

Making Sense of Statistics for Family Practitioners: “What are ecological studies?”

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Introduction

There are three quantitative study types usually used by medical and public health researchers to understand disease distribution patterns and risk factors: ecological, case-control and cohort studies. In the next three articles we will briefly consider each study type's strengths and weaknesses, beginning with ecological studies.

What are ecological studies?

Ecological studies consider where and when diseases are occurring in populations. The presence / absence of specific risk factors is not related to individuals with or without disease, but rather to populations. Thus, for example, comparison of published African HIV and circumcision rates demonstrated higher rates of HIV in those countries with low rates of male circumcision and visa versa.¹ Ecological studies are often denigrated as “weak” study types as they “cannot prove anything”. Skeptics argue that there are many other characteristics that differ between African countries that may affect HIV prevalence. However, the purpose of ecological studies is not to prove relationships but rather to raise questions that should be explored by means of the other study types we will discuss later. Ecological studies have the advantage that they are cheap and quick to conduct, as they use routine data that has already been collected for other purposes. This is obviously also a weakness, as the quality of data over time and from different places may be quite variable.

To further illustrate the value of ecological studies, let us consider a recent southern African example. KwaZulu-Natal province replaced DDT with synthetic pyrethroids for malaria control (indoor house spraying) in 1995; Mpumalanga province followed suit two years later, while Limpopo province began phasing out DDT in 1997. Swaziland did not replace DDT (annual

reported malaria cases are displayed in figure 1). Although all four areas experienced increased malaria cases with the heavy rainfall of 1996, the number of malaria cases in the three provinces showed a dramatic upward trend coinciding with pyrethroid introduction, while the incidence of malaria declined in Swaziland during the same period.² This ecological phenomenon was later shown to be due to the emergence of a mosquito vector that was resistant to pyrethroids but sensitive to DDT in South Africa and so DDT spraying for malaria control was recommenced in South Africa in 2001.³

A word of caution is in order, if other factors change over time, for example, the proportion of the Swaziland population that own a television set, then health trends, for example the increasing prevalence in cervical cancer may falsely be attributed to television set ownership.

This phenomenon is termed the “ecological fallacy”. These associations are then best discerned in studies of risk factors amongst individuals in the population of interest. In conclusion, ecological studies have their usefulness in describing differences between groups and help to identify questions for further investigations.

References

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