

EWASH trial: a cross-over cluster randomised trial comparing electrolysed water with bleach for hospital cleaning in Nigeria



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BACKGROUND

- Environmental hygiene is a key aspect of IPC in hospital settings.
- Cleaning practices in hospitals in low-income countries continue to rely on sodium hypochlorite ("bleach"), which is corrosive, toxic and requires accurate dilution¹.
- Neutral Electrolysed Water (EW) is an innovative surface disinfectant with high-level antimicrobial activity which is neither toxic nor corrosive, and presents no environmental hazard^{1,2,3}.
- Evidence Gap:** EW has never been tested for efficacy in LMICs hospitals, nor under a blinded comparison randomized design.

METHODS

Design

- A **non-inferiority, multi-period, cross-over cluster randomised trial** was used to evaluate the efficacy of EW for surface disinfection compared to standard disinfectant (chlorine-based bleach) in two hospitals in Abuja, Nigeria, over six weeks.
- Clusters** were the female (medical and surgical), male (medical and surgical), and labour wards in each hospital
- Three clusters were selected in each hospital and randomly allocated to one of the two intervention-control sequences. (Fig 1 for the allocation). The **allocation** was created by the study statistician.

	Week 1		Week 2		Week 3		Week 4		Week 5		Week 6	
	4 d	3 d	4 d	3 d	4 d	3 d	4 d	3 d	4 d	3 d	4 d	3 d
Cluster 1	EW											
Cluster 2	Bleach											
Cluster 3	EW											
Cluster 4	Bleach											
Cluster 5	EW											
Cluster 6	Bleach											

Fig1. Allocation sequence

EW Electrolyzed water Bleach Wash-out period

- Each week, the cluster received the allocated product for 4 days and there was a wash-out period of 3 consecutive days during which standard cleaning products were used.
- Hospital staff and data collectors were **blinded** to the treatment allocation because the products were provided daily with identical bottles and prepared by the project manager.

Sample size

- The study design was expected to have 87% power to demonstrate non-inferiority at a 5% margin.

Primary outcome definition

- Microbiological cleanliness was measured using double sided dipslides with non-selective agar for Aerobic Colony Count (<2.5 cfu/cm² = clean; ≥2.5 cfu/cm² = not clean).

Analysis

- Data were aggregated at the ward-period level. The proportion of "clean" surfaces were analysed with a standard linear regression. The model includes weeks and cluster as fixed effects.

RESULTS

Distribution of cleanliness by week

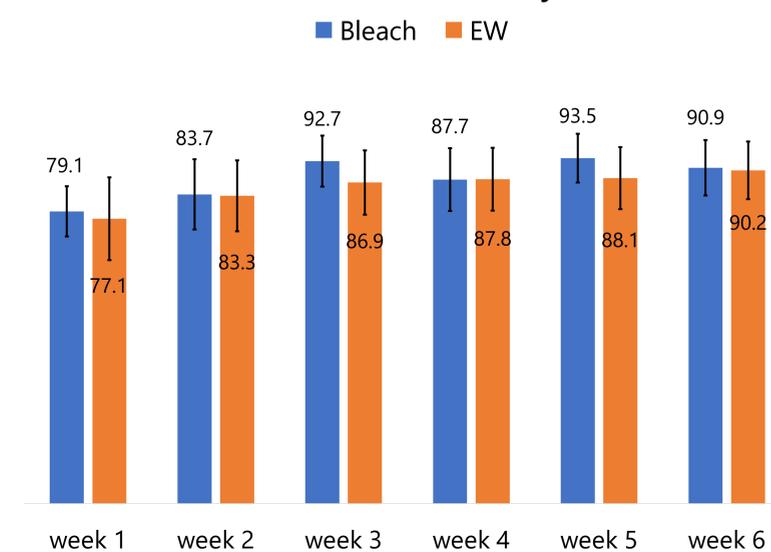


Table 1. Results from linear regression with week and cluster as fixed effects

Exposure*	% (N)	Difference	S.E.	P- value	C.I.
Bleach (ref)	87.3	1			
Electrolyzed water	84.8	-2.3%	0.0163	0.163	(-5.71 – 1.0)

DISCUSSION

This was the first randomised trial to assess the efficacy of EW compared to bleach for hospital disinfection in LMICs. Our findings suggest that EW performs similarly to bleach. Although the 5% non-inferiority margin was not strictly met, the observed average difference (2%) was small and not statistically significant (p=0.16).

Crucially these results are to be interpreted in the following context:

- EW performed at lower concentration compared to bleach (See product characteristics)
- Unplanned differences in group sizes led to less power compared to original sample size calculation

PRODUCT CHARACTERISTICS

ELECTROLYZED WATER (hypochlorous acid)

- Dilution 0.015% → 150 ppm
- Concentration → 150 ppm

BLEACH (sodium hypochlorite)

- Dilution 0.05% → 500 ppm
- Concentration → 500 ppm

ADVANTAGES OF EW IN PRACTICE

- EW performs similarly to bleach at a lower concentration
- We estimate that EW is ~10 times cheaper when produced locally compared to currently procured bleach
- EW is less corrosive for cleaners' skin and materials
- EW's environmental residue is negligible compared to bleach
- EW can be used for a wide set of applications: e.g. wound burns, medical equipment disinfection

Key references

- Meakin, N. S., Bowman, C., Lewis, M. R. & Dancer, S. J. Comparison of cleaning efficacy between in-use disinfectant and electrolysed water in an English residential care home. *J. Hosp. Infect.* 80, 122–127 (2012).
- Thorn, R. M. S., Lee, S. W. H., Robinson, G. M., Greenman, J. & Reynolds, D. M. Electrochemically activated solutions: Evidence for antimicrobial efficacy and applications in healthcare environments. *Eur. J. Clin. Microbiol. Infect. Dis.* 31, 641–653 (2012).
- Stewart, M. et al. Evaluating Use of Neutral Electrolyzed Water for Cleaning Near-Patient Surfaces. *Infect. Control Hosp. Epidemiol.* 35, 1505–1510 (2014).
- Dancer, S. J., Mallon, J., Murphy, R. & Murch, C. In-use effect of electrolysed water on transcutaneous oxygen sensors. *Healthc. Infect.* 20, 141–144 (2015).