

Chapter 25

A Simulation Framework for Evaluating the Effectiveness of Chronic Disease Management Interventions

Rafael Diaz

Old Dominion University, USA

Joshua G. Behr

Old Dominion University, USA

ABSTRACT

The treatment and management of chronic diseases currently comprise a major fraction of the United States' healthcare expenditures. These expenses are projected to increase as the US population ages. Utilization of the ambulatory healthcare system stemming from chronic conditions has been seen as contributory factor in the rising expenditures. Efforts to better manage chronic conditions ought to result in better health outcomes and, by extension, savings through lower utilization of ambulatory services. The longer-term financial consequences of such interventions, however, are more uncertain. This study offers a System Dynamics simulation framework that identifies and models the critical relationships associated with health outcomes and longer-term financial consequences. This framework is demonstrated through a comparison between groups with a similar generic chronic condition, but one group is subjected to a management intervention and the other group is not. The framework provides constructive insights into how the initial intervention cost estimates, the resulting savings, and the health status may change depending on uncertainties, feedback effects, and cost structures.

1. INTRODUCTION

Major portions of U.S. healthcare expenditures are attributable to the treatment and management of chronic conditions. Nearly 78 percent of healthcare dollars were spent for treatment of chronic conditions in 1998 with an estimated half the female population and 40 percent of the male population having at

DOI: 10.4018/978-1-5225-3168-5.ch025

least one chronic condition (Anderson & Horvath, 2004; Tu & Cohen, 2009). The increase in Medicare spending between 1987 and 2002 has been attributed to the treatment of patients with multiple chronic conditions (Thorpe & Howard, 2006). Medicare patients, for example, with a single chronic condition will have, on average, far fewer contacts with physicians annually relative those with multiple conditions (Vogeli et al., 2007). The per capita Medicare expenditure for those with at least four chronic conditions is roughly \$14,000 while the annual expenditure for those without a chronic condition is less than \$300 (Wolff & Starfield, 2002). Nearly half of the U.S. healthcare expenditures in 1996 are accounted for by the five chronic conditions of mood disorders, diabetes, heart disease, asthma, and hypertension (Druss et al., 2001). Chronic diseases are a persistent and escalating problem; 28 percent of adults with chronic conditions report financial problems in dealing with healthcare costs, more than double those with non-chronic medical conditions (Tu & Cohen, 2009) and the percent of personal income dedicated to the management of chronic conditions is significantly greater for the uninsured relative the insured (Hwang, Weller, Ireys, & G., 1996; Tu, 2004). Since chronic disease is common among non-disabled persons 18-64 years of age, these conditions frustrate U.S. work and productivity outputs (Hoffman, Rice, & Sung, 1996; Kessler, Greenberg, Mickelson, Meneades, & Wang, 2001).

Chronic diseases affect lifestyle, mobility, and longevity and are associated with ailments that do not have a recognized, permanent cure. There are a number of criteria available to assist clinicians and researchers in classifying chronic versus non-chronic conditions. Beginning in the 1990s, researchers argued for a non-categorical understanding of chronic vs. non-chronic conditions. Stein & Silver (1999) argue for a more inclusive definition, one that considers the functional status of the individual along with the degree of utilization of health care services over an extended period. Battersby et al. (2003) developed a generic self-assessment scale for management of chronic conditions. O'Halloran et al. (2004) provides a broader framework for defining chronic conditions wherein duration, prognosis, pattern, and sequelae are considered relevant factors.

The management of these chronic ailments may be approached through the application of a variety of interventions ranging from a medical-clinical management of the condition to an informed self-management of the condition (Barlow et al., 2002; Zwar 2006; Wagner et al., 1996). In its broadest sense, self-management includes engendering a sense of self efficacy and confidence in one's ability to change behavior and control the environment to better manage the impact of the chronic condition on quality of life (Bodenheimer, Lorig, Holman, & Grumbach, 2002; Newman, Steed, & Mulligan, 2004). Gorobets consider and identify major socio-economic and environmental roots of chronic diseases at the global scale (Gorobets, 2011). Other interventions may offer patient financial incentives to better manage conditions (Weingarten et al., 2002).

Evaluating the effectiveness of intervention alternatives upon the behavior of a targeted population for a given condition is a meaningful undertaking. Since resources available for implementing interventions are limited in most scenarios, the ability to better understand the various clinical outcomes stemming from the competing interventions allows for the most satisfactory solution relative to the available investment. Thus, it becomes imperative to perform a thorough analysis to determine which intervention, or set of interventions, produces satisfactory results in terms of population health and cost. Table 1 summarizes basic literature related to quantifying the health and financial benefits of interventions targeted to address chronic diseases.

Most papers found in the literature focus on analyzing the effects post-intervention of particular interventions on certain populations that suffer a specific set of chronic conditions. From Table 1 and the literature discussed before, the following conclusions are possible. The majority of application-

18 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the publisher's webpage:

www.igi-global.com/chapter/a-simulation-framework-for-evaluating-the-effectiveness-of-chronic-disease-management-interventions/186098

Related Content

Digital Ethics in Technology and Investments

Ritesh Jain (2024). *Research Anthology on Business Law, Policy, and Social Responsibility* (pp. 457-471).
www.irma-international.org/chapter/digital-ethics-in-technology-and-investments/335716

Being on the Safe Side: Intellectual Property Rights and Transparency in E-Learning

M. Banu Gundogan (2016). *Developing Successful Strategies for Global Policies and Cyber Transparency in E-Learning* (pp. 83-94).
www.irma-international.org/chapter/being-on-the-safe-side/139494

mHealth Environments for Chronic Disease Management

Eleni I. Georga, Athanasios N. Papadopoulos and Dimitrios I. Fotiadis (2019). *Healthcare Policy and Reform: Concepts, Methodologies, Tools, and Applications* (pp. 659-677).
www.irma-international.org/chapter/mhealth-environments-for-chronic-disease-management/209150

Synergizing Horizons: The Tech-Driven Unification of Health, Environment, and the Law

Anupreet Kaur Mokha (2024). *Bridging Health, Environment, and Legalities: A Holistic Approach* (pp. 229-253).
www.irma-international.org/chapter/synergizing-horizons/338124

The Mean Failure Cost Cybersecurity Model to Quantify Security in E-Learning Environments

Neila Rjaibi, Latifa Ben Arfa Rabai and Ali Mili (2016). *Developing Successful Strategies for Global Policies and Cyber Transparency in E-Learning* (pp. 95-120).
www.irma-international.org/chapter/the-mean-failure-cost-cybersecurity-model-to-quantify-security-in-e-learning-environments/139495