Patterns and Predictors of Adolescent and Young Adult Smoking

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Presentation to the Master Settlement Agreement Triennial Conference
September, 2016
Funding and Disclosures

• Funding from the National Cancer Institute grants 5P01CA098262, 5R01CA184681, and 5P01CA180945
• No other disclosures to report
Overview of Talk

- Overview of problem of adolescent and young adult smoking
- Framework for understanding smoking during adolescence and young adulthood
- Trajectories of adolescent smoking into young adulthood
- Emergence of dependence
- Proximal contexts: role of momentary mood and emotional responses to smoking
- Treatment Implications
Adolescents and Young Adults are Prime Targets for Intervention

- Greater health gains are achieved the earlier one stops smoking
- Smokers are more likely to succeed at quitting at lower levels of dependence and exposure
- Interrupting the progression from initial trials of smoking to dependence is critical.
- Almost all trials of smoking occur during adolescence and young adulthood
Trends in Prevalence of Ever Smoking for 8th, 10th, and 12th Graders (MTF)

Data from monitoringthefuture.org
Trends in 30-Day Prevalence of Cigarette Smoking for 8th, 10th, and 12th Graders (MTF)

Data from monitoringthefuture.org
Trends in Prevalence of Daily Cigarette Smoking for 8\textsuperscript{th}, 10\textsuperscript{th}, and 12\textsuperscript{th} Graders (MTF)

Data from monitoringthefuture.org
Adolescent Experimentation with Smoking

- A notable number of adolescents still try cigarette smoking
  - 2015 MTF data show lifetime use among 12th graders = 39.5% 
- But not all progress to regular/daily smoking in the short term
  - 5.5% of 12th graders (MTF, 2015) report daily smoking
- Need detailed understanding of factors that predict different trajectories of use beyond experimentation, timeline, and how dependence develops in order to develop most effective approaches to further reducing/eliminating use
Vulnerability and Opportunity is not fixed at age 18

• Smoking and tobacco use paths are only partially set in motion by age 18
• New vulnerabilities emerge after age 18
• New opportunities for both use and intervention
Trends in Young Adult Smoking

• Young adult years are period of greatest escalation and entrenchment of smoking
• Significant initiation of cigarette smoking and other forms of combustible tobacco use still occur after age 18
• Tobacco use in young adult years further complicated by strong association with escalation of other risk behaviors, including marijuana and problem alcohol use, both of which act synergistically with nicotine to increase tobacco dependency
Prevalence of Young Adult Smoking- 2015 (MMWR; “Some Days” or “Every Day”)

Rates of Poly-Combustible Use 10%-30% among current young adult smokers
Why People Smoke

- Understand developmental stages of smoking
  - Why do people start?
  - Why do people continue?
  - Why do people want to quit?
    - Why can’t people quit?
- What are the functional values of smoking
- Complex array of biological, genetic, psychological, social, environmental, and product features
Adolescence: A Time of Vulnerability and Opportunity

• Risk taking in adolescence may be normative
  ▫ Biological basis
  ▫ Neurocognitive basis
• Adolescents’ decision making is in flux
• Behaviors may be seen as a “phase” when identities are tried and put on and off
• Smoking still maintains an allure
Adolescents’ Smoking Disclosure
The Functional Value of Smoking for Adolescents: Reasons to Smoke

- Smoking serves multiple and complex functions for youth
- Youth start to smoke to improve their image, to achieve social belonging, and in response to perceived peer pressure
- Many youth describe themes of cigarettes providing “security” to those who feel insecure socially
- Youth continue to smoke because of the physiological/drug effects of nicotine, mood management, and because they feel addicted.
Young Adulthood: A Time of Transition

- 18-24 – “emerging adulthood” as distinct developmental period
- Demographic, sociocultural and labor market changes have made the 18-24 year old group more transitional than in the past
- Distinctive traits and functions to EA period
  - Time to make decisions about course of one’s life (marriage, careers, children)
  - Experimentation with different roles and possible selves
  - Reaching legal age for many events
  - Increasing executive functions and autonomy
  - Highly fluid and changeable time – leaving home, education, job, relationships
  - Special risks and opportunities
    - Risk behaviors peak during EA
- Tobacco industry marketing to this age group
Smoking and Adolescence: A dynamic interplay of distal and proximal influences
Trajectories of Adolescent and Young Adult Smoking from Trying Onward
Cigarette Smoking Trajectories
Cigarette Trajectories-- Magnified
Two important developmental stages

• Adolescence to age 18
• After age 18 (leave high school, legal age for tobacco purchase)
• Low trajectories show non-significant growth rate from mid adolescence to age 18, and then shift in rate in 2nd lowest group
• Three higher trajectories show significant upward trend in smoking between 14 and 18, and then a significant shift up after age 18
• Highest trajectory has steepest increase both before and after age 18
Trajectory Groups Differ Significantly in Smoking-Related Factors

- **Tobacco Use Patterns**
  - Number of days smoked per month
  - Amount smoked

- **Beliefs/Expectancies about Smoking**
  - Higher trajectories, more positive beliefs that smoking
    - Alleviates negative moods
    - Relieves boredom
    - Has social value

- **Motives for Smoking**
- “Smoker identity”
- Level of symptoms of nicotine dependence
Trajectory Groups Differ Significantly by Individual Background Factors

- Males are more likely to be in higher trajectories
- Whites, compared to non-whites, more likely to be in higher trajectories
- Linear and strong patterning of academic achievement/GPA by trajectory
- Genetic markers associated with trajectory – Nicotinic acetylcholine receptors, or nAChRs
  - Higher trajectories associated with CHRN$\beta$3A6 (tagged by rs2304297), CHRNA5A3B4 Haplotype C (tagged by rs569207), and with CHRNA2 SNP rs2271920 – associated with progression in smoking
Trajectory Groups Differ Significantly by Co-occurring Problem Behaviors

- Patterns of alcohol problems and frequency of marijuana use mimic smoking trajectory groups in ordered fashion.
- Association with peers who have problem behaviors (smoking, alcohol, academic problems) follows trajectory pattern.
Alcohol problems by trajectory over time

Age 15  Age 17

Alcohol problems

Non Smokers

- Non Smokers
- c1  - c2
- c3  - c4
Summary of Trajectories and Transitions

• Value in identifying even very low level, infrequent smokers during adolescence
• Even adolescents who had been nonsmokers throughout high school and those who were only very occasional “Triers” showed increases in smoking at this point and remain at risk for continued smoking
• Transition to age 18 and post high school is a vulnerable point
Patterns of Poly-Tobacco Product Use
Patterns of Poly-Tobacco Product Use Over time

- Increasing prevalence in use of non-cigarette tobacco products, especially among young adults
- Consider total use of combustible tobacco – cigarettes, hookah, cigars, little cigars
- Important to consider how use of more than one combustible or different combustible may influence total use and escalation
- Use of latent transition analysis to identify patterns, prevalence of patterns, and transitions between patterns over time
Latent Transition Analysis Results: Four Patterns of Combustible Tobacco Use

- **Cigarette Dominant/Frequent**
  - High probability (.86) of smoking cigarettes ≥ 21 days/past 30 and similarly high probability of not smoking other combustibles (hookah, cigars, etc)

- **Poly-Combustible**
  - High probability of using all 3 on one or more days/past 30 (.81-.60 probabilities for each)

- **Cigarette Dominant/Infrequent**
  - High probability of cigarette use (1.0) for one or more days and a similarly high probability of not smoking other combustibles

- **Low Use**
  - High probability of reporting zero days for each combustible
## Prevalence of Patterns Over Time (N=1200)

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<tr>
<th>Age</th>
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<tr>
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<th>Poly</th>
<th>Cig/Infreq</th>
<th>Low Use</th>
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<tr>
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<tr>
<td>Cig/Infreq</td>
<td>.29</td>
<td>.08</td>
<td>.11</td>
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Latent Transition Probabilities from Age 18 to 21

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<th>Age 18</th>
<th>Age 21</th>
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<tr>
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<tr>
<td>Low Use</td>
<td>.09</td>
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*Transitions most likely to occur from lower use to higher use.*

*Importance of age 18-21 to interrupt escalation.*
Summary of Poly-Tobacco Use and Escalation

• Importance of ages 18-21 for escalation in tobacco use – need to intervene early
• Even at low rates of use, poly-tobacco use is a signal for likely escalation into more frequent and dominant cigarette smoking
  ▫ Poly-users score higher on measures of nicotine dependence
  ▫ Even dual users more likely to escalate (not only poly users)
  ▫ Later timeline analyses show poly-use continues into mid 20s
Emergence of Dependence
What is Nicotine Dependence?

• Cluster of symptoms
  ▫ Continued use and difficulty quitting, even with negative health effects
  ▫ Psychoactive effects
    • Withdrawal symptoms (negative)
    • Pleasant (euphoriant) effects
  ▫ Cravings
  ▫ Behavioral effects and conditioned use patterns
  ▫ Physiological effects
• Predicts cessation/relapse/continuation
Nicotine Dependence May Follow Different Developmental Trajectories

• Growing longitudinal evidence from multiple groups examining symptoms of nicotine dependence suggests that nicotine dependence may have different developmental trajectories

• Symptoms of nicotine dependence may emerge for some adolescents at very low levels of exposure and sporadic smoking

• Some symptoms may be more predictive of later dependence
  ▫ Patterning of symptoms may be important
Early Emerging Nicotine Dependence Symptoms

- Do nicotine dependence symptoms predict smoking 2 years- 6 years later?
- Across a series of studies, compared light smokers (< 100 cigarettes lifetime) and more regular smokers (> 100 cigarettes)
- Examined symptom endorsement of items on ND scales (NDSS at baseline) to predict smoking at later time points
- Examined patterns of endorsement of symptoms
- Early endorsement of even low levels of symptoms predicts daily smoking 2, 4, and 6 years into late adolescence/early adulthood

Dierker & Mermelstein, 2010; Zhan et al., 2012; Selya et al., 2015; Rose et al, 2015
Dierker et al., 2016
Predictive Symptoms for Low Level Smokers (items from NDSS)

- Whenever I go without a smoke for a few hours, I experience craving
- If there were no cigarettes in the house and there was a big rainstorm, I would still go out of the house and find a cigarette
- In situations where I need to go outside to smoke, it’s worth it to be able to smoke a cigarette, even in cold or rainy weather
- After not smoking for awhile, I need to smoke to relieve feelings of restlessness and irritability
- After not smoking for awhile, I need to smoke to keep myself from experiencing any discomfort
- I can function much better in the morning after I’ve had a cigarette
Importance of Assessing Early Symptoms of Nicotine Dependence

• For low level adolescent smokers whose lifetime smoking < 100 cigarettes, individual symptoms of craving, withdrawal, and perceived functioning predicted past week or daily smoking two years, four years, and six years later
• Individual differences in nicotine dependence may drive lower levels of use
  ▫ Even light, infrequent smokers experience craving and get relief from smoking
Proximal Contexts of Smoking: Role of Momentary Mood and Emotional Responses to Smoking

What prompts adolescents to smoke “in the moment”?
Contexts and Subjective Reactions Surrounding Smoking

- Collect data in “real time” as adolescents and young adults go about their daily lives
  - Ecologically valid
  - Reduce retrospective recall bias
- Understand the contexts of smoking – with whom, doing what, how one is feeling, and where
- Can address questions of within-person variability
Does smoking occur at times when adolescents feel subjectively different than random times?
Random Vs. Pre-Smoke Mood

Positive Affect

Random

Pre-Smoke

Negative Affect

Random

Pre-Smoke

Within subject effects for both positive and negative affect: $p < .003$; Robust findings across 600+ adolescents/young adults
Consequences of Smoking

• Do adolescents’ subjective mood states change after smoking?
  ▫ E.g., Do adolescents experience decreases in negative moods and stress, and feel better after smoking?
All mood changes significant (P < .001) except Tired/Bored. Change does not Vary by either gender or smoking rate.
Do changes in mood bring teens back to random baseline or improve mood beyond random levels?
Both within subject effects significant, $p < .001$. No interactions with gender. Significant interaction with smoking rate for negative affect.
Do baseline changes in mood following smoking predict escalation?
Subjective Mood Responses and Trajectory Group

• Positive Affect Changes
  ▫ Lowest level of nonescalating triers (class 1) did not show a significant boost in positive affect at baseline
  ▫ Two escalating classes both showed significant and substantial boosts in positive affect at baseline, $p < .0001$)

• Negative Affect Changes
  ▫ Highest escalating smokers showed a consistent and significant reduction in negative affect at baseline
Positive Affect Prior to and After Tobacco Product Use in Young Adults
Negative Affect Prior to and After Tobacco Product Use in Young Adults
Conclusions About Affective Antecedents and Consequences of Smoking

• Mood states just prior to smoking are overall, subjectively worse than background, random times
• Following smoking, there are significant and notable improvements in mood.
• Mood improvements predict escalation and last over time
• Mood improvements are seen with all tobacco products
Longitudinal Relationship Between Mood and Smoking

• Are there more persistent longitudinal benefits to mood from increases in smoking during adolescence?
• If indeed, smoking helps manage mood, do we see longitudinal declines in negative affect?
Dynamic Associations Over Time

Negative Mood

Increased Smoking Level

Negative Mood Increases

Negative Mood Reductions
Smoking Over Time

Correlation between smoking level intercept and slope over time: $r = -.14$, $p < .05$
Negative Affect Over Time

Correlation between NA intercept and slope over time: $r = -0.44, p < 0.0001$
Dynamic Changes in Mood and Smoking

- High initial levels of negative affect significantly associated with increased smoking over time (estimate = 0.17, p < .02)
- As smoking increases over time, negative affect decreased (slope estimate = -0.18, p < .01)
- Significant gender effect
  - Relationship between smoking and change in negative affect was significantly stronger for boys than girls
Summary of Proximal Contexts and Mood Effects

• Among adolescents who are smoking at relatively low levels, daily levels of negative affect and smoking rates are dynamically linked
  ▫ High initial levels of negative affect are associated with increased smoking over a 2 year period
  ▫ As smoking increased over time, negative affect decreased
• Increasing suggestion that escalation and maintenance of smoking among even low using adolescents may be driven by mood factors.
Predictors of Progression

- Multiple levels of influence with synchrony and dynamic interplay across levels
  - Macro environmental influences (e.g., exposure to marketing, advertising, media)
  - Social influences (norms, messages)
  - Individual level differences (SES, comorbid symptoms, substance use, expectancies)
  - These factors create openness to trying tobacco
- Proximal driver of whether use continues, escalates, or discontinues is immediate experience and context – social and emotional
Vulnerabilities and Opportunities for Intervention

- Common core set of psychological symptoms may create vulnerability for tobacco use and escalation among adolescents and young adults
  - Diminished pleasure
  - Boredom
  - Higher negative moods
  - Need to manage social identity/persona
- These vulnerabilities also provide key targets for intervention
“Prevescalation”

• Key time for intervening between youth prevention and adult cessation
• Patterns of adolescent and young adult smoking and tobacco use make case for “prevescalation”
  ▫ Nondaily use
  ▫ Smoking in social settings
  ▫ Pairing with alcohol, other substances
  ▫ Low levels of smoking
  ▫ Poly tobacco use
• These patterns have been neglected by traditional interventions
• Need to develop new intervention approaches for adolescents and young adults that redefine new targets for intervention
  ▫ Goal to prevent escalation and entrenchment of smoking
Conclusions

• Significant portions of adolescents and young adults still smoke cigarettes and use combustible tobacco
• Period of vulnerability for tobacco use may be shifting and expanding – now extends from mid-adolescence to early 20s
• Symptoms of dependence can arise early in course of use and even low levels are predictive of escalation
• We can identify individuals at risk for escalation based on mood responses to early trials of smoking
  ▫ Psychological status and expectancies matter
• Need to target key leverage points to intervene
  ▫ Moods and early in the tobacco use continuum
• Work is not yet done