Simulation of the Effect of an Intervention That Reduces the Number of Friends Who Smoke on Transition from Non- to Daily Smoking in Adolescents

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Context

- Progression in smoking can be conceptualized as movement among discrete states, with never smoked at one end of the spectrum and daily smoking at the other end
- Discrete time Markov Chains Modeling can be used to model transition in smoking states from one time-point to the next

$$STATE_t \times TRANSITION\ MATRIX = STATE_{t+1}$$

Objective

- To simulate the impact of a theoretical intervention for adolescents that reduces the number of friends who smoke, on transition from non- to daily smoking. "Friends smoking" is a well-established and strong risk factor for smoking initiation

Methods

Participants

- Data were drawn from the NDIT Study, a prospective cohort investigation of 1293 grade 7 students recruited in 10 secondary schools in Montreal (Canada) in 1999-2000.
- Questionnaires were administered every 3 months during the 10-month school years for 5 years until students graduated from high school (total of 20 survey cycles).

Variables

- Smoking status (never smoker, puffer, smoked whole cigarette, monthly smoker, weekly smoker, daily smoker) was measured at each survey cycle
- Number of friends who smoke (no friends smoke, a few, about half, more than half, most or all) was measured in each survey cycle

Analysis

- Ordinal logistic regression (which "saves" on the number of parameters to estimate) was used to estimate a Markov transition matrix, and relate transition probabilities to covariates
- We used the matrix to simulate transition in smoking states over time according to a hypothetical intervention that shifts participants from "a few friends who smoke" to "no friend smoke"
- We chose to model transitions from "a few" to " no friend smoke" as a realistic target for public health intervention
- We tested the effect of an intervention that shifts 25%, 50% and 75% of participants from "a few" to "no friends smoke"

Results

- Without intervention, the proportion of daily smokers was 24.7% at the end of follow-up
- A 25% shift in the proportion of participants with "a few friends smoke" to "no friends smoke" resulted in a 2.2% reduction in daily smoking at the end of follow-up (from 24.7% to 22.5%)
- A 75% shift in the proportion of participants with "a few friends smoke" to "no friends smoke" resulted in a 6.5% reduction in daily smoking at the end of follow-up (from 24.7% to 18.2%)

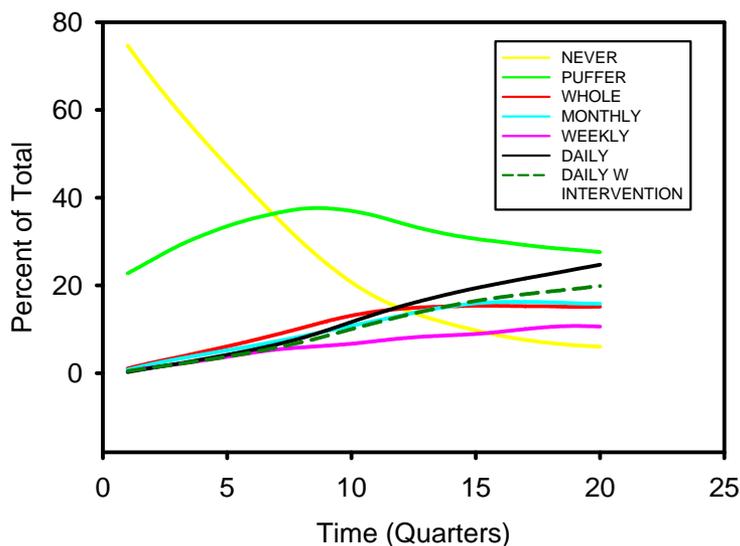**Figure. Proportion of participants in each smoking state over time**

Table. Proportion of participants in each smoking state at the end of follow-up according to the "success of the intervention"

	Success of intervention*			
	0%	**25%**	**50%**	**75%**
Never smoked	6.1	5.9	6.4	7.3
Puffer	27.6	31.7	35.2	39.8
Whole cigarette	15.2	14.6	14.4	13.0
Monthly smoker	15.9	14.6	14.8	13.4
Weekly smoker	10.5	10.7	9.4	8.3
Daily smoker	24.7	22.5	19.2	18.2

*Percent of participants in the "a few friends smoke" category shifted to the "no friends smoke" category

Reflection

- Discrete time Markov modeling offers an interesting approach to conducting "Thought Experiments"
- In this example, our "Thought Experiment" suggests that shifting even a few participants from "a few friends who smoke" to "no friends smoke" has an important effect on daily smoking

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