An Academic Approach:

A new approach of nonparametric estimation of incidence and lifetime risk based on birth rates and incident events
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http://www.biomedcentral.com/1471-2288/7/53/

I. Summary

This research study investigated methods of estimating disease incidence rates – using nonparametric estimates (those which are not based on the assumption that incidents rates will fall under a "normal distribution" curve.). The study used two methods:

- The first considers incident cases occurring within a fixed time window, linked explicitly to the birth process in the past.

- The second approach uses the Nelson-Aalen estimate requiring knowledge of observed time at risk for the entire cohort and their incident events.

Both approaches used data from individuals on anti-diabetic medications obtained from Odense Pharmacoepidemiological Database, which covers a population of approximately 470,000 over the period 1993–2003. For both methods we investigate if and how incidence rates can be projected.

II. Statement of purpose

Diabetes is a severe disease, which is becoming increasingly prevalent in countries throughout the world. From a public health perspective it is vital to get good estimates of the present and future burden of diabetes. One measure of primary interest is diabetes incidence, both with respect to calendar time and age. If combined with a model for mortality, it allows estimating lifetime risk of diabetes, another important public health measure. Also, if combined with data on birth rates, it is possible to obtain a projection of future incidence, often needed for planning of health care services.

As the annual risk of developing diabetes is low in a general population very few follow-up studies exist for a general population. Even fewer estimate increasing age-specific incidence rates in the general population. Previously, subjects of different ages in a survey originated from different birth cohorts. Consequently, the life-time risk that was estimated pertained to a hypothetical cohort subjected to the current age-specific incidence and

mortality rates. Likewise, future incidence was predicted from assuming birth cohorts of a given size and then subject these to the same age-specific incidence and mortality rates observed in the survey.

Researchers proposed a different approach which from the outset links past birth rates to the occurrence of incident events in a (often relatively short) time window. We will term this type of data *cohort-of-cases data* as it is a cohort consisting entirely of cases. More specifically, we require the sample to include all subjects who have advanced to a certain end-point (failure event) within a given calendar time period–and only these cases. Further, we assume that the time origin (initiating event, birth time) of each case can be retrospectively identified. So far, statistical methods for this type of doubly truncated data have not (to the extent of the authors' knowledge) been extensively studied, when the rate of initiating events is not assumed constant over calendar time.

Researchers used data from the Odense Pharmaco-Epidemiological Database (OPED). This database contains information on all redemptions of medications prescribed by a physician and subsidized by the national health insurance at any pharmacy within in a well defined geographical area holding nearly 500,000 inhabitants. The drug class of interest here is that used to treat diabetes. While such data by definition only concern pharmacologically treated diabetes, they do offer the opportunity for comparing the proposed approach with the traditional approach.

III. Outcomes

Both the new and standard method yield similar sigmoidal shaped estimates of the cumulative distribution function of age-specific incidence. The Nelson-Aalen estimator gives somewhat higher estimates of lifetime risk (15.65% (15.14%; 16.16%) for females, and 17.91% (17.38%; 18.44%) for males) than the estimate based on cohort-of-cases data (13.77% (13.74%; 13.81%) for females, 15.61% (15.58%; 15.65%) for males). Accordingly the projected incidence rates are higher based on the Nelson-Aalen estimate– also too high when compared to observed rates. In contrast, the cohort-of-cases approach gives projections that fit observed rates better.

The developed methodology for analysis of cohort-of-cases data has potential to become a cost-effective alternative to a traditional survey based study of incidence. To allow more general use of the methodology, more research is needed on how to relax stationarity assumptions.

IV. Additional Resources

Henrik Støvring, et al. “Counting drugs to understand the disease: The case of measuring the diabetes epidemic.” (Denmark)

http://www.pophealthmetrics.com/content/5/1/2