

# Optimizing financial effects of HIE: A multi-party linear programming approach

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## Motivation

Health Information Exchanges (HIEs) are organizations that foster the seamless integration of healthcare information from the laboratory through the clinical setting[3]. There have been very few systematic approaches to assist policy making that concerns HIE formation and participation. This research applies operations research to community health, thereby providing valuable insights about how HIE financial policies may stimulate or inhibit the participation of the various health care institutions involved. A better understanding of the economic consequences of different implementations of an HIE network is fundamental to the development of the National Health Information Network.

## Background

HIEs provide an efficient mechanism for sharing data across disparate institutions[2]. Accurate mathematical models are critical in designing sustainable HIEs that yield a financial benefit to all its participants. Previous research [4] describe simplified approaches such as single-actor return-on-investment models to estimate the societal value that HIEs create by providing participating institutions with access to relevant patient data. These approaches[1] do not incorporate the uncoordinated actions of individual institutions, thus resulting in policies that may conflict with an institution's best interest. In this work, we develop a multi-party linear programming-based framework that can quantify the financial consequences of HIEs on each participating institution. We demonstrate the use of this framework in designing sustainable HIE subscription policies.

## Methods and Procedures

Linear programming (LP) is a mathematical modeling framework for identifying an agent's decisions (HIE pricing policies) that lead to optimal outcomes (maximum HIE profit) given a set of requirements that the agent must satisfy (financial sustainability). We developed an LP framework to evaluate three HIE pricing policies: fixed-rate annual, charge per visit, and charge per look-up. We considered three, well documented, outcomes of HIE-related emergency care: preventing unrequired hospitalizations, reducing duplicate tests, and avoiding ED visits. We applied this framework to 4639 ED encounters (involving three diseases) over a 12-month period in three large EDs in Milwaukee, Wisconsin. Our framework was instantiated with Medicare/Medicaid claims data, public reports of hospital admissions, published payer mix data, and use data from a not-for-profit regional HIE.

## Results

HIE data accesses produced net financial gains to all providers and payers. Additionally, we observed that reducing unrequired hospitalizations and avoiding repeat ED visits were responsible for more than 70% of the savings. We concluded that fixed annual subscriptions can sustain the HIE, while ensuring financial gains to all participants.

## Future Work

Our HIE pricing recommendations apply only to the study population. However, the main contribution of our work lies in the modeling framework which can be extended to various settings. In order to increase the awareness and visibility of our framework in evaluating the effectiveness of an HIE's financial policies, we need to establish a plan for large-scale testing. In subsequent research, our models would need to be tested in a variety of HIEs, for larger study populations over longer periods of time. We seek collaborators from the medical informatics community to answer several exciting questions that can add quantitative evidence to our preliminary findings.

## References

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