Intake of thickened liquids by hospitalized adults with dysphagia after stroke

JO MURRAY[1,2], MICHELLE MILLER[1], SEBASTIAN DOELTGEN[1] & INGRID SCHOLTEN[1]

1. Flinders University, Adelaide, Australia

2. Hampstead Rehabilitation Centre, Adelaide, Australia

Correspondence to: Jo Murray, Speech Pathology and Audiology, Faculty of Health Sciences, Flinders University, GPO Box 2100, Adelaide SA 5001 AUSTRALIA, Email: jo.murray@health.sa.gov.au

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Abstract

There is widespread concern that individuals with dysphagia as a result of stroke do not drink enough fluids when they are prescribed thickened liquids. This paper details a retrospective audit of thickened liquid consumption of 69 individuals with dysphagia following stroke in acute and rehabilitation hospitals in Adelaide, South Australia. Hospitalized individuals with dysphagia following stroke drank a mean of 781ml (*SD* = 507ml) of prescribed thickened liquids per day, significantly less in the acute setting (*M* = 519ml, *SD* = 305ml) than in the rehabilitation setting (*M* = 1274ml, *SD* = 442ml) (*t* (67)= -8.34, *p* <0.001). This daily intake of thickened liquids was lower than recommended standards of fluid intake for hospitalized adults. Fluid intake could be increased with definitive protocols for the provision and

monitoring of consumption of thickened liquids, by offering more fluid via food or free water protocols or by routine use of non-oral supplementary routes. Future research into the effectiveness of such recommendations needs to evaluate not only the impact on fluid intake but also on health outcomes.

Introduction

Dysphagia, or difficulty swallowing, is a common consequence of stroke, with incidences reported to be between 37% and 78% of adults post-stroke (Martino, Foley, Bhogal, Diamant, Speechley, & Teasell, 2005). There is concern that individuals with dysphagia may be at risk of malnutrition and dehydration as a result of decreased food and fluid intake (Foley, Martin, Salter, & Teasell, 2009). Malnutrition and dehydration have an enormous impact on physical and cognitive function, recovery and quality of life, with greater susceptibility to low blood pressure, falls, pressure ulcers, infection and organ failure (Weinberg, Minaker, & American Medical Association Council on Scientific Affairs, 1995). Furthermore, dehydration has a known negative impact on hospitalisation rates, length of stay and ultimately on health care costs (American Medical Directors Association, 2001 Reviewed 2007). Following stroke, dehydration may affect the ischaemic penumbra, induce neurological deterioration, influence the evolution of the stroke itself (Britton, de Faire, & Helmers, 1980) and is strongly associated with an increased risk of venous thromboembolism (Kelly, Hunt, Lewis, Swaminathan, Moody, & Seed, 2004), and stroke mortality (Bhalla, Sankaralingam, Dundas, Swaminathan, & Wolfe, 2000).

Stroke is more prevalent in the elderly (National Centre for Monitoring Cardiovascular Disease, 2004) and they may be particularly vulnerable to the effects of dysphagia following

stroke due to the age related changes to swallowing, termed presbyphagia (Logemann, Pauloski, Rademaker, & Kahrilas, 2002; Logemann, Pauloski, Rademaker, Colangelo, Kahrilas, & Smith, 2000; Robbins, Duke Bridges, & Taylor, 2006). Dysphagia also compounds the sensory and physiological changes of swallowing function experienced by people who are getting older, e.g. reduced perception of thirst, a lower percentage of total body water and a reduced ability of the kidneys to concentrate urine (Bennett, 2000), increasing the risk for dehydration. In addition, some elderly people have a greater use of medications affecting water losses, particularly diuretics, sedatives, antipsychotics, tranquilizers, and non-steroidal anti-inflammatory drugs (Lavizzo-Mourey, Johnson, & Stolley, 1988). External factors such as the environmental temperature, amount of physical activity and even involuntary activity due to tremors and dystonias may also affect hydration status (Grandjean, 2005). For these reasons, the fluid requirements for each individual to maintain an adequate degree of hydration vary considerably.

Despite these concerns for the hydration status of the elderly, healthy and independent older individuals drink just as much as younger individuals (Bastiaansen & Kroot, 2000; Bossingham, Carnell, & Campbell, 2005). These findings suggest that it is not age itself but rather the level of functional dependence and the number of medical conditions that impact fluid intake (Morgan, Masterton, Fahlman, Topp, & Boardley, 2003).

For the general healthy population fluid comes from a variety of sources including drinking water, other beverages and approximately 20% from food (Campbell, 2007). Nutrient reference values suggest that healthy men, who are generally heavier than women and therefore have greater fluid requirements, should consume between 2600 and 3000ml per day

from beverages alone, whereas healthy women should consume between 2100 to 2200ml per day (Australian National Health and Medical Research Council, 2005; Grandjean, 2005; Institute of Medicine of the National Academies, 2004). Many hospitals aim to provide at least 1500ml to 1600ml of fluid for their clients to drink per day, recognising that it is difficult to apply these standards to acutely ill individuals (Chidester & Spangler, 1997). This figure is based on the conservative needs of a 50-80 kg adult at 30mls per kilo (Armstrong-Esther, Browne, Armstrong-Esther, & Sander, 1996; Gasper, 1999; Holben, Hassell, Williams, & Helle, 1999).

To reduce the risk of aspiration in individuals who are hospitalized following stroke, speech-language pathologists may prescribe thickened liquids, a starch or gum based product mixed with thin liquids at specific ratios to produce a desired viscosity (Lazarus, Logemann, Rademaker, Kahrilas, Pajak, Lazar, & Halper, 1993; Logemann, 1998). Thickening a liquid reduces its flow rate, making it more cohesive and dense and consequently easier for many people to control intra-orally, thus preventing premature spillage into the pharynx (Hamlet, Choi, Zormeier, Shamsa, Stachler, & Muz, 1996; Huckabee & Pelletier, 1999). Studies confirm that thickening liquids reduces aspiration occurrence, particularly for people with dysphagia of a neurological origin (Bülow, Olsson, & Ekberg, 2003; Kuhlemeier, Palmer, & Rosenberg, 2001).

Of concern is that thickeners adversely affect the appearance and palatability of liquids, e.g. by changing taste and oral perception (Cichero, 2013; Mertz Garcia, Chambers, & Molander, 2005) and may require greater effort to be managed (Daniels, 2008; Groher, Crary, Carnaby, Vickers, & Aguilar, 2006). As a result, adults prescribed thickened liquids may not drink

sufficient amounts and the benefits of minimizing aspiration may not outweigh the risk of dehydration. Indeed, adults receiving non-oral (enteral or intravenous) feeding have been found to have a much higher fluid intake (3158ml) than individuals with dysphagia following stroke on an oral diet only, including thickened liquids (755ml) (Finestone, Foley, Woodbury, & Greene-Finestone, 2001). While this study is frequently cited as demonstrating the inadequacy of fluid intake of adults prescribed thickened liquids, the small participant numbers and variably accurate fluid intake monitoring limit the conclusiveness of these findings. Likewise, many adults with dysphagia in the acute setting are reported to only achieve their recommended fluid intake when receiving supplementary enteral or intravenous fluids. This was regardless of the level of thickness of the fluid prescribed for those on oral diets (Vivanti, Campbell, Suter, Hannan-Jones, & Hulcombe, 2009). In the studied individuals, the greatest source of fluid intake was from food, with the mean intake from thickened liquids being less than 400ml per day. Interestingly, in the rehabilitation context on average only 40% of thickened liquids offered was consumed (600ml of 1500ml) (Patch, Mason, Curcio-Borg, & Tapsell, 2003). Whelan (2001) documented that in an acute hospital setting individuals with dysphagia following stroke receiving either ready prepared pre-thickened drinks or hospital prepared powder-thickened drinks consumed on average 455ml, well below their fluid requirements.

Across these studies, the authors raise important concerns regarding the institutional frameworks in which thickened liquids are offered. For example, Whelan et al. (2001) report that individuals who were prescribed thickened liquids were offered only half of that offered to individuals on normal consistency drinks. Offering a greater amount of thickened liquids at mealtimes, when nursing staff are more available to assist individuals, may improve intake, as

opposed to relying on consumption at snack times when individuals are largely left to drink on their own (Patch, et al., 2003). Other recommendations included offering greater amounts of thickened liquids, with protocols for monitoring hydration (Finestone, et al., 2001) or providing more fluid dense food to individuals with known dysphagia for thin fluids (Vivanti, et al., 2009).These studies provide evidence that individuals who have dysphagia and are prescribed thickened liquids are at significant risk of insufficient oral fluid intake to meet their needs although few of them specifically compare differences in fluid intake across variables such as age, stroke severity, level of independence or level of care.

In order to improve fluid intake of individuals with dysphagia and combat the risk of dehydration, speech-language pathologists have developed the *free water protocol* (Panther, 2003) which allows individuals who are at known risk of aspirating thin fluid to drink water between meals under certain conditions, including the maintenance of good oral hygiene. In three randomised control trials conducted in inpatient rehabilitation settings with mixed clinical populations, individuals in the free water protocol groups had greater fluid intake than those in the thickened liquids only group (Carlaw, Finlayson, Beggs, Visser, Marcoux, Coney, & Steele, 2012; Garon, Engle, & Ormiston, 1997; Karagiannis, Chivers, & Karagiannis, 2011). However, none of these studies investigated the fluid intake from thickened liquids in a stroke specific population across both the acute and rehabilitation inpatient settings. They also did not specifically analyse the variation in fluid intake with factors such as age or independence level.

Therefore, the purpose of the present study was to measure the thickened liquid intake of individuals with dysphagia following stroke who had been prescribed thickened liquids.

These individuals had been hospitalized in acute and rehabilitation settings. It also examined whether the amount of intake was associated with any particular demographic or clinical factors such as age or level of independence of participants. We hypothesised that mean thickened liquid intake of adults hospitalized in an acute setting would be less than that of individuals hospitalized in a rehabilitation setting due to a stronger focus of fluid supplementation in the early post-stroke phase and acuity of stroke and dysphagia.

Methods

Design: The study was conducted as a retrospective audit of medical records of adults who had been admitted due to stroke and subsequently diagnosed with dysphagia. Ethics approval was obtained from the Ethics committees governing human research at the hospitals involved. Medical records of the identified individuals were audited by the first author and three final year speech-language pathology students. Information from the medical records such as gender, age, severity of stroke and the presence of supplementary non-oral feeding/hydration and the primary measure of thickened liquid consumption was recorded.

Inclusion/Exclusion criteria: Records were included of people who had been hospitalized with a primary admission diagnosis of stroke, who had been assessed as being at risk of aspirating thin fluids and who had been prescribed thickened liquids by their speech-language pathologist. Records were excluded if there were no fluid balance charts available or if less than two days of thickened liquid consumption had been recorded. Of 72 records screened, three were excluded as they had fewer than two days of fluid intake recorded. The profile of the 69 participants whose data proceeded to analysis is illustrated in Table 1.

Participant characteristics: Of the 69 participants, 45 (65%) were from four acute hospitals and 24 (35%) from three inpatient rehabilitation facilities. The sample was consistent with hospitalized stroke populations (National Stroke Foundation, 2009) with men and women fairly equally represented and the majority of participants falling into the older age range with a mean age of 78 years (*SD* 12.3 years). For the purposes of analysis, participants were grouped into age ranges that are commonly used in the literature to represent younger adults (up to 64 years), the older population (65 to 75 years) and the elderly (over 75 years). The majority of participants (77%) in both the acute and rehabilitation settings were in the over 75 year age group.

Severity of stroke for the participants in the acute hospitals was estimated using the National Institute of Stroke Severity (NIHSS) scale which rates level of consciousness, ability to follow commands, motor weakness, sensation, speech and language, gaze and vision to obtain a total score from 0 to 42; the higher the score, the more severe the stroke presentation. The NHISS provides four severity groupings based on scores but due to small numbers of participants in this sample with an NIHSS score, these four groups were collapsed into two groups by the authors; mild to moderate (scores 0 to 15) and severe (scores 16 to 42). In this sample only 31% (n = 14) of the 45 participants in the acute hospitals were allocated an NIHSS score; the mean (*SD*) was 14.7 (7.1), with 18% (n = 8) classified as severe and 13% (n = 6) classified as mild to moderate.

In the rehabilitation setting, the Functional Independence Measure (FIM) is used to measure

an individual's independence in functional areas such as eating, mobility, dressing, toileting, speaking and problem solving. A total score from 18 to 126 is obtained; a higher score representing greater independence. In this sample only 8 of the 24 participants from rehabilitation hospitals had a FIM score recorded in their medical records; the mean FIM score was 59.6 (*SD* = 26.8).

Supplementary feeding and /or hydration was marked as *present* if a percutaneous endoscopic gastrostomy (PEG), naso-enteric tube (NET) or intravenous therapy (IVT) was in use as evidenced by regular input in the non-oral column of the fluid balance chart (FBC) along with dated entries in the medical records. In this sample 55% (*n* = 38) had supplementary non-oral feeding and/or hydration, the majority of which (*n* = 34) were located in the acute settings.

Outcome measurement: The thickened liquid intake from a minimum of two days of FBCs was recorded for each identified participant. Fluid balance charts contain a record of fluid consumed from both oral and non-oral sources along with a record of fluid output from urine and vomiting. They are a tool that is familiar to nursing staff but it is generally acknowledged that nursing staff frequently use estimates rather than objectively measuring amounts of fluids offered and consumed. Participants' FBCs were not included if they were incomplete (e.g., a full nursing shift missing, or patient discharged half-way through 24 hour period). The computation of totals recorded on the FBCs was checked for accuracy by the researchers. Fluids that were included in the total intake recorded in this study were those that were thickened beverages (water, cordial, coffee, tea, flavoured milk, fruit juices, high energy drinks). Not included were fluids that begin as foods (i.e., soups, custards, ice-cream or yoghurt). In addition, the consumption of water or ice chips, a practice that varied across hospital settings, was also not included. Unfortunately, for one of the rehabilitation sites an

aggregate of fluid intake per day was the only record available on a single observation chart. The individual FBCs had been discarded and could therefore not be examined by the researchers for drinks included, nor checked for calculation accuracies. The aggregated totals may have been inflated by foods such as soup or yoghurts. For this reason, statistical analyses were performed on the complete data sample as well as the sub-sample that did not contain the data from this hospital.

Analysis: The average thickened liquid intake from two days of consumption (those days closest to cessation of thickened liquids) was calculated to allow a consistent approach for each participant and represent the best case scenario for participants; that is, when their consumption of fluids would be at its best. The means and standard deviations (*SD*) of thickened liquid intake were calculated from the total sample and from sub-samples based on level of care. An analysis of variables including age, gender and stroke severity with the 2-day average fluid intake was undertaken using a one-way ANOVA and two tailed independent sample t-tests. A two-way ANOVA was performed to analyse the interaction effect of two independent variables, gender and age range, on average thickened liquid consumption (Field, 2009). Significance was set at $p < 0.05$. The distribution of intake between acute and rehabilitation settings was highly variable but when considered as two separate sub-samples, acute and rehabilitation, the data were normally distributed and thus were analysed further using parametric statistics.

Results

Acute versus Rehabilitation settings

The mean thickened liquid consumption for the total sample (n = 69) was 781ml (SD = 507ml). The mean thickened liquid consumption for those in the four acute hospitals was 519ml (SD = 305ml). This was significantly lower than the intake of those in the three rehabilitation hospitals, with a mean of 1274ml (SD = 442ml) (t (67) = -8.34, p <0.001). When the rehabilitation centre which provided only an aggregated figure of fluid intake was removed from the analysis, there was still a significant difference in mean thickened liquid intake between participants in the acute setting compared to the rehabilitation setting (519ml and 901ml, respectively) (t (51) = -.2.58, p = 0.013). Figure 1 illustrates the significant differences in fluid intake between participants in the acute settings and those in rehabilitation.

There was also a significant difference in thickened liquid intake between participants with or without supplementary non-oral feeding/hydration (t (67) = -4.87, p < 0.001); those receiving supplementary intake (M = 549ml, SD = 401ml) drinking less than those without supplementation (M = 1066ml, SD = 483). These data are illustrated in Table 1.

Acute settings

Gender: There was no significant difference in mean thickened liquid intake between men (M = 541ml, SD = 278ml) and women (M = 496, SD = 336) in the acute setting (t (43) = 0.487, p = 0.629).

Age: There was a significant difference in mean intake between age groups in the acute setting (F (2,42) = 4.699, p = 0.014), with those in the younger age group (41 to 64 years, n = 8) consuming a greater amount of thickened liquid (M = 795ml, SD = 250ml) when compared

directly to the older age group (65 to 75 years, $n = 7$, $M = 487$ml, $SD = 247$ml) and the elderly (over 75 years, $n = 30$, $M = 452$ml, $SD = 296$ml). According to the *Tukey* post hoc test, the most significant difference occurred between the younger age group and the elderly ($p = 0.011$).

Gender and age range: A two-way ANOVA confirmed that, in the interaction between age and gender, the significant independent variable impacting thickened liquid intake was the age of the participant; people in the older age groups consuming significantly less than those in the younger age group (F (2,39) = 5.380, $p = 0.009$). Again the Tukey post hoc test revealed this difference was most significant between the younger (41 to 64 year olds) and elderly age groups (>75 years) ($p = 0.012$). The less stringent Least Significant Difference post hoc test also revealed a significant difference between the younger age group (41to 64 year olds) and both the older age group (65 to 75 year olds) and the elderly (>75 years) ($p = 0.044$ and 0.005 respectively). The difference in thickened liquid consumption by the various age groups is illustrated in Figure 2.

Severity of stroke: There was no significant difference in intake between those with a severe stroke ($M = 478$ml, $SD = 268$ml) and those with a mild to moderate stroke ($M = 507$ml, $SD = 279$ml) (t (12) = 0.199, $p = 0.845$).

Supplementary feeding/hydration: A direct comparison of the intake of the 76% of participants on supplementary feeding/hydration in the acute settings ($M = 488$ml, $SD = 300$ml) with the 24% of participants who were not ($M = 613$ml, $SD = 314$ml) revealed no significant difference (t (43) = -1.183, $p = 0.243$), although the trend was for those on supplementary feeding/hydration to drink less. See Table 1 for these data.

Rehabilitation settings

Gender and age range: A two-way ANOVA revealed no significant difference in thickened liquid intake between participants in rehabilitation based on gender or age range or the interaction between both of these factors (F (1,20) = 0.088, p = 0.770) and age range (F (2,20) =1.398, p = 0.270). No further analysis was conducted for this sub-sample as numbers of participants whose FIM scores were recorded or who were on supplementary feeding were small.

Discussion

The findings from this study of thickened liquid consumption from medical record audit indicate that individuals with dysphagia following stroke drink inadequate amounts of thickened liquids to meet their estimated fluid requirements. The average daily intake of thickened liquids of 781mls by participants across acute and rehabilitation settings was only half the amount hospital inpatients are intended to consume (1500ml - 1600ml) and well below the recommended intake for the general community (2100ml for women and 2600ml for men) (Australian National Health and Medical Research Council, 2005).

This study contributes to the current literature in that it evaluated fluid intake of individuals with dysphagia following stroke employing the same methodology across acute and rehabilitation settings. Of greatest significance is, therefore, the disparity between the thickened liquid intake of participants in these settings; an average intake of 519ml per day in the acute setting versus 1274ml per day in the rehabilitation setting. It is hypothesised that the difference in oral fluid intake may be due to the impact of the stroke itself on consciousness,

physical ability or the severity of dysphagia, with individuals likely to have more severe dysphagia in the acute period post-stroke with improving function over time (Smithard, O'Neill, England, Park, Wyatt, Martin, & Morris, 1997). Hospitalized individuals are only selected for transfer to a rehabilitation setting when they are medically stable and at a certain overall level of function. An alternative explanation relates to the institutional frameworks in which acute and rehabilitation settings operate. Acute hospitals are focussed on investigation of stroke causes and prevention of further events and complications. An individual's sub-optimal fluid intake in the acute setting is likely to be addressed by medical intervention such as supplementary feeding/hydration, a situation supported by the data in this study, as a far greater number of participants in the acute setting were on supplementary feeding/hydration compared to those in the rehabilitation setting. In contrast, there is a much stronger focus in the rehabilitation setting to 'normalise' or 'maximise' an individual's function. Individuals with sub-optimal intake may be more likely to be encouraged by staff to drink more in the first instance to improve oral fluid intake (Kayser-Jones, Schell, Porter, Barbaccia, & Shaw, 1999). Furthermore, as an individual becomes more functionally adept and transitions to the rehabilitation setting, they may be more able to access drinks independently and in a greater variety of settings (bedside, dining room, therapy area, and kiosk) than in the acute setting where fluids are often only available at the bedside. Finally, individuals in a rehabilitation setting are often more active than those in an acute hospital (West & Bernhardt, 2012) which may be a physiological driver of greater fluid intake.

Acute setting

The finding of poor oral beverage intake in the acute setting (average daily intake of 519ml of thickened fluids) compares very closely with two previous studies conducted in acute settings;

400ml per day (Vivanti, et al., 2009) and 455ml per day (Whelan, 2001). The present study used fluid balance charts from days closest to cessation of thickened fluids to represent the best possible intake scenario which may explain why the intake in the present study was somewhat higher.

There was no significant difference in the intake between male and female participants in the acute setting. It is possible that the participants' dysphagia, their common dislike of thickened liquids, or the common system on which they rely for fluid provision resulted in equally sub-optimal oral fluid intake for both genders. This may be particularly concerning for the male participants as their biological need for fluid is likely greater.

Of interest is the effect of age on the mean daily thickened liquid consumption in the acute setting. In this sample those in the older age group (65-75 years) and elderly age group (>75 years) drank significantly less than those in the younger age group (41-64 years). Aging itself is known to negatively affect swallowing and older individuals may therefore be less able than their younger counterparts to compensate for their stroke-related dysphagia. In addition, older participants are more likely than their younger counterparts to have co-morbidities which are known to impact swallowing, such as congestive cardiac failure, chronic obstructive airways disease, gastro-oesophageal reflux disease. This finding confirms that hospitalized older and elderly individuals prescribed thickened liquids due to dysphagia are at greater risk of poor oral fluid intake.

With regard to the stroke severity itself, there was no significant difference in the intake

between those with a severe stroke compared to those with a mild to moderate stroke severity. There was, however, a general trend for those who were more severely affected by their stroke to drink less. It is noteworthy that only 14 (31%) of the acute sample were assigned a stroke severity score. Therefore the results of this study cannot draw definitive conclusions regarding the effect of stroke severity on fluid intake.

Most of the acute participants in the present study (76%) received supplementary non-oral feeding/hydration some or all of the time. This is the most common way to address fluid intake shortfall in the acute setting where individuals are more likely to be medically unstable and less mobile. It is concerning for several reasons that the remaining 24% of acute participants who did not receive supplementary non-oral feeding/hydration consumed grossly sub-optimal amounts, at an average of 613ml. Perhaps the participants not on supplementary non-oral feeding/hydration were showing signs of rapid clinical improvement of their swallowing and it was considered that supplementation was not required. The treating clinical team may have assumed that without supplementation the physiological need for fluid would be greater and would drive oral consumption of fluids, but results would indicate they needed to be supported to maximise their oral fluid intake.

Rehabilitation setting

The average thickened liquid intake per day for participants in the rehabilitation setting in this present study was 1274ml. This is very similar to thickened liquid intake quoted in the literature by other studies conducted in the rehabilitation setting, namely 1210ml (Garon, et al., 1997), 1474ml (Carlaw, et al., 2012) and 1378ml (Karagiannis, et al., 2011). Whilst this

amount of thickened liquid intake is closer to optimal compared to studies of intake conducted in the acute setting, it is still well below that recommended for the general population. In the three studies cited above, intake was higher under the free water protocol condition compared with the thickened liquid only condition. There is stronger evidence for implementing free water protocols safely in the rehabilitation setting than in the acute setting. As such, these protocols may be a way of increasing total fluid intake for individuals with dysphagia in rehabilitation settings. In this setting individuals are more likely to be progressing towards independence with self-care, including attending to oral hygiene and therefore more compliant with the strict conditions required for safe implementation of a free water protocol.

Limitations

The findings of this study have limitations inherent in the use of a retrospective audit by depending on the accuracy of recordings on FBCs by nursing staff. In order to minimise inaccuracies, incomplete FBCs were excluded from analysis but it was not possible to check the accuracy of the data that were included. The intake of participants in one rehabilitation site may be marginally inflated as only the aggregated intake figures could be used and any inclusions of soup, custard, yoghurt etc. could not be rejected. In recognition of this limitation and in order to avoid bias from this hospital's figures, fluid intake was re-analysed without the data from this hospital. The results reported here were not significantly affected by these aggregate figures (the differences that were significant using the total rehabilitation sample remained significant without these data included). Another limitation of the study is that the participants' medical acuity/stability was not recorded. It is likely that some participants, particularly in the acute sample, may have been medically unstable, or even been palliative which would have significantly affected fluid intake or requirements, but there was no

examination of this in our study. Of note, some of the sub-samples included small numbers of participants. As such, the findings of these analyses are preliminary in nature and warrant further prospective evaluation. Whilst the authors acknowledge these confounding factors, this study was designed to capture a snapshot of current thickened liquid intake across acute and rehabilitation settings to inform a larger prospective study of intake and hydration of hospitalized individuals following stroke. Its results add to the knowledge of oral fluid intake by an at risk population upon which future research can be based.

Future research

Future research is warranted to evaluate ways to improve the fluid intake of individuals with dysphagia following stroke, especially in the acute setting and particularly for the elderly. Changes to care protocols are critical to ensure intake is monitored and actions are taken when inadequate intake is recognised. These actions may include providing increased amounts of thickened liquid per day, improved access to drinks at the bedside and increased responsibility of nursing staff to regularly offer, observe and record consumption. Alternatives such as the implementation of free water protocols or routine use of supplementary non-oral hydration could be trialled. All of these actions will require prospective evaluation, to ensure they are effective in improving fluid intake and sustainable and cost-effective for the hospital. Ideally, evaluation would include a measure of how these actions impact not only individuals' fluid intake but also their overall health outcomes.

Conclusion

This study confirms that individuals with dysphagia following stroke in both the acute and

rehabilitation settings of one Australian city do not consume enough thickened liquids to meet estimated fluid requirements. This is of particular concern in the acute setting if supplementary non-oral feeding or hydration is not in place. The preliminary data of this study suggest that the people who are older are particularly at risk of poor oral fluid intake in the acute setting. Even people in the rehabilitation setting who are generally medically stable do not drink recommended amounts.

Declaration of interest: The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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Table 1 Thickened liquid intake of hospitalized individuals following stroke according to various demographics and clinical presentations

		Total sample		Acute		Rehabilitation	
		N (%)	**Mean (SD) ml**	**N (%)**	**Mean (SD) ml**	**N (%)**	**Mean (SD) ml**
Total		69 (100)	781 (507)	45 (65)	519 (305)*	24 (35)	1274 (442)*
Gender	**Male**	38 (55)	825 (538)	23 (51)	541 (278)	15 (63)	1262 (554)
	Female	31 (45)	727 (470)	22 (49)	496 (336)	9 (37)	1293 (154)
Age Range (years)	**41-64**	11 (16)	981 (576)	8 (18)	795 (250)^+	3 (12)	1476 (966)
	65-75	12 (17)	700 (340)	7 (15)	487 (247)^	5 (21)	998 (190)
	>75	46 (77)	755 (524)	30 (67)	452 (296)^+	16 (67)	1316 (363)
Acute Severity	**Mild to Moderate**	N/A	N/A	6 (13)	507 (279)	N/A	N/A
	Severe	N/A	N/A	8 (18)	478 (268)	N/A	N/A
Presence of non-oral supplementary feeding/hydration	**Yes**	38 (55)	549 (401)#	34 (76)	488 (300)	4 (17)	1062 (771)
	No	31 (45)	1066 (483)#	11 (24)	613 (314)	20 (83)	1316 (363)

N (%) = number of participants in the sample (percentage of the sample this represents)

Mean (SD) = Mean thickened liquid intake in millilitres (standard deviation)

* the mean intake of thickened liquids by participants in the acute settings was significantly lower than participants in rehabilitation settings ($p < 0.001$)

^ there was a significant difference in intake between all age groups in the acute setting ($p = 0.014$)

+ this difference was particularly marked between the younger age group and the elderly ($p < 0.011$)

thickened liquid intake for participants on supplementary non-oral feeding/hydration was significantly lower than those who weren't ($p < 0.001$)

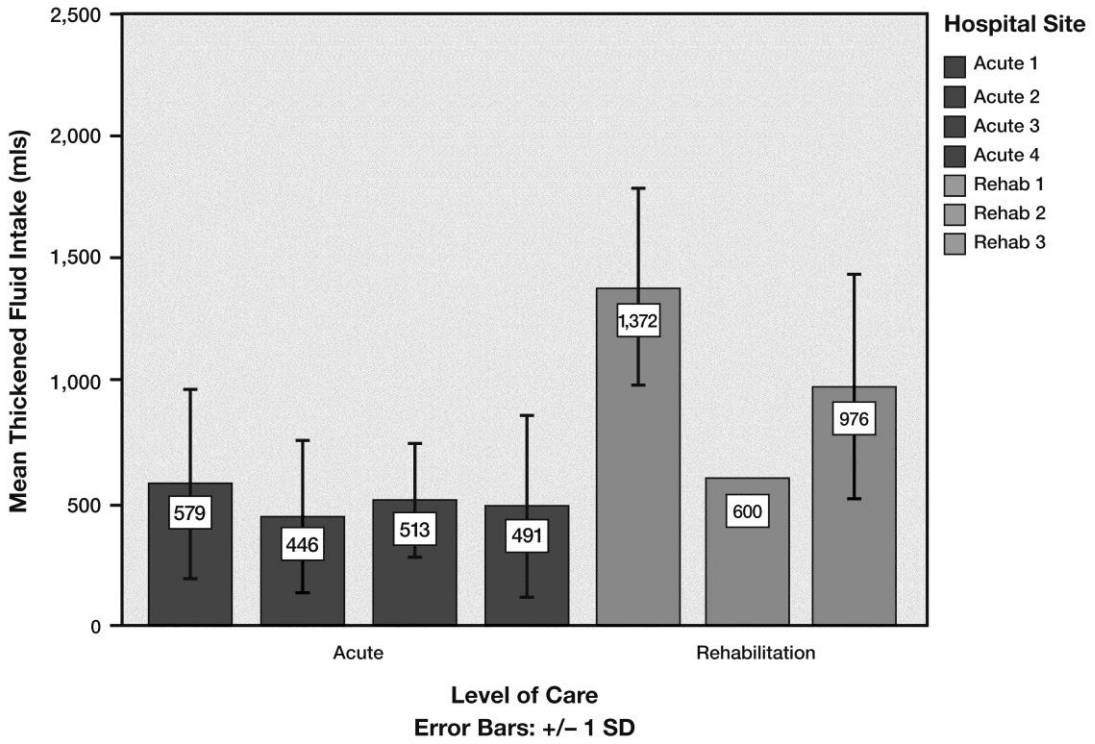

Figure 1 Thickened liquid consumption of individuals following stroke in acute hospitals and rehabilitation centres

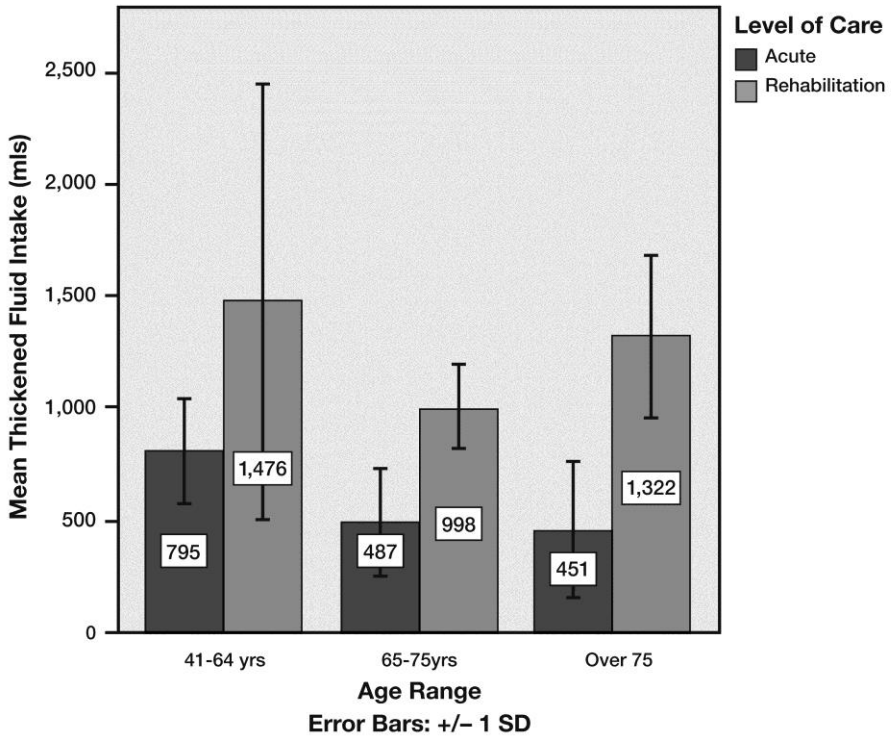

Figure 2 Thickened liquid consumption of younger, older and elderly age groups in acute hospitals and rehabilitation centres