Keywords: Fluid balance/Fluid intake/Older people/Measurement/Estimates

●This article has been double-blind peer reviewed

A pilot study explored how accurately nurses and care staff were able to estimate patient fluid intake by looking at residual fluid left in different containers

Nursing staff's ability to gauge fluid intake

In this article...

- Why good hydration is essential to maintain patients' health
- Pilot study on the accuracy of fluid volume measuring
- Why staff might find it difficult to measure fluid intake

Author Chris Tattersall is adult nurse and research and development manager, Hywel Dda University Health Board.

Abstract Tattersall C (2016) Nursing staff's ability to gauge fluid intake. *Nursing Times;* 112: 45/46, 19-21.

Patients, especially older ones, must stay well hydrated, but there is little data on how accurately nursing and care staff are able to measure fluid intake. To begin generating this evidence, 123 nurses and carers working in various hospitals and nursing homes were asked to evaluate the volumes of fluid drunk by a fictitious patient by looking at the residual fluid left in six commonly used containers. Only 25% of estimates were within the acceptable error margin of 10%, with no significant differences between professions or settings. This article describes the study methods and outcomes, as well as the conclusions that can be drawn from it.

Dehydration can have serious effects on patients' health so the ability to accurately gauge fluid intake is a crucial skill for nursing and care staff. Inaccurate measurement of fluid intake will decrease the accuracy of fluid balance charts, with potentially significant consequences. This study aimed to explore how accurately these staff estimate patients' fluid intake.

Why measure fluid intake?

Accurately recording fluid balance – that is, fluid input versus fluid output – is a crucial aspect of the nurse's role because good hydration is important for maintaining patients' health. This is particularly the case when monitoring patients who have renal disease (Gulanick and Myers, 2007), and also older people.

In older people, there are compounding factors that can reduce the intake of fluids. These may include:

- Fear of incontinence;
- Dementia;
- Frailty;
- Reliance on others;
- Reduced thirst sensation can cause them to drink less (Shepherd, 2011).

Factors such as medications (for example, laxatives and diuretics), the reduced ability to store fluids (Woodrow, 2002) and various disease processes can adversely affect fluid balance, which can in turn have a negative impact on outcomes in a relatively short period of time. People with dementia are one of the groups at the greatest risk of dehydration (Larson, 2003).

Accurately recording fluid intake can help prevent dehydration – this was a key aspect of care identified by the Francis report (Francis, 2013). To avoid dehydration, the Royal College of Nursing and National Patient Safety Agency (2007) suggest:

- Identifying at-risk patients;
- Monitoring fluid input;
- Encouraging fluid consumption.

Monitoring older patients' fluid intake to identify health issues early or avoid them altogether is common practice. However, if the monitoring itself is inaccurate, patients' health is put at risk, as insufficient fluid intake will increase the risk of constipation, kidney stones, hypotension, urinary infections, pressure ulcers and falls (RCN and NPSA, 2007).

Gap in the knowledge base

The importance of accurate fluid intake measurement is widely emphasised in literature (Dougherty and Lister, 2011;

5 key points

1. Adequate hydration is crucial, especially in older people
2. The margin separating insufficient and adequate hydration can be small
3. Monitoring fluid intake is common practice but it is crucial that this monitoring is accurate
4. Staff need to be able to accurately evaluate patients' fluid intake
5. More research into the accuracy of 'real-world' fluid volumes estimation is needed

Shepherd, 2011; Docherty and Coote 2006; Potter and Perry, 2005; Challinor and Sedgewick, 2001), which also contains evidence of inaccurate fluid balance records (Perren et al, 2011; Chung et al, 2002). There is also evidence that monitoring fluid balance is less accurate than recording changes in body weight – which is sometimes used to assess fluid balance: 1kg of body weight is equal to 1,000ml of fluid (Perren et al, 2011; Challinor and Sedgewick, 2001).

Jimoh et al (2015) investigated the accuracy of patient self-reported fluid intake and found it showed a high correlation between self-reported and actual intake (as measured through an observer weighing the fluid) and a low correlation between nursing staff's records and actual intake. However, the study did not take into account staff's ability to estimate volume.

Little is known, however, about the accuracy of fluid intake records by nurses in practice, as this aspect of nursing care is rarely examined. There is a gap in our knowledge base, which the study described here aimed to address.

Aim

This pilot study was conducted in West Wales. Its aim was to evaluate how accurately nurses and care staff who may care for older patients estimate patients' fluid intake when looking at containers with residual fluid, without the help of any protocols or tools (such as posters showing container volumes or incremented containers with marks on the side showing fluid volumes).

The study focused on fluid input, as it is easier to measure than fluid output: the latter is more difficult to measure because of factors, such as incontinence and the loss of fluid via respiration and perspiration.

As the study only recruited participants in a professional role, it did not require approval from ethics committees and was only subject to NHS research and development governance processes. It gained research and development approval, as well as sponsorship, in April 2014. Recruitment and testing took place between May and November 2015.

Method

Recruitment and settings

Participants were recruited from a variety of hospital departments and private nursing homes. All worked in areas where care for older patients may be necessary, but not in specialist wards where fluid balance is a crucial aspect of care (such as renal wards); this was done to reduce bias. The target sample size was between 50 and 100 staff members from each type of setting (hospital and nursing home).

Staff were asked to estimate the amount of fluid consumed by a fictitious patient

To avoid administrative burden and increase the response rate, hospital staff were approached in person at mandatory training events, and care home staff were approached at training days or handover periods. To keep discussions with potential participants to a minimum, the visits to the hospital or nursing home were unannounced (only senior staff were informed of them), and recruitment and testing were conducted during the course of one visit.

Estimating fluid intake

Staff were asked to estimate the amount of fluid consumed by a fictitious patient who had been drinking from six different, commonly used containers (a jug, a tea cup, a tall plastic cup, a mug, a medicine pot and a half-pint glass). Each of these contained some polyuretheane resin to represent fluid left by patients. This ensured all participants assessed exactly the same amounts. A mark on the container indicated the full level before the patient had drunk from it. Participants were asked to estimate how much the patient had drunk from each container, as accurate recording should be based on the actual intake, rather than the amount offered or the amount left.

There was no time limit set for participants to give their responses, but the testing had to be done during that one visit. It was conducted face to face, with participants being presented the different containers during:

- Handover or training (for nursing homes);
- Mandatory training sessions (for hospitals).

One month later at the earliest, a small number of participants repeated the test to allow the researcher to establish individual variability. The aim was to retest 10% of participants.

No protocols or tools

All care settings in the study had a protocol or tool – for example, incremented containers – in place as part of their standard care procedures to ensure accurate fluid intake measurement. However, because the study's aim was to examine how accurately nurses and carers could estimate fluid volume without any help, they were not allowed to use these aids. Therefore, the results are not a measure of an area's quality of care, but an indicator of the ability of staff as a whole to estimate fluid volumes consumed by patients. As such, the results can only be generalised to the nursing population as a whole in areas where no fluid measurement protocols or tools are in place.

Analysis

The outcomes were analysed according to five overlapping participant groups:

- All staff;
- All nurses;
- All carers;
- All hospital staff;
- All nursing home staff.

Each participant was included in three of the five groups: 'all staff' and two other groups according to their profession and work setting. In the statistical analysis, to avoid participants being counted twice, any two groups were not compared if participants may have been in both groups; for example, the 'all nurses' group was not compared with the 'all staff' group.

Level of error

The acceptable level of error in participants' estimates was set at 10%. There is no published data on what percentage

Alamy

TABLE 1. ACCURACY OF PARTICIPANTS' ESTIMATES

Container type (fluid actually consumed)	Mean estimate (standard deviation*)				
	All staff	All nurses	All carers	All hospital staff	All nursing home staff
1-litre jug (540ml)	562ml (191)	565ml (166)	560ml (212)	569ml (199)	554ml (182)
Tea cup (70ml)	94ml (37)	90ml (32)	98ml (40)	95ml (39)	94ml (35)
Tall plastic cup (140ml)	149ml (67)	130ml (58)	167ml (71)	146ml (65)	153ml (70)
Mug (150ml)	160ml (64)	147ml (54)	172ml (71)	150ml (54)	173ml (73)
Medicine pot (25ml)	31ml (16)	31ml (14)	31ml (18)	33ml (20)	29ml (11)
Half-pint glass (155ml)	179ml (104)	170ml (85)	188ml (118)	160ml (82)	202ml (122)

*The standard deviation is a quantity expressing by how much the members of a group differ from the mean value of the group.
■ = estimates outside the accepted error margin of 10%. ■ = estimates within the accepted error margin of 10%.

TABLE 2. ESTIMATES WITHIN ERROR MARGIN

Staff group	Estimate (%)
All staff	25
All nurses	27
All carers	23
All hospital staff	26
All nursing home staff	24

error is appropriate for this type of task, but 10% seemed appropriate considering the average daily fluid intake suggested in the literature.

The figure for average daily fluid intake varies: Dougherty and Lister (2011) suggested 30-35ml of fluid per kilo of body weight, while Potter and Perry (2005) suggested a total of 2,200-2,700ml of oral fluids, including fluid from foods – which accounts for approximately 20% of the total fluid intake (RCN and NPSA, 2007). In a systematic review of literature, Hodgkinson et al (2003) stated that no less than 1,600ml in 24 hours are required to maintain adequate hydration. However, a survey by the Royal Society for the Promotion of Health (2003) showed that most residents of care homes for older people only consumed 480-960ml per day.

The recommended daily intake varies and needs will also vary between individuals. However, the figures above demonstrate that a small percentage difference between what is actually consumed and what is thought to be consumed can easily lead to a fluid intake being perceived as adequate when it is not actually sufficient, especially for frail, undernourished older patients whose only oral intake may be from fluids.

Results

In total, 123 staff members participated in the study, 66 from hospitals and 57 from private nursing homes; 58 were nurses and 65 were care staff. Whether care staff were NVQ-trained was not considered, but time spent working in healthcare was.

Accuracy of estimates

The mean estimated volumes of fluid consumed for each container and in each participant group, as well as standard deviations (SDs), are given in Table 1. Each result is colour-coded: the field is red if the estimate is outside the acceptable error margin of 10%, and green if it is within that margin. Table 2 shows, as a percentage, how many individual estimates were within the 10% acceptable error margin for each participant group.

A chi-squared test was used to establish any statistically significant differences in the acceptability of responses from nurses versus care staff, and from hospital staff versus nursing home staff. No statistically significant differences were found (nurses versus carers p=0.27; hospital staff versus nursing home staff p=0.67).

Time in healthcare

The mean time working in healthcare was 10.7 years when all staff were considered together. For nurses only, it was 14.7 years and for carers only it was 7.2 years. To examine the impact of that factor on whether staff had made acceptable estimates, an unpaired t-test was used; this compared acceptable and unacceptable estimates for all six containers. No statistically significant results were found (p<0.05).

Individual variability

All participants were asked to give their contact details if they were willing to complete the test again in the future. The aim of having them repeat the test was to assess the variability of estimates in the same respondents. This individual variability was assessed using the intraclass correlation coefficient (ICC).

Six participants (5%) were retested, which was less than the 10% aimed for. This was because few respondents agreed to be retested, while some of those who did had changed their jobs before the second test took place. Those who were willing to be retested and had stayed in post were predominantly experienced nurses; the mean time working in healthcare for retested participants was 22.5 years. The average time between the first and second test was three months.

The ICC showed strong agreement between the first and second estimates, but this cannot be considered statistically valid because of the small sample size.

Discussion

If only estimates against actual volumes are considered, the outcomes can arguably be considered reasonable. However, they do not show the large spread of results, which is revealed by the SDs. For example, if half of the respondents were overestimating volumes and the other half were underestimating them, the mean estimates would be roughly similar to the actual volumes, but there may well be clinically significant differences for individual patients. If the percentage of estimates inside or outside the 10% error margin are considered, only 25% of responses were acceptable, which is far more relevant for clinical care.

The fact that only a quarter of estimates were acceptable is a poor outcome. What could explain such a result? One reason may be that there was a certain amount of calculation involved: participants would have had to subtract something from each container's total volume to ascertain what had been drunk, rather than simply stating the amount that was left.

There were no statistically significant differences between nurses and carers or between hospital and nursing home staff, and there were no differences according to participants' length of time working in

healthcare. Therefore, correctly estimating fluid volumes based on residual fluid in this study did not depend on qualification or experience.

Some may argue that an acceptable error margin of 10% is a very low threshold; as explained above, 10% was chosen to take into account the hydration needs of all patients, including the most frail. More accurate and/or concurring data from literature on what is a poor or a good fluid intake may, in the future, allow researchers conducting similar studies to refine the error margin.

Containers with increments are routinely used, but this study's aim was to evaluate nurses' and carers' ability to estimate fluid volumes without the help of such devices. In settings where fluid measurement protocols are in place, further research or clinical audit might be needed to explore staff's ability to estimate fluid volumes with the help of these protocols.

Conclusion

Only a quarter of nurses and care staff who participated in this study were found to give, without using any protocols or tools, an acceptable estimate of the volumes of fluid consumed by a fictitious patient from residual fluid left in a variety of commonly used containers. To ensure older patients are adequately hydrated, healthcare providers need to find ways to improve staff's ability to measure fluid volumes. More research into real-world fluid volume estimates in clinical practice is also needed. **NT**

References

Challinor P, Sedgewick J (2001) *The Principles and Practice of Renal Nursing*. London: Stanley Thornes.
Chung LH et al (2002) The efficiency of fluid balance charting: an evidence-based management project. *Journal of Nursing Management;* 10: 2, 103-113.
Docherty B, Coote S (2006) Fluid-balance monitoring, part of track and trigger. *Nursing Times;* 102: 45, 28-29.
Dougherty L, Lister S (2011) *The Royal Marsden Hospital of Clinical Nursing Procedures*. Chichester: Wiley-Blackwell.
Francis R (2013) *Report of the Mid Staffordshire NHS Foundation Trust Public Inquiry*. London: Stationery Office. Bit.ly/Francis2013
Gulanick M, Myers JL (2007) *Nursing Care Plans: Nursing Diagnosis and Intervention*. St Louis, MO: Mosby Elsevier.
Hodgkinson B et al (2003) Maintaining oral hydration in older adults: a systematic review. *International Journal of Nursing Practice;* 9: 3, S19-S28.
Jimoh FO et al (2015) Assessment of a self-reported drinks diary for the estimation of drinks intake by care home residents: Fluid Intake Study in the Elderly (FISE). *The Journal of Nutrition, Health and Aging*; 19: 5, 491-496.
Larson K (2003) Fluid balance in the elderly: assessment and intervention – important role in community health and home care nursing. *Geriatric Nursing;* 24: 5, 306-309.
Perren A et al (2011) Fluid balance in critically ill patients. Should we really rely on it? *Minerva Anestesiologica;* 77: 8, 802-811.
Potter P, Perry A (2005) *Fundamentals of Nursing*. St Louis, MO: Mosby Elsevier.
Royal College of Nursing, National Patient Safety Agency (2007) *Water for Health: Hydration Best Practice Toolkit for Hospitals and Healthcare*. Bit.ly/RCNWaterForHealth
Royal Society for the Promotion of Health (2003) *Water Provision in Care Homes for the Elderly*. London: RSPH.
Shepherd A (2011) Measuring and managing fluid balance. *Nursing Times;* 107: 28, 12-16.
Woodrow P (2002) Assessing fluid balance in older people: fluid needs. *Nursing Older People*; 14: 9, 31-32.

For more on this topic go online...

- Reducing dehydration in residents of care homes
- **Bit.ly/NTReducingDehydration**