

ABSTRACT

The need for statistical surveillance has been noticed in many different areas. Examples of applications discussed in this thesis include the detection of an increased incidence of a disease and the detection of intra-uterine growth restriction. In both cases, preventive actions might be possible if the alarm is made early. If the change is detected too late, this can have severe consequences both at a personal level for affected individuals and to society as a whole. We must evaluate the evidence value of the information we have about the process in order to guide us in the choice of making an alarm or not. The aim is to detect the change as quickly as possible and at the same time control the false alarms. The theory of statistical surveillance deals with the construction of alarm systems and the evaluation of such systems. This thesis consists of four papers with this common subject.

In Paper I, statistical surveillance in the area of public health is treated. A critical review with emphasis on the inferential issues is made. The merits of different approaches are discussed and two new methods are derived. Especially noticeable from the review is the lack of methods for surveillance of a spatial pattern, including many important applications not only in public health.

In Paper II, the properties of a special type of surveillance methods called EWMA methods are treated. Several ways of constructing alarm limits have previously been suggested in literature. New types of evaluations of the performance of suggested variants are made and the results cast new light on both the merits of the variants and the optimality criteria commonly used. Of special interest are the conceptual differences found between one- and two-sided versions of the methods.

In Paper III, several issues of optimality regarding EWMA methods are treated. Three different optimality criteria are studied. New types of alarm limits are suggested by approximation of the full likelihood ratio method. By using the new limits, the properties are considerably improved. The issue of comparability between methods is also discussed.

In Paper IV, the problem of detecting intra-uterine growth restriction based on repeated measurements of symphysis-fundus height is treated. A new method is proposed based on the theory of statistical surveillance. It is found superior to the one used in practice in Sweden today.