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Benefit efficient statistical distributions on patient lists

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Abstract

In this paper, we consider statistical distributions of different types of patients on the patient lists of doctors. In our framework different types of patients have different preferences regarding their preferred choice of doctor. Assuming that the system is benefit efficient in the sense that distributions with larger total utility have higher probability, we can construct unique probability measures describing the statistical distribution of the different types of patients.

JEL Classification: I18; I30

Keywords: Patient lists; Efficient welfare; Statistical distributions

1. Introduction

The Norwegian medical system is based on a construction where all people living in Norway are given the option to be a part of the "patient list system in general practice". A person can choose not to be part of the system, but a large majority (99.5%) have chosen to participate. The system works in the following way: in every community there is a pool of doctors having agreed to take care of certain numbers of patients. In the sequel we will refer to these numbers as the list lengths of the doctors. The list lengths may vary from doctor to doctor, and there are usually between 500 and 2000 patients on every list. The doctors receive a fixed annual income for each patient on their lists. In return the doctors agree to be medically responsible for the patients on their lists. It goes without saying that some doctors are more popular than others. Hence some

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patient lists are full, i.e., the doctor cannot undertake responsibility of more patients. A list of all doctors with vacancies is made public every month. Newcomers to the system can apply for vacancies, and those that are already members can apply to be transferred to a new doctor.

In a survey made by the Norwegian Ministry of Health and Care Services (2004) it is reported that a total of 3713 doctors participated in the system. Their average list length were 1203 patients, and they were serving a total of 4 563 751 patients. The 1687 doctors reported no vacancies, while the remaining 20 264 doctors had an average of 223 vacant places on their lists. Only 30% of the doctors participating in system are women. There is hence a general shortage of women doctors. A significant number of patients prefer female doctors to male doctors. These patients prefer being on the list of a female doctor where they often will have to wait several weeks for a consultation, rather than being on the list of a male doctor. On average 4000 patients change from a male to female doctor every year.

To obtain a statistical model which takes into account that different people have different preferences, we will consider a situation where there are S groups of patients and T types of doctors. The groups differ in their preferences for the different types of doctors. In particular we pay attention to a case where we divide the patients into male and female doctors, i.e., $T = 2$, and where the patients are divided into $S = 4$ groups:

- MM: men who want a male doctor;
- MF: men who want a female doctor;
- WM: women who want a male doctor;
- WF: women who want a female doctor.

The challenge is then to formulate a model expressing that different groups may differ in the strength of their preferences. In such a model we should allow constructions where some patients do not stay on any list, and allow for cases where we have vacancies.

The approach chosen in this paper is based on a newly developed theory of efficient systems, see Jörnsten and Ubøe (2005). The basic idea in this theory is to assume that each individual has a certain utility/disutility attached to his or hers allocation in the system. Given a specific allocation of all the individuals, we can describe the total welfare of that particular allocation by the sum of the utility of all the individuals. The individuals cannot freely choose their allocation; they can only choose allocations that are compatible with the various list lengths. In a well functioning society, authorities introduce incentives/legislation to avoid suboptimal allocations. In such cases we would then expect that the so-called efficiency principle holds:

> *LetA_1 and A_2 denote any two allocations of patients to lists. If the total utility of A_1 is larger than of A_2, the probability of A_1 should be larger than the probability of A_2.*

Assuming that our system is efficient, we should then seek to find all distributions that are compatible with the efficiency principle. It is surprising to observe that there are very few probability measures of this sort. Following the construction used in Jörnsten and Ubøe (2005), the only such probability measures can be described by explicit one-parameter formulas, see Section 2.1. The parameter quantifies the strength of peoples preferences, and can be interpreted as a choice of unit for utility. Once a choice of unit has been made, we are left with a unique probability measure, and we refer to this measure as the benefit efficient probability measure. Assuming that there are many patients of each type, we then expect to observe allocations that are compatible with this measure.

The main theory in Jörnsten and Ubøe (2005) is based on well known principles from gravity modeling. Since the first major results in the late 1960s, e.g., Wilson (1967), gravity models has