*dHealth 2023*
*B. Pfeifer et al. (Eds.)*


*doi:10.3233/SHTI230026*

# Logic Models for Evaluation of Complex Health Information Systems

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**Abstract.** Background: Complex health IT needs to be planned and evaluated. Objectives: To propose logic models for the evaluation of complex health IT. Methods: Logic models describe input, activities, output, outcome, and impact. Results and Conclusion: This first example of a logic model for patient portals shows how health IT planning and evaluation may benefit from logic models.

**Keywords.** Patient portals, evaluation study, outcome assessment

## 1. Introduction

Digital transformation of health care claims to support effectiveness and efficiency of health care. Systematic evaluation helps to assess the impact of health IT, identify areas of improvement, and promote medical informatics as a scientific discipline [1]. Randomized Controlled Trials are considered the gold standard for evaluating an intervention. However, RCTs are inadequate to evaluate the impact of health IT as a complex intervention comprising social, technical, and organizational components. We want to investigate how logic models may support planning and evaluating health IT. We will use patient portals as an example.

## 2. Background: Patient portals

A patient portal is a web-based application managed by a healthcare organization. It allows patients to access health-related data. Patient portals may comprise a variety of other functions, such as scheduling appointments, examination reminders, secure communication with a physician, or uploading patient-generated data [2]. Patient portals are complex interventions consisting of technical (i.e., secure web-based access), organizational (i.e., the role of physicians in handling patient-generated data), and social components (i.e., patient's health and digital literacy). A recent Cochrane Review [2] on the impact of patient portals found no or limited impact on patient empowerment or health-related outcomes. This Cochrane Review only included RCTs. Logic models may help better understand patient portals' impact (or missing impact).

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## 3. Methods and Results

Logic models are conceptual models. They describe causal relationships between several components of an intervention, the interaction of the components, and the effects [3]. Logic models support the planning and evaluation of complex interventions [4]. They have been successfully used in many fields, such as social science, political science, educational science, and Health Technology Assessment [3]. Medical Informatics has not yet made much use of logic models to plan and evaluate complex interventions such as patient portals, telemonitoring programs, or electronic health records [5].

In most cases, logic models comprise five elements: Input (resources to implement the intervention), activities (what the intervention "does"), output (what the intervention presents as immediate results), outcome (the impact of the intervention on the intended target groups) and impact (the long-term societal impact of the intervention). Simple logic models display these elements from left to right. More complex logic models (such as Theory of Change logic models) show how the various components interact and affect outcome and impact (Figure 1). This visualization helps to plan and optimize each component and their relation, to reach the expected impact of health IT [4].

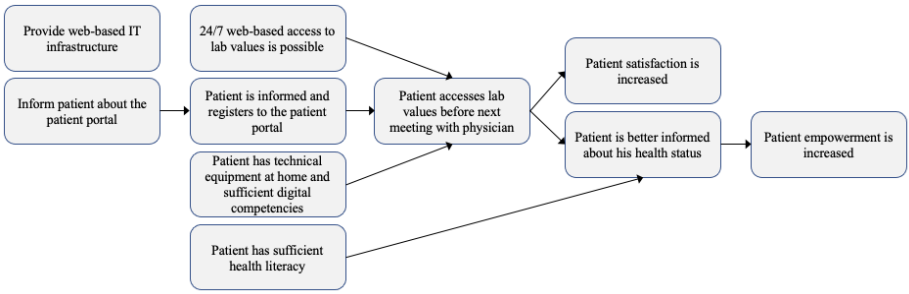


**Figure 1.** A simple logic model (extract) for describing the impact of a portal on patient empowerment.

## 4. Discussion

Logic models have been found useful to plan and evaluate complex socio-technical-organizational interventions. Medical informatics may profit from using logic models to understand complex IT interventions' effect mechanisms better and optimize them [5].

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