

**Abstract Submission No.: A-1518****Optimizing Dialysate Temperature Control Through Predictive Machine Learning for Improved Patient Comfort and Resource Efficiency in Green Nephrology**

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**Objectives :** Optimal dialysate temperature control plays a pivotal role in hemodialysis, influencing both patient well-being and equipment efficiency. This study aims to develop and validate a predictive machine learning model for real-time dialysate temperature adjustment, with a strong emphasis on sustainability in the field of nephrology.

**Methods :** We gathered a dataset from 800 hemodialysis sessions, including a wide range of patient-specific parameters, environmental variables, and real-time adjustments in dialysate temperature. Utilizing this dataset, we developed and meticulously trained a recurrent neural network (RNN) model tailored to forecast optimal dialysate temperatures based on the multifaceted input parameters. The model's performance was rigorously validated. Following validation, we conducted a randomized controlled trial involving 300 hemodialysis patients to assess the predictive model's effectiveness when compared to traditional manual temperature control methods.

**Results :** The predictive machine learning model demonstrated its efficacy by maintaining dialysate temperatures within a clinically appropriate and narrow range. This achievement yielded a remarkable 27.6% reduction in energy consumption and a 16.8% decrease in water usage during hemodialysis sessions. Additionally, it led to substantial enhancements in patient satisfaction scores, with 87.5% (95% CI: 85.3% - 89.7%) of patients reporting heightened comfort and reduced post-dialysis fatigue. Moreover, the model contributed significantly to a 21.2% reduction in maintenance costs for dialysis machines, translating to an estimated cost savings of \$23,700 per machine annually.

**Conclusions :** Our study demonstrates the potential of predictive machine learning in advancing sustainability in nephrology through optimized dialysate temperature control. This approach conserves resources, enhances patient experiences, and reduces maintenance costs, making hemodialysis more environmentally responsible, economically viable, and patient-centric.