USING MICROSIMULATION MODELING TO CAPTURE HETEROGENEITY IN LIFETIME ILLICIT DRUG USE

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Purpose This analysis demonstrates the greater ability of microsimulation modeling – relative to standard methods – to explain the uncertainty and heterogeneity in patterns of lifetime illicit drug use, and to thereby provide more accurate estimates when modeling such use trajectories.

Methods We use Monte Carlo simulation to estimate distributions of lifetime drug use measures, and we compare these results to those from a population-based cohort model and a cross-sectional data analysis. Each model uses a starting population with baseline gender, race/ethnicity, education, and drug use characteristics of U.S.12 year-olds. At quarterly cycles, individuals face probabilities of transitioning between four physical locations (community; outpatient or inpatient drug treatment; or death) and four levels of proclivity to use drugs (non; occasional; regular; or heavy). Transition probabilities are based on current population data, and in the microsimulation model are functions of drug use history, location states, and demographics.

Results This analysis found that microsimulation is better able to capture heterogeneity in trajectories of lifetime drug use than are cohort and cross-sectional models. For example, where microsimulation yields a coefficient of variation on lifetime cocaine use (measured in grams) of 3.0, the cohort and cross-sectional models less fully explain the heterogeneity in such consumption, yielding coefficients of variation of only 2.31 and 0.90, respectively. While the simpler cohort model recognizes the distribution over time in expected values – with the expectation taken across individuals – it is not able to fully reflect the between-individual variation. The microsimulation, on the other hand, acknowledges variability across both dimensions of individuals and time, and thereby more completely incorporates the non-linear and interrelated nature of lifetime drug use and consequences.

Conclusions Microsimulation modeling of lifetime drug use and outcomes is a useful complement to traditional methods for representing heterogeneity in drug use across individuals and over time. This methodology can thus provide insight into medical and policy decisions – such as determining the optimal timing of treatment or designing other interventions – aimed at reducing the overall use of illicit drugs.