



York Health Economics Consortium



## NHS INNOVATION ACCELERATOR

### Economic Impact Case Study: The Water-Drop

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#### Summary

Dehydration of patients in hospital can result in a number of serious, negative health impacts. One approach to preventing this is intravenous (IV) hydration, which can be resource intensive. Some patients on hospital wards may require nursing assistance to be able to drink enough to stay hydrated. The Water-Drop provides a simple and low cost alternative, enabling patients to be able to drink water without assistance, when they are not able to use a water jug and cup. There is a lack of published evidence on the use and costs of hydration interventions, as a result of which it is not possible to undertake a robust cost-benefit analysis. This case study presents a cost comparison of the options for similar types of intervention, on the assumption that the outcomes will be similar. This indicates that The Water-Drop is the lowest cost of the alternatives, at £13.69 to £14.19 estimated cost per patient over a 12-hour period, or £3.50 to £4.00 for consumables only. Potential commissioners of the Water-Drop will need to consider the likely extent of its use in their own circumstances.



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## 1. BACKGROUND

Dehydration has been defined as “a state in which a relative deficiency of fluid causes adverse effects on function and clinical outcome”.<sup>1</sup> Older people are particularly susceptible to dehydration for a range of reasons including restricted access to fluid intake due to physical disability; polypharmacy use; physical and mental decline.<sup>2</sup> In a UK study of patients aged 65 or over who were admitted to a large teaching hospital as emergencies, 37% of these patients were dehydrated on admission, and of those, 62% were still dehydrated when reviewed at 48 hours after admission.<sup>3</sup>

Dehydration is associated with a wide range of health consequences, including fatigue, headaches, constipation, hypotension, urinary tract infection (UTI), and acute kidney injury (AKI).<sup>4</sup> Loss of as little as 2% of body weight due to dehydration can result in impairment to physical, visuomotor, psychomotor, and cognitive performance.<sup>5</sup> However, hospitalised patients may have difficulty in ensuring they drink sufficient water. In one survey of surgical patients in a district general hospital, it was found that 31% of patients found the task of pouring a glass of water difficult, very difficult or impossible, and 42% of patients were not able to reach a jug of water at the time of their interview.<sup>6</sup>

Hospital patients who require fluids may be given them by means of an intravenous (IV) drip. As this requires the application of fluids directly into a patient’s vein, IV hydration requires a competent, trained professional to prescribe and deliver the therapy, which includes recognising and preventing possible consequences of mismanaged IV fluid therapy.<sup>7</sup> This makes it a relatively costly intervention, when applied to a large number of patients.

To address this, The Water-Drop has been developed as an easy-to-use drinking bladder system with the intention of substituting IV hydration. It is specifically targeted at those patients (such as the elderly) who have problems being able to drink independently. The bladder is filled with water and is attached to an appropriate article, such as a drip stand, bed rail, chair back, drawer handle, or wheelchair frame. The patient bites on a non-return valve at the end of a tube to release fluids in an easy to control flow.

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<sup>1</sup> NHS England. Guidance – Commissioning Excellent Nutrition and Hydration 2015 – 2018. October 2015

<sup>2</sup> El-Sharkawy AM, et al. The pathophysiology of fluid and electrolyte balance in the older adult surgical patient. Clin Nutr. 2014 Feb;33(1):6-13. doi: 10.1016/j.clnu.2013.11.010.

<sup>3</sup> El-Sharkawy AM, et al. Hydration and outcome in older patients admitted to hospital (The HOOP prospective cohort study). Age and Ageing 2015; 44: 943–947 doi: 10.1093/ageing/afv119

<sup>4</sup> Sheils, R and Morrell-Scott, NE (2018) Prevention of Dehydration in Hospital Patients. British Journal of Nursing, 27 (10). ISSN 0966-0461

<sup>5</sup> Grandjean AC, Grandjean NR. Dehydration and cognitive performance. J Am Coll Nutr. 2007 Oct;26(5 Suppl):549S-554S. doi: 10.1080/07315724.2007.10719657. PMID: 17921464.

<sup>6</sup> Johnstone P, Alexander R, Hickey N. Prevention of dehydration in hospital inpatients. Br J Nurs. 2015 Jun 11-24;24(11):568-70, 572-3. doi: 10.12968/bjon.2015.24.11.568. PMID: 26067790.

<sup>7</sup> NICE. Intravenous fluid therapy in adults in hospital. Clinical guideline [CG174] Published: 10 December 2013 Last updated: 05 May 2017

The proposed benefits of using The Water-Drop include:

- Independence and dignity for the user – being able to drink without calling for help.
- Efficiencies on hospital wards – releasing time to care.
- Bottom line cost savings – reduced levels of infection, use of drips and length of stay.
- Potential reduction in the use of plastics – by substituting IV hydration with The Water-Drop system.

In a pragmatic literature review for this case study, it has not been possible to find published evidence on the health economics of hydration. Due to this, and uncertainties about the use of The Water-Drop, this case study is not able to draw definitive conclusions about cost impacts. As a result, the following sections set out a number of alternatives that may facilitate understanding of the use of The Water-Drop and the costs and consequences of it as an intervention.

The analysis was developed in summer/autumn 2021 and was based on the information and evidence available at the time. The limitations of the analysis are as follows:

- There is a lack of published evidence on the use of and costs of different hydration approaches in hospitals, so a number of costs have been taken from different sources and others have had to be estimated.
- No robust evidence has been found on which to base an estimate of the potential use of The Water-Drop in a hospital. It is not clear to what extent it may be an appropriate substitute for IV hydration.
- As this is a cost-minimisation analysis, we do not know whether outcomes are equivalent between different interventions.

## **2. ALTERNATIVE APPROACHES TO HYDRATION IN HOSPITAL**

In considering the appropriate comparator to the use of The Water-Drop, the assumption is made that if the intervention were not used, this would not result in patients becoming dehydrated. This is because the identification of the need for hydration would be necessary for the use of The Water-Drop, just as it would be necessary for any other appropriate intervention.

Whilst most hospital patients can manage their own hydration, by using a water jug and cup at the bedside, some cannot, for various reasons. Patients in emergency departments, acute admission units, general medical and surgical wards may need IV fluid therapy to prevent or correct problems with their fluid and/or electrolyte status. In these cases, the NICE guidance on IV fluid therapy should be followed.

Patients on general wards may not require full IV fluid therapy, but they may not be physically able to manage a jug and cup due to injury or frailty. In these instances, a nurse may need to assist the patient at frequent intervals so that they can drink enough water to avoid dehydration.

An estimate of the costs of each of these alternatives is presented in the following sections. In the absence of evidence around the effectiveness of The Water Drop compared with alternatives, we have considered the incremental costs of each.

## 2.1 IV Hydration Therapy

The NICE guidance on IV hydration therapy includes the requirement that a patient's likely fluid and electrolyte needs are assessed, based on: their history; clinical examination; current medications; clinical monitoring; and laboratory investigations.<sup>8</sup> Each patient should have an IV fluid management plan, which should include details of: the fluid and electrolyte prescription over the next 24 hours; the assessment and monitoring plan. All patients receiving IV fluids should have regular monitoring, with at least daily reassessments.

The most recent cost for IV hydration therapy that we have been able to find is from NICE guidance on point-of-care creatinine devices, which uses a reference cost of £340.89 per patient for the financial year 2017/18. Adjusted for inflation,<sup>9</sup> this would result in a cost of £369.12 per intervention in 2021/22.

Much of this cost is the cost of staff involved in assessing and monitoring a patient. If The Water-Drop were used as a substitute for IV hydration therapy, these staff resources would presumably be the same; the difference would be in the cost of the equipment, or consumables, only. An analysis from 2009 identified the consumable costs for IV fluid therapy presented in Table 2.1.

**Table 2.1: IV fluid therapy consumables costs per 12 hours**

Variable	Quantity	Unit cost	Cost
Infusion giving set with burette (graduated chamber)	1 per 12 hours	£1.75	£1.75
Fluid micron filter	1	£2.94	£2.94
Cannula	2	£0.78	£1.56
Swabs	1 pack of 5	£0.05	£0.23
Alcohol skin prep	2	£0.01	£0.01
0.9% saline flushes	1 × 5 ml vial	£0.33	£0.33
<b>Total (not including cost of fluid)</b>			<b>£6.82</b>

Source: National Collaborating Centre for Women's and Children's Health. Diarrhoea and vomiting caused by gastroenteritis diagnosis, assessment and management in children younger than 5 years. April 2009. Appendix A. Cost-effectiveness of IVT versus ORT for children with dehydration

Adjusted for inflation,<sup>10</sup> this would result in a cost of £8.71 per 12-hour intervention in 2021/22.

## 2.2 Nursing Assistance

Another intervention that The Water-Drop might replace, for patients unable to drink from a bedside water jug and cup, is assistance from ward nurses. It is assumed that, with nursing assistance, these patients could drink water, but would need frequent help to ensure that they drink enough to avoid dehydration.

<sup>8</sup> NICE. Intravenous fluid therapy in adults in hospital. Clinical guideline [CG174] Published: 10 December 2013 Last updated: 05 May 2017.

<sup>9</sup> From: PSSRU unit costs of health & social care 2020. Using the NHSCII pay and prices index. Last two years are estimates.

<sup>10</sup> From: PSSRU unit costs of health & social care 2020. Using the HCHS pay and prices index from 2008/09 to 2014/15, then the NHSCII pay and prices index. First year and last two years are estimates.

In the absence of any published evidence, it is assumed here that a Band 5 ward nurse would spend 5 minutes each hour helping a patient to drink. No cost is included for the reusable jug and cup as these would be negligible on a per-use basis. The cost per working hour at nursing Band 5 is £40,<sup>11</sup> which is equivalent to £3.33 for a 5-minute intervention. For a 12-hour shift (comparable to the costs of the IV fluid therapy consumables over 12 hours) the opportunity cost of nursing assistance would be £40; or £40.75 at 2021/22 costs.

### 2.3 The Water-Drop

The consumable costs of the Water-Drop are listed as £3.50 to £4.00.<sup>12</sup> We assume that the provision of the system would be by a Band 5 ward nurse and that it would take 15 minutes to set up and explain it to a patient. The staff costs (estimated on the same basis as above) would be £10.00 (£10.19 at 2021/22 prices). The total cost, including consumables, would therefore range from £13.69 to £14.19.

A record of the food and drink consumed by patients, as well as the urine output, should be kept for patients thought to be at risk of dehydration.<sup>13</sup> This will be the same regardless of whether the patient has The Water-Drop or nursing assistance in drinking. As a result, these costs are not included in these two estimates.

## 3. COST COMPARISON

Table 3.1 summarises the costs of the approaches to inpatient hydration described above. These are all calculated over a period of 12 hours, reflecting a daytime shift on a general or geriatric inpatient ward. The costs of IV hydration and for The Water-Drop are presented as a total cost for the intervention and as costs for the consumables only.

**Table 3.1: Summary of costs of inpatient hydration over a 12-hour period**

Hydration method	Cost over 12 hours
IV hydration total costs	£369.12
IV hydration consumables only	£8.71
Nursing assistance	£40.75
The Water-Drop total costs	£13.69 - £14.19
The Water-Drop consumables only	£3.50 - £4.00

<sup>11</sup> PSSRU unit costs of health & social care 2020. Hospital-based nurses.

<sup>12</sup> <https://thewaterdrop.co.uk/potential-impact.html> Accessed 24/11/21.

<sup>13</sup> Cambell, N. (2014) Recognising and preventing dehydration among patients. Nursing Times; 110: 46, 20-21.

#### 4. DISCUSSION

As we have found no evidence on the impacts of different interventions, this case study presents a cost-minimisation analysis. This compares the costs of different alternatives, assuming no difference in outcomes. The calculations described above indicate that The Water-Drop is the lowest cost of the alternatives considered here. Based on the costs of consumables only, the cost of using the Water-Drop would be a reduction of between 54% and 60% compared to IV hydration (a reduction of around 96% based on the total costs of each. Compared to nursing assistance, there would be a cost reduction of around 90% (consumables only) or 65% (total costs).

The costs used in this case study are our best estimates based on little available literature. Hydration appears to be a greatly under-researched subject matter, despite its importance in patient care and wellbeing.

There are also benefits of reduced use of single-use plastics for The Water-Drop, compared to the consumables used in IV hydration. This is due to the fact that the plastics used in The Water-Drop can be recycled, whereas those used in IV hydration cannot, as they will be contaminated after use. However, plastics used in nurse assisted hydration, for jugs and cups, may not all be single-use, so would cut down on disposal of plastic waste even further.

There is an important uncertainty in this case study, which is the extent to which The Water-Drop can substitute for IV hydration therapy and nurse assisted hydration. The complexity of IV hydration therapy, and the use of fluids other than water, make it unclear whether it can often be replaced by this system. On the other hand, it seems probable that nurse assisted hydration could mostly be substituted by The Water-Drop. This question of the potential extent of the use of The Water-Drop will be fundamental to decisions about its uptake.

The UK study by El-Sharkawy *et al.* cited in the introduction, found that 37% of elderly admissions were dehydrated, based on a cohort of 200 patients, out of a total of 1,409 admissions over the study period. Reasons for non-inclusion in this study were: severe or terminal illness; admission more than 12 hours before contact with researchers; refusal to participate.<sup>14</sup> The figure of 37% therefore may not reflect the actual incidence among elderly admissions. Elsewhere, the level of hydration has been measured as 6.7% of hospitalisations among the elderly on Medicare,<sup>15</sup> or between 40% and 20% among adults (aged 20 to 90 years) in the community.<sup>16</sup>

Further, detailed research on the application and uptake of The Water-Drop would be very helpful in order to develop robust estimates of its costs and benefits. We understand that work to test The Water-Drop and promote its uptake have recently been suspended due to the impact of the Covid-19 pandemic.

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<sup>14</sup> El-Sharkawy AM, et al. Hydration and outcome in older patients admitted to hospital (The HOOP prospective cohort study). *Age and Ageing* 2015; 44: 943–947 doi: 10.1093/ageing/afv119.

<sup>15</sup> Warren JL, et al. (1994). The burden and outcomes associated with dehydration among US elderly, 1991. *American journal of public health*, 84(8), 1265-1269. <https://doi.org/10.2105/AJPH.84.8.1265>.

<sup>16</sup> Stookey JD. High prevalence of plasma hypertonicity among community-dwelling older adults: results from NHANES III. *J Am Diet Assoc*. 2005 Aug;105(8):1231-9. doi: 10.1016/j.jada.2005.05.003.