Using Optimization Tools to Improve Policy Decisions and Implementation: Obstacles and Potential Solutions for Health Policy

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Abstract:

An optimization modeling approach has been gradually used as a guide to evidence-based policy making and implementation process in many national and regional governments. Not only academic researchers but also practical policy analysts become more interested in developing and applying optimization tools, such as operational research, location models, systems analysis, decision science, and statistical simulation, in order to enhance effectiveness and transparency of decision-making and implementation process in a variety of public policy matters, such as health policy. However, it is widely reported that policymakers and planners who have actually used mathematical tools usually faced many obstacles to successful application which often overshadowed the benefits of the tools. Due to such obstacles, there has been no widespread adoption or implementation of mathematical tools in policy process despite the increasing number of academic publications dealing with mathematical modeling for public health problems. The implementation problem is even more critical when applied to the contexts of developing countries.

This paper discusses how the optimization tools could best be used in the actual health planning processes in developing countries. It reviews the key literature to examine how mathematical tools have been used in a variety of different planning practices in developing countries, such as economic development planning. This literature review summarizes the potential obstacles to adopting and implementing mathematical tools and the recommendations for overcoming such obstacles. Based on the literature review, it discusses how to put the mathematical tool into practice in vaccination planning processes in China. In particular, it highlights how to present the potential contributions of the mathematical tool to vaccination policy-makers in China for the design of vaccination strategies which would be best for the entire society. It is hoped that these efforts help facilitate the successful adoption and utilization of this tool in the national vaccination planning process in China and in other developing countries.
Introduction

The mathematical tools, particularly the optimization tools, have been available for health planners in developing countries to use for supporting policy making and implementation processes. However, it is widely reported that planners who have actually used optimization tools\(^1\) usually faced many obstacles to successful application which often overshadowed the benefits of the tools (Ravn and Vidal, 1986). Due to such obstacles, there has been no widespread adoption or implementation of optimization tools in the health planning process despite the increasing number of academic publications dealing with optimization research for health problems (Wilson, 1981; Fone et al., 2003; Brailsford, 2005). As Carter et al. (1973) pointed out, the implementation problem is even more critical when applied to the contexts of developing countries.

This paper discusses how the optimization tools could best be used in the actual health planning processes in developing countries. It reviews the key literature in the field to examine how optimization tools have been used in a variety of different planning practices in developing countries, such as economic development planning (Ackoff, 1977; Fisher and Rushton, 1979; Clayson, 1980), water resources planning (Yeh, 1985; Rogers and Fiering, 1986; Cai et al., 2002), and health care planning (Wilson, 1981; Hassam et al., 1986; Durrheim et al., 2002; Harper and Pitt, 2004). This literature review summarizes the potential obstacles to adopting and implementing optimization tools and the recommendations for overcoming such obstacles. Based on the literature review, it discusses how to put the optimization tools into practice in vaccination planning processes in China.

Use of optimization tools for health policy: Obstacles and resolutions

A number of studies argue that the systematic selection of locations for health services is one of the main keys to improving the results of such services in developing countries (Hassam et al., 1986; Rushton, 1988; Rahman and Smith, 1999). The literature has demonstrated that location decisions based upon optimization tools may provide better results than conventional decisions in the absence of any formal analysis (Rahman and Smith, 2000). In spite of many academic authors praising the virtues of optimization tools, however, they have often gone neglected as locations for health services frequently have been determined politically or pragmatically without a systematic approach (Fisher and Rushton, 1979; Nyonator and Kutzin 1999).

Since the 1960s, optimization tools have been applied to a wide range of public problems. The potential contributions of optimization tools are now widely recognized among researchers, but the issue at hand is how to ensure their utilization (Lee and Olson, 1980). While a majority of the academic literature has been dedicated to developing more sophisticated optimization models, few researchers discussed how they have been put into practice in the planning process. Furthermore, most of the literature reported significant problems in implementation. Among others, Ackoff (1960) examined a number of published reports dealing with optimization research, and found that only a few adopted or implemented the results from such findings in actual planning practices. Rogers (1986) reviewed 22 case studies of applications of optimization tools to water resources planning.

\(^1\) In this paper, the term “optimization tools” is used in a broad sense which covers operational research (OR), OR-type mathematical tools, location models, and systems analysis (Rogers and Fiering, 1986).