RETASTE Conference Abstracts
RETASTE-FWM-1433-In-person Oral
Rethymno, September 16-18, 2026
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DOI:10.5281/zenodo.23678417

Understanding Hospital Food Waste Through System Dynamics: Evidence from a Full-system Direct Weighing Study

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Abstract

Hospital food waste (HFW) remains underexplored as a systemic institutional inefficiency despite increasing sustainability pressures in healthcare systems. This study combined full-system direct weighing, mixed-method triangulation and causal loop diagramming to analyse HFW generation across inpatient, staff and public food service sectors in one of the largest hospitals in Spain. Results showed that 92% of discarded food remained edible at the point of disposal, while inpatient inefficiency substantially exceeded that of non-clinical food service areas. Importantly, 36-39% of inpatient edible waste originated upstream of patient consumption, indicating that a substantial share of HFW was generated through operational surplus and production buffer dynamics rather than plate waste alone. Although digital-logistical improvements reduced several operational inefficiencies, substantial waste persisted after intervention, suggesting an efficacy ceiling for optimization strategies focused exclusively on coordination and menu flexibility. The findings conceptualize HFW as an emergent property of interacting clinical, operational and regulatory dynamics requiring systemic institutional redesign beyond downstream behavioural interventions.

Keywords: hospital food waste, institutional foodservice, system dynamics, causal loop diagram, circular economy