

FLUID BALANCE THE ELECTRONIC JOURNEY

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Introduction

When I left my acute care role in the NHS and joined Nervecentre, I did so because of my belief that there were so many care areas that technology could improve, with my primary focus always being patient safety.

There is a valid place for technology in healthcare when it is used in a way that benefits and supports clinicians, fitting in with working practice rather than hindering it. Information made easily accessible, intelligent and direct to the hands of the person needing it, with the end benefit of faster recognition of the deteriorating patient. Nervecentre have had great success with e-observations and escalations as well as our Sepsis module with fantastic measurable results and we are setting out to achieve something equally as transformative with Fluid balance.

Thanks to evidence-based research, vital signs monitoring and recognition has moved on leaps and bounds over the past 20 years. To my knowledge every acute care facility and many community-based services across the UK uses an 'Early Warning Score' mechanism in Paediatrics, Adults and Maternity care. The introduction of the National Early Warning Score (RCP) in 2012 further solidified the standard across the UK of "Recognise and Rescue", but there is yet to be a similar National standard for fluid management and fluid balance.

Why is this? NICE have a guideline for Intravenous fluid therapy in hospitals (2013) and the guideline for Acutely Ill adults in hospital (2007) but neither tackle the actual detail and management of fluid balance. The reality is that fluid balance is much more complex and complicated due to the vast difference between patients and their condition's making it difficult to produce clear rules. That should not however stop us from trying to improve the way that we record, assess and escalate concerns, when often the precluding factor to physiological deterioration that presents as physiological deterioration is a fluid issue- dehydration, AKI, or fluid overload.



Background

After years of nursing in different care areas, my observation and frustration that fluid balance is not consistently recorded accurately is a view supported by research (Bennett, 2010; Reid, 2004; Perren et al ,2011). Monitoring fluid balance in order to recognise dehydration or overload is not complicated but is notorious as a document for being poorly completed.

The NMC dedicate a whole standard in the “Code of Conduct” (2015) to record keeping. Nurses are governed by the standards, yet whilst Fluid balance charts are an essential part of the patient record in many areas they are treated by many as insignificant, or a task that someone has to total at midnight. Much of the practice that still surrounds fluid balance monitoring in hospitals is archaic, totalling at midnight for example when there are fewer doctors and when it may already be a very late in the detecting of issues. This is not to say that every area is poor ITU, HDU and CCU environments tend to be a lot better at the record keeping however nurse to patient ratios in these areas are higher and therefore unsurprisingly the charts are filled in and totalled much more regularly.

Why is the accurate recording of fluid balance so important? For patients whom are already sick or elderly the body’s ability to regulate fluid is impaired and can lead to complications such as dehydration or overhydration. Add to that environmental factors, such as reliance on health care professionals (who change on a shift basis) to provide and assist in the intake of fluids. Without monitoring it is feasible that a patient can develop fluid issues relatively quickly whilst under hospital care. The relatively simple task of recording and assessing fluids should be a priority so that patients do not deteriorate though preventable factors whilst in our hospitals. This is challenging due to factors such as staffing but must not be excused by this.

We aim to improve this process, our goal making this intuitive quick and easy to use.



Fluid balance Trial Pilot

In mid-2017 Nervecentre realised a beta version of the fluid balance module.

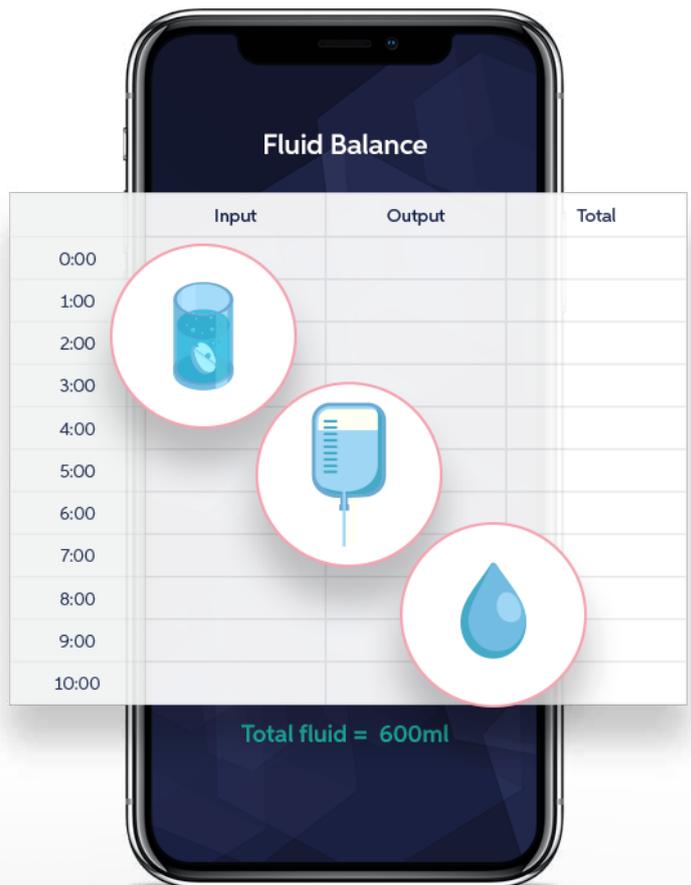
The development was initially done in collaboration with active clinicians in some of our trusts with the aim of;

- Ease of recording (should be no harder than paper)
- Accuracy of balance at all times of the day (computers will auto calculate in real time)
- Visibility of fluid balance (no lost charts, reduction in missed fluid balance observations)

It was widely agreed that we should deploy a pilot in a contained and controlled manner in order to evaluate the feedback and make necessary product enhancements, before deploying widely across our trusts, when it would be more difficult to make the release-based updates across the board.

The pilot happened in November and December 2017 across 5 wards in 3 different trusts all different specialities and staffing ratios. This was purposeful to obtain well rounded feedback from as much diversity across nursing and medics as we could. The pilot sites were at Hull and East Yorks Castle Hill site, Leicester Royal Infirmary and Darlington hospital. Active and well-planned collaboration with these trusts allowed us to deploy safely over a 4-week period. Terms of engagement for pilot, product limitations and clinical safety evaluations were put in place and in all cases the staff recorded on both Nervecentre and on paper ensuring the transition back after pilot was safe and seamless.

Prior to the pilot we asked staff to complete questionnaires to gauge opinion and information about the current paper process. Following the 4-week period another survey was completed by the users to assess success of product in current state and to and recognise improvements required. Each trust also has a senior nursing lead who oversaw the pilot and monitored compliance and queries.



Evaluation and product improvements

The results of the surveys although anecdotal, were interesting and considered throughout the evaluation phase.

Prior to pilot only 6% of staff reported they thought their working areas were 'very accurate' at fluid balance recording whilst 11 % of staff thought that their working areas were 'very poor' with 24% saying poor, meaning the majority 59% felt that on paper they were 'reasonably accurate'. Monitoring fluid balance to prevent dehydration or over hydration is a relatively simple task but Bennet (2010) says that it is often inadequately or inaccurately completed.

Before deploying the pilot, the known product limitations were declared and arguably the most impactful one was the lack of ability to back date or amend fluid balance entries v's paper. Prior to pilot 54% of staff said they would regularly back date missed entries or amend them and following the pilot every Trust fed back that whilst entries should routinely always be entered in real time, the ability to be able to amend an entry was essential. This would allow for real limitations of care to be safely amended. This has led to development of the product to allow the necessary actions following amendment to recalculate all totals, balance and cumulative balance. The product will now safely allow amendments, with the benefit of mandating a reason for change and an automatic identifier of the person who made the change.

One of the most interesting finds from the survey was the occurrence of abbreviations on fluid balance charts with 66% of users prior to pilot saying they used abbreviations such as 'PU'd' or 'passed urine ++' on paper charts. Shepard (2011) condemns this as unacceptable practice due to the lack of information made by the statements and the inability to calculate

a figure from them and during pilot only numerical values could be entered in the fluid balance module. During the evaluation stage the feedback from staff was still that they would still like to be able to use some form of estimate, for the cases that were impossible to measure such as blood loss on floor or incontinence. The legitimate reasons for estimate were considered against clinical safety and in the second stage of development we have now added the ability to be able to add estimate volumes as well as small cup, large glass etc. These estimates and cup sizes have configurable associated numeric volumes with them so whilst the chart will use a number associated with the estimate the clinicians can also see that it was an estimated volume to give context and safely allow the 'balance' to still be calculated.

As mentioned above, our key objective has always been to improve patient safety. Untreated or uncorrected fluid balance can lead to issues such as dehydration AKI, hypovolemic shock, fluid overload all of which can lead to organ failure and death. We are now able to use the clinical decision support rules to highlight patients at risk of fluid issues. Using the clinical rules module we have provided a set of configurable rules that allows Trusts to create a number of variations of clinical decision support to suit the requirements of the hospital, different cohorts of patients and different circumstances. Clinical decision support rules are not mandatory, should a Trust just wish to focus upon replacement of paper and driving compliance. Visibility to not only monitor compliance at a ward, and a hospital level but also the safety net of highlighting at risk patients whom often are missed. This will give hospitals the ability to view and prompt early action with the intention to improve care and reduce fluid balance failure to rescue incidents. One of our pilot trusts reported 16 Datix incidents related to fluid balance in the 2017-2018 period.

When we met as at the post pilot review all the senior clinicians reviewing the product felt that despite it not being directly asked for at a user level, this would be a good opportunity to use one of the best features of technology (and one that has driven rates of compliance in eobs) which is the ability to standardise practice and mandate key entry points, making it harder for patients to deteriorate without anyone noticing. The ability for trusts to now mandate that e.g. Urine output is filled in at every entry will ensure that this is detected. Furthermore, the clinical rules can also use this data to evaluate whether someone has not had output for 'x' amount of hours and flag this patient as a concern.

Many staff acknowledged that they really valued the features that electronic fluid balance offered versus paper. Not only the real-time accuracy of totals, but also the visibility and accessibility to charts. Electronic charts are not as fallible as paper and cannot be lost, which is a common problem when paper records only exist in a 1 time document that can easily be misplaced. The pilot trusts declared the cost for fluid balance charts per year on the base wards, all these figures exclude ITU; Leicester approx. £ 7,000; Durham and Darlington approx. £ 8,500; Hull and East Yorks in excess of £4,000 per annum.

The most widely asked for product enhancement across all three hospitals was the ability to individualise fluid balance charts at a patient level. The ability to bespoke a chart to a patient based on their intake and output types but taking this further and being able to name multiple same entry types and see them as individual components e.g. abdominal drain, chest drain etc and to be able to add and remove input and output components as the patients care changed. In version 1 of fluid balance the product had a core set of input and output values but now the configurability is such that at a user level on both the mobile device and the PC the input and output columns can be added and named so that the review process of the chart is much clearer and more useful in context of the patient.

Over 80% of staff felt that using an electronic method of fluid balance recording made them consider whether patients needed to be on fluid balance. The feedback was largely related to the due and overdue indicators and the visibility of compliance leading to review and consideration of which patients did and didn't require this level of monitoring. In light of this we did not change the way that fluid balance is commenced and whilst the enhanced capability of choosing the chart type is now available the act of having to 'start' the chart and 'remove' the chart remains the same. During pilot a strict hourly chart was deployed but in the interest of aiding areas that use a 4 hourly fluid monitoring tool, we have developed a chart type that assists with this and allows 4 hourly monitoring rules and well as charting in a different format.

After the pilot a significant amount of development went into ensuring the mobile charts were more clinically functional. Previously they were only able to show totals for input, output and balance due to space restrictions, but feedback (largely from doctors) was that they needed to be able to see all entries on the mobile to save them valuable time in having to log in to a PC. The change in product following this feedback is now expander columns with scroll capacity to allow even on the smallest of devices the clinicians to review all entries for the 24hours.

Many more product enhancements have been added following the review in December such as the ability to add notes that sit against an entry to add value, and the submission page summarising all the daily and cumulative totals for the user to analyse aiding decision support. Following the pilot 61% of staff felt that using Nervecentre fluid balance had already improved frequency of recording even with the recognised limitations. With the addition of the product improvements confidence that this figure will improve is high.

Many thanks to the clinical leads from Leicester, Durham & Darlington and Hull & East Yorks plus all the staff that evaluated and gave their time to feed back on the module. The outcome of which means of the 10 stated 'essential' improvements all now exist in the product and many of the 'nice to have' features now exist also. The collaborative working with our customers is a method that has been a success throughout the evolution of the Nervecentre product, it has allowed us to listen closely to the clinicians working with the product on an everyday basis, putting the needs of the clinicians and the safety of the patients at the for-front of our design.

- The National Institute for Health and Care Excellence (NICE) (2017) Intravenous fluid therapy in adults in hospital. NICE, Clinical guideline [CG174] Published date: December 2013 Last updated: May 2017
- The National Institute for Health and Care Excellence (NICE) (2007) Acutely ill adults in hospital: recognising and responding to deterioration. NICE, Clinical guideline [CG50] Published date: July 2007

Reference

- Bennett JA et al (2004) Unrecognized chronic dehydration in older adults: examining prevalence rates and risk factors. *Journal of Gerontological Nursing*; 30: 11, 22-28.
- Leach, R (2013) *British Medical Journal* It's time to take nutrition and fluid balance seriously. Volume 346.
- Nursing and Midwifery Council (2015) CODE OF CONDUCT. NMC, London.
- Perren A et al (2011) Fluid balance in critically ill patients. Should we rely on it? *Minerva Anestesiologica*. tinyurl.com/fluid-balance-rely
- Reid J et al (2004) Improving the monitoring and assessment of fluid balance. *Nursing Times*; 100: 20, 36-39. Resuscitation Council UK (2006)
- Royal College of Physicians (RCP) (2012) National Early Warning Score. RCP, London.
- Shepherd A (2011) Measuring and managing fluid balance. *Nursing Times*; 107: 28, 12-16.