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A review of analytical approaches to assess transitions in patterns of tobacco product use in the population

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REDUCED-RISK PRODUCTS (RRPs)

Reduced-Risk Products ("RRPs") is the term PMI uses to refer to products that present, are likely to present, or have the potential to present less risk of harm to smokers who switch to these products versus continued smoking. PMI's RRPs in various stages of development, scientific assessment, and commercialization. Because our RRPs do not burn tobacco, they produce far lower quantities of harmful and potentially harmful compounds than found in cigarette smoke.

Outline

- Post-doc project
- Review objectives
- Methods
- Overview of findings
- Next steps

Post-Doc Project Aims

Identification and assessment of data collection and statistical tools to capture and characterize the pattern of tobacco/nicotine-containing product use in the population

- Tools to evaluate and analyze patterns and transition in use across different products over time
- Tools to accurately describe prevalence of use and exposure across different products

Review objectives

- Identify and describe analytical approaches to characterize transitions in product use patterns and trajectories

- Applicability to assess transitions between use patterns:
  - In longitudinal studies assessing use patterns over time
  - Considering possibilities of single, dual, or multiple product use, occasional and daily use, initiation, cessation, and switching between products

Methods

- **A scoping review**

- Literature search on PubMed database
  - Search terms capturing concepts relating to use behaviors
  - Key journals and bibliographies of identified studies

- Inclusion criteria
  - Study describes trajectory of use of at least one tobacco- or nicotine-containing product over a period of time

Overview of findings

The review identified six distinct approaches across the 35 studies

- Descriptive net transition percentage [N = 6 studies]
- Conditional (Markov) transition probability estimates [N = 4 studies]
- Probabilistic discrete event system [N = 3 studies]
- Survival analysis Kaplan Meier estimates (N = 2 studies)
- Latent growth mixture modelling [N = 14 studies]
- Latent transition analysis [N = 6 studies]

Overview of findings

Approach 1: Descriptive net transition percentage

Describes number and percentages of individuals in a cohort moving between predefined stages between two or more follow-up intervals.

Approach 2: Conditional (Markov) transitional probability estimates

Assesseschanges in the distribution of predefined categories; the transition probability of being in a state at Time B, conditional on membership in state at Time A.

Overview of findings

Approach 3: Probabilistic discrete event system

A variant of conditional transition probabilities to predict trajectories of tobacco use behaviors and extract transition probabilities from cross -sectional survey data rather than longitudinal data.

Approach 4: Survival analysis (Kaplan Maier) estimates

Assessthe time between start of an observation period and a subsequent event (“survival”).

Overview of findings

Approach 5: Latent growth mixture modelling

A clustering approach that identifies discrete classes or similar subgroups of individuals on the basis of common patterns of growth and changes over time.

Approach 6: Latent transition analysis (LTA)

A variant of cluster analysis using a probabilistic model with unknown “latent” parameters for identifying underlying subgroups (“latent classes”). LTA estimates transitions over time in latent class membership.

Overview of findings

- Findings synthesize available knowledge from a range of study designs and provide understanding and direction for future research analyses
- Approaches that derive conditional transition probability estimates and Kaplan Meier estimates, for example, may be suited to define and track specific use behaviors over time
- Clustering approaches (e.g., latent transition analysis) may provide broader interpretable insight into key use patterns and transitions within a population

Next steps

- Main product of focus in the reviewed studies was cigarettes; assessment of other products was scant
- Evolving market demands greater attention into patterns and trajectory of multiple product use and use of novel and potential RRPs
- Analysis of population surveys and datasets (e.g., PMI post-market surveys, PATH survey) to describe transitions in patterns of novel potential RRP use and associated outcomes

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QUESTIONS?