System dynamics modeling of congestive heart failure in chronic kidney disease

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BACKGROUND: This study aims to evaluate the impact of two promising strategies to reduce risk of patients with chronic kidney disease (CKD) and congestive heart failure (CHF), using a strong evidence-base in a system dynamic model.

METHODS: Systematic review was used to create a causal loop diagram which was qualitatively validated with content experts. The Computational (stock-flow) model was developed based on the salient points in Vensim (Harvard).

RESULTS: The ROI of increased RAAS blockade usage to 70% and 90% were 23% and 24% respectively. Implementation of NTproBNP quarterly monitoring for all CKD-CHF patients required an investment of $312 million with an ROI of 87% and lead to 3.1% and 3.0% reduction in CHF hospitalizations and deaths.

CONCLUSION: NTproBNP guided therapy has a higher ROI and a moderate degree of reduction in poor outcomes compared to RAAS blockade in combating CHF in CKD.