Incidence estimation methods to inform drug policy.

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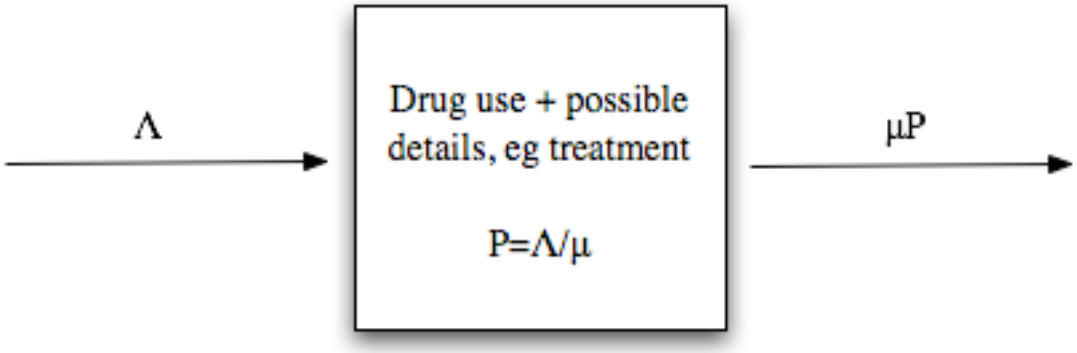
Basic idea of drug use modelling



Λ = incidence, μ = cessation, 1/duration
Prevention acts on Λ, treatment partially on μ, partially on activity level.

Incidence estimation "classically" performed using treatment incidence = "delayed" version of drug use... (also OD mortality, other events for which a "latency" period can be imagined...)

Depending on level of information about individuals in data, either RDA (reporting delay adjustment) or back-calculation methods are used to estimate drug use incidence over time, based on a longish time series of data and, in the case of BC, an estimate of the latency time distribution.

(see recent EMCDDA guidelines: Scalia Tomba GP, Rossi C, Taylor C, Klempova D, Wiessing L. (2008) Guidelines for Estimating the Incidence of Problem Drug Use. EMCDDA, Lisbon)

Only real assumption = constancy over time of latency period, alternatives (different between cohorts, in real time) rarely considered.

Usually, nonparametric method, i.e. no specific form of incidence is assumed.

Cessation before treatment usually not considered, external estimate necessary...

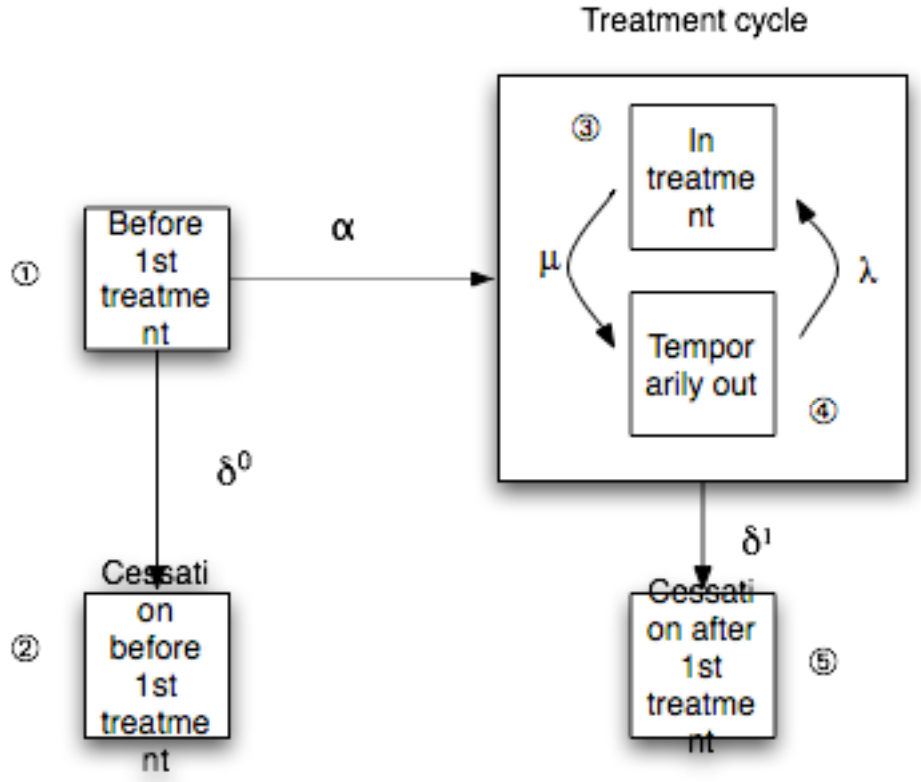
Also problem = expressing total uncertainty in estimation = statistical uncertainty about parameters + uncertainty in model.

Recently Nordt & Stohler have revived the idea of estimating incidence using prevalence data, specifically prevalence in treatment.

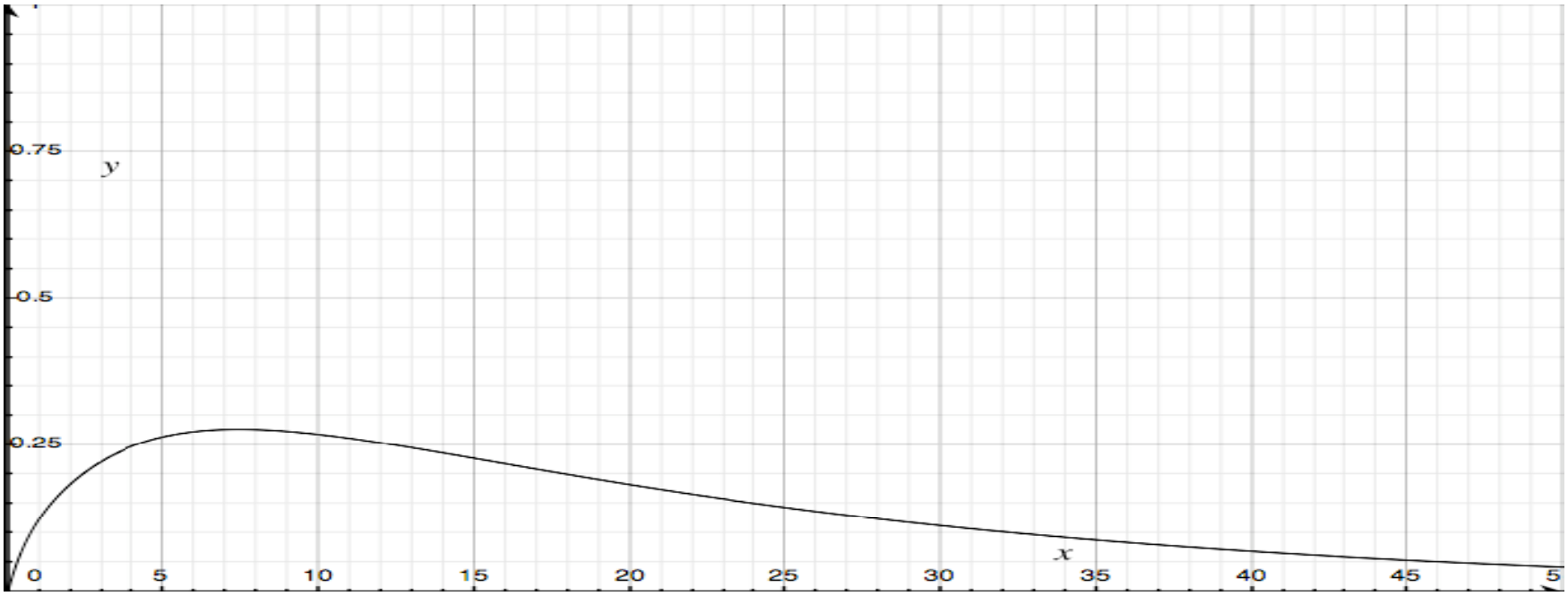
Based on very interesting observation on Zürich data (complete, long series of treatment data) that all onset cohorts seem to behave similarly in terms of future presence in treatment -> once a "general inclusion function" (GIF) has been estimated, prevalence data + individual info on onset year "even for a single day" is enough for reconstruction of past incidence...

(Nordt C, Stohler R (2008) Estimating heroin epidemics with data of patients in methadone maintenance treatment, collected during a single treatment day. *Addiction* 103,591-597)

A possible way to understand the GIF is by considering a (simple) model of the drug use career.



The GIF is then the probabilty over time of being in the treatment compartment. The advantage of this representation is that the GIF can be calculated based on estimates of the various parameters in the model, rather than on complete treatment data over time.



Specific choice of constants ($1/\alpha=5$, $\lambda=\mu=1$, $1/\delta_0=1/\delta_1=20$)

Problems with GIF approach

- estimating latency period, cessation rates, "in/out of treatment" cycle

- constancy over time of parameters, of cohort behaviour

- reasonable assumptions about the drug use career before treatment became available (cessation rate, entry in treatment when it becomes available)

(these last two considerations important also for RDA and BC...)

- becoming more "model dependent"...

Starting to get away from a "heroin-centric" view of drug use, essentially based on the distinction user/non-user and in/out of treatment, towards an understanding of "newer" drugs...

- instead of heavy & constant use vs no use, possible modelling approach is "distribution of intensity of use" representation of population (cf. tobacco & alcohol use...)
-> need to estimate the current state of such a distribution and its dynamics..
-> no more single "prevalence" measure but more advanced description...
-> single "incidence" and "cessation" replaced by movement rates between "intensity of use" levels...
-> interesting philosophical aspect: assigning a low intensity to an individual is a statement about his future...? maybe related to willingness to use/buy?

-> anyway, more studies of "drug use patterns and careers"

-> make mathematicians happy, because these new models would be of the partial differential equation (PDE) type, with real time, age and intensity as "independent" variables, more complicated than previously :-)