated by counting the number of agreements and disagreements evident from the data sheet. A percentage calculation was then done.

(b) Inter-rater reliability between trained nursing staff and speech and language therapist.

The Kappa (κ) statistic was used to determine inter-rater reliability. This statistic measures chance corrected proportional agreement i.e. measures agreement between two raters/observers taking agreement by chance into account (Altman 1991). Strength of agreement is measured as in Table 3 below

Table 3 Kappa ratings (Altman 1991)

Value of κ	Strength of agreement
< 0.2	Poor
0.21 - 0.40	Fair
0.41 - 0.60	Moderate
0.61 - 0.80	Good
0.81 - 1.00	Very good

(c) For statistical purposes 5 trained nursing staff were selected from the main data set as each had screened approximately 10 subjects each (range 8 -12)

Each was compared with the speech and language therapist and individual Kappa ratings were calculated.

A mean Kappa was then calculated.

2.4(vi) Predictors of aspiration on videofluoroscopy as identified by nursing staff using the swallow screening test

(a) All subjects who had videofluoroscopy were included.

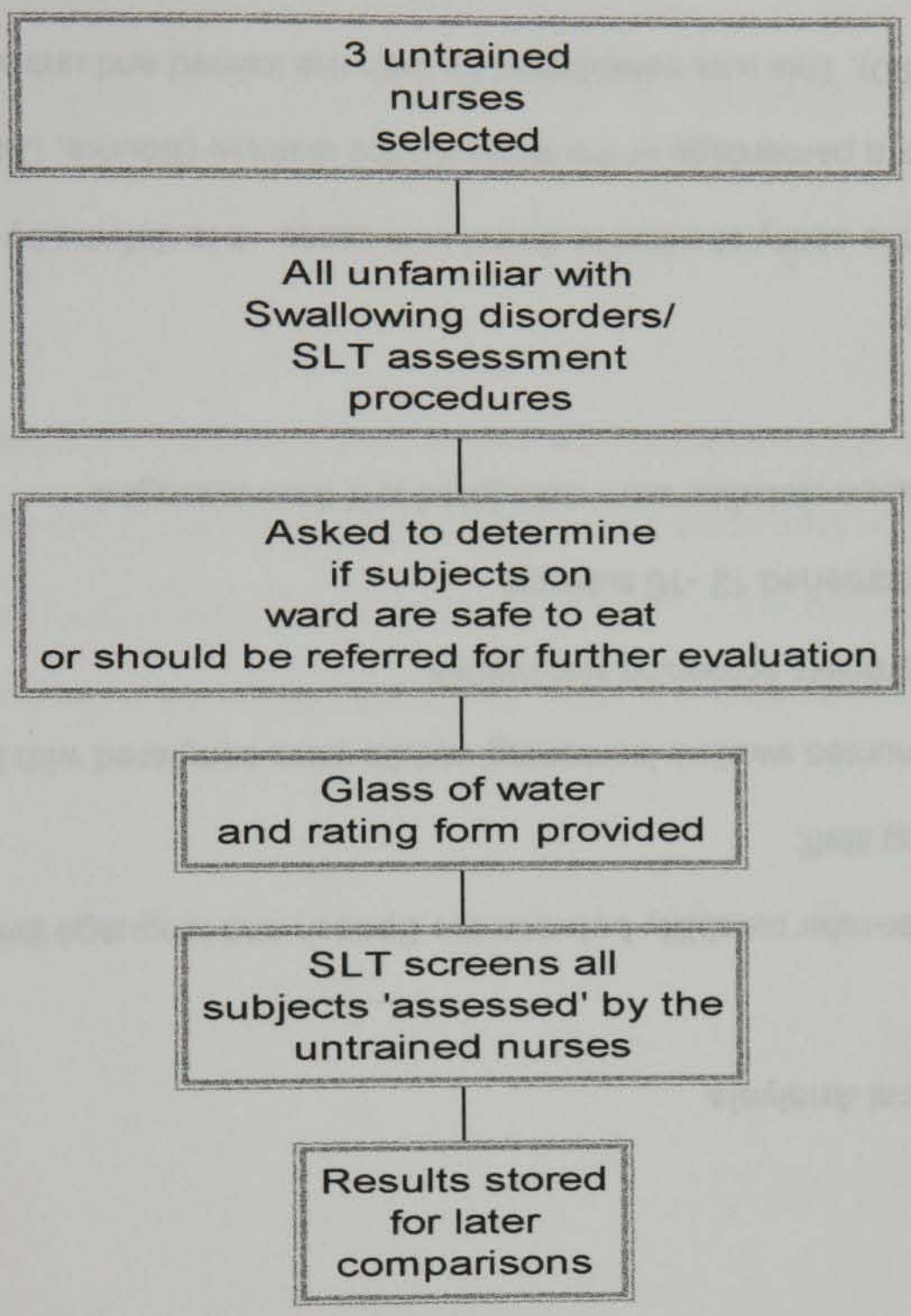
(b) Features which nursing staff documented as present/positive on their screening tests were compared with findings on videofluoroscopy (Table 4)

(c) The features which most readily identified dysphagia/aspiration on the swallow screening test were then evident.

Table 4 Information collated to identify nurse predictors of aspiration

Features positive on screening test as identified by nursing staff	Number of subjects with feature present and also dysphagia on videofluoroscopy (Total N = 28)
Repeated laryngeal elevations Respiratory rate Voice change Delayed cough Delayed swallow Absent swallow Drooling	

Figure 6 Untrained nurse screening procedure



2.5.(iv) Speech and language therapist procedure

Every patient that was 'screened' by the nurse using the above procedure was then screened by the Speech and language therapist using the swallow screening test form.

2.5.(v) Data Collection

Swallow screening test forms were stored with the nurse rating forms for later comparison.

2.5.(vi) Statistical Analysis

To establish Inter-rater reliability between the Speech and language therapist and the untrained nursing staff,

- 3 untrained nurses swallow 'screening' results were compared with the speech and language therapists screening test results.
- Each nurse screened 12 -16 subjects
- Individual Kappa statistics were calculated and then averaged.

Test sensitivity

This measures the ability of a test to detect true cases. It is defined by the number of true positives as a percentage of the total with the disease (Bourke, Daly, McGilvray 1985; Clegg 1990). This was established for both the trained and untrained nurses.

Test specificity

This measures the ability of a test to detect disease free individuals. It is defined as the number of true negatives divided by the total without the disease (Bourke et al 1985). This was also established for both the trained and untrained nurses.

Significance

This indicates the probability that a result could have arisen if the null hypothesis were true i.e. a significant result is a result which is not likely to have occurred by chance (Bourke et al 1985; Clegg 1990). Trained and untrained nurses were compared and significance was calculated using the Chi-Square test to obtain a '***p*** value'.

2.6 Speech and Language Therapy Case Note Audit

2.6.(i) Aim

To identify the number of inappropriate swallowing referrals received in the speech and language therapy department

(a) before the introduction of the swallow screening test (Jan 1995 - Dec 1995)

(b) after the introduction of the swallow screening test (June 1997 - June 1998)

in order to measure the effectiveness of the introduction of the swallow screening test.

2.6.(ii) Materials

All available Speech and language therapy charts for selected periods

2.6.(iii) Procedure

(a) The research speech and language therapist reviewed the charts

(b) Referral cards were checked for appropriacy of referral by reviewing the speech and language therapy assessment records in the file.

(c) The research speech and language therapist recorded on a separate sheet the patient's name and whether or not the referral was appropriate as deemed by the speech and language therapist who dealt with the referral at the time as well as standard departmental discharge codes.

2.6.(iv) Data Collection

Data were stored for later comparison between the two periods.

2.6.(v) Statistical analysis

Chi square test with Yeats correction was used to establish if a significant reduction in inappropriate referral rates occurred.

Figure 7 **Bedside Clinical Assessment of Swallowing using Cervical Auscultation**

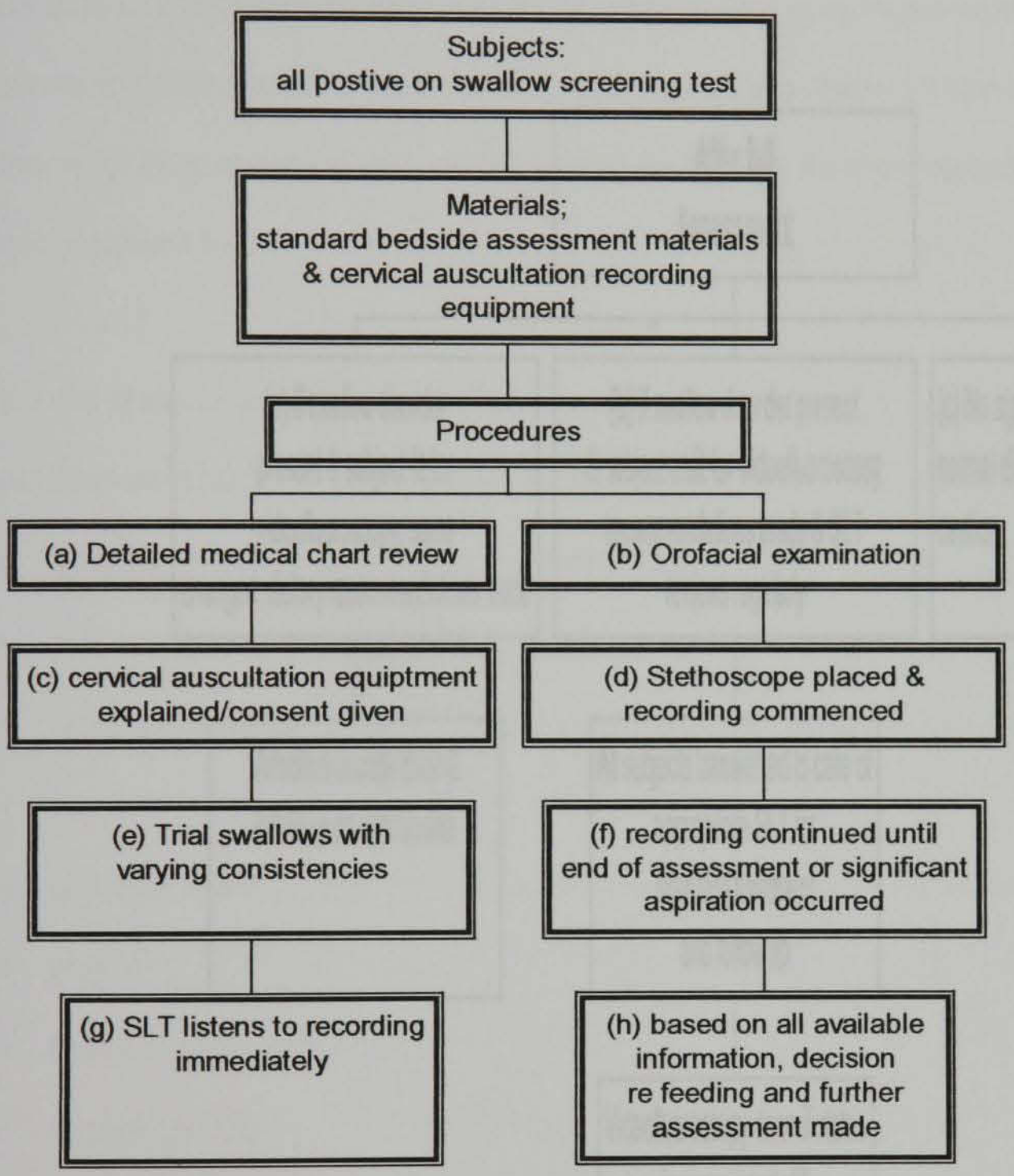
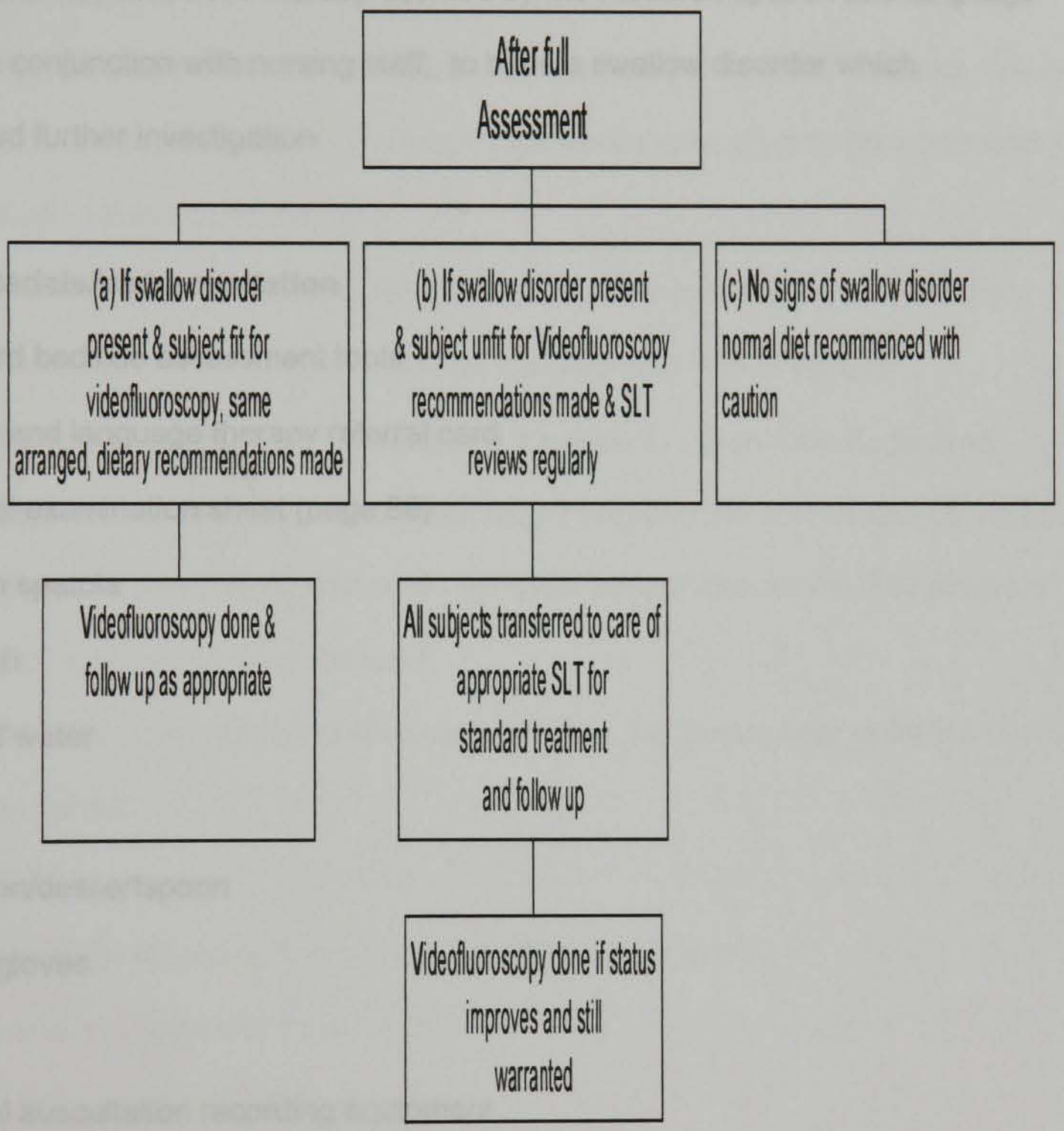


Figure 8 **Decision making after bedside clinical assessment with cervical auscultation**



2.7 Bedside Clinical Examination with Cervical Auscultation

2.7.(i) Subjects

All subjects who tested positively for oropharyngeal dysphagia on the swallow screening test and who were thereby deemed by the research speech and language therapist in conjunction with nursing staff, to have a swallow disorder which necessitated further investigation

2.7.(ii) Materials/instrumentation

(a) Standard bedside assessment tools

- speech and language therapy referral card
- orofacial examination sheet (page 89)
- wooden spatula
- pentorch
- glass of water
- yogurt
- teaspoon/dessertspoon
- rubber gloves

(b) Cervical auscultation recording equipment

A customised recording system was assembled in association with the Department of Medical Physics and Bioengineering (MPBE) as follows (see illustration 1 page 89);

- a paediatric Litmann II stethoscope head was attached to a microphone (omnidirectional miniature condensor AKG MicroMic C 417). This stethoscope was attached to the subject's neck using a velcro strap.
- The microphone was attached to a battery supply unit (B 29 Battery Supply Unit - AKG acoustics)
- This in turn was connected to a minidisc recorder (Sony Digital MD Walkman Mega Bass Recorder M2-R30) where the recordings were stored on minidiscs (Maxwell 74 Digital Audio Minidisc MD-74RM)
- A set of headphones (Panasonic RP-HT210) from the minidisc recorder to the listener so adjustments could be made as the recording is in progress
- *The minidisc recorder can be connected to a computer via an Altai Audio lead (3.5mm stereo jack to 3.5mm stereo jack plug/1.2m) and the sounds can be digitally edited analysed using 'Cool Edit' audio software, industry standard (This phase of the project is currently being installed)*

The equipment was calibrated and checked weekly by the Department of MPBE during the research period.

(c) A rating form for recording findings on auscultation (page 89).

(d) A consent form (Appendix 1 page 189)

2.7.(iii) Procedures

(a) Detailed medical chart review

The research speech and language therapist reviewed the subject's medical chart to establish significant factors in the subject's past and present medical history which may be contributing to dysphagia/may be signs and symptoms of dysphagia that have previously been unrecognised.

(b) Orofacial examination

- This was conducted using a standard departmental format
- This form was completed for every subject and a copy was kept in that subject's standard speech and language therapy file.

(c) Swallow assessment with cervical auscultation

1. The speech and language therapist showed the equipment to the subject and explained the nature of the procedure. The subject was asked to read and sign the consent form which explained the procedure and the rationale for the research (see section 2.7 (iv) (page 92) for ethical information. This form was also stored in the subject's speech and language therapy file.
2. The stethoscope head was then attached to the subject's throat with the velcro strap as was comfortable. The speech and language therapist began recording and listened through the headphones until the clearest sounds possible were achieved.

Placement of the stethoscope head was at the lateral border of the trachea immediately inferior to the cricoid cartilage as recommended by Takahashi et al (1994). If necessary the stethoscope head was adjusted in order to achieve this. Assessment then commenced.

3. Foods of graded consistency and amounts were presented to the subject. If the subject was unable to self feed the speech and language therapist presented the food.
4. Water was presented first from teaspoons to small sips to continuous drinking, depending on how well the subject coped with the varying volumes.
5. If there were any definite signs of aspiration (e.g. coughing/significantly increased respiratory distress) the speech and language therapist stopped giving fluids and proceeded to the next consistency i.e. semi-solids (see appendix 2 page 190)
6. Food was presented from a teaspoon. If any obvious signs of aspiration occurred, testing was stopped. Once testing had ended, the recording was stopped and the stethoscope was removed from the subject's neck.
7. Before making a decision regarding the exact swallow status of the subject, the speech and language therapist listened to the recording and filled in the rating form which was stored in the subject's file
8. Based on all the available evidence i.e. past and current medical history, cognitive status, orofacial examination, direct assessment of swallow using cervical auscultation, a decision was made regarding the feeding status of that subject as follows

- NPO (Nil Per Orally) and videofluoroscopy
- thickened fluids, altered consistency diet and videofluoroscopy

- thickened fluids, altered consistency diet and regular review as videofluoroscopy is not possible
- normal fluids and soft diet with monitoring
- normal diet with no monitoring.

9. Care of the subject was transferred to the relevant speech and language therapist following this initial assessment.

(e) Protocol for videofluoroscopy of the Oropharyngeal Swallow

Videofluoroscopy was performed according to hospital and departmental policy based on standards recommended by Logemann (1993). The full hospital policy for videofluoroscopy is in appendix 3 (page 191)

2.7 (iv) Ethical Considerations

Ethical approval was received for this research from the Ethics committee of Federated Voluntary Hospitals in Dublin. All subjects undergoing assessment using cervical asucultation were required to sign a consent form as a recording device was being physically attached to their person.

With regard to giving patients sips of water as part of the screening process, it is generally accepted that this is a necessary part of regular clinical practice to establish presence or absence of swallow disorders despite the risk of aspiration related complications (Schulze-Delrieu et al 1997; RCSLT 1998; Logemann et al 1999). Additionally sips of water are more likely to facilitate swallow function as it is more normal to take a sip from a glass than from a spoon thus preserving pre-swallow sensory function (Logemann 1996). Each subject was informed on admission that they would undergo a screening test that involved taking a sip of water. A consent form was not used in this instance. Verbal consent was given. However there was a subsection included on the swallow screening form which catered for subjects who may have been non-compliant or uncooperative with the screening procedure. As the screening test involved a two step procedure, subjects who appeared to have problems with small volumes of water were not given larger volumes and were referred to the speech and language therapist. There was some flexibility built into the form to allow nursing staff to decide whether or not the test should be continued.

Definite stop criteria were outlined for subjects who underwent swallow assessment with cervical auscultation by the speech and language therapist and who had definite signs of dysphagia and aspiration. Written consent was sought for all subjects who underwent videofluoroscopy as this is standard hospital policy. Additionally, an information booklet about videofluoroscopy was provided for each subject as standard clinical practice. Throughout the study nursing staff were keen and willing to be involved and gave verbal consent to participate in the study.

2.8 Subject Follow up and Outcome Measurement

2.8.(i) Each subject was followed up three months after the initial screening test to screen for any signs of aspiration and/or oropharyngeal dysphagia as follows

(a) Medical charts were audited by the speech and language therapist with input from a medical physician to examine for the presence of the following criteria;

- recurrence of pneumonia defined by De Pippo et al (1992) as chest x-ray evidence of pneumonia or 3 or more of the following features;
    - ◊ sustained febrile illness greater than 100 F/ 38 C
    - ◊ presence of rales or rhonci on chest auscultation
    - ◊ drop in arterial PO2 greater than 10 torr compared with baseline values
    - ◊ sputum gram's stain showing significant leukocytes
    - ◊ Sputum culture showing respiratory pathogen.
- recurrent upper airway obstruction, if the patient requires the Heimlich manoeuvre on more than two occasions.
- death, noting cause.
- significant unexplained weight loss i.e. 10 -20% of pre-illness weight in last three months (British Dietetics Association 1997)
- videofluoroscopy with aspiration/dysphagia (including reduced oropharyngeal efficiency)

- videofluoroscopy with no aspiration/dysphagia.

This information was recorded on the subject information sheet.

(b) If the medical chart was not available or the information contained therein not sufficient, GPs were contacted to check the number of chest infections the person was treated for since discharge from hospital, if any.

(c) If the GP was unavailable, carers were contacted for this information.

2.8.(ii) Potential outcome scenarios envisaged were as follows;

Table 5 Potential outcome scenarios

Scenario 1	**Scenario 2**	**Scenario 3**
Admission ↓ Screened ↓ Problem detected ↓ speech and language therapist Referral for full assessment ↓ Assessment predicts dysphagia ↓ Videofluoroscopy confirms → Dysphagia	Admission ↓ Screened ↓ Problem detected ↓ speech and language therapist referral for full assessment ↓ No problem detected ↓ No problem at follow up *(or)*	Admission ↓ Screened ↓ No problem detected ↓ ↓ ↓ Problem at follow up

2.8. (iii) Data entry and storage

(a) All assessment forms used by the speech and language therapist during the bedside clinical examination were stored in the subject's speech and language therapy file i.e. orofacial assessment sheet, cervical auscultation assessment sheet, videofluoroscopy assessment forms, general notes regarding assessment findings (including medical history etc.) and all consent forms.

(b) Information from the screening test forms, data collection sheets and speech and language therapist assessment sheets were entered into a spreadsheet (Excel - Version 7/Windows '95) using the headings shown in table 6 (page 97)

(c) Yes (Y) or No (N) was used to indicate presence of absence of signs of dysphagia

Y ➡ Sign was present/observed by tester

N ➡ Sign was not present/observed by tester

(d) Information regarding further speech and language therapist assessment and general follow up were entered in the database for analysis from the subject information sheets.

Table 6 Data as Entered into Excel Data Sheet **Background Information**	**Database representation**	**Indicator**
Name Age Medical Diagnoses	 Med Dx	
Outcome of screening test - Nurse opinion		
Nurse/Repeat Test later? Nurse/Test unnecessary? Nurse/Uncooperative? Nurse/NPO & Refer to Speech and language therapist? Nurse/Refer to Speech and language therapist & Observe? Nurse/start feeding?	N: Rpt test later N: Test unnecessary N: Uncooperative N: NPO/Refer Speech and language therapist N: Refer/observe N: Start feeding	Y/N Y/N Y/N Y/N Y/N Y/N
Outcome of screening test - Speech and language therapist opinion		
Speech and language therapist/Repeat test later? Speech and language therapist/Test unnecessary? Speech and language therapist/Uncooperative? Speech and language therapist/NPO & Refer to Speech and language therapist? Speech and language therapist/Refer to Speech and language therapist and observe? Speech and language therapist Start feeding? Change in status observed?	Speech and language therapist: Rpt test later Speech and language therapist: Test unnecessary Speech and language therapist: Uncooperative Speech and language therapist: NPO/Refer Speech and language therapist: Refer/observe Speech and language therapist: Start feeding Change in status	Y/N Y/N Y/N Y/N Y/N Y/N
Small sip of water - signs and symptoms observed by Nursing staff: was there.....		
Nurse small sip - drooling? Nurse small sip - absent swallow? Nurse small sip - delayed swallow? Nurse small sip - immediate cough? Nurse small sip - delayed cough? Nurse/small sip - voice change? Nurse/small sip - change in respiratory rate? Nurse/small sip - Repeated laryngeal elevations?	Nsmsp Drooling Nsmsp abs sw Nsmsp delayed sw Nsmsp immed cough Nsmsp del cough Nsmsp voice change Nsmsp resp rate Nsmsp rptd lary ele	Y/N Y/N Y/N Y/N Y/N Y/N Y/N Y/N

Small sip of water - signs and symptoms observed by Speech and language therapist: was there.....		
Speech and language therapist/small sip - drooling?	Speech and language therapist: Drooling	Y/N
Speech and language therapist/small sip - absent swallow?	Speech and language therapist: abs sw	Y/N
Speech and language therapist/small sip - delayed swallow?	Speech and language therapist: delayed sw	Y/N
Speech and language therapist/small sip - immediate cough?	Speech and language therapist: immed cough	Y/N
Speech and language therapist/small sip - delayed cough?	Speech and language therapist: del cough	Y/N
Speech and language therapist/small sip - voice change?	Speech and language therapist: voice change	Y/N
Speech and language therapist/small sip - change in respiratory rate?	Speech and language therapist: resp rate	Y/N
Speech and language therapist/small sip - Repeated laryngeal elevations?	Speech and language therapist: rptd lary ele	Y/N
Continuous drink - signs and symptoms observed by Nurse		
Nurse/continuous drink - drooling?	NCD: Drooling	Y/N
Nurse/continuous drink - absent swallow?	NCD: abs sw	Y/N
Nurse/continuous drink - delayed swallow?	NCD: delayed sw	Y/N
Nurse/continuous drink - immediate cough?	NCD: immed cough	Y/N
Nurse/continuous drink - delayed cough?	NCD: del cough	Y/N
Nurse/continuous drink - voice change?	NCD: voice change	Y/N
Nurse/continuous drink - change in respiratory status?	NCD: resp rate	Y/N
Nurse/continuous drink - repeated laryngeal elevations?	NCD: rptd lary ele	Y/N
Continuous drink - signs and symptoms observed by Speech and language therapist		
Speech and language therapist/continuous drink - drooling?	Speech and language therapistCD: Drooling	Y/N
Speech and language therapist /continuous drink - absent swallow?	Speech and language therapistCD: abs sw	Y/N
Speech and language therapist /continuous drink - delayed swallow?	Speech and language therapistCD: delayed sw	Y/N
Speech and language therapist /continuous drink - immediate cough?	Speech and language therapistCD: immed cough	Y/N
Speech and language therapist /continuous drink - delayed cough?	Speech and language therapistCD: del cough	Y/N
Speech and language therapist /continuous drink - voice change?	Speech and language therapistCD: voice change	Y/N
Speech and language therapist /continuous drink - change in respiratory status?	Speech and language therapistCD: resp rate	Y/N
Speech and language therapist /continuous drink - repeated laryngeal elevations?	Speech and language therapistCD: rptd lary ele	
Other data		
Speech and language therapy Assessment?	Speech and language therapist Ax	Y/N

Aspiration suspected with cervical auscultation?	Asp on CA	Y/N
Videofluoroscopy performed?	Video	Y/N
Aspiration observed on videofluoroscopy?	Aspiration	Y/N
Reduced oropharyngeal swallow observed on videofluoroscopy?	Reduced OPSE	Y/N
Outcome at follow up?	Outcome	Diagnosis/NAD
Nurse code (to facilitate data analysis)	Nurse Code	1,2,3 etc

2.8 (iv) Statistical analysis

Analysis of the resultant data is mainly descriptive in nature. Due to the small numbers in some data subsections comprehensive statistical analysis was not possible.

The data describe the numbers of subjects

- screened
- assessed by the speech and language therapist
- presenting with oropharyngeal dysphagia and aspiration
- and videofluoroscopy details.

2.9 Outcome Calculations

(a) Once the subjects were followed up at three months the outcomes were entered into the database according to the criteria outlined in section 2.8 (pages 94-95)

(b) Each subject was assigned an outcome as follows;

- Nothing Abnormal Detected
- Respiratory disease evident at outcome including
  - ⇒ Pneumonia
  - ⇒ Exacerbation of COAD
  - ⇒ Respiratory tract infection (RTI)
  - ⇒ Lung cancer (Lung Ca)
- Death and cause

(c) The following factors were recorded in the database for each subject that was followed up after three months.

- positive/negative swallow screening test
- full speech and language therapy swallow evaluation
- presence/absence of aspiration & dysphagia at bedside
- videofluoroscopy performed/not performed
- presence/absence of aspiration & dysphagia on videofluoroscopy
- compliance with speech and language therapy

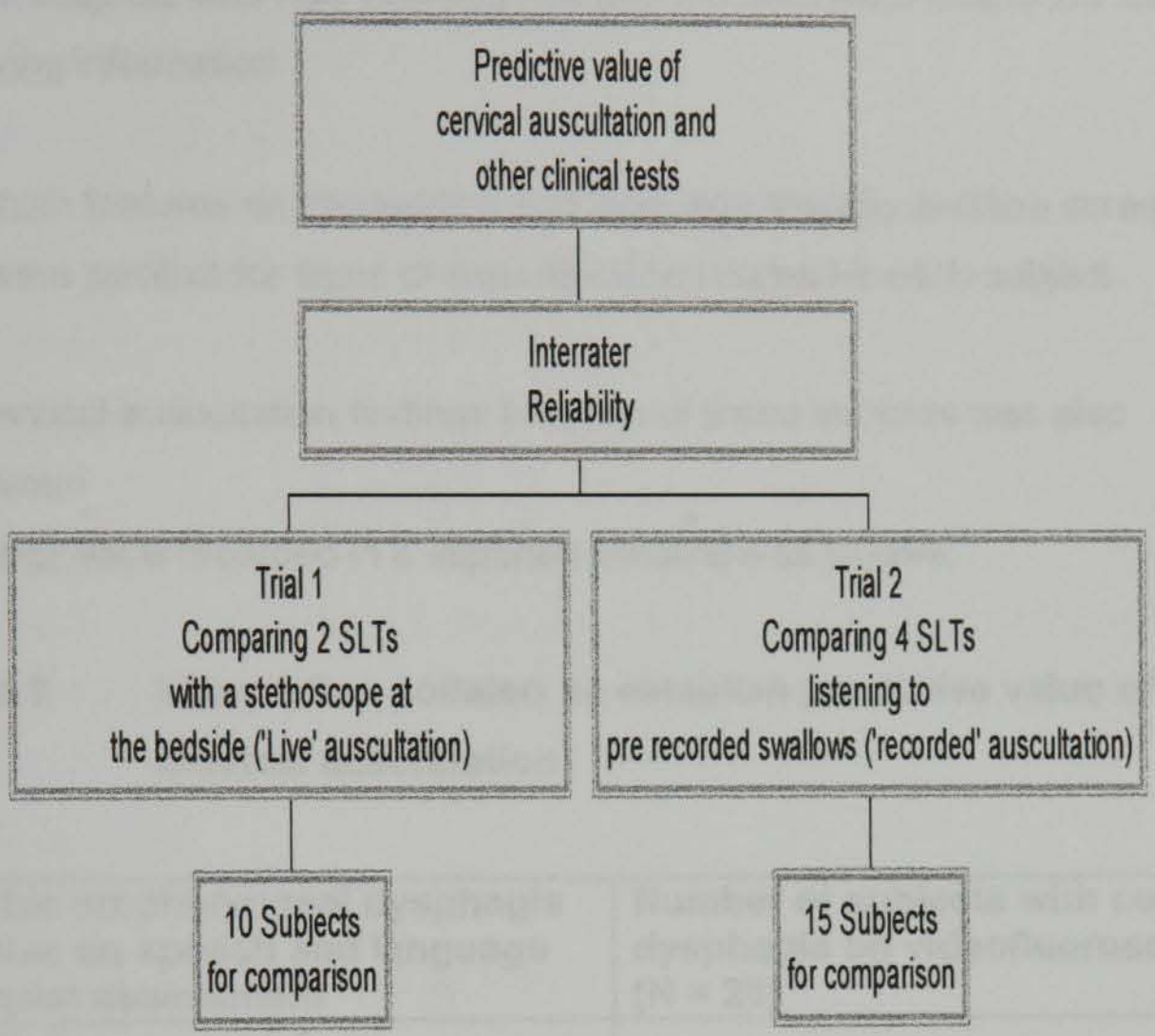
(d) The data were then examined to describe the following;

- Respiratory disease presented with at outcome for the total sample
- Detailed breakdown of respiratory diseases presented with

- Outcomes for subjects who had negative swallow screening tests with no speech and language therapist assessment or follow up
- outcomes for subjects who had negative full speech and language therapist assessment and who did not therefore have a videofluoroscopy
- outcomes for subjects who had positive screening test and full speech and language therapy intervention including cervical auscultation and videofluoroscopy
- outcomes for subjects who had positive speech and language therapy swallow assessment but no videofluoroscopy
- outcomes of subjects who presented with respiratory disease on initial admission to hospital

The data are descriptive in nature.

Figure 9 **Cervical Auscultation: Establishing (a) diagnostic significance and (b) interrater reliability between Speech and Language Therapists**



2.10 (i) Predictive Value of Cervical Auscultation and Other Clinical Tests compared with Videofluoroscopy

For all subjects who had videofluoroscopy the data were examined for the following information

(a) which features on the speech and language therapy swallow screening test were positive for signs of aspiration/dysphagia for each subject

(b) cervical auscultation findings for each of these subjects was also examined

Findings were recorded in a separate database as follows;

Table 7 Information collated to establish predictive value of cervical auscultation

Test for oropharyngeal dysphagia positive on speech and language therapist assessment	Number of subjects with confirmed dysphagia on videofluoroscopy (N = 28)
Drooling Delayed swallow Immediate cough Delayed cough Voice change Respiratory rate change Repeated laryngeal elevations Cervical auscultation at the bedside	

The most accurate test in predicting videofluoroscopy outcome was then evident and was reproduced graphically.

2.11 Cervical Auscultation - Establishing Inter-rater Reliability between Speech and Language Therapists using a Stethoscope at the Bedside ('Live' auscultation)

2.11.(i) Subjects

10 subjects were selected.

All were consecutive new admissions to the hospital test wards.

All were identified as needing a speech and language therapy swallow assessment as per the swallow screening test which was done on admission by nursing staff.

2.11.(ii) Materials

- A double sided training stethoscope fitted with a Littmann II Paediatric stethoscope diaphragm.
- Glass of water
- Teaspoons
- semisolid consistency foods
- Cervical auscultation rating form

2.11.(iii) Procedures

1. The trial was conduced by one research speech and language therapist with one other speech and language therapist familiar with using cervical auscultation with a stethoscope
2. Verbal consent was sought from each subject to participate.
3. Both speech and language therapists must have agreed that the subject was fit and able to co-operate with drinking water and taking yoghurt prior to the assessment.
4. The diaphragm of the stethoscope was placed at the subject's throat as per Takahashi et al (1994). Both therapists listened through the double headed stethoscope as the subject swallowed.
5. The subject was asked to take three sips of water.
6. After the third sip, the swallow was rated by the therapists independent of each other, according to the rating form provided.

7. The stethoscope was placed on the other side of the subject's throat as described by Takahashi et al 1994 and three more sips of water were given.
8. After three sips the swallow was rated again independently by the therapists according to the rating form.
9. If the subject was judged by either clinician to be aspirating on two out of three swallows, the Speech and language therapists did not proceed with more sips and findings were recorded on the rating form.
10. The trial was continued with six teaspoons of yoghurt (three given whilst the therapists listened on the left side of the throat and three given whilst listening on the right side of the throat).
11. Each therapist was asked to state on the rating form whether or not the person was, in her opinion, aspirating and if further investigations were warranted e.g. videofluoroscopy/Fibreoptic Endoscopic Evaluation of Swallowing (FEES).
12. Rating forms were stored for comparison to establish inter-rater reliability.

STOP CRITERIA: If at any stage either clinician determined that further oral intake for assessment purposes was inappropriate e.g. significantly increased respiratory rate or obvious patient distress, then the trial ceased and findings were recorded.

2.11.(iv) Data Entry and Storage

The swallow screening test forms and the two cervical auscultation test forms were stored together for each subject. Information from these forms was entered into a data sheet as outlined in table 8.

Table 8 Data collected for cervical auscultation inter-rater reliability trial 1

Subject name	
Agreement between Speech and language therapists regarding whether or not aspiration/ ⇓ oropharyngeal swallow efficiency (OPSE) present	Yes/No
Dysphagia present	Yes/No
Dysphagia not present	Yes/No
Agree risk indicated/needs investigation	Yes/No

2.11.(v) Statistical analysis

The Kappa statistic (K) was used to determine Inter-rater reliability.

2.12 Cervical Auscultation - Establishing Inter-rater Reliability Between Speech and Language Therapists; Listening to Previously Recorded Swallows ('Recorded' auscultation)

2.12.(i) Subjects

10 subjects who were previously recorded swallowing

The subjects were selected randomly from all available recordings by an independent observer/person who was given a list of disc and track numbers and was asked to randomly assign letters to 10 subjects as follows

Subject A	Disc 1	Track 5	
Subject B	Disc 3	Track 2	
Subject C	Disc 1	Track 15	*etc.*

2.12.(ii) Materials

1. The recordings were made using equipment as previously described. The recordings were played from the minidiscs on which they were originally recorded.
2. Two audio speakers were attached to the minidisc recorder to make recordings audible to all the participating speech and language therapists
3. Cervical auscultation recording forms.

2.12.(iii) Procedures

1. All subjects had previously given written consent for the recording to be used for research as part of the overall study.
2. The recordings were audible to 3 speech and language therapists at one sitting using the two audio speakers
3. The speech and language therapists listened to selected recordings, played on the mini-disc recorder by the research speech and language therapist
4. A rating form was filled in by each therapist during and at the end of each recording.
5. The subject's identifying letter was recorded by each therapist on the rating form.

2.12.(iv) Data Entry and Storage

(a) Cervical auscultation rating forms filled in by each of the therapists were stored together for each subject.

(b) Information as outlined in table 9 was collected from the rating forms

Table 9 Data collected for inter-rater reliability trial 2

Subject identification (letter)	**A,B,C, etc.**
Research Therapist: Aspiration/⇓ OPSE ?/needs video?	Yes/No
Therapist 1: Aspiration/ ⇓ OPSE ? /needs video?	Yes/No
Therapist 2: Aspiration/ ⇓ OPSE ? /needs video?	Yes/No
Therapist 3: Aspiration/ ⇓ OPSE ? /needs video?	Yes/No

2.12.(v) Data Analysis

As all the recorded subjects presented with signs of dysphagia statistical analysis was difficult as statistical tests need a balance of positive and negative subjects in order to be effective. Therefore, this information is descriptive in nature and involves a percentage rating and a description of the features of swallow sounds as agreed by the raters using the following rating system;

1 → Rater identifies feature as present/not present

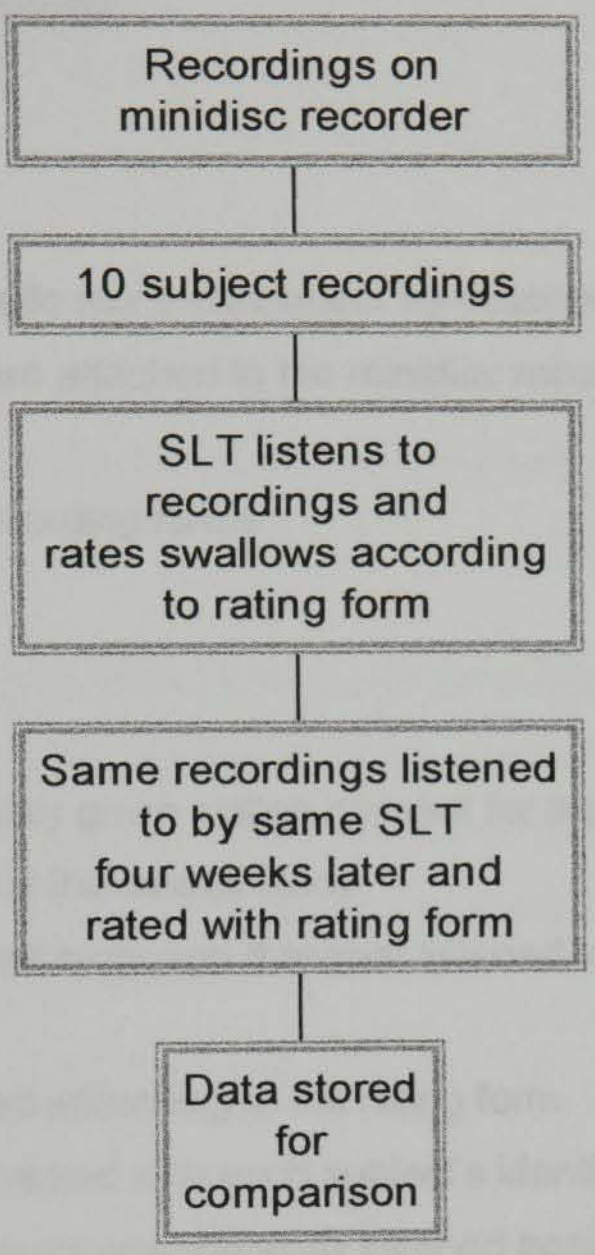
i.e. agreement

2 → Rater does not agree feature is present/not present

i.e. disagreement

Findings of two different therapists were individually compared with the research speech and language therapist.

Figure 10 **Establishing Intrarater reliability of a Speech and LanguageTherapist with Cervical Auscultation audio recordings**



2.13 Establishing Intra-rater Reliability of Cervical Auscultation

2.13.(i) Subjects

10 subjects who were previously recorded swallowing. The subjects were selected randomly as previously.

2.13.(ii) Materials

1. The recordings were made using equipment as described previously.
2. Two audio speakers were attached to the minidisc recorder so tracks could be played aloud
3. Cervical auscultation recording forms

2.13.(iii) Procedures

1. All subjects had previously given written consent for the recording to be used for research as part of the overall study
2. The research speech and language therapist listened to the selected tracks of swallow sounds.
3. The swallows were rated according to the rating form.
4. Each rating form was marked with each subject's identifying label
5. The same speech and language therapist listened again to the same recordings in the same order 4 weeks later.
6. Again the swallows were rated according to the rating form

2.13.(iv) Data Entry and Storage

(a) The two assessment sheets for each subject were stored together for comparison.
(b) Information was entered into a data sheet under headings as shown in table10.

Table 10 Data collected for intra- rater reliability of cervical auscultation

First listening session Aspiration/↓ OPSE?/Needs further investigation?	**Subject A,B,C,D….** Yes/No
Second listening session Aspiration/↓ OPSE?/Needs further investigation?	Yes/No

2.13.(v) Data analysis

This is descriptive data looking at features observed on auscultation using the following rating system;

1 → Rater identifies feature as present/not present at both listening sessions i.e. agreement

2 → Rater does not agree feature is present/not present for both listening sessions i.e. disagreement

2.14 Review of Hospital In Patient Enquiry (HIPE) Data for a 12 month period

1. HIPE is a system which identifies the six primary diagnoses for each patient selected from their medical chart. It is based on ICD 9 i.e. International Classification of Diseases, 9th revision (1978) adopted by the World Health Organisation. The resultant information is grouped by a computer programme.

2. Medical admission data for the period during which the research took place, June 1997 - June 1998 was requested from the hospital medical records/HIPE department

3. The data were examined and organised into the following sections relevant to this study;

- Number of admissions presenting with *respiratory disease* as a primary diagnosis
- Number of admissions presenting with *neurological disease* as a primary diagnosis
- Number of admissions presenting with *gastrointestinal disease* as a primary diagnosis
- Number of admissions presenting with some *other medical* diagnosis

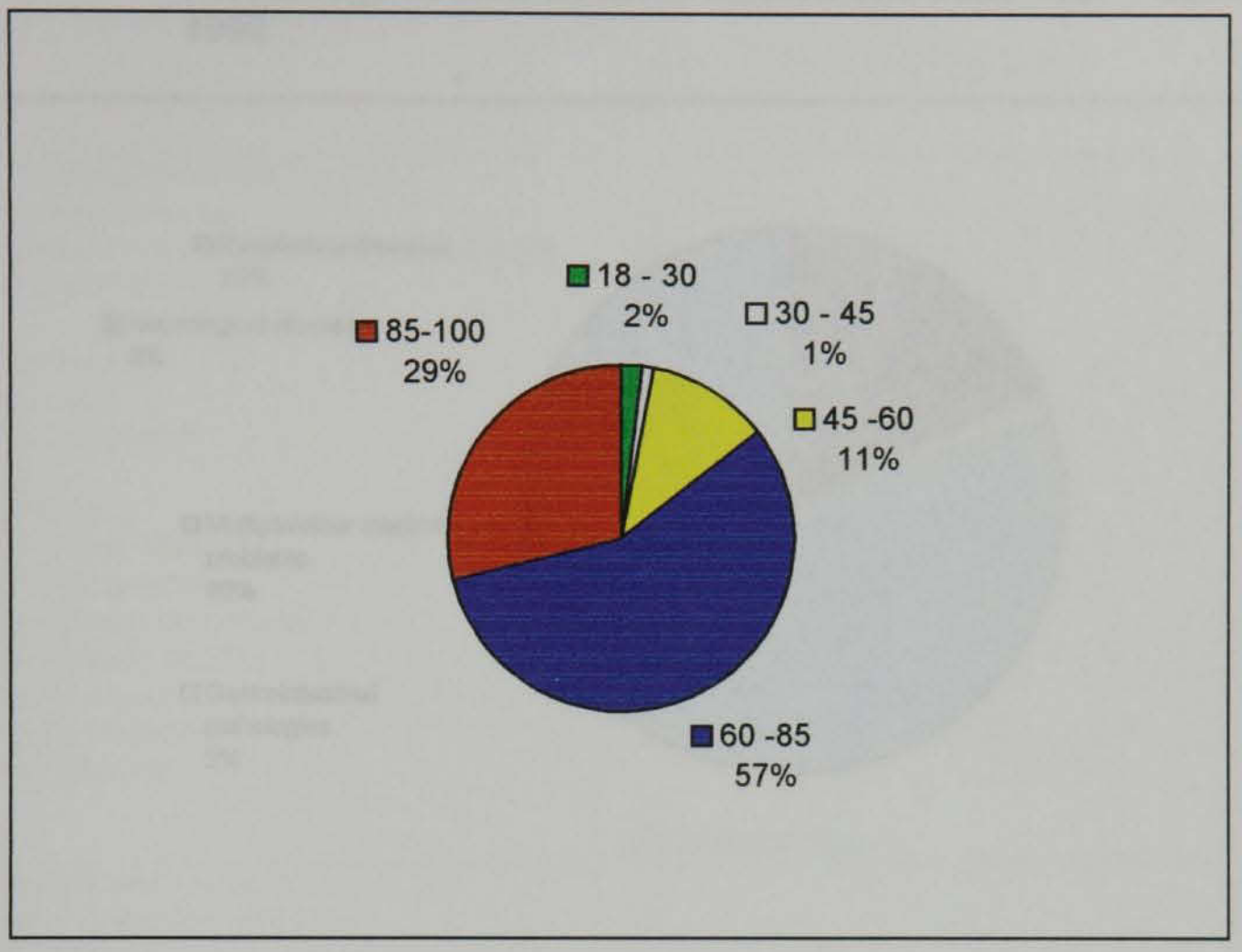
4. The results were tabulated and percentages for each presenting disorder were calculated (table 11 page 115)

Chapter 3

Results

Figure 11

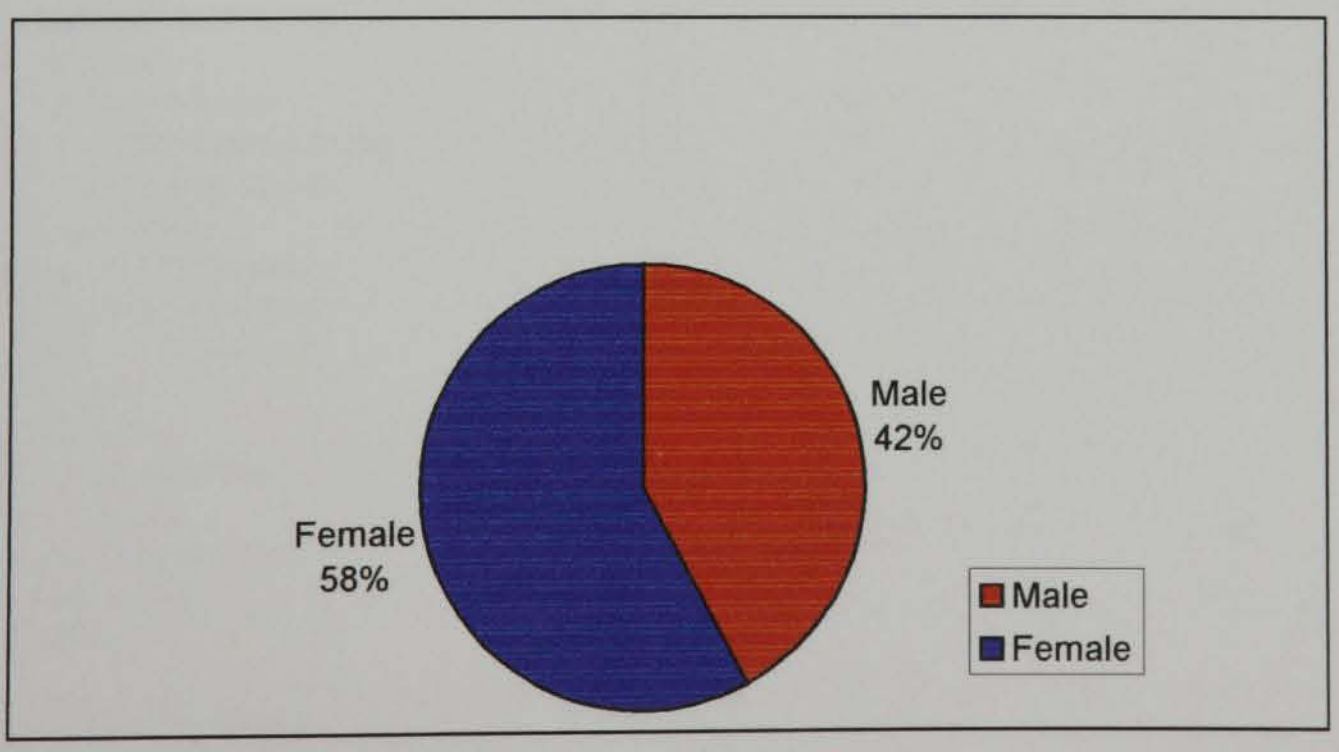
Subject Age Distribution



The majority of subjects are aged over 60 years

Figure 12

Sex distribution, male Vs female



There are slightly more females than males.

Figure 13

Percentage of total hospital admissions June 1997 – June 1998

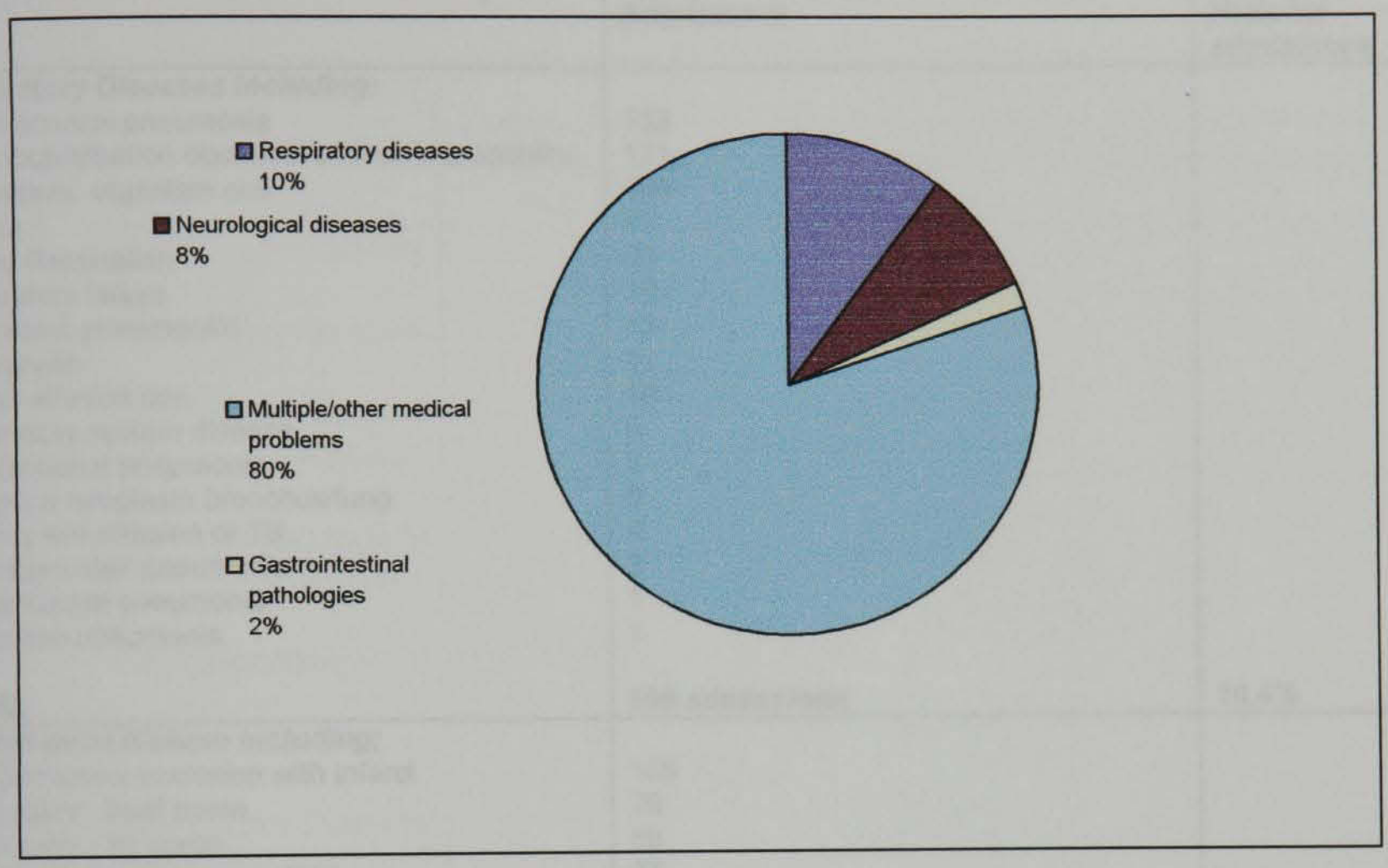


Table 11

Hospital admission data June1997 - June1998

TOTAL Medical admissions for period = 4893

Diagnosis	Number Presenting to Hospital Admissions	% of total Hospital admissions
Respiratory Diseases including:		
pneumococcal pneumonia	133	
acute exacerbation obstructive chronic bronchitis	121	
Pneumonia, organism nos	108	
asthma	47	
Painful Respiration	20	
Respiratory failure	19	
Food/vomit pneumonitis	13	
Hemoptysis	11	
Pleural effusion nos	10	
Respiratory system disease	6	
Pseudomonal pneumonia	6	
Malignant neoplasm bronchus/lung	6	
Pleurisy w/o effusion or TB	4	
K. Pneumoniae pneumonia	3	
Streptococcal pneumonia	1	
Influenzae pneumonia	1	
TOTAL	**509 admissions**	**10.4%**
Neurological disease including;		
Cerebral artery occlusion with infarct	106	
Brain injury - brief coma	76	
Brain injury - no coma	59	
Other brain injury - unspecified	27	
CVA	27	
Convulsions	27	
Intracerebral haemorrhage	22	
Cerebrovascular disease	16	
Senile dementia	7	
Brain injury - concussion	5	
Epilepsy - intractable	4	
Subarachnoid haemorrhage	4	
Acute cerebrovascular insufficiency	4	
Cerebral thrombosis with infarct	3	
Basiler Artery syndrome	2	
Malignant neoplasm brain nos	2	
Subdural haemorrhage - coma	2	
Malignant neoplasm brain nec	1	
Brain neoplasm nos	1	
Frontal lobe syndrome	1	
Acute infectious polyneuritis	1	
Amyotrophic sclerosis	1	
Cerebrovascular disease nec	1	
Alcoholic dementia nec	1	
Anoxic brain damage	1	
TOTAL	**392 Admissions**	**8%**
Gastrointestinal pathologies	**81 Admissions**	**1.65%**
Multiple/other Medical Problems	**3911 admissions**	**80%**

Table 12

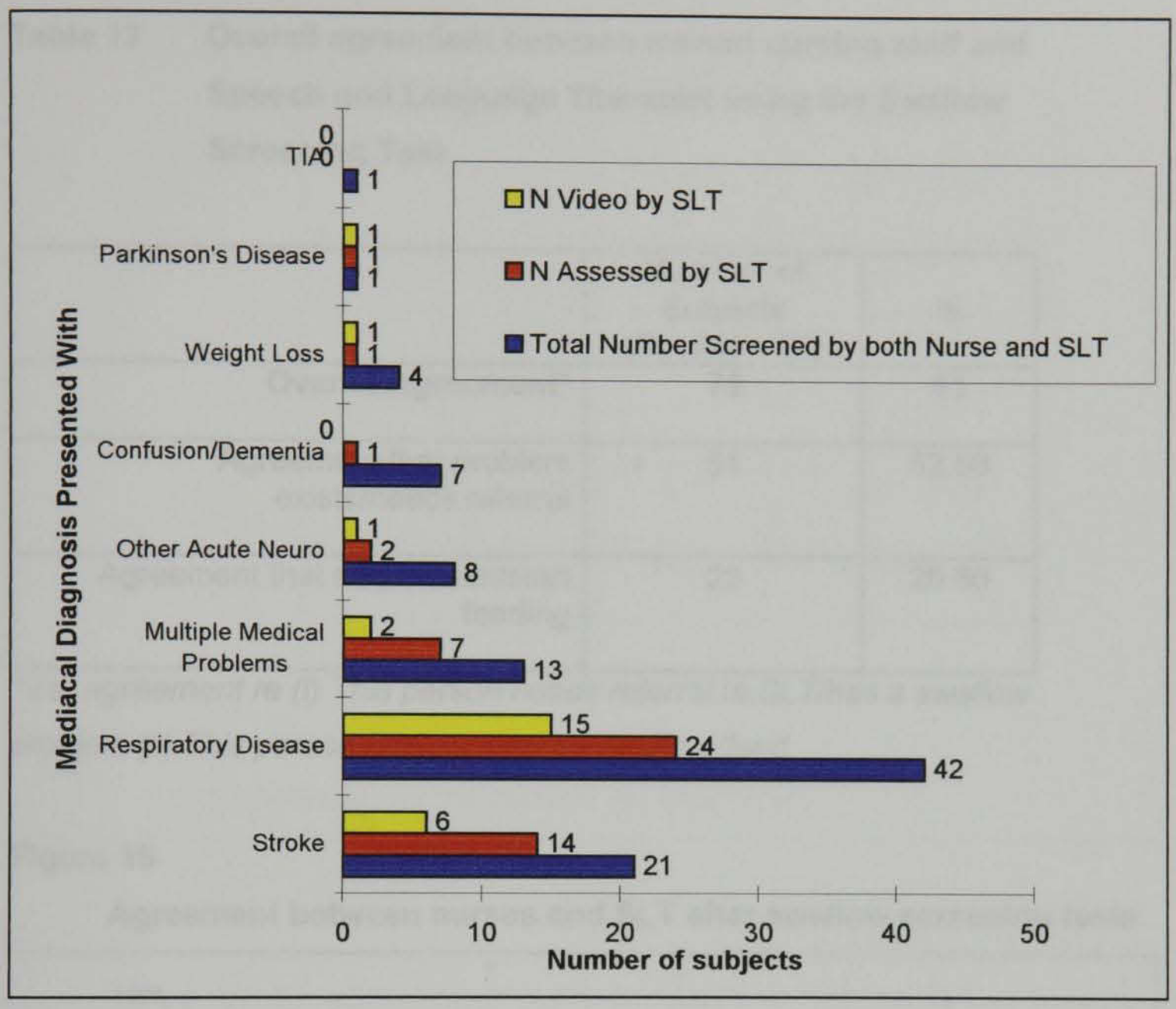
Subject assessment profile (N = 97)

Diagnosis	N screened by both Nurses and SLT	N who underwent full SLT clinical evaluation	N who underwent Videofluoroscopy
Stroke	21	14	7
Respiratory disease	42	24	17
Multiple Medical Problems	13	7	2
Other Acute Neurological illnesses	8	2	1
Confusion/dementia	7	1	0
Weight loss	4	1	1
Parkinson's Disease	1	1	1
TIA	1	1	0
Total N	**97**		
Total N with SLT assessment		**50**	
Total N of videofluoroscopies			**29**

The majority of patients presented with respiratory disease (N=42) and Stroke (N = 21). Just over half of those screened had a full Speech and Language Therapy clinical evaluation of swallow status (N = 50) and over half of these subjects had a videofluoroscopy (N = 29).

Figure 14

Subject assessment profile



The majority of intervention occurred with subjects groups presenting with respiratory disease, stroke and multiple medical problems. Almost half required speech and language therapist assessment and half of these had a videofluoroscopy.

Swallow Screening Test Data

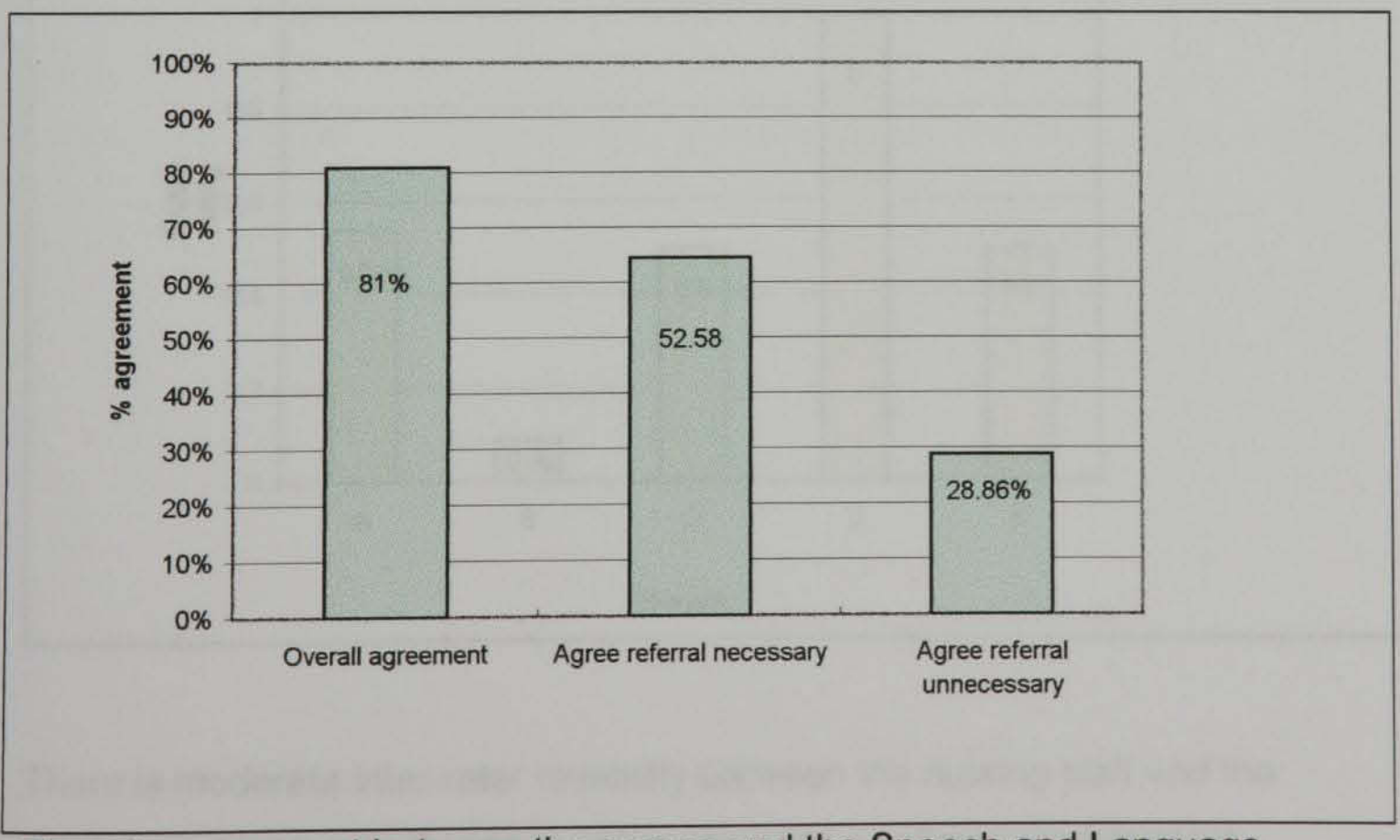
Table 13 **Overall agreement between trained nursing staff and Speech and Language Therapist using the Swallow Screening Test**

	Number of Subjects (Total N = 97)	%
Overall Agreement*	**79**	**81**
Agreement that problem exists/needs referral	51	52.58
Agreement that no problem/start feeding	28	28.86

** i.e. agreement re (i) This person needs referral to SLT/has a swallow problem (ii) This person has no swallow problem/feed*

Figure 15

Agreement between nurses and SLT after swallow screening tests



There is agreement between the nurses and the Speech and Language Therapist in 81% of cases.

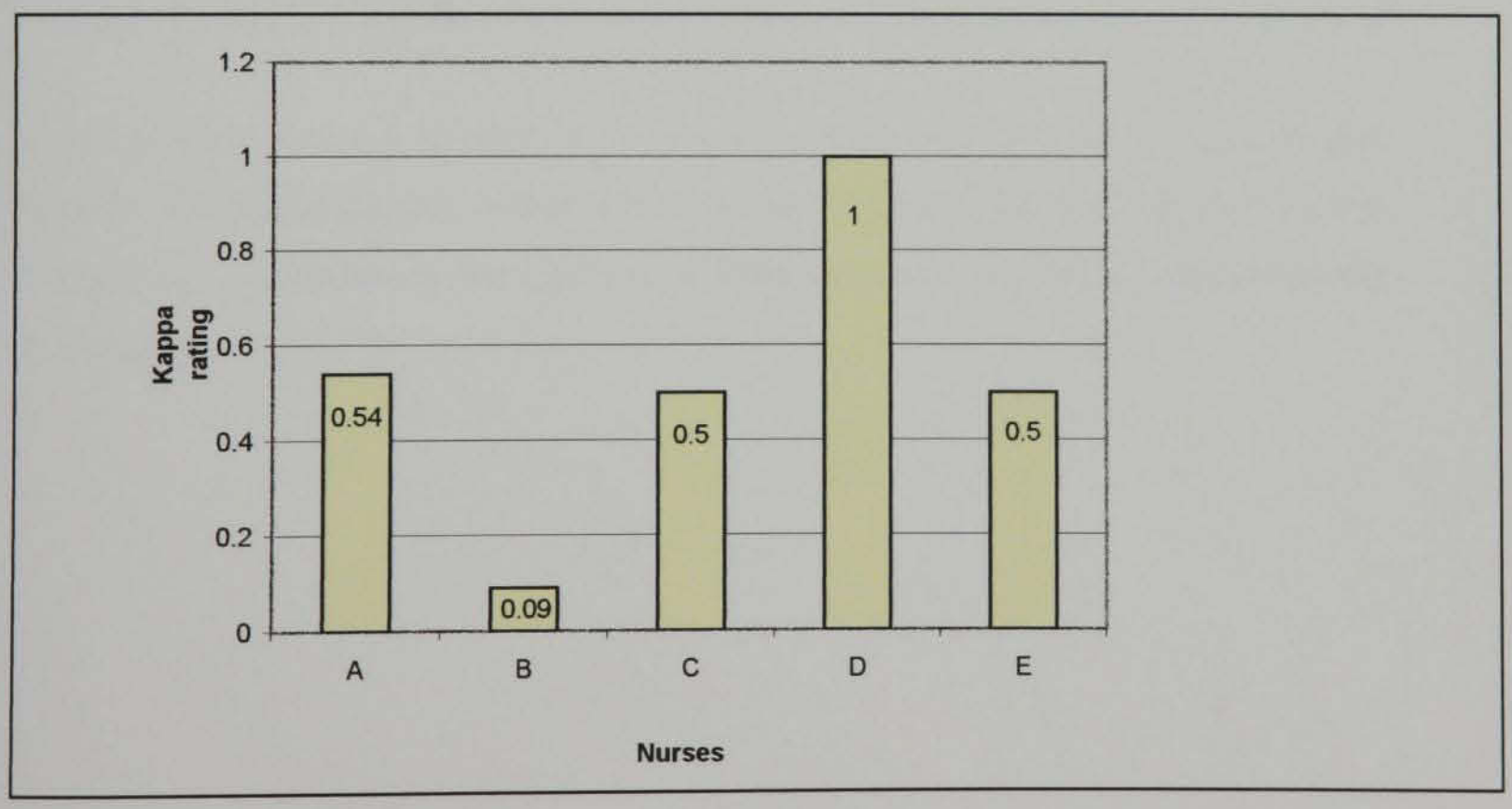
Table 14

Inter-rater reliability between five trained nurses and a speech and language therapist using the screening test

Nurse	*k*	Agreement
A	0.54	moderate
B	0.09	poor
C	0.5	moderate
D	1	good
E	0.5	moderate
Mean *k*	**0.53**	**Moderate**

Figure 16

Kappa ratings for trained nursing staff



There is moderate inter-rater reliability between the nursing staff and the speech and language therapist when using the swallow screening test.

Table 15

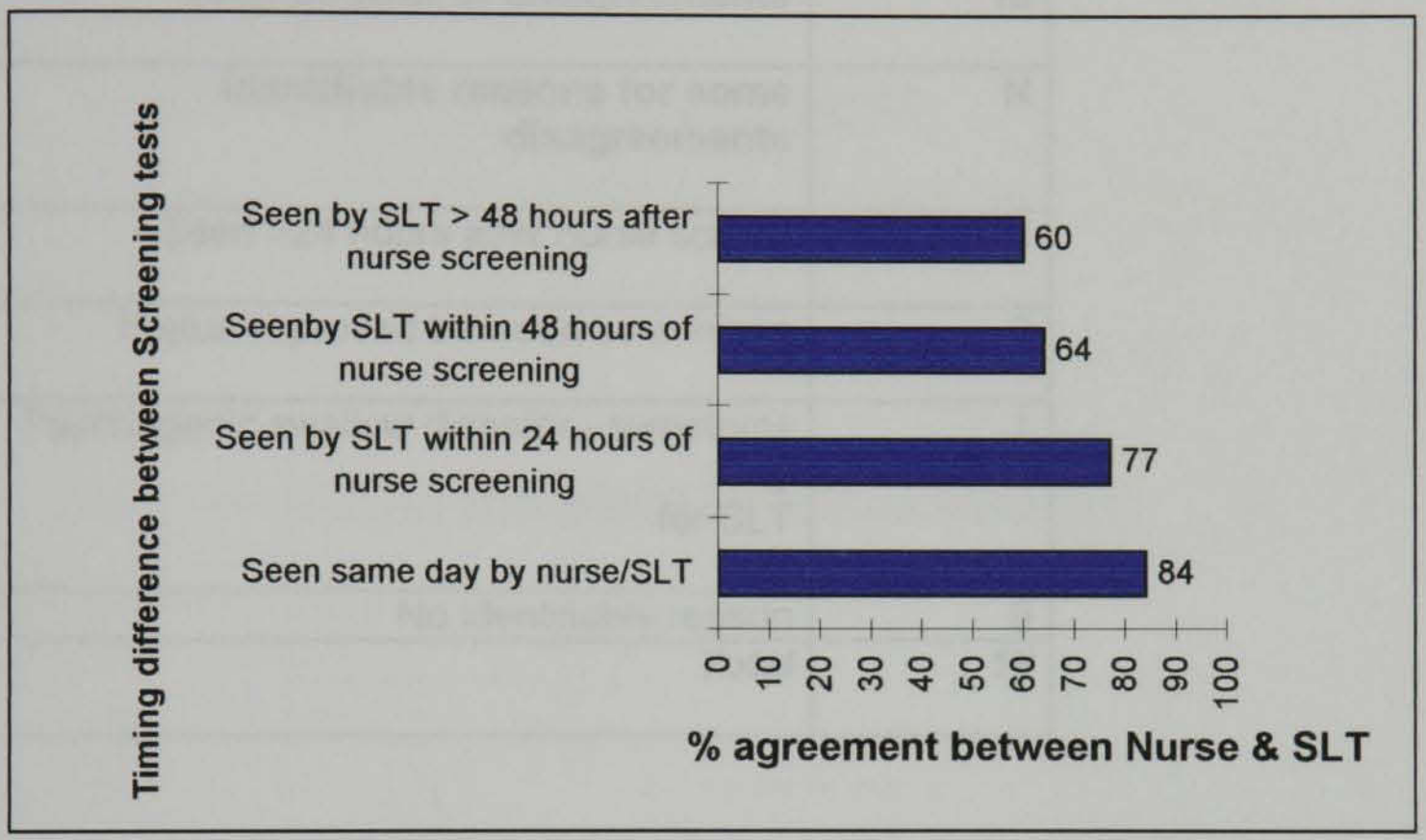
Agreement re 'NPO/Refer' option VS 'Refer/Observe' option

Agreement Options	N
Both agreed referral necessary	51 subjects
Both agreed NPO/Refer option necessary	12 subjects
Both agreed Refer/observe option necessary	26 subjects
Disagreement occurred for i.e. where;	***13 subjects***
(a) Nurses recommended NPO/Refer option Vs SLT recommended refer/observe option	9 subjects
(b) Nurses recommended Refer/observe option Vs SLT recommended NPO/Refer option	4

Nursing staff made more recommendations that subjects be maintained NPO with referral to Speech and Language Therapy.

Figure 17

Effects of time between screening tests on level of agreement



Nursing staff and the speech and language therapist tended to have higher agreement about subject status if both screening tests were conducted on the same day. Agreement was poorer if time between screening assessments increased.

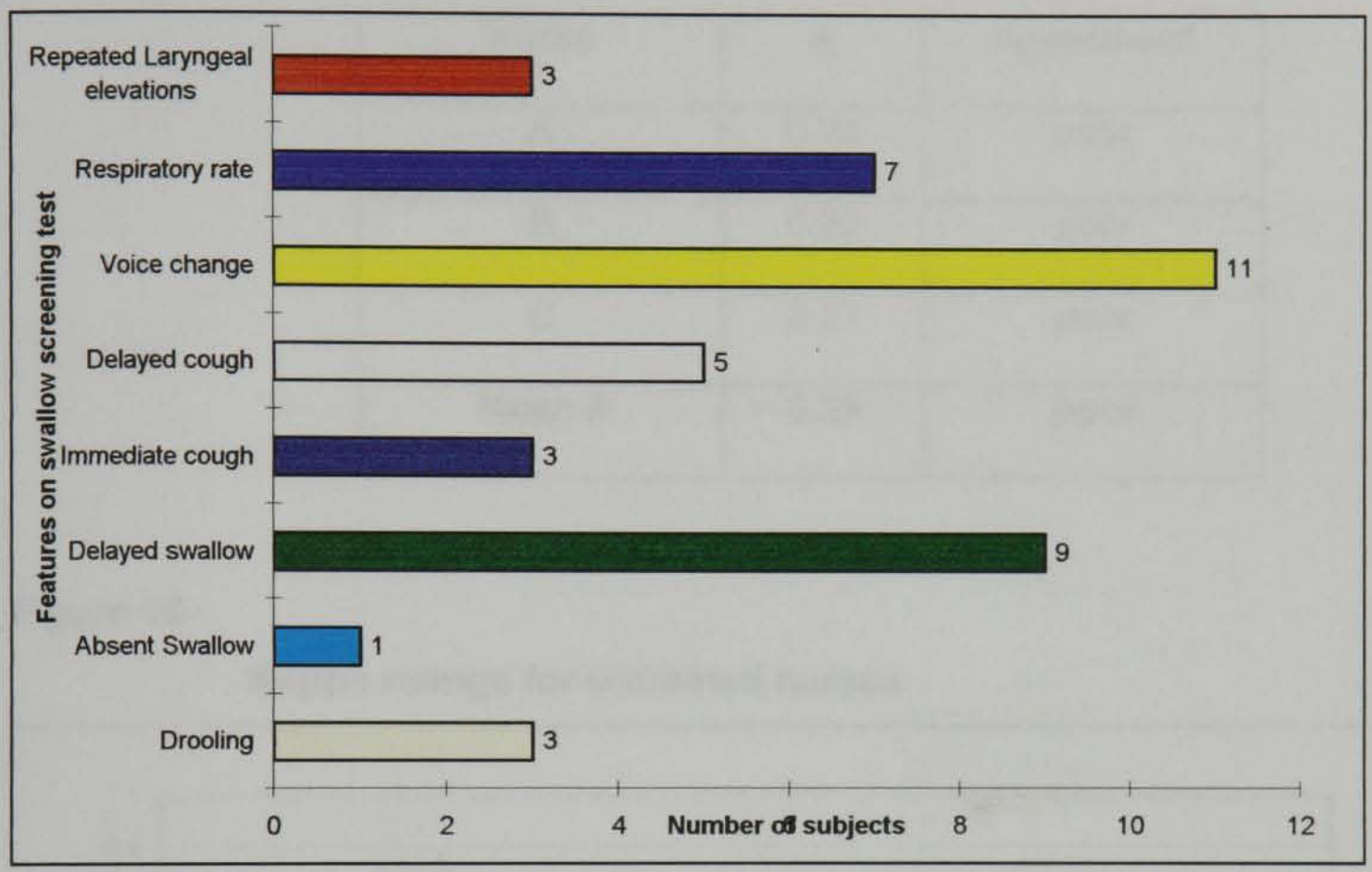
Table 16

General Disagreements: incidences where nurse and Speech and Language Therapist disagree about subject status after screening test

Total number of disagreements	**18**
Identifiable reasons for some disagreements	**N**
Seen >24 hours after nurse screen	6
Status improved between screenings	2
Psychogenic swallow disorder - symptoms only for SLT	1
No identifiable reason	9
Total	***18***

50% of the cases where disagreement arose have identifiable reasons for the disagreement

Fig 18 **Predictors of aspiration on videofluoroscopy as identified by nursing staff using the swallow screening test**



Voice changes, delayed swallow and changes in respiratory rate were the features most often detected by nursing staff when screening subjects who eventually demonstrated aspiration on videofluoroscopy.

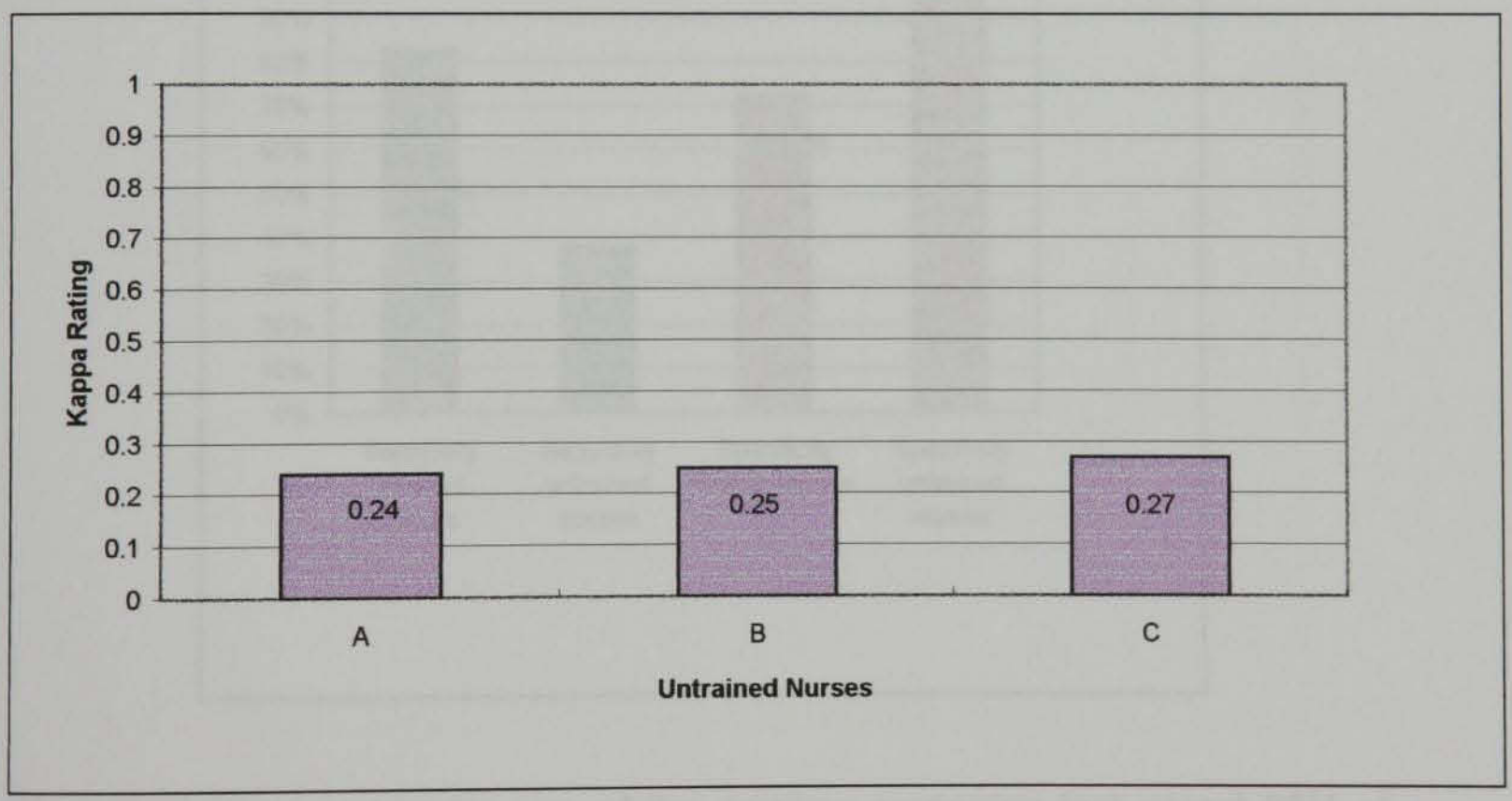
Table 17

Interrater reliability between nurses not trained in the use of the swallow screening test and a speech and language therapist

Nurse	*k*	Agreement
A	0.24	poor
B	0.25	poor
C	0.27	poor
Mean *k*	**0.25**	**poor**

Figure 19

Kappa ratings for untrained nurses



There is consistently poor inter-rater reliability between the nurses who are untrained in the swallow screening test when compared with the speech and language therapist

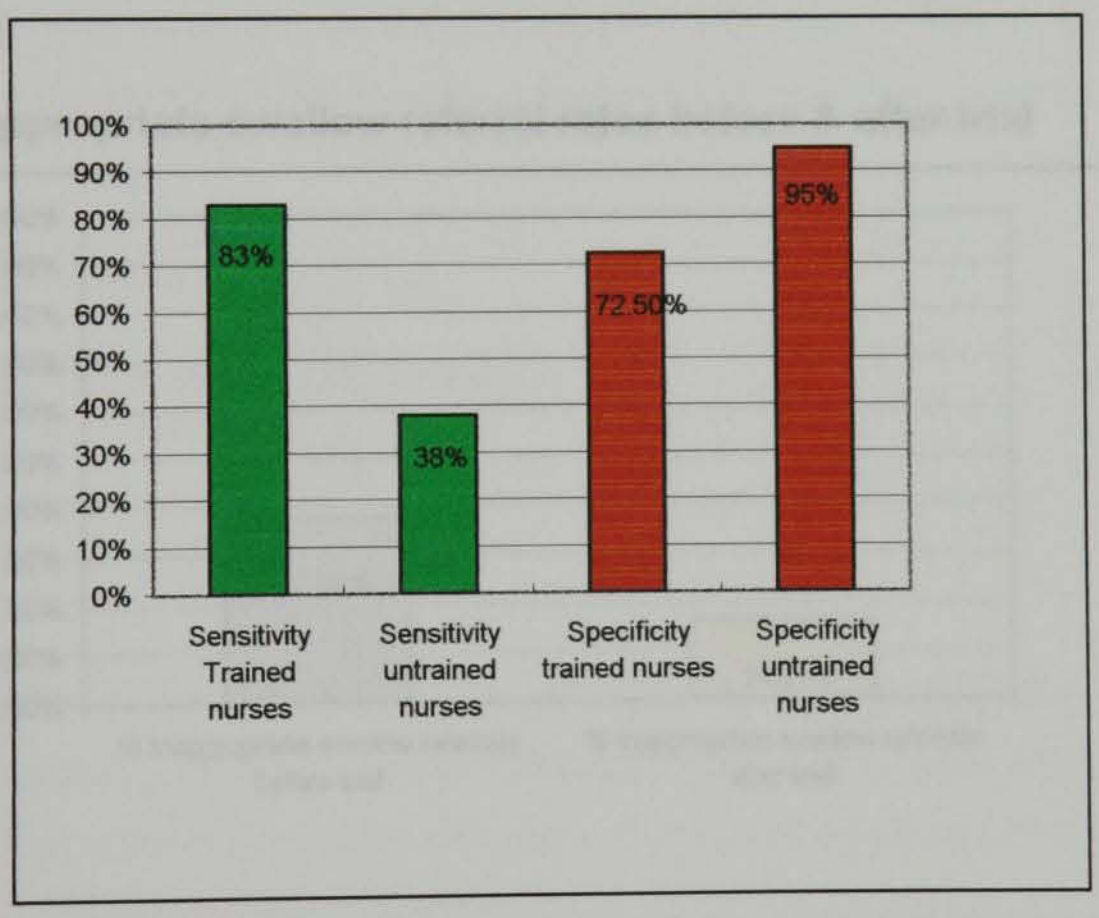
Table 18

Trained and untrained nursing staff sensitivity and specificity

	Average *k*	Sensitivity	Specificity
Trained Nurses	0.25	0.83 (83%)	0.725 (72.5%)
Untrained Nurses	0.52	0. 38 (38%)	0.95 (95%)
Significance		***p = 0.031***	

Figure 20

Sensitivity and specificity of trained Vs untrained nursing staff



Nursing staff trained in the use of the swallow screening test detect 83% of the subjects at risk of oropharyngeal dysphagia, compared with untrained nursing staff who only detect 38% of those at risk. This is statistically significant. The untrained staff will detect only those subjects who have very obvious, specific signs of aspiration.

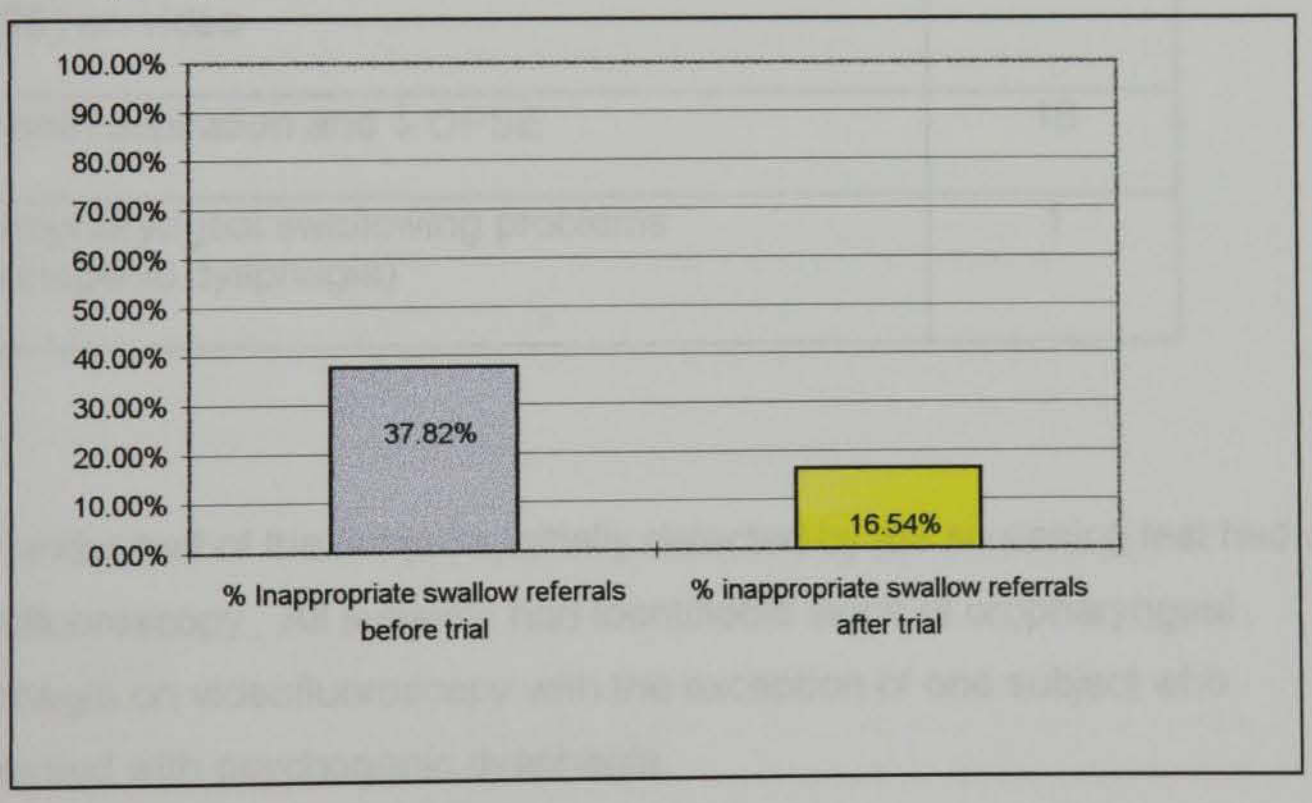
Table 19

Trends in SLT referral rates for swallow assessments before and after the introduction of the screening test on two hospital wards

	Before Trial	**After Trial**
	Jan 1995/Dec 1995	**June 1997 - June 1998**
Total number of available SLT charts for review	185	305
Total number of requests for swallow assessment	156	272
Number of inappropriate referrals (%) received for swallow assessment	59/156 i.e. **37.82%**	45/272 i.e. **16.54%**
Overall drop in referral rates		***21.28%***
***X^2 with Yates correction* 23.83, $p < 0.001$, *df* = 1**		

Figure 21

Inappropriate swallow referral rates before & after trial



There was more than 20% drop in the number of inappropriate referrals for swallow assessment received by the Speech and Language Therapy Department since the introduction of the screening test on two hospital wards. This difference is highly significant ($p < 0.001$)

SPEECH AND LANGUAGE THERAPY SWALLOW ASSESSMENT DATA

Table 20

Swallow Assessment Data profile

Subjects who:	**N**
were recommended for referral by SLT	57
were assessed by SLT with Cervical Auscultation	50
were recommended for Videofluoroscopy	38
Underwent videofluoroscopy	29
showed signs of oropharyngeal dysphagia on video	28
Had only ↓ Oropharyngeal swallow efficiency (OPSE) on video	10
Had both aspiration and ↓ OPSE	18
No oropharyngeal swallowing problems (psychogenic dysphagia)	1

Just under half of the subjects initially detected by the screening test had a videofluoroscopy. All subjects had identifiable signs of oropharyngeal dysphagia on videofluoroscopy with the exception of one subject who presented with psychogenic dysphagia.

Table 21

Reasons for not assessing 7 subjects identified on the screening test as needing assessment

Reason for not assessing subject	Number of subjects
Too unwell/poor prognosis	2
Refused assessment/confusion	2
Discharged home prior to assessment	1
Status improved since screening test	2
Total	**7**

Table 22

Reasons for not doing Videofluoroscopies (N = 9)

No of subjects	Reason
2	No need/Swallow status improved at bedside/Tolerating diet
3	Deterioration in status/RIP
1	Non complicance with SLT
3	Discharged home prior to Video/unable to return
Total 9	

Table 23

Timing from SLT screening test to SLT full bedside assessment

	N	Reason for delay	Videos
Assessed same day as screened	22	-	12
Assessed within 1 day	23	-	14
Assessed within 2 days	2	1 -Caseload prioritisation 1 - no specific reason	2
Assessed within 3 days	2	2 - weekend between assessments	1
Assessed within 5 days	1	Non compliance initially	0
Total assessed	**50**		**29**

The majority of subjects requiring assessment by a speech and language therapist after the initial screening process were seen on the same day as the screening assessment or within one working day.

Table 24

Timing between full clinical swallow assessment (with cervical auscultation) and Videofluoroscopy (N = 29)

Videofluoroscopy done on/within;	N	Reason for delay
Same day as bedside evaluation	1	-
1 day post bedside evaluation	3	-
4 days post bedside evaluation	4	Standard practice at the time
5 days post bedside evaluation	8	Standard practice at the time
6 days post bedside evaluation	7	Standard practice at the time
7 days post bedside evaluation	2	Standard practice at the time
11 days post bedside evaluation	2	1 Subject - too unwell first week 1 subject - proper seating unavailable first week
> 1 month post bedside evaluation	1	Very unwell/admitted to CCU/subsequently improved
> 2 months post bedside evaluation	1	Discharged from hospital/returned as outpatient once equipment available at new hospital site
TOTAL	***29***	

The majority of videofluoroscopies were conducted within 7 days of the initial swallow evaluation by the Speech and Language Therapist, as per standard hospital practice at the time.

OUTCOMES AFTER THREE MONTHS FOLLOW UP

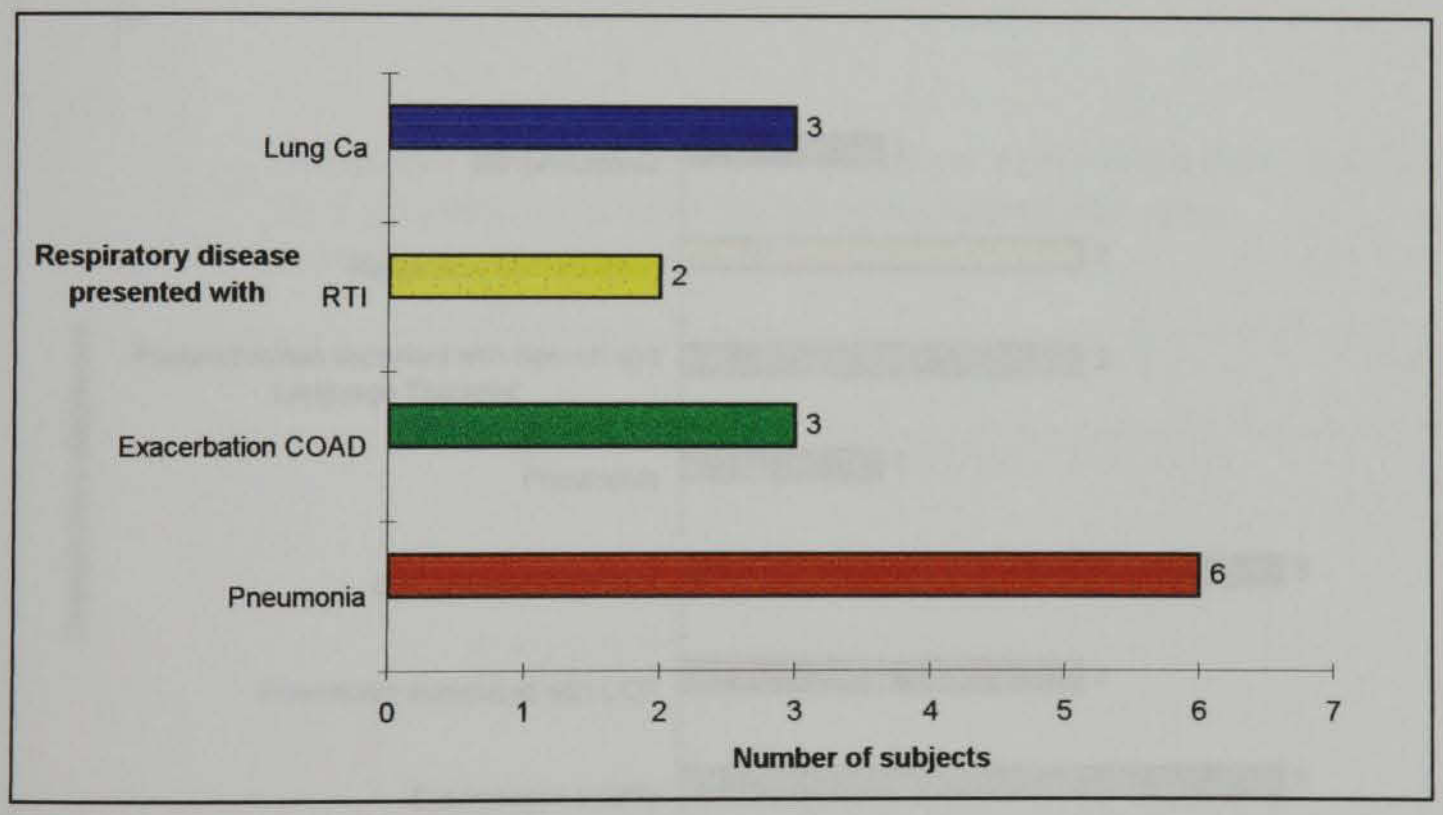
Table 25

Respiratory disease presented with at outcome for the total sample (N = 97)

Respiratory Disease	Number of subjects
Pneumonia	6
Exacerbation COAD	3
RTI	2
Lung Ca	3
TOTAL	**14**
% of total sample	**14.5%**

Figure 22

Respiratory disease presented with at outcome



Fourteen subjects from the total sample of 97 presented with respiratory complications at three month follow up. Pneumonia was the most common diagnosis presented with. A more detailed breakdown of these diagnoses is in *table 26/figure 23 page 132*

Table 26

Breakdown of respiratory diseases presented with at follow up

Respiratory Disease	Number of subjects
Exacerbation COPD	3
Pneumonia associated with CCF	2
Lung cancer diagnosed	3
Pneumonia	1
Pneumonia/non compliant with Speech and Language Therapist	2
Respiratory tract infection	2
RIP/pneumonia	1
TOTAL	**14**

Figure 23

Detailed breakdown of respiratory outcomes

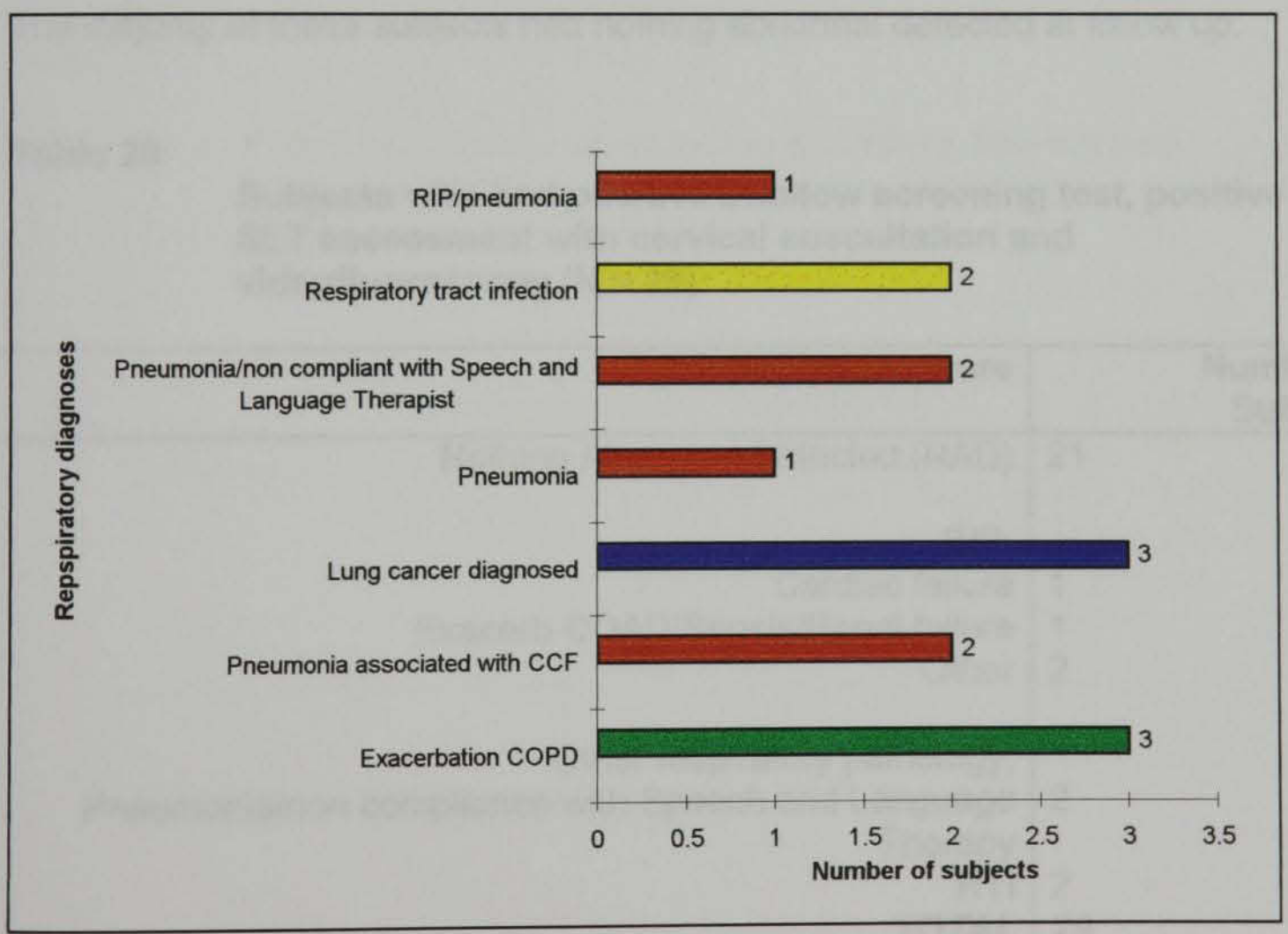


Table 27

Outcomes for subjects who had negative swallow screening test with no Speech and Language Therapy Assessment or follow up (N = 40)

Outcome measure	Number of subjects
Nothing Abnormal Detected (NAD)	30
Exacerbation COPD	3
RIP	1
Other respiratory pathology; Lung Cancer	3
Pneumonia assoc with CCF	3
TOTAL	**40**

The majority of these subjects had nothing abnormal detected at follow up.

Table 28

Subjects who had positive swallow screening test, positive SLT assessment with cervical auscultation and videofluoroscopy (N = 29)

Outcome measure	Number of Subjects
Nothing Abnormal Detected (NAD)	21
RIP; Cardiac failure	1
Exacerb COAD/Sepsis/Renal failure	1
Other	2
Other respiratory pathology; Pneumonia/non compliance with Speech and Language Therapy	2
RTI	2
TOTAL	***29***

The majority of subjects demonstrated NAD at follow up. Four subjects had respiratory pathologies possibly linked with aspiration or reduced oropharyngeal swallow efficiency.

Table 29

Subjects at follow up who had negative Speech and Language Therapist and therefore did not have a videofluoroscopy (N = 11)

Outcome measure	Number of subjects
Nothing Abnormal Detected (NAD)	11
TOTAL	**11**

None of these subjects developed any complications associated with aspiration/dysphagia

Table 30

Subjects at follow up who had a positive Speech and Language Therapy swallow assessment but no videofluoroscopy (N = 10)

Outcome measure	Number of subjects
NAD	6
RIP	4
TOTAL	***10***

Table 31

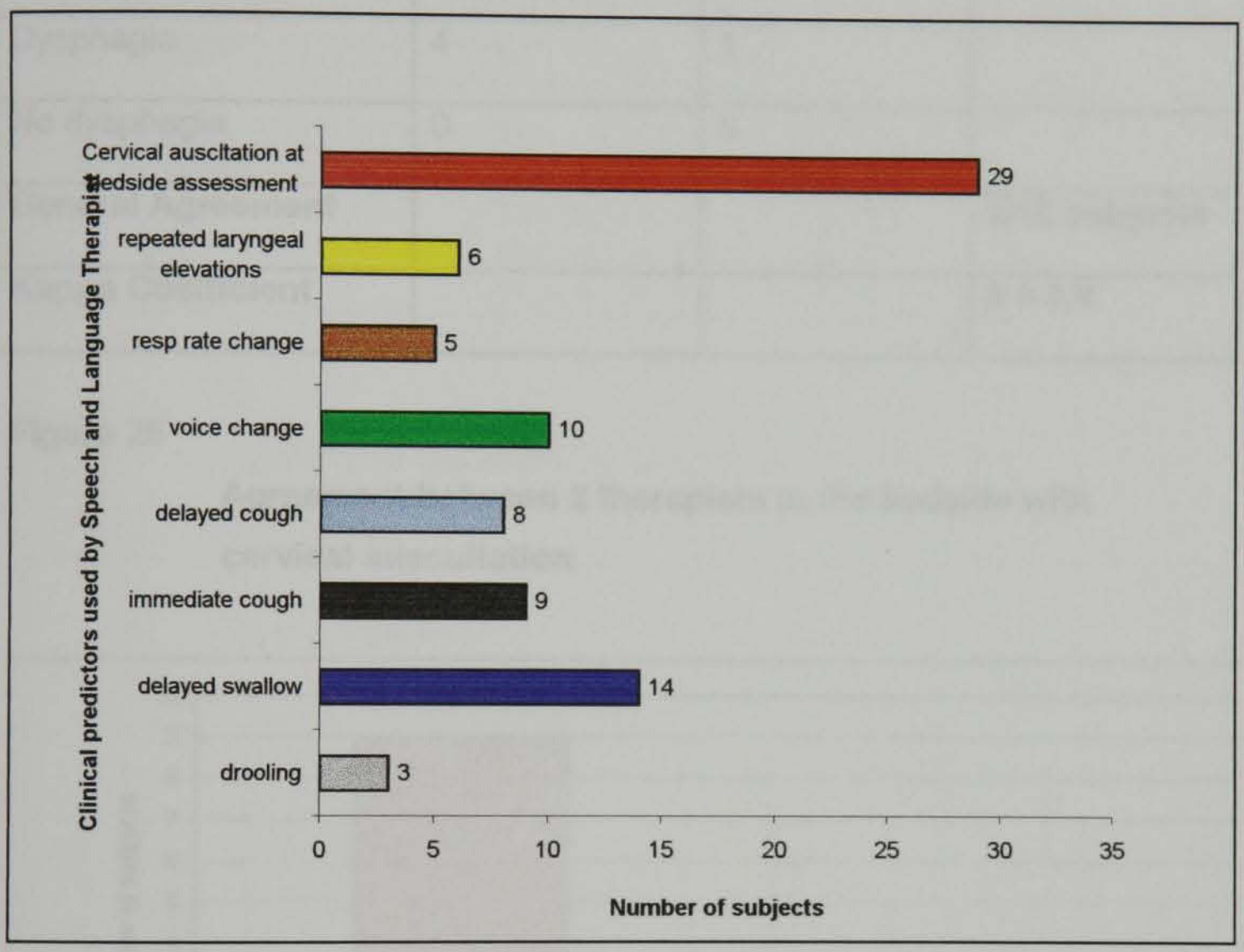
Outcomes of subjects who presented with respiratory disease on admission to hospital

	N
Number followed up	30
Definite signs of dysphagia on bedside Ax with Cervical auscultation	20
Confirmed by videofluoroscopy	16
RIP	4
Received speech and language therapy/advice	16
Recurrence of respiratory disease	3
Nothing abnormal detected at follow up	26

CERVICAL AUSCULTATION DATA

Figure 24

Predictive value of cervical auscultation and other clinical tests compared with videofluoroscopic findings (N = 29)



Cervical auscultation most accurately identifies all those who presented with aspiration/oropharyngeal dysphagia on videofluoroscopy in comparison with traditional features used at the bedside.

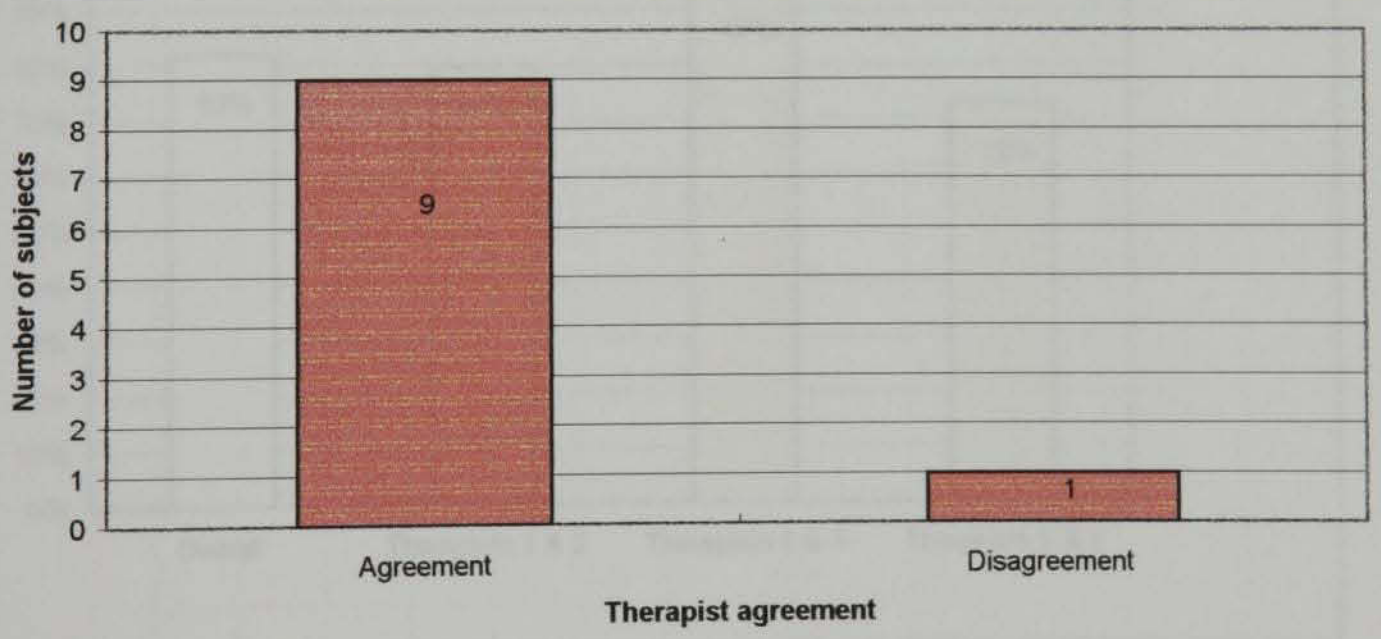
Table 32

Interrater reliability of cervical auscultation: two therapists with Stethoscope at the bedside ('Live' Auscultation) (N = 10)

	Therapist 2		
Therapist 1	Dysphagia	No Dysphagia	
Dysphagia	4	1	
No dysphagia	0	5	
General Agreement			**9/10 subjects**
Kappa Coefficient			***k* = 0.8**

Figure 25

Agreement between 2 therapists at the bedside with cervical auscultation



There is good interrater reliability of cervical auscultation between two therapists at the bedside

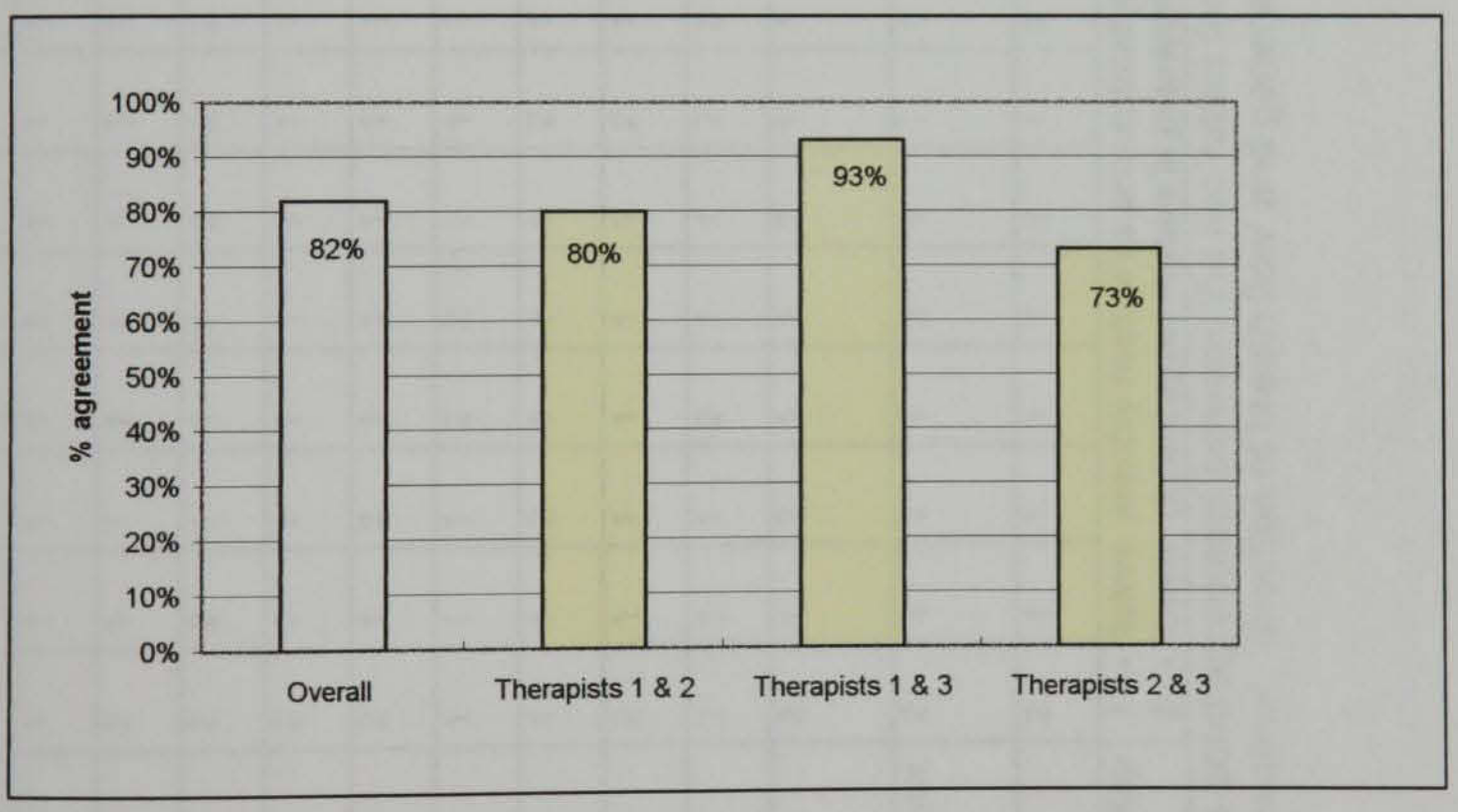
Table 33

Inter-rater agreement of cervical auscultation findings: several Speech and Language Therapists listening to audio recordings

	N
Number of subjects	15
Number of therapists listening to recordings	3
Potential total number of agreements	45
Actual number of agreements	37
% overall agreement between 3 therapists	82%
% agreement between individual therapists	
Therapists 1 & 2	80%
Therapists 1 & 3	93%
Therapists 2 & 3	73%

Figure 26

Agreement between SLTs listening to recorded Auscultation



There is high agreement between the speech and language therapists listening to recordings of cervical auscultation.

Table 34 Inter rater agreement of cervical auscultation recordings (N = 15) Research Therapist Vs Therapist 1

Features observed on cervical Auscultation	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	% agreement
Breath Sounds before swallow	1	1	1	1	2	1	1	1	2	1	1	2	1	2	1	73
Swallow sounds	2	1	1	1	1	1	1	1	2	1	2	2	1	1	1	73
Apnoea during swallow	2	2	1	1	1	2	2	2	1	1	2	2	2	2	1	40
Direction of breath flow	2	1	1	1	1	1	1	1	1	1	1	1	2	1	2	80
Timing of swallow	2	1	2	1	1	1	1	1	2	1	2	1	1	1	2	66.6
Breath sounds after swallow	1	1	1	2	2	1	1	1	1	1	1	1	2	1	1	80
Respiratory rate after swallow	1	1	2	1	1	1	2	1	1	2	1	1	2	1	1	73
Vocal quality after swallow	2	1	1	1	1	1	2	1	1	1	1	2	2	2	2	60
Number of swallows	1	1	1	2	1	1	2	2	2	2	2	2	1	1	1	53
Laryngeal response (cough/ Throat clearing/blowout)	2	1	2	1	2	2	1	1	2	2	2	2	1	1	1	46
Other sounds (flushing in pharynx before/after the swallow)	2	1	1	1	2	1	1	1	1	1	1	1	1	1	1	86.6
Needs further investigation?	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	93
Key	***1 → Raters identify feature as present/not present i.e. agreement*** ***2 → Raters do not agree feature is present/not present i.e. disagreement***															

= *highest agreement* There is good agreement between the two raters for a number of features including 'flushing sounds in pharynx', 'breath sounds after the swallow', 'direction of breath flow' and general agreement re the 'need for further investigation'.

Table 35 Inter rater agreement of cervical auscultation recordings (N = 15) Research Therapist Vs Therapist 2

Features observed on cervical Auscultation	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	% agreement
Breath Sounds before swallow	1	1	2	1	1	2	2	1	1	1	1	2	2	2	1	60
Swallow sounds	2	1	1	1	2	2	1	1	1	1	1	2	1	1	1	73
Apnoea during swallow	2	2	2	2	1	1	2	1	1	1	1	1	2	2	2	46
Direction of breath flow	2	2	2	2	1	2	1	1	1	1	2	2	1	2	2	40
Timing of swallow	2	1	2	2	2	1	2	2	1	1	2	1	2	1	1	46
Breath sounds after swallow	2	1	2	2	1	2	2	1	2	1	1	2	2	1	2	40
Respiratory rate after swallow	2	1	1	1	1	1	1	1	1	2	1	1	2	1	2	73
Vocal quality after swallow	2	2	1	2	1	2	2	2	1	1	1	1	1	2	2	46
Number of swallows	2	1	2	2	1	2	2	1	2	1	1	1	2	1	2	46
Laryngeal response (cough/ throat clearing/blowout)	2	1	2	2	1	1	1	1	2	2	1	1	1	1	1	66.6
Other sounds (flushing in pharynx before/after the swallow)	2	1	2	1	1	1	2	2	1	2	2	1	1	1	1	60
Needs further investigation?	1	1	2	1	2	1	1	1	2	2	2	1	1	1	1	66.6
Key	***1 → Raters identify feature as present/not present i.e. agreement*** ***2 → Raters do not agree feature is present/not present i.e. disagreement***															

* = *Highest agreement* For these two raters agreement is highest for the features 'respiratory rate after swallow' and 'swallow sounds'.

Figure 27

Agreement between therapists on features observed on recorded auscultation

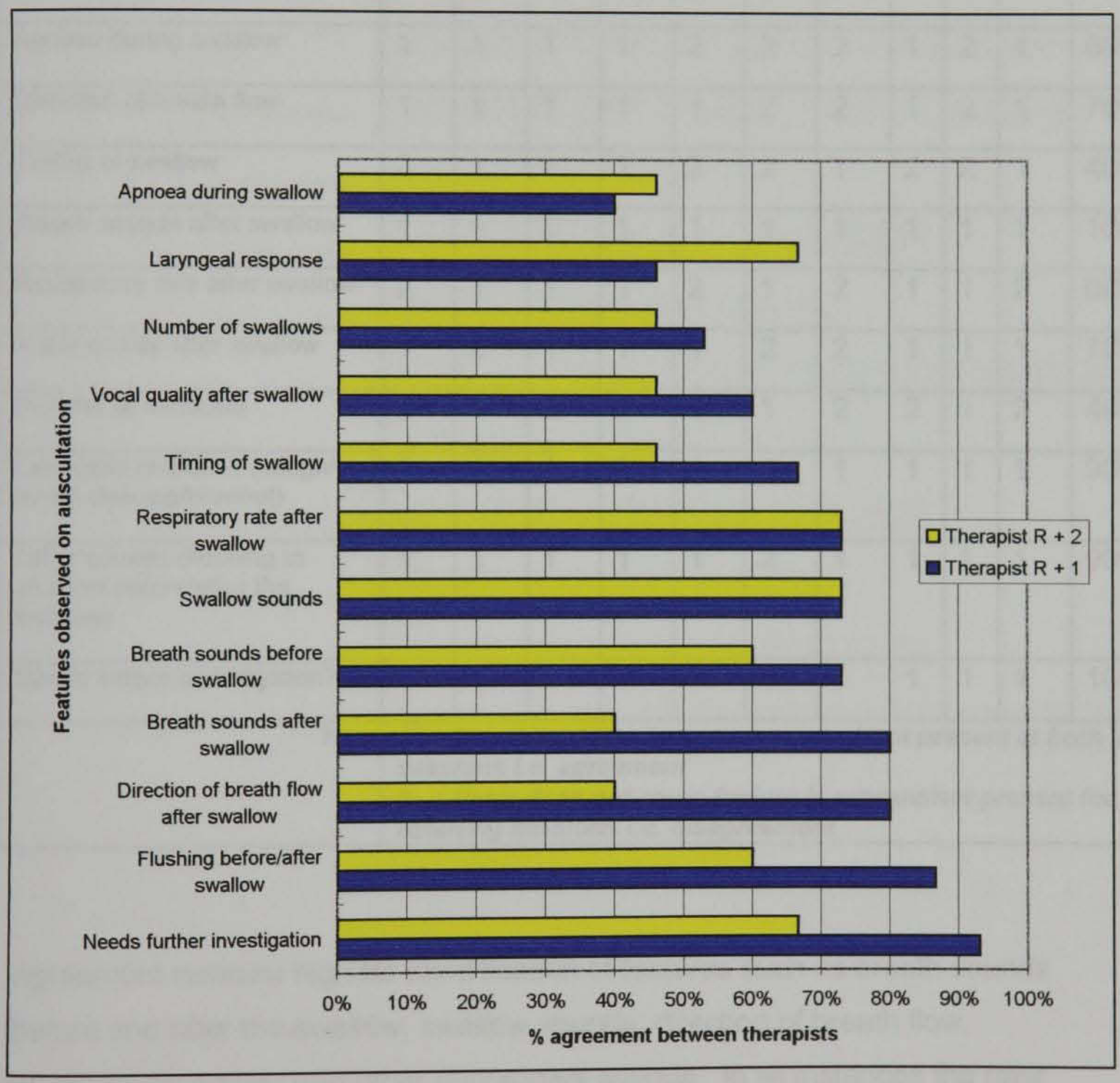


Table 36

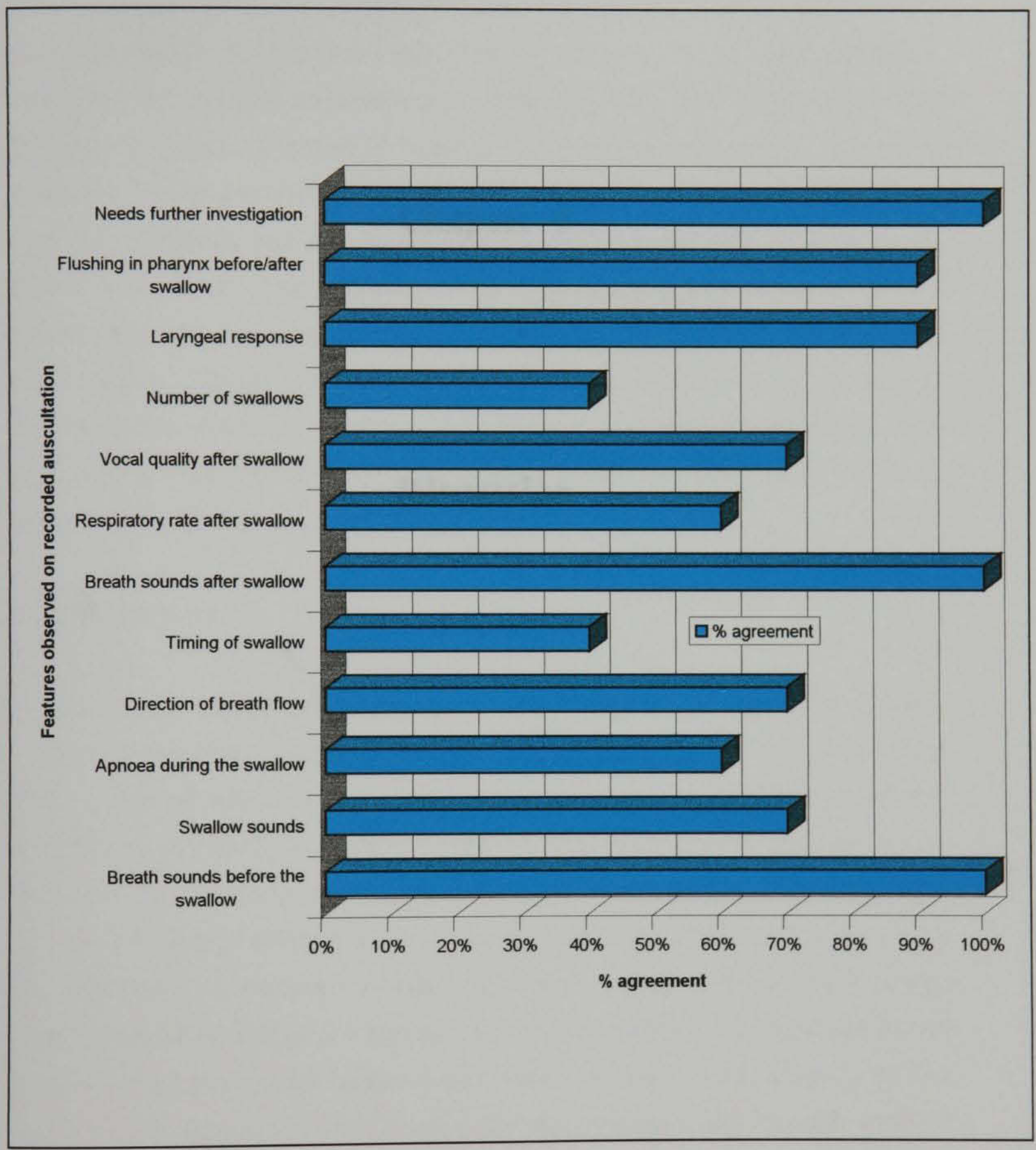
Intra rater reliability of cervical auscultation (Recorded Auscultation) (N = 10)

** = Highest Agreement*	**Subjects**										
Features observed on Cervical Auscultation	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**% Agreement**
Breath Sounds before swallow	1	1	1	1	1	1	1	1	1	1	100%
Swallow sounds	2	1	1	1	2	2	1	1	1	1	70%
Apnoea during swallow	1	1	1	1	2	2	2	1	2	1	60%
Direction of breath flow	1	1	1	1	1	2	2	1	2	1	70%
Timing of swallow	2	1	2	1	2	2	1	2	2	1	40%
Breath sounds after swallow	1	1	1	1	1	1	1	1	1	1	100%
Respiratory rate after swallow	2	1	1	1	2	1	2	1	1	2	60%
Vocal quality after swallow	1	2	1	1	1	2	2	1	1	1	70%
Number of swallows	2	1	2	2	1	1	2	2	1	2	40%
Laryngeal response (cough/ throat clearing/blowout)	1	1	1	2	1	1	1	1	1	1	90%
Other sounds (flushing in pharynx before/after the swallow)	1	1	1	1	1	2	1	1	1	1	90%
Needs further investigation?	1	1	1	1	1	1	1	1	1	1	100%
Key	***1 → Rater identifies feature as present/not present at both listening sessions i.e. agreement*** ***2 → Rater does not agree feature is present/not present for both listening sessions i.e. disagreement***										

Agreement remains high for identification of features such as breath sounds before and after the swallow, swallow sounds, direction of breath flow, laryngeal response, and other pharyngeal sounds. In all instances the rater agrees whether or not further investigation is necessary.

Figure 28

Intra-rater reliability trial:agreement for one rater at two different times



Chapter 4

Discussion

As awareness of the prevalence of oropharyngeal dysphagia in the acute care setting increases, so too do the demands placed on speech and language therapy departments who provide a service to these client groups. Inappropriate detection methods can result in increased inappropriate referral rates and wasted clinical time spent with unnecessary assessments. This study examined the swallow assessment process at two distinct levels, screening for swallow disorders on admission and improving speech and language therapist detection of swallow disorders at the bedside. A swallow screening test and training programme for nursing staff was developed and an Inter-rater reliability trial was conducted. In addition, a customised recording device was used during speech and language therapy bedside clinical examination of swallowing to investigate the diagnostic significance of cervical auscultation. Outcomes of subjects after three months were studied to determine the effectiveness of the screening and assessment procedure. The implications that changes in current assessment protocol could have on service delivery were also examined.

4.1 Subject data

In examining subject demographics in this study the need for a swallow screening measure on admission is further highlighted for this population. They concur with the expected trends of a mostly elderly population presenting with multiple medical problems, and neurological and respiratory illnesses. The elderly constituted the majority of subjects, a finding which agrees with that of Nilsson et al (1996) and Feinberg (1997). This sample is representative of general hospital admission trends with an increasingly elderly population needing hospitalisation (O'Shea 1993). As expected for an acute care setting a wide range of disorders were presented. Subjects in this study mainly presented with stroke, respiratory disease and multiple medical diseases (table 12 page 117). The largest group of subjects (N=42) presented primarily with respiratory disease. Patients with respiratory disease constituted more than 10% of all medical admissions for the 12 months in which the study took place (table 11 page 116; figure 13 page 115). This underscores the high admission figures for individuals with respiratory disease

who are potentially at risk of oropharyngeal dysphagia. As one of the main concerns which fuelled this research was the under-detection of oropharyngeal swallowing disorders in certain client groups, this high rate of detection of subjects with respiratory disease over the five month trial period is encouraging.

Female subjects slightly outnumbered male subjects (Figure 12 page 114). As outlined in Figure 14 (page 118) the main focus of speech and language therapy intervention was with subjects presenting with respiratory disease, stroke and multiple medical problems. The majority of bedside assessments and videofluoroscopies were also carried out on these groups. Again this reflects hospital admission trends as seen in table 11 (page 116) and figure 13 (page 115) These groups of individuals are likely to constitute the largest part of the speech and language therapist dysphagia caseload in any acute care setting. With such relatively large numbers of admissions potentially needing speech and language therapy input, the need for an appropriate dysphagia detection procedure is apparent.

4.2 Swallow Screening Test Data

For all 97 subjects recruited for the study, the nursing staff and the speech and language therapist agreed in 81% of cases that either a swallow problem existed or did not exist when screened (Table 13 figure 15 page 119). This high level of agreement is encouraging. In looking at individual nurse performance when compared with speech and language therapist (Table 14 figure 16 page 120) a range of agreement can be observed. This may be for several reasons e.g. small numbers assessed by each nurse, experience of the nurse in using the screening test, previous familiarity and experience with speech and language therapist, and timing of the nurse assessment with the speech and language therapist assessment (see figure 17 page 122). As shown in figure 16 (page 120) nurse B displays poor agreement with the speech and language therapist ($k = 0.25$) whereas nurse D displays excellent agreement with the speech and language therapist about subject status($k = 1$). This distribution is likely to reflect clinical reality and variations in nursing staff

as regular staff changes occur in acute settings. It may also indicate that some means of regular refresher training sessions are necessary and should be incorporated into the overall training protocol. The Kappa calculation for nurse B lowers the overall average kappa to a moderate rating of 0.53 (Table 14 page 120). If the average kappa is calculated excluding nurse B the inter-rater reliability rating shifts form moderate to good (k = 0.635). Whilst the numbers of subjects used to calculate the kappa for each nurse are relatively small, it allows an observation of a general pattern of agreement which is likely to present in clinical practice. If the trial had been conducted with fewer nurses trained and more subjects screened per nurse it would be interesting to speculate if the results would have been different with less variability between nurses. Nonetheless, this study took place in a realistic clinical setting and the results reflect this.

The difference between trained nurses' ability to detect dysphagia compared with that of nursing staff who are untrained in the swallow screening test procedure is quite evident (Table 17; figure 19 page 125). Those who are untrained have consistently poor agreement with the speech and language therapist about the subjects 'screened'. In comparing the two groups to look at sensitivity and specificity the trained nurses have higher sensitivity and better specificity than the untrained nurses (Table 18 figure 20 page 126). This difference is statistically significant (p = 0.031). In general, these results indicate that trained nursing staff are likely to detect 83% of subjects at risk of oropharyngeal dysphagia, compared with untrained nursing staff, who are more likely to detect 38% of at risk subjects and only those who have very obvious signs of aspiration and dysphagia. The sensitivity calculated here is favourably comparable with the findings of other authors who have developed screening tests.

DePippo et al (1994) reports a screening test sensitivity of 80% and specificity of 54% for a stroke population. In comparison, Smithard et al (1997) report a test specificity of 86% for an acute general medical population. Test sensitivity is not reported in this instance. Logemann et al (1999) describes a

detailed 28 item screening procedure for oropharyngeal dysphagia. This is equivalent to most therapists' bedside clinical evaluations. Overall test sensitivity for detecting aspiration is 78%, with 58% specificity. Sensitivity for detecting oral stage problems is reported at 64% with 75% specificity, Detection of pharyngeal delay is 69% sensitivity and 71% specificity, whilst the presence of a pharyngeal stage disorder has a sensitivity of 72% with specificity of 67%. Both the DePippo and Logemann tests are administered by the authors who are experts in the field of dysphagia and both tests take at least 15 minutes to administer.

The test developed for this study (sensitivity 83%; specificity 72.5%), like that reported by Smithard et al (1997) takes less than 5 minutes to administer and can be done by trained personnel with relatively minimal training. This test form also contains the critical features which have been identified by other tests as being strongly correlated with aspiration and dysphagia on videofluoroscopy including cough/throat clear during trial swallows, reduced laryngeal elevation, oral stage problems (drooling), and pharyngeal delay (Logemann 1999; Linden et al 1993; De Pippo et al 1994). Trained nursing staff in this study also detected these critical features on screening test which were eventually predictive of dysphagia on videofluoroscopy (for N = 29) as outlined in figure 18 (page 124). Voice changes, delayed swallow and changes in respiratory rate were most often detected with coughing also proving an indicator. Nursing staff also observed features such as repeated laryngeal elevations, absent swallow and drooling which are incorporated on the Meath Hospital Swallow Screening test form but not to date on any other screening test forms (De Pippo et al 1992; Smithard et al 1997; Nathadwarala 1994). Although again the numbers of subjects are small it demonstrates that nursing staff are capable of detecting features known to be predictive of dysphagia and aspiration at the bedside once trained and alerted to such features.

As Logemann et al point out (1999) the ideal test is one with relatively equal sensitivity and specificity. In previous studies the general trend appears to be that the higher the sensitivity, the lower the specificity becomes. This means

that the test will identify with high likelihood that a patient has a particular disorder but over-identifies patients who do not have the disorder. The sensitivity and specificity achieved with the Meath Hospital Swallow Screening Test are closer together than that attained in other studies, meaning it identifies with a high likelihood that a patient has a swallow disorder but does not over-identify as much those who don't have dysphagia. This certainly adds to the overall reliability of the swallow screening test.

Even though staff initially requested more flexibility with feeding options on the test form as a result of the pilot study, it appears from the data that nursing staff displayed a stronger tendency than the speech and language therapist to select the 'NPO/refer' option on the screening test instead of the 'Refer/observe' option (Table 15 page 121). This possibly reflects over cautiousness by the nursing staff but may also be accounted for by other reasons for disagreement as outlined in table 16 (page 123) where there were identifiable reasons for disagreement for nine subjects.

Timing between nurse and speech and language therapist screening tests is an interesting factor to look at as depicted in figure 17 (page 122). Despite the fact that a time limit in which both screening tests should be conducted (within 3 hours) was stated in the study methodology, as the study progressed it became apparent that it was not possible to see all the subjects on the same day as the nurse did the initial screening test. The speech and language therapist was dependent on the nursing staff to make contact when a new subject was screened post admission e.g. subject screened teatime and speech and language therapist not notified until lunch-time the following day. Delays in contacting the speech and language therapist therefore resulted in delays in speech and language therapist screening. Also general caseload prioritisation issues often caused delays in the speech and language therapist getting to the wards within this time limit to screen subjects. Weekends occasionally caused delays of up to forty-eight hours or more between nurse and speech and language therapist screening tests. Regular trips to the wards and signs posted over nursing stations helped the situation somewhat

but delays were inevitable in such a busy acute setting. If both screening tests were conducted on the same day, agreement between the two parties was much higher i.e. 84%. Therefore as time between the screening tests elapsed, the level of agreement between the two raters decreased e.g. only 60% agreement if the subject was seen by the speech and language therapist more than 48 hours after the nurse screening test. In addition, subject status often changes rapidly in the first 24 to 48 hours post admission as acute medical problems are dealt with. Two subjects improved in general status between screening tests as detailed in Table 16 (page 123).

In general the study so far confirms that trained nursing staff can detect swallow disorders with good reliability and sensitivity. As evident from the pilot study nursing staff are willing to be involved. In terms of overall service delivery, table 19 (page 127) observes trends in referral rates for swallow assessments before and after the introduction of the screening test on the two selected wards. As previously discussed, with increased referral rates often comes a significant number of inappropriate referrals which are a waste of valuable clinical time (IASLT1996/RCSLT 1998). In this study, speech and language therapy referral records were reviewed for two twelve month periods, once before and once after the introduction of the screening test and training programme. There was a significant drop in the number of inappropriate referrals received by the speech and language therapy department after the introduction of the training programme (more than 21% decrease). This has significant implications for the speech and language therapy department. By saving this clinical time, services can be delivered more effectively to individuals who need therapy and support for a range of acquired disorders, especially individuals with communication disorders who in many instances may appear to be receiving less therapy time due to increasing demands for dysphagia and swallow assessments (RCSLT Aug 1998). This should in time contribute significantly to improved overall service efficiency and hence better quality of service for patients.

4.3 Swallow assessment data

Every subject who had signs of oropharyngeal dysphagia on screening were referred for a full speech and language therapy clinical swallow evaluation. This evaluation included cervical auscultation as detailed in chapter two. Previous authors have demonstrated that this technique adds significantly to the detection of oropharyngeal dysphagia at the bedside (Stroud 1996, Zenner 1995). A customised recording device was developed and used in this trial.

Although 57 subjects were recommended for referral to speech and language therapy for a full swallow assessment, seven subjects did not have a full clinical assessment (Table 20 page 128). The reasons for this as outlined in table 21 (page 129) are fully representative of clinical reality as many individuals who need intervention are simply too unwell or unwilling to co-operate with a full assessment. Following bedside clinical assessment with cervical auscultation as outlined in chapter 2, 38 subjects were recommended for videofluoroscopy. Of these 38 subjects, 29 were eligible for videofluoroscopy whilst in 9 cases it was not possible to carry out a videofluoroscopy for reasons as outlined in Table 22 (page 129). Therefore of all potential subjects needing videofluoroscopy as identified at the bedside examination, approximately 10% could not undergo the procedure. Although videofluoroscopy is often considered the gold standard assessment for swallow disorders, the figures in this study, which reflect standard clinical practice, underline the clinical inaccessibility of videofluoroscopy and its limitations as a clinical tool (Bastian 1993; Logemann 1997). Ideally for the purposes of the study, all subjects assessed by the speech and language therapist should have undergone a videofluoroscopy for direct comparison/control. However, this is difficult in most clinical settings for the reasons outlined in table 22. In addition, ethical issues arise given the nature of the procedure which exposes subjects to radiation (Logemann 1993). Increases in videofluoroscopy time may place an extra burden on already overstretched x-ray facilities. This further reinforces the need for other

objective, accessible and reliable tools for easy use at the bedside and with diagnostic potential.

The majority of subjects who were assessed by a speech and language therapist with cervical auscultation were seen either on the same day as the swallow screening test or within one working day of the referral being made as was standard practice at the time (Table 23 page 130). In some instances the timing between the screening test and the full swallow assessment with auscultation was longer than one working day. Fifty subjects were assessed in total and 29 eventually had videofluoroscopy.

In the majority of cases, videofluoroscopies were carried out within 7 days of the initial bedside assessment (table 24 page 131). One two hour videofluoroscopy 'slot' in the x-ray department every week meant that this was standard practice at the time. Four subjects had videofluoroscopies done outside this seven day period for reasons identified in table 24. As all subjects still had identifiable signs of oropharyngeal dysphagia with or without aspiration on videofluoroscopy, the waiting period for videofluoroscopy is not likely to have affected results adversely. None appeared to have 'improved' during the waiting period.

On videofluoroscopy, all but one subject presented with identifiable oropharyngeal dysphagia (Table 20 page 128). One subject had psychogenic dysphagia and whilst displaying signs and symptoms at the bedside assessment (coughing, complaining of food stuck in throat, choking) no anatomical or physiological abnormalities were observed on videofluoroscopy (Barofsky, Fontaine 1998; Neumann, Buchholz, Ravich, Jones 1998). Ten subjects had reduced oropharyngeal swallow efficiency with no aspiration, identified by residue in the pharynx, and overall reduced rate and efficiency of swallow musculature and sensation (Logemann 1993). Eighteen subjects displayed definite aspiration as well as reduced overall oropharyngeal swallow efficiency. Taking all 29 subjects who had videofluoroscopy after a bedside assessment with cervical auscultation, all subjects (with the exception of the

subject presenting with psychogenic dysphagia) were correctly identified with cervical auscultation.

4.4 Outcome

As outlined in chapter two all subjects were followed up after three months to check for any signs of dysphagia or aspiration according to the criteria outlined. All subjects' medical charts were reviewed. This proved a lengthy process as the hospital had moved site and several charts remained unlocated for some time. Eventually all but six charts were reviewed.

Of the 91 charts that were reviewed, 14 subjects re-presented with some respiratory pathology within the three month period (table 25, figure 22 page 132). Pneumonia was the most common diagnosis presented with (N = 6).In looking at the breakdown of the respiratory illnesses (table 26; figure 23 page 133) it is evident that two subjects who were non-compliant with Speech and language therapy recommendations (both following videofluoroscopy) re-presented with pneumonia. Interestingly, both these subjects initially presented with respiratory disease as their primary medical diagnosis requiring admission. Two other subjects who re-presented with respiratory tract infections also initially presented with respiratory disease as their primary medical diagnosis. Both of these subjects had videofluoroscopy and demonstrated oropharyngeal dysphagia (one aspirated, one did not but had reduced oropharyngeal swallow efficiency). Given the confirmed existence of dysphagia it is plausible to suggest a link between their development of respiratory disease in these four subjects, with ongoing aspiration due to unresolved swallow disorders, despite speech and language therapy intervention. In contrast, three subjects had developed exacerbation of COAD at follow up, all of whom initially presented with respiratory disease as a primary diagnosis. All three screened negatively on the swallow screening test and did not have any further follow up from speech and language therapist.

The COAD population have been studied somewhat in regard to their swallow integrity and patterns of impairment which may exist but a lot remains to be identified about this group. Whilst certain abnormalities do exist in this group with regard to respiratory patterns and pharyngolaryngeal sensation, the actual incidence of aspiration and how this affects the population has yet to be quantified. The characteristics of aspiration related respiratory disease are also unclear. Many questions remain unanswered. Does aspiration cause respiratory disease which in turn decompensates the swallow which increases aspiration leading to continued exacerbations? Or does respiratory disease exist first and then disrupt the delicate sensory pattern which exists in the oropharyngeal area thus leading to disrupted swallowing, aspiration and therefore exacerbation? All three of these subjects with COAD passed the swallow test. Despite these very small figures (N = 3) it raises the question of how should this population be studied.

As this was the largest group screened on admission it is worth examining the other subjects who initially presented with respiratory disease on admission (Table 31 page 136). These patients can often represent a significant part of the speech and language therapist's caseload. Of the 30 subjects who were followed up, 20 had definite signs of dysphagia on bedside assessment with cervical auscultation, 16 of these had this confirmed by videofluoroscopy and 4 died. At follow up, 26 had nothing abnormal detected. Of the 16 who demonstrated dysphagia on videofluoroscopy, all received speech and language therapy advice and appropriate therapy where indicated. Looking at patterns of impairment and intervention with this population in itself requires a prospective controlled trial but it would appear that those caught within the 'speech and language therapy dysphagia management net' do have better outcomes that those who are unidentified. This is purely speculative derived from a small sample of subjects and requires proper investigation. However it echoes the general consensus that speech and language therapist intervention does make a difference and minimises the complications of aspiration and dysphagia (AHCPR 1999; Gottlieb et al 1996; RCSLT 1996; Rosenbek 1995; Martens et al 1990; Langmore 1995).

As should be expected, subjects who had no signs of aspiration or dysphagia at speech and language therapy assessment had nothing abnormal detected at follow up (Table 29 page 135). For those subjects who had a negative swallow screening test and therefore no speech and language therapy intervention, 30 had nothing abnormal detected whilst 9 developed respiratory disease as outlined in table 27 (page 134). The respiratory diseases outlined in the table are more unlikely to be aspiration related except for the COAD group about which uncertainty remains.

Of all the subjects who had dysphagia, videofluoroscopy and active speech and language therapy intervention, the majority had nothing abnormal detected at follow up (Table 28 page 134). Four died and four as outlined above developed respiratory complications which could possibly be related to aspiration. Of the subjects who had dysphagia at a clinical examination but were unable to undergo videofluoroscopy (Table 30 page 135) four died (probably too unwell for video procedure) and 6 had no problems identified at follow up, suggesting that their problems either resolved spontaneously or were managed appropriately by the speech and language therapist at the bedside. This reinforces the therapeutic importance of speech and language therapists in working with the dysphagic population and how appropriate intervention can minimise medical complications. Whether or not these subjects could have resolved spontaneously or achieved these outcomes by some other means e.g. tolerating aspiration, is open to speculation. A matched control group to compare outcomes would be ideal to investigate this but presents many ethical considerations as therapy would be offered to some subjects and not to others. This further confirms what is apparent in the literature, that active speech and language therapy intervention particularly in the acute stages of a medical admission is important in preventing complications which can arise as a result of swallow disorder and the therapeutic strategies employed by speech and language therapists in order to remediate such disorders are efficacious.

In summary, 14 subjects out of the 91 followed up had some redevelopment of respiratory disease/infection. This leaves 77 subjects who had presented

with no difficulties at follow up. These subjects either presented with or without a swallow disorder. Those who appeared to have a swallow disorder appear to have been managed effectively by the speech and language therapist, excluding those who refused to comply with therapeutic recommendations. Those who did not have any signs of swallow disorder either at screening or at speech and language therapist assessment presented with little or no complications. This means that this group must have been accurately detected by the screening test on admission as not having a swallow disorder. This reinforces the reliability of the swallow screening test as an initial detector of swallow disorders in an acute care setting.

4.5 Cervical Auscultation

In examining the predictive value of auscultation in comparison with other clinical indicators of aspiration/dysphagia as outlined on the swallow screening test form, findings on cervical auscultation appear to be most predictive of dysphagia as outlined in figure 24 (page 137). Although these figures are descriptive in nature, they do reflect trends in the literature which suggest that cervical auscultation significantly increases clinical accuracy in detecting dysphagia and aspiration at the bedside (Stroud 1996, Zenner 1995, Selley et al 1990). As the figures in this study are so small (N =29) and all subjects who had videofluoroscopy presented with oropharyngeal dysphagia, whether or not they would have been detected with clinical assessment alone remains a matter of speculation. Ideally, a larger trial independently comparing predictors of aspiration and dysphagia during both bedside assessment and cervical auscultation with videofluoroscopy in a variety of subjects presenting with/without dysphagia is necessary to establish exact clinical usefulness of auscultation. Nonetheless, it appears that auscultation has some clinical utility and does add extra important information to the assessment and identification process as other authors have found.

This study also looked, preliminarily, at the inter-rater reliability of cervical auscultation between trained speech and language therapists which was previously uninvestigated. Despite a small sample (N = 10), good inter-rater reliability was demonstrated when two speech and language therapists listened to swallows at the bedside with a training stethoscope as outlined in chapter two. The therapists had to agree or disagree if dysphagia was present with or without aspiration. A Kappa of 0.8 was calculated which indicates excellent agreement (Table 32, figure 25 page 138). A stethoscope is a readily available, portable tool which is simple to use at the bedside. Good inter-rater reliability adds to the clinical utility of this tool and should give therapists confidence in using it. As this was a small sample and very much a preliminary study, the subjects were not compared with videofluoroscopy to confirm presence or absence of dysphagia. This perhaps could be investigated in a larger trial. Nonetheless it does provide further support that cervical auscultation is a reliable tool for use during bedside swallow assessments with trained therapists.

Whilst the stethoscope may be useful and give additional information it is still a largely subjective tool. Recording swallow and respiratory sounds instantly makes the process more objective and reproducible. As outlined in chapter 1 there are various methods of recording respiratory and swallow sounds during deglutition. Many of these however remain invasive to the patient and are not easily portable to a bedside setting. In conjunction with the Department of Medical Physics and Bioengineering a recording system was developed which should be easily portable to the bedside and provide high quality recordings of respiration and swallowing sounds during a bedside swallow assessment as described in chapter two. This study was essentially a 'test run' for the equipment.

Speech and language therapists who listened to 15 recordings agreed about subject status in 82% of cases (Table 33; figure 26 page 139). However, all the subjects despite being randomly selected had definite signs of dysphagia with or without aspiration on cervical auscultation. This gave rise to several problems particularly in analysing the data. As all recorded subjects were

positive for dysphagia, the sample was positively biased and therefore skewed. In the first instance, the chance that the speech and language therapists would agree was high. In addition, the data were difficult to analyse statistically as statistical testing (particularly the kappa test which measures inter-rater reliability) relies on data samples with a balance of positive and negative findings. The fact that all findings were positive skewed the sample. It is interesting however to look descriptively at the data. In particular, examining the agreement between raters when detecting features of swallow and respiration on listening to recorded auscultation. Whilst an overall agreement of 82% was reached, the research therapist agreed in 80% of cases with therapist 1 and 93% of cases with therapist 2.

Tables 34 & 35 (pages 140/141) show specifically how raters agreed on certain features on auscultation. Examining figure 27 (page 142) gives an indication of the features for which there was good agreement, moderate agreement and poor agreement. Both groups of raters agreed equally about the respiratory rate after the swallow and the swallow sounds heard during auscultation. There was more than 50% agreement for both raters on the features 'breath sounds before the swallow' and 'flushing before/after the swallow'. Both groups of raters also agreed that further investigation was warranted in more than 50% of instances. Agreement for the feature 'apnoea during swallow' was poor (<50%) for both sets of raters. In general there was overall lower agreement between the two groups about features such as timing of the swallow, vocal quality after the swallow, number of swallows and laryngeal response.

The quality of the recordings may be, in some part, to blame for the poorer detection of these features. In particular, timing related features such as swallow apnoea and timing of swallows is difficult to quantify in the absence of some time indicator. As the recording equipment lacked a timer unit i.e. some audio measure of when food/fluid was delivered to the mouth, it was difficult at times to determine when the swallow began. Even though the speech and language therapist could be heard giving instructions to 'swallow' or 'take food into the mouth', this was often not clear and timing remained uncertain. On

listening to the recordings afterwards it was difficult to determine at times what was/was not a swallow and when did the swallow happen. The microphone which was attached to the stethoscope head was very sensitive and picked up not only breathing and swallowing sounds but also several environmental noises e.g. telephones ringing on the ward, noisy dinner trolleys being delivered, scratching of the stethoscope head against clothing or the subject's skin. Some extraneous sounds were difficult to discriminate between e.g. flushing of food in pharynx or subject moving head causing microphone position to shift?

The intra-rater reliability of a test is also important and this study also looked at this aspect of cervical auscultation with the customised recording system (Table 36 page 143). The research speech and language therapist listened to the same recordings on two different occasions as outlined in chapter two. The data is small but descriptive and gives interesting information about the signs/features of respiration and swallowing sounds on cervical auscultation that the therapist consistently detected, particularly when compared with the first trial of several therapists. Figure 28 (page 144) indicates agreement for all the features. Those for which there was consistently higher agreement again included such as breath sounds before and after the swallow, laryngeal response to aspiration and other pharyngeal sounds e.g. flushing noises in pharynx. In all instances the rater agreed that further assessment/investigation was warranted. Features for which less than 50% agreement existed included timing of the swallow and number of swallows. Swallow apnoea had relatively poor agreement as had direction of breath flow and respiratory rate. As outlined above, the quality of the recordings may be to blame for poorer detection of these features.

It is, however, interesting to note that the features that therapists detected and agreed upon most consistently i.e. swallow sounds, breath sounds before swallow and flushing sounds in the pharynx can only be detected using cervical auscultation. The features for which there was poorer agreement are usually part of a 'traditional bedside assessment'. They include timing of swallow, vocal quality after swallow, number of swallows and laryngeal

response. The recording equipment may be to blame for the inability to clearly detect some of these features. However, if the features with good agreement are readily detectable on auscultation, then they can only add to the sensitivity of the overall bedside clinical assessment. Cervical auscultation has been shown to improve clinical sensitivity to aspiration and dysphagia (Zenner 1995; Stroud 1996). No studies have specifically correlated sounds heard on auscultation with discrete pathological patterns in different types of swallow disorders. This study may be a step in the right direction but a larger sample and correlation with videofluoroscopy would be necessary in order to pinpoint specific features with specific events. Nonetheless, it does bolster the argument that cervical auscultation adds 'something extra' to the bedside clinical assessment which can improve earlier detection of dysphagia.

It appeared (to the research speech and language therapist) much easier to identify sounds recorded when listening immediately after the bedside assessment was conducted when the therapist had a fresh image of the subject and of how the assessment was conducted. This reinforces the idea that cervical auscultation is only part of the overall bedside assessment and whilst possibly giving valuable information to the assessment, there are many other factors which will influence the assessment and its outcome (Schulze-Delrieu et al 1997; Miller 1992; Baker 1993). The importance of training in the technique is also emphasised so that therapists know how to interpret sounds recorded. Replacing the microphone with an accelerometer as described by Takahashi et al (1994) would eliminate to some extent background noise. An accelerometer transduces sounds of movement only. In addition a measure of time should be incorporated into the present recording system to allow for decisions regarding transit times and delays in these times which may signal a swallow disorder.

This study has demonstrated that cervical auscultation has good inter-rater reliability and adds to the predictive value of the bedside clinical assessment in detecting dysphagia. Features of dysphagia which can only be detected by auscultation are detectable by speech and language therapists with good

agreement between them. This adds to the overall clinical usefulness of the tool and suggests it has diagnostic significance. Further research is necessary to confirm diagnostic significance which should incorporate correlation of swallow sound events with oropharyngeal disorders as observed visually on videofluoroscopy.

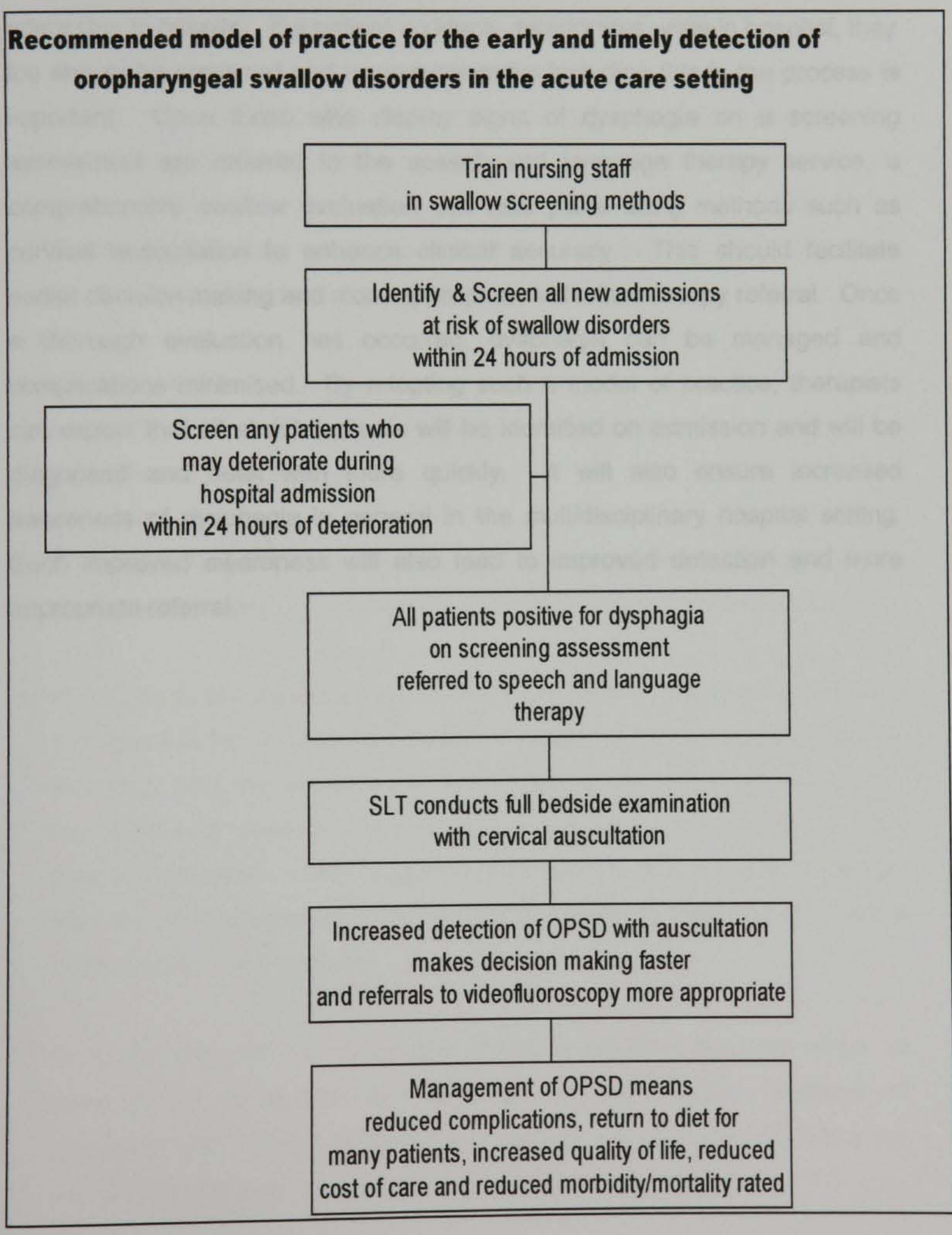
4.6 Changes in practice - a model of service delivery

This study has addressed issues which are a cause for concern in the acute setting and which initially fuelled this research. It has established that a significant proportion of patients admitted to acute care facilities are a risk of oropharyngeal dysphagia and need to be screened to identify this. In addition, the management of dysphagia appears to minimise complications associated with aspiration thereby reducing risks of morbidity and mortality and improving quality of life for several patients. The swallow screening tool which was developed has good reliability, sensitivity and specificity. Training nursing staff to screen for swallow disorders using the tool is effective, allowing more flexible decision making about feeding on admission, as well as leading to a significant drop in inappropriate referrals to the speech and language therapy department. This will allow speech and language therapists to use their clinical time more effectively to improve the quality of service delivery. In addition, the study has confirmed that cervical auscultation has good inter-rater reliability and that it improves clinical accuracy at the bedside by adding 'extra' information to the clinical assessment. Such increased confidence at the bedside should minimise the inappropriate use of videofluoroscopy which may be performed by many therapists just to confirm the presence/absence of dysphagia. By avoiding unnecessary radiological procedures, costs and radiation exposure can be reduced.

Such findings should encourage speech and language therapists to work towards a specific model of service delivery in dealing with patients with oropharyngeal dysphagia in the acute care setting. Making adaptations to clinical practice should contribute to overall streamlining of services resulting

in improved quality of care for all speech and language therapy clients, more efficient service delivery, reduced costs of care and also, most importantly, improved quality of life for patients who might otherwise have a high morbidity or mortality risk. A proposed model of clinical practice for speech and language therapists is outlined below.

Figure 29



This model outlines a step by step approach to the optimal identification process for oropharyngeal dysphagia in the acute care setting. Step one involves establishing a training regime for nursing staff. This leads to step two which

necesitates some means of assessing all at risk patients within 24 hours of admission to hospital. If a patient suddenly deteriorates while in hospital, they too should be screened and a mechanism for including this in the process is important. Once those who display signs of dysphagia on a screening assessment are referred to the speech and language therapy service, a comprehensive swallow evaluation can take place using methods such as cervical auscultation to enhance clinical accuracy. This should facilitate earlier decision making and more appropriate videofluoroscopy referral. Once a thorough evaluation has occurred, dysphagia can be managed and complications minimised. By adopting such a model of practice, therapists can expect that all at risk patients will be identified on admission and will be diagnosed and dealt with more quickly. It will also ensure increased awareness of dysphagia in general in the multidisciplinary hospital setting. Such improved awareness will also lead to improved detection and more appropriate referral.

Conclusions

1. H.I.P.E data suggests a significant proportion of all hospital admissions are potentially at risk of oropharyngeal swallow disorders, particularly patients with respiratory disease, thereby emphasising the necessity for some means of screening for swallow disorders

2. The swallow screening tool which was designed for nursing staff in an acute care setting has good inter-rater reliability, sensitivity and specificity and is comparable with other reported screening assessments.

3. Nursing staff readily identified critical features of oropharyngeal dysphagia which are correlated with dysphagia on videofluoroscopy.

4. Nursing staff trained in the swallow screening test procedure have better sensitivity and specificity for detecting swallowing disorders than nursing staff who are untrained.

5. Training nursing staff to use the swallow screening test had positive effects on speech and language therapy inappropriate swallow referral rates.

6. The majority of subjects who underwent full speech and language therapy management for oropharyngeal swallow disorders had no complications at follow up with the exception of four subjects, two of whom were non-compliant with speech and language therapy recommendations. This supports research which suggests that speech and language therapy intervention in people with oropharyngeal swallowing disorders is effective in minimising complications

7. Subjects who did not have any signs of swallow disorder either at screening or as speech and language therapy swallow assessment presented with little or no dysphagia related complications at follow up, suggesting that they were appropriately detected as 'normal'.

8. Cervical auscultation has good inter-rater reliability at the bedside

9. Good intra-rater reliability was demonstrated for cervical auscultation recordings despite some shortcomings of the recording equipment.

10. Speech and language therapists can detect and highly agree upon several features on cervical auscultation recordings which are associated with the presence of dysphagia.

11. Cervical auscultation appears to add to the predictive ability of a therapist to identify the presence of dysphagia at the bedside as correlation with videofluoroscopy shows.

12. Recording devices for cervical auscultation need to eliminate background noise from the recording environment and need to incorporate a timer unit to allow timing of swallow events.

13. A model of practice for earlier and improved detection of swallow disorders in the acute care setting should facilitate detection of at risk patients on admission and ensure timely referral to speech and language therapy for appropriate management.

Study Limitations

1. As a large number of nurses were trained, with each screening a small number of subjects, this may have affected statistical results as resultant numbers for analysis were small.

2. The timing between nurse and speech and language therapy screening tests caused differences in agreement to arise in some instances. It was difficult in some instances to keep within the three hour recommended time. Ideally both tests should be done within a few minutes of each other or at the same time.

3. Ideally all subjects assessed by the speech and language therapist should have undergone videofluoroscopy to confirm speech and language therapy assessment findings However this was not possible in some cases and was also considered unethical.

4. The recording equipment for cervical auscultation was not refined enough to detect solely swallow and respiratory sounds and lacked some unit for measuring time for swallow events. This probably affected raters ability to detect certain signs of dysphagia when listening to recordings

5. The study did not specifically establish diagnostic significance of cervical auscultation. As the figures studied were too small and biased for proper statistical analysis, it merely demonstrated that the technique appears to add 'extra information' to the clinical evaluation of swallowing.

6. The 10 subjects in the inter-rater reliability trial of two therapists at the bedside with a stethoscope did not undergo videofluoroscopy or follow up after three months. This information may have further substantiated the results.

Implications for future research

1. Patients with respiratory disease represented a significant proportion of subjects in this study and many responded to therapeutic procedures to remediate their dysphagia. The COAD population have been studied somewhat in regard to their swallow integrity and patterns of impairment which may exist but a lot remains to be identified about this group. This population need to be studied in more depth to determine the exact nature of oropharyngeal dysphagia in the group and what management strategies are most effective in minimising complications.

2. Repeating the trial with fewer nurses screening a larger number of subjects each would lead to better statistical analysis and determine variance between nurses.

3. Some mechanism to minimise the delay between the nurse and speech and language therapist screening tests should be devised. Ideally the screening should be done within minutes of each other or possibly even at the same time, with results recorded separately.

4. It would appear that subjects who have full speech and language therapy management of dysphagia have better outcomes that those who are unidentified. Determining exact efficacy of SLT intervention in the dysphagic population would require a matched control group to compare outcomes. This would be ideal but it presents many ethical considerations as therapy would be offered to some subjects and not to others. Therapists need to develop ways of measuring outcome and efficacy of therapeutic interventions.

5. For the recording equipment, the microphone should be replaced with an accelerometer for clarity of sound. In addition a measure of time should be incorporated into the present recording system to allow for decisions regarding transit times which may signal a swallow disorder.

6. No studies have looked at what features on auscultation specifically predict dysphagia signs. This study may be a step in the right direction but a larger sample and correlation with videofluoroscopy would be necessary in order to pinpoint specific features with specific events.

7. In the trial investigating Inter-rater reliability of cervical auscultation with two therapists and a stethoscope, a small sample of subjects was used as this was very much a preliminary study. In addition, the subjects were not compared with videofluoroscopy to confirm presence or absence of dysphagia. This perhaps could be investigated in a larger trial with more subjects who also undergo videofluoroscopy.

8. Ideally, a larger trial independently comparing predictors of aspiration and dysphagia during both bedside assessment and cervical auscultation with videofluoroscopy in variety of subjects presenting with/without dysphagia is necessary to establish exact clinical usefulness of auscultation.

As we move into the next millennium, the availability of newer technologies and higher than ever standards of care is contributing to a remarkable rate of change within the health care sector. Speech and language therapists are very much at the core of these developing services and have a significant role to play in contributing to overall health care standards. As the population ages, the demands on speech and language therapists will continually increase, particularly in relation to swallowing disorders. Therapists must streamline services now in order to cope with these increasing demands. Education and training of other health professionals does make a significant difference in identifying swallowing disorders that are potentially costly and disabling. Objective methods of assessment, such as cervical auscultation, allow for further streamlining of services as well as savings in time and cost. Most importantly, the future consumers of these services will potentially experience a better quality of life as a result. All speech and language therapy clients deserve high standards of care. By adopting proven models of intervention and service delivery, this goal becomes more achievable. By establishing research to demonstrate clinical efficacy further it becomes more achievable still. This is the challenge facing the profession as it moves into the year 2000 and beyond. For our patients, we must rise to this challenge.

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Appendices

Appendix 1

CERVICAL AUSCULTATION CONSENT FORM

ST JAMES'S HOSPITAL AND FEDERATED DUBLIN VOLUNTARY HOSPITALS

JOINT RESEARCH ETHICS COMMITTEE

Consent Form

Title of research study: ***Earlier and improved detection of swallowing disorders in medical patients - using cervical auscultation recording equipment***

Study description:

For this study, the Speech and Language Therapist will place a stethoscope at your neck. A microphone and tape recorder will be attached to the stethoscope. This will enable her to listen to your breathing and swallow sounds as you swallow. She will ask you to take a few sips of water and some food as part of the assessment. The equipment is being tested to ensure that it can accurately detect if you are able to swallow your food and drink safely.

The study and this consent form have been explained to me. The Speech and Language Therapist has answered all my questions to my satisfaction. I believe I understand what will happen if I agree to be part of this study.

I have read, or had read to me, this consent form. I have had the opportunity to ask questions which have been answered to my satisfaction.

(a) PARTICIPANT'S NAME: _____

PARTICIPANT'S SIGNATURE: _____

DATE: _____

(b) SIGNATURE OF GUARDIAN/NEXT OF KIN_____
(in event where the participant is unable to give informed consent)

(c) SIGNATURE OF FIRST WITNESS _____
SIGNATURE OF SECOND WITNESS _____
(In the event that the participant can give informed consent but is physically unable to sign written consent)

I have explained the nature and purpose of this research study. I believe that the participant understands my explanation and informed consent has been given.

_____
ZELDA FARRELL BSc MIASLT
Speech and Language Therapist

Appendix 2

DEFINITIONS OF FOOD AND LIQUID CONSISTENCIES

Thin Liquid	Thin drinks, Normal fluids (e.g. tea, coffee, milk).
Slow moving drink	Liquid that is smooth and can be poured slowly yet easily from jug to glass (e.g. canned tomato soup, pouring custard)
Semisolid	Smooth, soft consistency where plastic spoon can stand up momentarily on its own. **Test**: Dip spoon into food Trace figure 8 on surface with spoon. This '8' should be easily formed and maintained for several seconds.
Set	Set mousse - like consistency which is not sticky (e.g. Fortipudding, creme caramel) **Test**: Dip spoon into food, lift spoon, Food should maintain cohesiveness and not fall easily off the spoon.
Solid	Food which requires chewing and mastication.

Appendix 3

The Adelaide & Meath Hospital, Dublin

POLICY FOR

OROPHARYNGEAL SWALLOW TEST

(VIDEO FLUOROSCOPY)

DEPARTMENTS OF

SPEECH & LANGUAGE THERAPY & RADIOLOGY

CONTENTS

1. Definition of Procedure

2. Personnel

3. Equipment

4. Referral Policy
   - In-Patients
   - Out-Patients

5. Transport
   - In-Patients
   - Out-Patients

6. Transferring Patients

7. Positioning Patients

8. Test Procedure

9. Radiation Safety

10. Reporting

11. Follow-up

12. Tracheostomy Patients

1.0 DEFINITION OF PROCEDURE.

1.1 Video Fluoroscopy is a radiological procedure which examines the oropharyngeal area and the dynamic swallowing process. The dynamic image is recorded onto a videotape.

1.2 It is necessary to:

(a) Examine the anatomy and physiology (structure and function) of the oropharyngeal and upper oesophageal areas before, during and after swallowing.

(b) Identify causes of aspiration and reduced swallow efficiency.

(c) Direct treatment and management strategies to minimise aspiration and improve swallow efficiency.

(d) Facilitate appropriate onward referral to assist in the diagnostic process.

1.3 It is part of the overall dysphagia examination by the Speech & Language Therapist. It provides more objective information than is available at the bedside assessment.

2.0 PERSONNEL RESPONSIBILITIES :

2.1 Speech & Language Therapist (SLT).
Professional who works with children and adults with disorders of communication, eating and swallowing. The Speech & Language Therapist must have supervised (specialist) post graduate training to work in the field of swallowing disorders and to conduct videofluoroscopies. The Speech & Language Therapist interprets the anatomy/physiology of the oropharyngeal swallow.

2.2 Radiologist.
Medical Doctor specialised in taking and interpreting X-Rays. S/he operates the X-Ray Equipment and assists the Speech & Language Therapist in interpreting the anatomy and physiology of the oropharyngeal area.In particular he/she focuses on abnormalities of structure.

2.3 Radiographer.
Professionals trained in the operation of X-Ray equipment and in patient care during examinations. They assist in the technical aspects and patient care during the procedure.

2.4 Nursing Staff.
Prepare the room for the procedure, help if the patient gets sick or if his/her condition deteriorates, ensure maintenance of suction equipment and accessories.

2.5 Porter / Rehab Attendant.
Transport the patients and equipment to and from the X-Ray Department and assists with transferring the patient from the wheelchair to the Videofluoroscopy chair.
He also carries out appropriate cleaning and maintenance of equipment used during the procedure.

2.6 Physiotherapist.
May need to be present for certain patients if mobility and/or chest status is poor. They assist in safe positioning of patient and provide chest physiotherapy if indicated

2.7 Person to Register patient on Arrival to X-ray.
All relevant patient details must be registered for recording and reporting purposes.

2.8 Family Members.
Sometimes family members will attend the procedure. Their role is one of observation only and/or of reassuring the patient.

2.9 Biomedical Engineers.
Professionals trained in the operation and maintenance of technical equipment.
They will provide an on-call service in the event of a technical breakdown and regular maintenance of equipment.

3.0 EQUIPMENT.

Videofluoroscopy adjustable chair(e.g. VESS chair)

Video Recorder / TV screen - with frame by frame analysis facility.

Timer unit.

Fluoroscopy unit.

Lead to connect fluoroscopy unit and video / monitor.

Portable clip on microphone and lead.

Video character generator to label patient.

Video printer.

Lead aprons for therapists / certain patients.

Thyroid collars.

TLD badges for Therapists/Radiologists.

Protective lead spectacles.

Barium : E.Z. Hd powder.

Feeding utensils (metal and plastic).

Paper drinking cups.

Paper tissue.

Video tapes.

Foods of different consistencies (Angel Delight).

Mixing bowl.

Batteries for microphone.

Microphone.

Suctioning Equipment.

Plastic aprons & protective gloves

Drinking straws.

Synthetic saliva sprays.

Videofluoroscopy consent forms.

Advice and guidelines sheets/booklets.

Sterile wipes

Notebook for recording data

4.0 REFERRAL POLICY.

The Speech & Language Therapist decides who needs a videofluoroscopy of the OPS. The process is as follows.

In-Patients.

4.1(a) The Speech & Language Therapist receives requests (referrals) for swallow assessment from medical team, signed by a medical doctor on the team.

4.1(b) The Speech & Language Therapist conducts a thorough bedside clinical assessment taking into account:

medical diagnosis and prognosis
positioning and posture of patient
level of alertness / co-operation / cognition
oromotor / oropharyngeal and laryngeal exam
swallow performance at bedside
present medical condition
attitude to alternative feeding.
presence of infection(e.g. MRSA)

4.1(c) Based on findings the Speech & Language Therapist will decide, following discussion with medical team, whether a video fluoroscopy is necessary and appropriate based on the following:

PATIENT SELECTION CRITERIA

Video fluoroscopy will be considered if:

1. After bedside clinical assessment there is insufficient information obtained in order to accurately determine diagnosis and management and Videofluoroscopy would provide more objective information re. swallow function.

2. Patients are alert, co-operative and able to cope with video fluoroscopy procedure.

3. Patients are reasonably stable medically.

4. Patients have an adequate degree of trunk control, head control and transfer ability.

5. The results obtained from the video fluoroscopy should influence patient management in some way.

6. Female patients who are pregnant or suspect they might be pregnant are excluded from the video fluoroscopy.

4.1(d) The medical team is advised. An X-Ray requisition form is filled in requesting an O.P.S. This must be signed by a member of the patients medical team and returned to the Speech and Language Therapist.

4.1(e) The patient is listed for the video fluoroscopy clinic. This list is prioritized by the Speech & Language Therapist the day before the clinic.

4.1(f) The Speech & Language Therapist makes arrangements with ward staff and transport / portering staff re. collection and delivery of patient to the X-Ray department.

4.1(g) The procedure is explained to the patient and a video fluoroscopy consent form is completed by either patient or carer.

4.2 Patients From Out-Lying Centres.

When a request for an Oropharyngeal Swallow Test is received the process is as follows:

4.2(a) Check that the referring Centre has access to a Speech and Language Therapist who has knowledge of the treatment of dysphagia.

If no SLT service is available the patient can only be seen if they are admitted to the hospital under a Consultant for full assessment and follow-up.

If an SLT service is available we require a written medical referral (either by post or by fax) before the patient can be placed on our waiting list. The written medical referral must include the following information:
- Medical Diagnosis
- Brief clinical history
- Reason for referral for videofluoroscopy
- Signature of the relevant practitioner

The referring centre should be informed of our out patient policy and length of waiting list.

4.2(b) Once a written referral has been received, information on videofluoroscopy rocedure as well as a detailed questionnaire, and consent form are sent to the carer to obtain bckground history and information regarding the medical history, diagnosis and present feeding/swallow status.

4.2(c) Upon return of the questionnaire the Speech & Language Therapist may arrange for the person to attend the out patient day clinic for an informal assessment prior to deciding if videofluoroscopy is necessary.

Alternatively, a video may be arranged immediately (especially if the patient is under the care of the Speech & Language Therapist in another centre where VDF is not available).

4.2(c) The relevant carers organise transport to and from the hospital.

4.2(d) A carer who is familiar with the patient must accompany them and remain with them for the duration of the stay on the hospital premises. This may be a nurse or a family member.

4.2(e) Once the above criteria can be met totally, the patient is accepted for a video fluoroscopy.

(For more detailed procedures refer to SLT Departmental Procedures for seeing patients from Out-lying centres for Videofluoroscopy).

5.0 TRANSPORTING THE PATIENT TO AND FROM X-RAY.

5.1 In-Patients.

5.1(a) An appointment time is given in advance to nursing staff on the ward.

5.1(b) The patient is collected by the rehab attendant or ward attendant.

5.1(c) The patient is transported to the X-Ray department by wheelchair or by videofluoroscopy adjustable chair or, if walking, is accompanied by the attendant. Patients will be collected in the video fluoroscopy chair if available.

5.1(d) A trolley may be necessary to transport the patient, in which case two porters must be present during the transporting period.

5.1(e) Appropriate equipment relevant to the patients status should also accompany the patient to x-ray e.g. specialist feeding tools, etc.

5.2 Patients from Out-Lying Centres.

5.2(a) An appointment time is given well in advance to the patient / carers. Waiting time for an appointment may vary depending on caseload demands.

5.2(b) The patient arrives at the clinic either by ambulance service or private transport.

5.2(c) On arrival at X-Ray the patient waits in the waiting area with carer until called for.

6.0 TRANSFERRING THE PATIENT IN X-RAY.

6.1 The patient must be transferred from wheelchair or trolley to the videofluoroscopy chair or x-ray chair.

6.2 Trained staff will assist in transferring the patient e.g. nursing staff, porters, rehab attendant, physiotherapists.

6.3 The patient must be positioned safely on the chair before the procedure begins.

7.0 **POSITIONING THE PATIENT.**

7.1 Sitting.

The person must be seated upright in the chair or in the most optimum position for feeding. There should be no risk of falling from the chair.

7.2 Lying.

If the test must be done with the patient lying down, physiotherapy involvement is recommended to advise re: correct and safe positioning.

8.0 **THE PROCEDURE.**

During the procedure the Speech & Language Therapist gives the patient foods/drink of different consistencies to assess swallow efficiency and aspiration risk. Compensatory strategies will then be tried out to improve swallow performance.

8.1 The food consistencies are prepared by the Speech & Language Therapist. The standard tested consistencies are:

- Liquid (barium)
- Slow moving drink
- Semi-solid (Angel Delight)
- Set (Angel Delight)
- Solid (Biscuits)

(Definitions in Appendix)

8.2 The radiologist screens the patient in the lateral position to obtain a lateral view of the oropharynx and examines the area for any structural abnormalities. In the lateral plane the structures to be viewed should include : The lips anteriorly, the soft palate superiorly, the posterior pharyngeal wall posteriorly, and as far as the 7th cervical vertebrae inferiorly.

8.3 The Speech & Language Therapist asks (where appropriate) the patient to count to 5, swallow (voluntary) and cough (voluntary) whilst observing the oropharyngeal area on the screen.

8.4 The patient who wears dentures is assessed with his dentures either out/in or both. This depends on what is most comfortable for the patient and what he/she normally does while eating.

8.5 Then the Speech & Language Therapist gives consistencies as follows. There may be variations in quantity and in order of presentation of food consistencies,depending on the patient.

- 3 tsps of thin Barium liquid

- 3 sips of thin Barium liquid
- 3 tsps of slow moving (Barium) drink
- 3 sips of slow moving (Barium) drink
- 3 tsps semi-solid
- 3 tsps Set
- ¼ biscuit, coated with Barium mixture.

If dysphagia and aspiration are observed various changes in position or specialmanoeuvres / techniques may be recommended by the Speech & Language Therapist during the procedure to improve swallow function and minimise aspiration.

The assessment proceeds even if aspiration occurs. However if aspiration is quite significant i.e. > 50% of the bolus on all consistencies then the procedure is terminated. For all patients who aspirate the appropriate Physiotherapist should be contacted to inform them that aspiration has occurred.

8.6 The radiologist screens every time the person has food in their mouth before and during a swallow. They may need to screen for extra time after the swallow to observe the effects of post swallow residue in the pharynx. The radiologist should <u>not</u> screen if the Speech & Language Therapist is giving food to the patient or is handling the patient. The Radiologist may take stills during the procedure.

8.7 Once testing in the lateral view has been completed if considered appropriate, the person's position is changed to an anterior posterior position.

8.8 Once in this position, the patient is asked to raise chin and say 'ah' to visualise vocal cord adduction.

8.9 The patient is given any consistency which was problematic for him / her in the lateral view and which will give the best information on pharyngeal peristalsis.

8.10 Total recommended screening time = 4 - 10 minutes.

8.11 <u>Suctioning.</u>

Trained nursing staff should be available to suction the patient if necessary. Procedure should be aborted if the patient is aspirating significant amounts which will endanger him / her. In this instance, the person should be suctioned before returning to the ward and should be seen by a physiotherapist on return.

8.12 <u>Oxygen</u>

Oxygen should be transferred from ward with patient if necessary.

8.13 Patient returned to the ward by porter (attendant).

Patient returned to the carer if an Out-Patient. Carers will be advised after the procedure and will be provided with guidelines and recommendations if necessary.

9.0 **RADIATION SAFETY.**

9.1 All staff involved in videofluoroscopy should familiarise themselves with Radiation Safety procedures/policies (e.g. where to stand vis-a-vis the x-ray machine, etc.)

9.2 Badges

TLD Badges should be worn by staff under lead aprons during the procedure. These should be checked regularly for radiation levels by the radiation officer.

9.3 Clothing

Lead aprons, thyroid shields and protective eyewear should be worn by the Speech & Language Therapist when conducting the procedure.

9.4 Recommended Screening Time:

Approximately 4 - 10 minutes.

9.5 Handling the Patient

The Speech & Language Therapist should avoid handling the patient whilst screening is in progress.

9.6 LMP Dates

Check patient LMP dates if appropriate.

10.0 **HEALTH AND SAFETY**

10.1 All staff involved in videofluoroscopy should be familiar with hospital health and safety procedures.

10.2 In particular, for patients with infectious diseases (e.g. MRSA), all necessary precautions should be taken.

11.0 **REPORTING.**

11.1 Speech & Language Therapist's/Radiologist Report.

With assistance from the Radiologist, the Speech & Language Therapist will watch the video recording and analyse it according to a detailed report from for Speech & Language Therapy files. (See Appendix).

In-Patients

A summary report of observations and recommendations is prepared and put in the medical chart on the same day if possible.

Out-Patients

A report is placed in the medical chart if available. The relevant referral source is notified of results e.g. GP, other Speech and Language Therapists, other non-Hospital Consultants and a report is forwarded to them.

12.0 FOLLOW-UP

The Speech and Language Department will follow up by inplementing appropriate treatment and management strategies based on video fluoroscopy indications.

12.1 Repeat Studies

Patient may need a repeat study either

a) during his treatment to determine progress, measure efficacy of current therapy and to direct further management.

b) at the end of a treatment programme to determine extent of overall recovery and to direct future management if necessary

13.0 PATIENTS WITH TRACHEOSTOMY TUBES.

13.1 If a cuffed tube is in situ, permission from the medical team is necessary before deflating the cuff.

13.2 A physiotherapist should be present to monitor patient chest status, O_2 saturation levels and to suction the patient immediately if necessary.

13.3 The tracheostomy tube should be occluded when swallowing takes place, either by finger occlusion or by speaking valve.

14.0 PATIENTS WITH DRY MOUTH

14.1 Patients who present with xerostomia may require the use of artificial saliva sprays during the Videofluoroscopy.

APPENDIX 4

SAMPLE OF SWALLOW SCREENING TRIAL FORMS

Swallow Screening Trial - Subject information sheet

(1)Subject Name _____

(2)GP Name _____ Address _____

Phone No _____

(3)Next of Kin/Carer _____ Address same

Phone no —

Date Screened 16/3/98 Proposed follow up date June '98

Readmitted May 1998 c ⊙ based pneum 2° to Aspiration

AT THREE MONTHS FOLLOW UP - INDICATORS?	**YES**	**NO**	
(a) Recurrence of pneumonia/chest infection	☑	☐	
(b) Recurrent upper airway obstruction	☐	☐	
(c) Death (cause?)	☐	☐	
(d) Significant unexplained weight loss	☐	☐	
(e) SLT follow-up for dysphagia	☑	☐	
(f) Videofluoroscopy with aspiration/dysphagia	☐	☑	Inappropriate ∴ no Impⁿt
(g) Videofluoroscopy with no aspiration/dysphagia	☐	☐	

MEATH HOSPITAL
SWALLOW TEST

Name:
Med Ch No:

A screening test for swallowing difficulties to be used by trained nursing staff within 12 hours of patient admission. Repeat every 24 hours if the patient fails the test and the Speech and Language Therapist (SLT) is unavailable.

---

1. AT RISK GROUPS: *(Tick as appropriate)*

Stroke	☐	Parkinson's disease	☐	MND	☐
TIA	☐	Multiple medical problems	☐	MS	☐
Confusion/Dementia	☐	c/o problem swallowing	☐	Psychiatric Hx	☐
Weight loss (sig)	☐	Respiratory disease	☑		
Other acute neuro event	☐	Other Progressive neurological illness	☐		

If √ to any of the above → continue test ☑
If none apply → discontinue test ☐

---

2. READY FOR ASSESSMENT ?

Drowsy?	☐	→	Repeat later when alert
Drooling saliva?	☐	→	Refer to SLT immediately
Poor sitting posture?	☐	→	Repeat later if appropriate
Uncooperative?	☐	→	Repeat later if appropriate

If the patient is appropriate for assessment continue with test ☑
If not appropriate, repeat within 24 hours ☐

---

3. SWALLOW ASSESSMENT - Sit patient upright with support
- Use a glass (do not use a beaker)
- Listen to the patient's voice

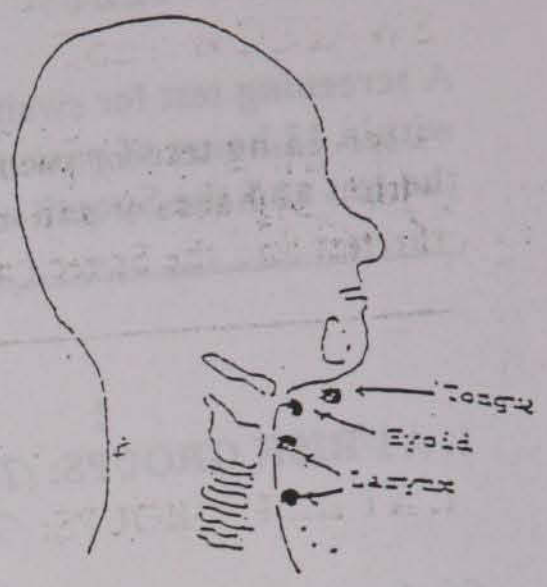
(Turn over for test instructions)
→

NURSE Ax

(1) Give 3 small sips of water/feel throat for swallow/
Observe for signs (circle appropriately)

↓

Drooling water?	Yes (No)
Absent swallow?	Yes (No)
Delayed initiation of swallow(> 3 secs)	Yes (No)
Immediate cough?	Yes (No)
Delayed cough (up to 2 min after swallowing)	Yes (No)
Wet voice/voice change	Yes (No)
↑ Respiratory rate	Yes (No)
Repeated Laryngeal elevations (>3)	Yes (No)



↓

If **YES** to any of the signs above→**(a) If status poor, keep NPO and refer to SLT** ☐
(b) If status good, refer to SLT/Observe eating ☐

If **NO** to any of the signs above → **Continue test** ✓

↓

(2) Let patient continuously drink one third of a glass of water/Feel throat/observe for signs (circle appropriately)

↓

Drooling water?	Yes (No)
Absent swallow?	Yes (No)
Delayed initiation of swallow(> 3 secs)	Yes (No)
Immediate cough?	Yes (No)
Delayed cough (up to 2 min after swallowing)	Yes (No)
Wet voice/voice change	(Yes) No
↑ Respiratory rate	(Yes) No
Repeated Laryngeal elevations (>3)	(Yes) No

↓

If **YES** to any of the signs above→**(a) If status poor, keep NPO and refer to SLT** ☐
(b) If status good, refer to SLT/Observe eating ☑

If **NO** to any of the above signs → **Start normal feeding with caution**
(This test will not detect patients who have difficulty swallowing solids. Continue to observe for swallowing difficulties such as coughing with food or development of a chest infection if oral feeding is recommenced)

Change in Status? _____ **(SLT use only)**

---

4. OUTCOME

Repeat test later	☐	**Test unnecessary**	☐	**Uncooperative**	☐
NPO/Refer SLT	☐	**Start feeding**	☐	**Refer/observe**	☑ ✓

Signature: Regina Boyle SRN **Date:** 16/03/1998 **Time:** 11.45.

MEATH HOSPITAL
SWALLOW TEST

A screening test for swallowing difficulties to be used by trained nursing staff within 12 hours of patient admission. Repeat every 24 hours if the patient fails the test and the Speech and Language Therapist (SLT) is unavailable.

PHX: COAD
CCF
A-fib & IHD / MIO / hypertens
CVA - ⊙ ½ paresis.

1. AT RISK GROUPS: *(Tick as appropriate)*

Stroke	☐	Parkinson's disease	☐	MND	☐
TIA	☐	Multiple medical problems	☑	MS	☐
Confusion/Dementia	☑	c/o problem swallowing	☐	Psychiatric Hx	☐
Weight loss (sig)	☐	Respiratory disease	☑	LRTI	
Other acute neuro event	☐	Other Progressive neurological illness	☐		

If √ to any of the above → continue test ☑
If none apply → discontinue test ☐

---

2. READY FOR ASSESSMENT ?

Drowsy?	☐	→	Repeat later when alert
Drooling saliva?	☐	→	Refer to SLT immediately
Poor sitting posture?	☐	→	Repeat later if appropriate
Uncooperative?	☐	→	Repeat later if appropriate

If the patient is appropriate for assessment continue with test ☑
If not appropriate, repeat within 24 hours ☐

---

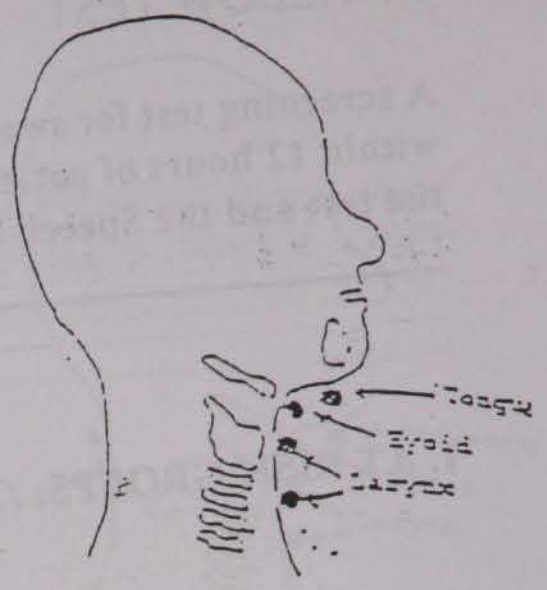
3. SWALLOW ASSESSMENT - Sit patient upright with support
- Use a glass (do not use a beaker)
- Listen to the patient's voice

(Turn over for test instructions) →

(1) Give 3 small sips of water/feel throat for swallow/
Observe for signs (circle appropriately)

↓

Drooling water?	Yes/No
Absent swallow?	Yes/No
Delayed initiation of swallow(> 3 secs)	Yes/No
Immediate cough?	Yes/No
Delayed cough (up to 2 min after swallowing)	(Yes)/No
Wet voice/voice change	Yes/No
↑ Respiratory rate	Yes/No
Repeated Laryngeal elevations (>3)	Yes/No



↓

If **YES** to any of the signs above→**(a) If status poor, keep NPO and refer to SLT** ☐
(b) If status good, refer to SLT/Observe eating ☐

If **NO** to any of the signs above → **Continue test**

↓

(2) Let patient continuously drink one third of a glass of water/Feel throat/observe for signs (circle appropriately)

↓

Some belching

Drooling water?	Yes/No
Absent swallow?	Yes/No
Delayed initiation of swallow(> 3 secs)	Yes/No
Immediate cough?	Yes/No
Delayed cough (up to 2 min after swallowing)	(Yes)/No
Wet voice/voice change	Yes/No
↑ Respiratory rate	Yes/No
Repeated Laryngeal elevations (>3)	Yes/No

↓

If **YES** to any of the signs above→**(a) If status poor, keep NPO and refer to SLT** ☐
(b) If status good, refer to SLT/Observe eating ☐

If **NO** to any of the above signs → **Start normal feeding with caution**

(This test will not detect patients who have difficulty swallowing solids. Continue to observe for swallowing difficulties such as coughing with food or development of a chest infection if oral feeding is recommenced)

Change in Status? NO **(SLT use only)**

---

4. OUTCOME

Repeat test later	☐	**Test unnecessary**	☐	**Uncooperative**	☐
NPO/Refer SLT	☐	**Start feeding**	☐	**Refer/observe**	☑

Signature: Zelde Farrell **Date:** 16/3/18 **Time:** 16^{00}

APPENDIX 5

SAMPLE OF FORMS FROM CERVICAL AUSCULATION INTERRATER RELIABILITY TRIAL AT THE BEDSIDE

MEATH HOSPITAL
SWALLOW TEST

Name:
Med Ch No:

A screening test for swallowing difficulties to be used by trained nursing staff within 12 hours of patient admission. Repeat every 24 hours if the patient fails the test and the Speech and Language Therapist (SLT) is unavailable.

---

1. AT RISK GROUPS: *(Tick as appropriate)*

Stroke	☐	Parkinson's disease	☐	MND	☐
TIA	☐	Multiple medical problems	☑	MS	☐
Confusion/Dementia	☑	c/o ~~pro~~blem swallowing	☐	Psychiatric Hx	☐
Weight loss (sig)	☐	Respiratory disease	☑		
Other acute neuro event	☐	Other Progressive neurological illness	☐		

If √ to any of the above → continue test ☑
If none apply → discontinue test ☐

---

2. READY FOR ASSESSMENT ?

Drowsy?	☐	→	Repeat later when alert
Drooling saliva?	☐	→	Refer to SLT immediately
Poor sitting posture?	☐	→	Repeat later if appropriate
Uncooperative?	☐	→	Repeat later if appropriate

If the patient is appropriate for assessment continue with test ☑
If not appropriate, repeat within 24 hours ☐

---

3. SWALLOW ASSESSMENT - Sit patient upright with support
- Use a glass (do not use a beaker)
- Listen to the patient's voice

(Turn over for test instructions)
→

MEATH HOSPITAL
SWALLOW TEST

Name:
Med Ch No:

A screening test for swallowing difficulties to be used by trained nursing staff within 12 hours of patient admission. Repeat every 24 hours if the patient fails the test and the Speech and Language Therapist (SLT) is unavailable.

---

1. AT RISK GROUPS: *(Tick as appropriate)*

Stroke	☐	Parkinson's disease	☐	MND	☐
TIA	☐	Multiple medical problems	☑	MS	☐
Confusion/Dementia	☑	c/o ~~pr~~oblem swallowing	☐	Psychiatric Hx	☐
Weight loss (sig)	☐	Respiratory disease	☑		
Other acute neuro event	☐	Other Progressive neurological illness	☐		

If √ to any of the above → continue test ☑
If none apply → discontinue test ☐

---

2. READY FOR ASSESSMENT ?

Drowsy?	☐	→	Repeat later when alert
Drooling saliva?	☐	→	Refer to SLT immediately
Poor sitting posture?	☐	→	Repeat later if appropriate
Uncooperative?	☐	→	Repeat later if appropriate

If the patient is appropriate for assessment continue with test ☑
If not appropriate, repeat within 24 hours ☐

---

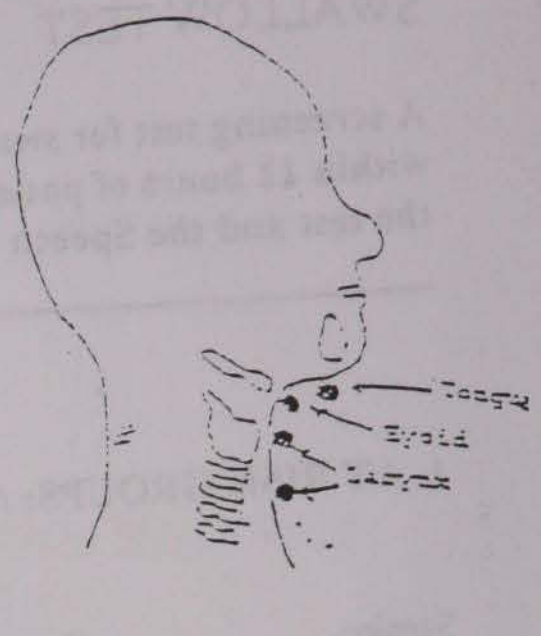
3. SWALLOW ASSESSMENT - **Sit patient upright with support**
- **Use a glass (do <u>not</u> use a beaker)**
- **Listen to the patient's voice**

(Turn over for test instructions)
→

(1) Give 3 small sips of water/feel throat for swallow/ Observe for signs (circle appropriately)

↓

Drooling water?	Yes/No
Absent swallow?	Yes/No
Delayed initiation of swallow(> 3 secs)	Yes/No
Immediate cough?	Yes/No
Delayed cough (up to 2 min after swallowing)	Yes/No
Wet voice/voice change	Yes/No
↑ Respiratory rate	Yes/No
Repeated Laryngeal elevations (>3)	Yes/No



↓

If **YES** to any of the signs above→**(a) If status poor, keep NPO and refer to SLT** ☐
(b) If status good, refer to SLT/Observe eating ☐

If **NO** to any of the signs above → **Continue test**

↓

(2) Let patient continuously drink one third of a glass of water/Feel throat/observe for signs (circle appropriately)

↓

Drooling water?	Yes/No
Absent swallow?	Yes/No
Delayed initiation of swallow(> 3 secs)	Yes/No
Immediate cough?	Yes/No
Delayed cough (up to 2 min after swallowing)	Yes/No
Wet voice/voice change	Yes/No
↑ Respiratory rate	Yes/No
Repeated Laryngeal elevations (>3)	Yes/No

↓

If **YES** to any of the signs above→**(a) If status poor, keep NPO and refer to SLT** ☐
(b) If status good, refer to SLT/Observe eating ☐

If **NO** to any of the above signs → **Start normal feeding with caution**

(This test will not detect patients who have difficulty swallowing solids. Continue to observe for swallowing difficulties such as coughing with food or development of a chest infection if oral feeding is recommenced)

Change in Status?_____ **(SLT use only)**

---

4. OUTCOME

Repeat test later	☐	**Test unnecessary**	☐	**Uncooperative**	☐
NPO/Refer SLT	☐	**Start feeding**	☐	**Refer/observe**	☑

Signature: [signature] **Date:** 4/5/98 **Time:** 11.45hrs

SWALLOW ASSESSMENT WITH CERVICAL AUSCULTATION

Patient Name: **SLT:** Zelda **DATE:**

FACTORS: **FLUID CONSISTENCY**	**SIGNS**		
Breath sounds before swallow	(Clear)	Wet	Uncertain
Swallow sounds during swallow	Crisp	Dulled – ? ng placement	Uncertain
Apnoea during swallow	(<1sec)	> 1 sec	Uncertain
Direction of breathflow after swallow	Inspiration	(Expiration)	Uncertain
Timing of swallow	(Normal (3sec))	Delayed (>3sec)	Uncertain
Breath sounds after swallow	(Clear)	Wet	Uncertain
Respiratory rate after swallow	(No change)	Increased	Uncertain
Vocal quality after swallow	No change	Wet/dysphonic	(Uncertain)
Number of swallows heard per mouthful	(Single swallow)	Double swallow	Multiple (>2)
Laryngeal response	Overt cough	Throat clearing/'blowout'	(None)
Other audible sounds	'Flushing' sound prior to swallow	('Flushing' sound after swallow)	
Aspiration Suspected?	YES ☐	NO ☑	
Need for further investigation?	YES ☐	NO ☐	
SEMISOLID CONSISTENCY			
Breath sounds before swallow	(Clear)	Wet	Uncertain
Swallow sounds during swallow	(Crisp)	Dulled	Uncertain
Apnoea during swallow	(<1sec)	> 1 sec	Uncertain
Direction of breathflow after swallow	Inspiration	(Expiration)	Uncertain
Timing of swallow	Normal (3sec)	(Delayed (>3sec)) ?	Uncertain
Breath sounds after swallow	(Clear)	Wet	Uncertain
Respiratory rate after swallow	(No change)	Increased	Uncertain
Vocal quality after swallow	(No change)	(Wet/dysphonic)	Uncertain
Number of swallows heard per mouthful	Single swallow	(Double swallow) ccc	Multiple (>2)
Laryngeal response	Overt cough	Throat clearing/'blowout'	None
Other audible sounds	('Flushing' sound prior to swallow)	('Flushing' sound after swallow)	
Aspiration Suspected?	YES ☐	NO ☐	
Need for further investigation? PENETRATION ?	YES ☐	NO ☒	
OTHER CONSISTENCY			
Breath sounds before swallow	Clear	Wet	Uncertain
Swallow sounds during swallow	Crisp	Dulled	Uncertain
Apnoea during swallow	<1sec	> 1 sec	Uncertain
Direction of breathflow after swallow	Inspiration	Expiration	Uncertain
Timing of swallow	Normal (3sec)	Delayed (>3sec)	Uncertain
Breath sounds after swallow	Clear	Wet	Uncertain
Respiratory rate after swallow	No change	Increased	Uncertain
Vocal quality after swallow	No change	Wet/dysphonic	Uncertain
Number of swallows heard per mouthful	Single swallow	Double swallow	Multiple (>2)
Laryngeal response	Overt cough	Throat clearing/'blowout'	None
Other audible sounds	'Flushing' sound prior to swallow	'Flushing' sound after swallow	
Aspiration Suspected?	YES ☐	NO ☐	
Need for further investigation?	YES ☐	NO ☐	

CA Assessment Draft 2/Z Farrell/8 Jan 1998

SWALLOW ASSESSMENT WITH CERVICAL AUSCULTATION

Patient Name: **SLT:** Aisling **DATE:** 4/5/98

FACTORS: FLUID CONSISTENCY	SIGNS		
Breath sounds before swallow	(Clear)	Wet	Uncertain
Swallow sounds during swallow	Crisp	(Dulled)	Uncertain
Apnoea during swallow	(<1sec)	> 1 sec	Uncertain
Direction of breathflow after swallow	Inspiration	(Expiration)	Uncertain
Timing of swallow	(Normal (3sec))	Delayed (>3sec)	Uncertain
Breath sounds after swallow	Clear	(Wet)	Uncertain
Respiratory rate after swallow	No change	Increased	(Uncertain)
Vocal quality after swallow	No change	Wet/dysphonic after last 3 tsp	Uncertain
Number of swallows heard per mouthful	(Single swallow)	Double swallow	Multiple (>2)
Laryngeal response	(Overt cough)	(Throat clearing/'blowout')	None
Other audible sounds	'Flushing' sound prior to swallow	('Flushing' sound after swallow)	
Aspiration Suspected?	YES ☑	NO ☐	
Need for further investigation?	YES ☑	NO ☐	
SEMISOLID CONSISTENCY			
Breath sounds before swallow	(Clear)	Wet	Uncertain
Swallow sounds during swallow	Crisp	(Dulled)	Uncertain
Apnoea during swallow	(<1sec)	> 1 sec	Uncertain
Direction of breathflow after swallow	Inspiration	(Expiration)	Uncertain
Timing of swallow	(Normal (3sec))	Delayed (>3sec)	Uncertain
Breath sounds after swallow	Clear	(Wet)	Uncertain
Respiratory rate after swallow	No change	(Increased)	Uncertain
Vocal quality after swallow	No change	Wet/dysphonic ?	Uncertain
Number of swallows heard per mouthful	(Single swallow)	Double swallow	Multiple (>2)
Laryngeal response	Overt cough	Throat clearing/'blowout'	None
Other audible sounds	'Flushing' sound prior to swallow	('Flushing' sound after swallow)	
Aspiration Suspected? At risk	YES ☐	NO ☐	
Need for further investigation? ? Penetration	YES ☑	NO ☐	
OTHER CONSISTENCY			
Breath sounds before swallow	Clear	Wet	Uncertain
Swallow sounds during swallow	Crisp	Dulled	Uncertain
Apnoea during swallow	<1sec	> 1 sec	Uncertain
Direction of breathflow after swallow	Inspiration	Expiration	Uncertain
Timing of swallow	Normal (3sec)	Delayed (>3sec)	Uncertain
Breath sounds after swallow	Clear	Wet	Uncertain
Respiratory rate after swallow	No change	Increased	Uncertain
Vocal quality after swallow	No change	Wet/dysphonic	Uncertain
Number of swallows heard per mouthful	Single swallow	Double swallow	Multiple (>2)
Laryngeal response	Overt cough	Throat clearing/'blowout'	None
Other audible sounds	'Flushing' sound prior to swallow	'Flushing' sound after swallow	
Aspiration Suspected?	YES ☐	NO ☐	
Need for further investigation?	YES ☐	NO ☐	

APPENDIX 6

SAMPLE OF FORMS FROM INTERRATER RELIABILITY TRIAL OF CERVICAL AUSCULTATION: THERAPISTS LISTENING TO LIVE RECORDINGS

CA Assessment Draft 2/Z Farrell/8 Jan 1998

SWALLOW ASSESSMENT WITH CERVICAL AUSCULTATION

Patient Name: C **SLT:** Zelda **DATE:**

FACTORS: FLUID CONSISTENCY	SIGNS		
Breath sounds before swallow	Clear	Wet	Uncertain
Swallow sounds during swallow	Crisp	Dulled	Uncertain
Apnoea during swallow	<1sec	> 1sec	Uncertain
Direction of breathflow after swallow	Inspiration	Expiration	Uncertain
Timing of swallow	Normal (3sec)	Delayed (>3sec)	Uncertain
Breath sounds after swallow	Clear	Wet	Uncertain
Respiratory rate after swallow	No change	Increased	Uncertain
Vocal quality after swallow	No change	Wet/dysphonic	Uncertain
Number of swallows neard per mouthful	Single swallow	Double swallow	Multiple (>2)
Laryngeal response	Overt cough	Throat clearing/'blowout'	None
Other audible sounds	'Flushing' sound prior to swallow	'Flushing' sound after swallow	
Aspiration Suspected?	YES ☐	NO ☐	
Need for further investigation?	YES ☑	NO ☐	
SEMISOLID CONSISTENCY			
Breath sounds before swallow	Clear	Wet	Uncertain
Swallow sounds during swallow	Crisp	Dulled	Uncertain
Apnoea during swallow	<1sec	> 1 sec	Uncertain
Direction of breathflow after swallow	Inspiration	Expiration	Uncertain
Timing of swallow	Normal (3sec)	Delayed (>3sec)	Uncertain
Breath sounds after swallow	Clear	Wet	Uncertain
Respiratory rate after swallow	No change	Increased	Uncertain
Vocal quality after swallow	No change	Wet/dysphonic	Uncertain
Number of swallows heard per mouthful	Single swallow	Double swallow	Multiple (>2)
Laryngeal response	Overt cough	Throat clearing/'blowout'	None
Other audible sounds	'Flushing' sound prior to swallow	'Flushing' sound after swallow	
Aspiration Suspected?	YES ☐	NO ☐	
Need for further investigation?	YES ☑	NO ☐	
OTHER CONSISTENCY			
Breath sounds before swallow	Clear	Wet	Uncertain
Swallow sounds during swallow	Crisp	Dulled	Uncertain
Apnoea during swallow	<1sec	> 1 sec	Uncertain
Direction of breathflow after swallow	Inspiration	Expiration	Uncertain
Timing of swallow	Normal (3sec)	Delayed (>3sec)	Uncertain
Breath sounds after swallow	Clear	Wet	Uncertain
Respiratory rate after swallow	No change	Increased	Uncertain
Vocal quality after swallow	No change	Wet/dysphonic	Uncertain
Number of swallows heard per mouthful	Single swallow	Double swallow	Multiple (>2)
Laryngeal response	Overt cough	Throat clearing/'blowout'	None
Other audible sounds	'Flushing' sound prior to swallow	'Flushing' sound after swallow	
Aspiration Suspected?	YES ☐	NO ☐	
Need for further investigation?	YES ☐	NO ☐	

SWALLOW ASSESSMENT WITH CERVICAL AUSCULTATION

Patient Name: C **SLT:** Maeve **DATE:**

FACTORS: FLUID CONSISTENCY	SIGNS		
Breath sounds before swallow	(Clear)	Wet	Uncertain
Swallow sounds during swallow	Crisp	(Dulled)	Uncertain
Apnoea during swallow	<1sec	> 1 sec	Uncertain
Direction of breathflow after swallow	Inspiration	(Expiration)	Uncertain
Timing of swallow	Normal (3sec)	(Delayed (>3sec))	Uncertain
Breath sounds after swallow	Clear	Wet	(Uncertain)
Respiratory rate after swallow	No change	(Increased) Slight	Uncertain
Vocal quality after swallow	(No change)	Wet/dysphonic	Uncertain
Number of swallows neard per mouthful	Single swallow	Double swallow	(Multiple (>2))
Laryngeal response	Overt cough	Throat clearing/'blowout'	(None)
Other audible sounds	(prior to swallow)	'Flushing' sound after swallow	
Aspiration Suspected?	YES Z ?	NO ☐	
Need for further investigation?	YES Z	NO ☐	
SEMISOLID CONSISTENCY			
Breath sounds before swallow	(Clear)	Wet	Uncertain
Swallow sounds during swallow	Crisp	(Dulled)	Uncertain
Apnoea during swallow	<1sec	> 1 sec	Uncertain
Direction of breathflow after swallow	Inspiration	(Expiration)	Uncertain
Timing of swallow	Normal (3sec)	Delayed (>3sec)	(Uncertain)
Breath sounds after swallow	Clear	Wet	(Uncertain)
Respiratory rate after swallow	No change	(Increased)	Uncertain
Vocal quality after swallow	(No change)	Wet/dysphonic	Uncertain
Number of swallows heard per mouthful	Single swallow	Double swallow	(Multiple (>2))
Laryngeal response	Overt cough	Throat clearing/'blowout'	(None)
Other audible sounds	'Flushing' sound prior to swallow	'Flushing' sound after swallow	
Aspiration Suspected?	YES ☐	NO ☐	
Need for further investigation?	YES Z	NO ☐	
OTHER CONSISTENCY			
Breath sounds before swallow	Clear	Wet	Uncertain
Swallow sounds during swallow	Crisp	Dulled	Uncertain
Apnoea during swallow	<1sec	> 1 sec	Uncertain
Direction of breathflow after swallow	Inspiration	Expiration	Uncertain
Timing of swallow	Normal (3sec)	Delayed (>3sec)	Uncertain
Breath sounds after swallow	Clear	Wet	Uncertain
Respiratory rate after swallow	No change	Increased	Uncertain
Vocal quality after swallow	No change	Wet/dysphonic	Uncertain
Number of swallows heard per mouthful	Single swallow	Double swallow	Multiple (>2)
Laryngeal response	Overt cough	Throat clearing/'blowout'	None
Other audible sounds	'Flushing' sound prior to swallow	'Flushing' sound after swallow	
Aspiration Suspected?	YES ☐	NO ☐	
Need for further investigation?	YES ☐	NO ☐	

SWALLOW ASSESSMENT WITH CERVICAL AUSCULTATION

Patient Name: C **SLT:** Emir **DATE:**

FACTORS: FLUID CONSISTENCY	**SIGNS**		
Breath sounds before swallow	Clear	(Wet)	Uncertain
Swallow sounds during swallow	Crisp	(Dulled)	Uncertain
Apnoea during swallow	(<1sec)	> 1 sec	Uncertain
Direction of breathflow after swallow	(Inspiration)	Expiration	Uncertain
Timing of swallow	(Normal (3sec))	Delayed (>3sec)	Uncertain
Breath sounds after swallow	Clear	(Wet)	Uncertain
Respiratory rate after swallow	(No change)	Increased	Uncertain
Vocal quality after swallow	(No change)	Wet/dysphonic	Uncertain
Number of swallows neard per mouthful	(Single swallow)	Double swallow	Multiple (>2)
Laryngeal response	Overt cough	Throat clearing/'blowout'	(None)
Other audible sounds	'Flushing' sound prior to swallow	'Flushing' sound after swallow	
Aspiration Suspected?	YES ☐	NO ☑	
Need for further investigation?	YES ☐	NO ☑	
SEMISOLID CONSISTENCY			
Breath sounds before swallow	Clear	(Wet)	Uncertain
Swallow sounds during swallow	Crisp	(Dulled)	Uncertain
Apnoea during swallow	<1sec	(> 1 sec)	Uncertain
Direction of breathflow after swallow	Inspiration	Expiration	(Uncertain)
Timing of swallow	Normal (3sec)	(Delayed (>3sec)) intermittently	Uncertain
Breath sounds after swallow	Clear	(Wet)	Uncertain
Respiratory rate after swallow	No change	(Increased)	Uncertain
Vocal quality after swallow	(No change)	Wet/dysphonic	Uncertain
Number of swallows heard per mouthful	Single swallow	(Double swallow)	Multiple (>2)
Laryngeal response	Overt cough	Throat clearing/'blowout'	(None)
Other audible sounds	'Flushing' sound prior to swallow	'Flushing' sound after swallow	
Aspiration Suspected?	YES ☐	NO ☐ ? Residue	
Need for further investigation?	YES ☑ Repeat auscultation	NO ☐	
OTHER CONSISTENCY			
Breath sounds before swallow	Clear	Wet	Uncertain
Swallow sounds during swallow	Crisp	Dulled	Uncertain
Apnoea during swallow	<1sec	> 1 sec	Uncertain
Direction of breathflow after swallow	Inspiration	Expiration	Uncertain
Timing of swallow	Normal (3sec)	Delayed (>3sec)	Uncertain
Breath sounds after swallow	Clear	Wet	Uncertain
Respiratory rate after swallow	No change	Increased	Uncertain
Vocal quality after swallow	No change	Wet/dysphonic	Uncertain
Number of swallows heard per mouthful	Single swallow	Double swallow	Multiple (>2)
Laryngeal response	Overt cough	Throat clearing/'blowout'	None
Other audible sounds	'Flushing' sound prior to swallow	'Flushing' sound after swallow	
Aspiration Suspected?	YES ☐	NO ☐	
Need for further investigation?	YES ☐	NO ☐	

APPENDIX 7

STATISTICAL CALCULATIONS FOR SENSITIVITY AND SPECIFICITY OF SWALLOW SCREENING TEST

Nurses	Trained?	Kappa	s.e.	From	To	Sensitivity	Specificity	PPV	NPV
jr	N	0.243243		-0.17722	0.663703	0.461538462	1	1	0.3
em	N	0.25		-0.2521	0.752101	0.285714286	1	1	0.5
pg	N	0.272727		-0.30921	0.854667	0.4	0.8571429	0.666667	0.666667
cmk	Y	0.541667		-0.03291	1.116243	0.666666667	0.875	0.666667	0.875
n1	Y	0.090909		-0.59919	0.781004	0.833333333	0.25	0.625	0.5
n5	Y	0.5		-0.10012	1.100125	1	0.5	0.666667	1
n9	Y	1		1	1	1	1	1	1
n14	Y	0.5		-0.10012	1.100125	0.666666667	1	1	0.5

Untrained

Kappa	0.255324		-0.24618	0.756823
Sensitivity	0.382418	0.134786	0.118237	0.646598
Specificity	0.952381	0.059064	0.836615	1
PPV	0.888889	0.087163	0.71805	1
NPV	0.488889	0.138641	0.217153	0.760625

Trained

kappa	0.526515		0.033531	1	pop. proportion	s.e.	pt-pu	z	Probability
Sensitivity	0.833333	0.121554	0.595087	1	0.607875458	0.2090296	0.450916	2.157186	0.031
Specificity	0.725	0.145637	0.439552	1	0.838690476	0.1574778	0.227381	1.443892	0.15
PPV	0.791667	0.132461	0.532044	1					
NPV	0.775	0.1362	0.508047	1					