Determinants of Tobacco Use Disorder

Biological, Psychological and Social Factors

Key Points:

• We will begin this training by examining the major factors that influence tobacco use and dependence. The goal is to provide you with background information that you can later apply to the treatment process.

• At the end of this module you will have the opportunity to practice how you might discuss this information with your clients so please listen with that in mind.
Objectives

- Review the definition of tobacco use disorder and the “biopsychosocial” model
- Describe the biological, psychological, and social factors associated with tobacco dependence and its continued use
- Describe the characteristics of nicotine that contribute to tobacco dependence

Key Point:

*Review the objectives with your group*
The World Health Organization describes smoking as an Epidemic that currently causes nearly 6 million deaths per year and will lead to 8 million deaths annually by 2030 if current trends continue

World Health Organization, 2011

Key Points:

• Tobacco use is a worldwide epidemic. It kills nearly 6 million people each year, accounting for 1 in 10 adult deaths. It causes hundreds of billions of dollars of economic damage worldwide each year.

• Tobacco use continues to be the leading global cause of preventable death. Most of these deaths occur in low- and middle-income countries, and this disparity is expected to widen further over the next several decades.

• Who is consuming tobacco? Demand in high income countries is declining slowly due to an increased awareness of the damaging health effects of smoking, together with anti-smoking measures of governments. Demand among many low and middle income countries, however, has increased, especially in the Far East, particularly China.
“Indeed, it is difficult to identify any other condition that presents such a mix of lethality, prevalence, and neglect, despite effective and readily available interventions.”

Fiore et al, 2008

Key Point:

• Given these global and national trends, this quote from the 2008 Clinical Practice Guideline says it all . . .
Tobacco is the most widely used drug of abuse

<table>
<thead>
<tr>
<th>Drug and Action</th>
<th>Number Who Used in the Past Month (12 years or older)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heroin</td>
<td>494,000</td>
</tr>
<tr>
<td>Triggers release of dopamine; acts on other neurotransmitters</td>
<td></td>
</tr>
<tr>
<td>Opioid (heroin use or pain reliever misuse)</td>
<td>3.5 million</td>
</tr>
<tr>
<td>Methamphetamines</td>
<td>774,000</td>
</tr>
<tr>
<td>Stimulate excess release of dopamine</td>
<td></td>
</tr>
<tr>
<td>Cocaine</td>
<td>2.16 million</td>
</tr>
<tr>
<td>Blocks dopamine absorption</td>
<td></td>
</tr>
<tr>
<td>Marijuana</td>
<td>26 million</td>
</tr>
<tr>
<td>Binds to areas of the brain involved in mood and memory; triggers release of dopamine</td>
<td></td>
</tr>
<tr>
<td>Alcohol</td>
<td>16.7 million heavy drinkers</td>
</tr>
<tr>
<td>Triggers release of dopamine; acts on other neurotransmitters</td>
<td></td>
</tr>
<tr>
<td>Nicotine in tobacco products</td>
<td>61.1 million</td>
</tr>
<tr>
<td>Triggers release of dopamine</td>
<td></td>
</tr>
</tbody>
</table>

Substance Abuse and Mental Health Services Administration, 2018

Key Points:

- This chart is from the 2017 National Survey on Drug Use and Health. It summarizes and highlights the magnitude of nicotine use in terms of the comparative prevalence with other addictive drugs.

- **Nicotine is the most widely used drug of dependence.** Over 61 million people aged 12 and older had used tobacco at least once in the past month at the time of this report.
The Diagnostic and Statistical Manual defines Tobacco Use Disorder (DSM 5)

Definition
- A problematic pattern of tobacco use
- Results in clinically significant impairment or distress

Severity
- Mild: 2-3 symptoms
- Moderate: 4-5 symptoms
- Severe: 6 or more symptoms

HOWEVER: all tobacco use can be considered problematic since there is no safe level of use.

American Psychiatric Association, 2013; DHHS 2014

Key Points:

- This was covered in Basic Skills for Working with Smokers and will be reviewed briefly here.

- The term Tobacco Use Disorder is consistent with how all substance use is now defined.

- We can grade the severity of the dependence by the number of symptoms present.

- However, the DSM 5 is controversial when applied to billing practices since clinicians may not be reimbursed for treating MILD disorder.

- Therefore - it is important to remember that all tobacco use increases the risk for disease and as such should be treated

BEFORE the next slide ask participants to recall the Tobacco Use Disorder Criteria (can be short small group activity)
An overview of the 11 criteria

1. Taken in larger amounts or over longer period than intended
2. Persistent desire or unsuccessful efforts to cut down or quit
3. Great deal of time spent to obtain or use
4. Craving
5. Recurrent use resulting in failure to fulfill major role obligations
6. Use despite persistent social or interpersonal problems
7. Giving up or reducing important activities because of use
8. Recurrent use in physically hazardous situations
9. Use despite persistent physical or psychological problems
10. Tolerance
11. Withdrawal

Key Points:

• According to the DSM 5, these are the criteria/symptoms (simplified) needed to be diagnosed with tobacco use disorder - must have 2

• Why is it important to have a common list of criteria for tobacco use disorder?
  • to provide a common language through which improved communications can be established among clinicians and researchers.
  • to serve as a tool to guide treatment.
  • to legitimize the disorder and provide a basis for possible reimbursement of services.
How does Tobacco Use Disorder develop?

- Dependence does not indicate a long smoking history
- Withdrawal symptoms occur in new and social smokers
- Concern for adolescence
  - Priming Effect: Adolescent brain is more responsive to nicotine’s rewarding effects than adults’
  - May report symptoms and assume they are dependent
  - 80% of smokers have their first cigarette before age 18

Key Points:

- Research suggests that tobacco dependence may occur early in the smoker’s history of smoking.

- Novice, occasional smokers experience withdrawal symptoms, although it may takes days to appear.

- A “priming” effect may occur in youth, where “the adolescent brain appears to be more responsive to nicotine’s rewarding effects than the adult brain”. This may explain widespread and continued use of tobacco among adolescents that continues into adulthood.

- This research has shown that occasional, non-daily smokers do experience withdrawal symptoms, although it may take days to appear. About 20% of 15 year olds and 54% of 18 year olds meet DSM criteria for nicotine dependence.

- Given this, it is important to consider that the adult smoker who is trying to quit has had many years for dependence to strengthen its hold.

Activity:
• **ASK:** How would you define this term, “Biopsychosocial model”?

Key Points:
• Many models of causation of substance abuse and nicotine dependence have been proposed, but no one clear etiology has been identified.

• As such, the “Biopsychosocial” model is one model endorsed by treatment researchers because it addresses the intricate nature of nicotine dependence.

• This model helps to explain the complex interaction of factors in establishing and maintaining dependence. Directly impacting one of the components of the dependence can significantly impact the other two major components.

References:
Dawkins, 2013
Heather, 2018
Volkow, 2016
Biological Factors

Key Point:

• Now, let’s take a look at the biological factors that influence tobacco use and its maintenance.
Vignette: Kent M.

“I have been smoking since I was 20 years old. I really want to quit smoking, but I just can’t stop from picking up another cigarette, the urges are just too great and I still can’t resist my first cigarette in the morning. I recently tried to quit with the 21 mg patch, but I don’t think I was using it correctly and my urges were just too strong.”

Activities:

• **ASK** a participant to read the vignette

• **ASK and DISCUSS:** From this vignette, what are some of the potential *biological* factors that affect Kent?
Dopamine is a key neurotransmitter

This brain chemical is involved in many different functions:

- Movement
- Motivation
- Reward
- Dependence

Key Point:

- Nearly all drugs of abuse directly or indirectly increase dopamine in the pleasure and motivation pathways and in so doing, alter the normal communication between brain cells.
Natural rewards elevate Dopamine levels

Key Points:

• Natural rewards like food, sex and nurturing stimulate dopamine neurotransmission. The brain is hard-wired to seek out this stimulation.

• In these graphs, dopamine is being measured inside the brains of animals. Its increase is shown in response to food or sex cues.

• This basic mechanism of **controlled dopamine release and reuptake has been carefully shaped by evolution to reward normal activities critical for our survival.**
Dopamine activates the reward pathway

- Addictive drugs increase dopamine levels and activate the reward pathway
- Continual use of drug reduces ability to experience pleasure
  - From the drug
  - From natural rewards
- These effects can be overcome

Key Point:
- Nicotine and other drugs that activate the reward pathway are very likely to be abused
- They hijack the reward pathway to make us think that we ‘need’ it for survival
- However, these effects can be overcome and tobacco users can be given hope
Key Points:

- This is the general pathway for drugs, including nicotine, that impact the dopamine reward pathway.
- The increase in dopamine effects the decision making process that takes place in the prefrontal cortex.
Where Does Nicotine Fit In?

Key Points: (the animation in this slide can be turned off if desired)

- After talking about dopamine and the reward pathway, it is important to know where nicotine fits into this pathway; how nicotine triggers dopamine signaling and the reward pathway.
- There are naturally occurring receptors in the body that also bind nicotine, called nicotinic acetylcholine receptors (nAChR).
- These receptors normally bind acetylcholine (ACh), a neurotransmitter involved in brain and muscle signaling. These receptors were discovered because they bound to radio-labeled nicotine.
- They are found in muscle and nerve cells of the autonomic nervous system (ANS, fight or flight). Here is the process (click at each step to run animation):
  1. Nicotine travels in the blood to the brain, where it binds to nAChRs in the VTA.
  2. Nicotine causes the VTA neurons (brain cells) to send electrical impulses down the axons to synapses in the nucleus accumbens (NAc). These neurons release dopamine as their chemical messenger, which binds to dopamine receptors on the neurons in the NAc.
  3. The neurons in the NAc also use dopamine as their signaling molecule to activate neurons in the prefrontal cortex (PFC), which also has dopamine receptors.
  4. This leads to feelings of pleasure and/or withdrawal relief. This pleasure activates memory which maintains memory for continued use.
Activity: Show video - this video has been downloaded from the link below and titled “Smoking – YouTube.wmv”. It must be in the same file as the PowerPoint file in order to play when you click on the slide. The video will ONLY play when in Slide Show view. STOP video at 4:24 when discussion of varenicline development begins.

- Present this disclaimer before showing the video – this presentation of this video is not intended to promote the use of varenicline. It is useful in understanding the function of nicotinic acetylcholine receptors
- Following video ask participants what main messages were heard
- The next two slides are additional methods of describing the effect of nicotine on the chemistry of the brain.

Practice Session 1

In a small group work together to create 3-4 short sentences, in everyday language, to describe the effects of nicotine on the brain.

OR find a creative way to explain it.

Ask participants to use the blank page labeled ‘How Nicotine Affects the Brain” in the Handout section to create, as a group, 3-4 sentences in everyday language to describe the key points from the video.

Ask a spokesperson from each group to read their description.
Video Summary: Nicotine and the Brain

- Neuroadaptation leads to **tolerance**
  - Occurs with repeated exposure to nicotine
  - Receptor cells are desensitized or unresponsive
  - Brain compensates by increasing receptors and binding sites - **brain chemistry is altered**!
- Period of abstinence result in **withdrawal symptoms**
  - After longer abstinence (e.g. sleeping) receptors become responsive again
- End of abstinence (e.g. smoking a cigarette)
  - Nicotine binds to the receptors
  - Alleviates cravings and withdrawal symptoms

Breese, 1997; Perry, 1999.

Key Points:

- With continued smoking, **neuroadaptation** or tolerance to the effects of nicotine develops.
- The process of chronic nicotine administration leads to altered brain chemistry. Compared to non-smokers, smokers have a significantly higher number of nicotine receptors (Breese et al., 1997; Perry et al., 1999).
- This occurs due to **desensitization** (lack of responsiveness) of the receptors-leading to tolerance and dependence
- For example, **after even a short period of not smoking**, like when sleeping, desensitized receptors can once again become responsive. **This period of responsiveness during abstinence instigates symptoms of craving and withdrawal.**
- When a person smokes again (e.g. first thing in the morning), nicotine once again binds to the nicotinic cholinergic receptors and alleviates the cravings and withdrawal symptoms.
- The amount that a person smokes in a typical day probably helps to maintain near-complete saturation of nicotine and thus desensitization of the nicotinic cholinergic receptors. Thus, when in a desensitized state, smokers are likely to avoid withdrawal symptoms by smoking that next cigarette.

- The accumulation of nicotine receptors or upregulation leads to the development of **tolerance**, which we will discuss on the next slide. Some post-mortem data suggest these smoking-induced changes are in fact reversible following smoking cessation (Breese et al., 1997).
Tolerance contributes to dependence

- Need to use **more** to achieve the **desired effects** as were achieved previously at lower doses
- Diminished effect with continued use of same amount
- Influencing factors
  - Duration and amount of nicotine exposure
  - Pattern of use
  - Environmental/learned factors
  - Genetics

**Key Points:**

As we saw on the previous slide, due to the increase in receptors, smokers may require **more nicotine to get the desired response**.

- **Factors influencing development of tolerance:**
  
  **Exposure**: the duration and amount of nicotine intake.
  
  **Patterns of use**: the effects of intermittent versus steady use.
  
  **Learning factors**: environmental cues and the pairing of stimuli with smoking (memory). The environment can determine the effect smoking has on the person; people may lose tolerance in a new setting.
  
  **Genetic factors**: influence how nicotine is metabolized, which affects the need for re-dosing.
Key Points:

- Withdrawal can be considered the brain’s effort to restore balance in the absence of nicotine.
- The withdrawal pathway is another important pathway that contributes to nicotine tolerance and dependence. The withdrawal circuit takes place in the *locus ceruleus* (LC), located in the brainstem.
- The LC pulses more when the drug is absent and this pulsing causes increased firing of norepinephrine (NE) neurons.
- This increased NE activity has direct effects on the autonomic nervous system (ANS), and results in anxiety and increased heart rate and blood pressure. Thus, this system is responsible for acute withdrawal.
- When repeated many times a day, as happens in chronic, repetitive tobacco use, the stress response systems in the brain may become hypersensitive, leading to stress-induced relapse.
- Interestingly, Clonidine (antihypertensive medication used to detox from alcohol & opiates) works on the LC to decrease pulse rate, and is useful to alleviate nicotine withdrawal symptoms.
Tobacco Withdrawal: Criteria

- Tobacco use for at least several weeks
- Presence of ≥ 4 withdrawal symptoms within 24 hours of stopping or reducing tobacco
- Symptoms are not due to a general medical condition or mental disorder
- Symptoms must cause clinically significant distress or impairment

Key Points:

- Remember that experiencing withdrawal is one of the 11 possible criteria for the diagnosis of tobacco use disorder according to the DSM-5.
- Withdrawal symptoms experienced cause clinically significant distress or impairment in social, occupational, or other important areas of functioning.
Tobacco Withdrawal: Symptoms

- Irritability/frustration/anger
- Anxiety
- Difficulty concentrating
- Increased appetite/weight gain
- Restlessness/impatience
- Depressed mood/dysphoria
- Insomnia

Onset: 1-2 days
Peak: first 7 days
Lessen: 2-4 weeks

Key Points:

- Withdrawal symptoms according to the DMS-5

- Note that withdrawal symptoms usually peak within the first week and gradually diminish over the next 2-4 weeks.

- Withdrawal symptoms for smokeless tobacco are similar to those of cigarette smoking.
Characteristics of Nicotine

Key Point:

• We will now take a look at characteristics of nicotine itself to understand its addictive properties and other physiological effects.
What is Nicotine?

### Where is it found?
- Virtually all nicotine (including nicotine replacement therapies) is from tobacco plants
- Also found in tomatoes, potatoes, and eggplant

### Chemical structure
- Readily crosses cell membranes (including placental and blood/brain barriers)
- Binds to nicotinic acetylcholine receptors (nAChR) throughout body, primarily in brain and muscle

### Key Points:
- Nicotine is a clear, naturally occurring poisonous liquid, which turns brown when burned, and smells like...yes, tobacco!
- The major source of significant amounts of nicotine is the tobacco plant. It is also present in tomato, potato, and eggplant.
- It can be synthesized, but it is very expensive to do so.
- Virtually all nicotine, including that used for NRT, is derived from tobacco plants.
- It readily crosses the blood/brain barrier and placental membranes and binds to nicotinic acetylcholine receptors throughout the body, primarily in the brain and muscle.
- Chemical structure
  - Expensive to synthesize
  - pH determines how much is lipid soluble
Absorption of nicotine depends on pH

pH differs based on form

- Spit tobacco, pipe and cigar smoke nicotine is alkaline – ideal for absorption in mouth
  - Slower absorption
- Cigarette smoke is acidic – ideal for absorption in lungs
  - Quicker absorption
- pH of vapor from e-cigarettes varies widely
  - Likely influenced by flavor additives
  - Absorbed in both mouth and lungs

Key Points:

- Nicotine is carried on tar droplets that are deposited in the lungs.
- The pH of the tobacco determines where and how much nicotine is absorbed.
- More alkaline (basic) molecules are absorbed in the mouth.
- Smokeless tobacco, pipe and cigar smoke nicotine is alkaline (pH 8.5) and therefore ideal for absorption in the mouth by oral mucus membranes (buccal mucosa).
- More acidic molecules are absorbed by the lungs.
- Cigarette smoke is designed to be acidic (pH 5.5) and is therefore ideally suited to be absorbed in the lungs.
- Because the e-liquid used in e-cigarettes varies greatly there is wide variation in the pH levels measured. One study found a range of 4.33 to 9.10 among 14 brands.

References:
National Academy of Sciences, Engineering and Medicine, 2018
Cigarette smokers control nicotine levels

- Wide variability in the amount of nicotine absorbed among smokers
  - If nicotine level is too low = withdrawal
  - If nicotine level is too high = toxicity (nausea, palpitations, tremors)
- Personal regulation: “Finger-tip control”
  - Block ventilation holes in filters
  - Smoke more of the cigarette
  - Change the rate and intensity of puffing
- 1.8 mg of nicotine in most cigarettes

Key Points:

- There are many ways that a smoker can control the amount of nicotine they get in order to keep their plasma levels at the desired concentration.
- When the concentration of nicotine in a user's blood becomes too low, they experience the first withdrawal symptoms.
- If nicotine concentration becomes too high, they begin to experience toxicity, including nausea, palpitations, and tremors.
- This leads smokers to refine their technique such that they have “fingertip” control over their blood nicotine levels.

- **Steady state blood nicotine level = 30-35 ng/ml; single cigarette = 5-30 ng/mL**

- **The clinical implications:**
  - One cannot rely on the amount smoked/used to determine the degree of dependence. “Light” smokers may be just as dependent.
  - Studies have shown that those who work harder to maintain nicotine levels are more likely to relapse when they try to quit.
Drop in nicotine levels results in need to smoke frequently

Individual Smoker, 1 cig./hour

Key Points:

- This chart shows blood nicotine concentrations when smoking 1 cigarette per hour. The exact pattern varies person to person.
- The peak and trough values may have implications for maintaining the level of smoking. The general trend over the day is for peaks and troughs to become closer together with the nicotine level gradually increasing (at troughs), reflective of acute tolerance:
  - People reach a comfortable steady state of nicotine. This may have something to do with the individual response to nicotine (genetics, tolerance of toxicity) and to their preferred level (avoiding withdrawal and toxicity).
  - The acute desired effects wear off quickly, so that the smoker constantly tries to recapture the prior experience.
  - Tolerance measures are not very accurate, and not easily assessed, probably because tolerance data is collected mostly as self-report measures.
  - Tolerance has not been shown to be related to quit outcomes.

Benowitz et al., 1982
Nicotine from smokeless tobacco (ST) is absorbed more slowly

- Peak concentration at 30 minutes, absorption for up to 60 minutes after ST is removed
- Levels of nicotine more consistent than with combustible tobacco
- Amount of nicotine absorbed depends on:
  - Concentration of nicotine in the ST product
  - Size of the tobacco cuttings (fine cut has more nicotine available)
  - Acidity level of the product (lower acidity=more free nicotine available)
  - 1 can snuff can equal 4 packs cigarettes

Benowitz, 1989; Henningfield et al, 1997; Dale 2003

Key Points:

- Several factors affect how much nicotine will be absorbed by the user:
  - Concentration of nicotine in the ST product
  - Size of the tobacco cuttings (fine cut has more nicotine available)
  - Acidity level of the product (the lower the acidity, the more free nicotine available)
- ST products have been specifically designed and marketed with a "graduation strategy" in mind, with increasing levels of nicotine available, and hence potentially higher levels of dependence as one moves up to stronger products.

When snuff or chewing tobacco is used throughout the day, blood nicotine concentrations are similar to those seen with smoking cigarettes

- With ST there is a slower initial peak with higher sustained levels of nicotine and a more consistent level throughout the day
- Heavy ST users can achieve quite high nicotine levels, so it is important to determine amount of ST being used.
- **1 can of snuff = 4 packs of cigarettes**
- Gram for gram, moist snuff contains a great deal more nicotine than cigarette tobacco.
Blood Nicotine Concentration: Smokeless Tobacco (ST)

Key Points:

• A graph for chewing tobacco looks similar to this.
• Nicotine levels are much more consistent throughout the day with smokeless tobacco than with combustible tobacco.
Nicotine content in e-cigarettes varies widely

- Labeling of nicotine levels is inconsistent e.g.
  - Low, medium, high
  - Amount (mg) per cartridge
  - Percent per cartridge
- Power of the device impacts delivery of nicotine
- User behavior, e.g. puff duration, influences absorption
- Differences in nicotine absorption can vary by more than 50-fold

National Academies of Sciences, 2018; Talid, 2016)

Key Points

- Because of the immense number and variation in the types of e-cigarettes it is impossible to accurately describe nicotine intake.
- The recent systematic review by the National Academies of Sciences, Engineering and Medicine provides a helpful summary of some of the key considerations.
- With these variations users could have tremendous control over the amount of nicotine consumed if they have sufficient knowledge of the products being used.
Key Points:

• Nicotine that is absorbed by the skin or oral or nasal mucosa (e.g. the patch, gum, lozenge, inhaler or spray) passes through the entire peripheral circulation of the body, including liver and kidneys, before reaching the heart, going to the lungs, back to the heart, and finally to the brain. This can take a couple of minutes.

• Smoked tobacco bypasses the main circulation. It is absorbed directly in the lungs.

• Nicotine reaches the brain quickly when inhaled. It goes from LUNG to HEART to BRAIN.
  • This takes only about 7 (5-11) seconds
  • The faster the brain perceives pleasure, the stronger the behavior is reinforced. The faster a drug reaches the brain, the more likely it will be abused.

• When nicotine is absorbed through the skin, it goes to the heart, lungs, back to the heart, and then to the brain.

• Potential for dependence increases as the time to reward decreases.
Nicotine Distribution

Plasma nicotine (ng/ml)

Arterial

Venous

Minutes after light-up of cigarette

0 1 2 3 4 5 6 7 8 9 10

Nicotine reaches the brain within 7-10 seconds

Benowitz, 1990; Henningfield 1993

Key Points:

• Inhalation of tobacco smoke is an effective means of delivering nicotine to the central nervous system.
• After inhalation, nicotine is rapidly absorbed across pulmonary epithelium into the arterial circulation (heart), traveling via the carotid arteries to the central nervous system.
• Nicotine readily penetrates the blood-brain barrier, resulting in transient exposure of the brain to high levels of nicotine.
• Nicotine has been estimated to reach the brain within 7 to 10 seconds of inhalation. Following systemic distribution, brain nicotine levels decline rapidly (Benowitz, 1990).
• In this figure, we can see that the plasma nicotine levels in the arteries are quite high compared to other body absorption of nicotine (venous) (Henningfield et al., 1993).
• Therefore, cigarette smoking produces an almost immediate effect, thereby reinforcing the behavioral act of smoking, which further stimulates repeated administration. Nicotine administration by skin, gum, or oral does not produce this high immediate effect leading to repeated administration.
**Peripheral Effects of Nicotine**

- ↑ Heart rate
- ↑ Blood pressure
- Vasoconstriction
- ↑ Metabolic rate
- Lipolysis
- Skeletal muscle relaxation
- EEG desynchronization
- ↑ ACTH Adrenal steroids

**Key Points:**
- Nicotine affects other systems in the body in addition to the brain. (These do not need to be described in detail – see Background section for a brief description of each item for the benefit of the trainer)

**Background**
- Nicotine’s effects on the cardiovascular system include increased heart rate, cardiac output, and blood pressure as well as cutaneous and coronary vasoconstriction (Benowitz, 2003).
- After a cigarette is smoked, the smoker’s blood pressure rises by 5–10 mmHg for 15–30 minutes, and the heart rate increases an average of 10–20 beats/min for up to 60 minutes (Benowitz et al., 1988).
- Nicotine is also an effective appetite suppressant and causes modest acute increases in the metabolic rate (Benowitz, 1992). Most people who quit using tobacco will gain weight, although the average person will gain less than 10 pounds (Fiore et al., 2008). Weight gain after tobacco cessation is a major concern for many patients, especially females.
- Nicotine also causes relaxation of some skeletal muscle, lipolysis (fat cells release fatty acids for quick energy), and EEG changes consistent with more relaxation- all of which reinforce continued use (Benowitz, 1992).
Key Points:

• Nicotine binds in many areas of the brain, and hence affects many neurotransmitters with the effects shown on the slide.

• The final effects of nicotine and the withdrawal symptoms that a person experiences are dependent on individual wiring and genetics.

• Overall, we see that nicotine can induce effects that reinforce tobacco use behavior.

• Research is ongoing to explore the role of these and other neurotransmitters and the possible interactions in the brain.
Nicotine is metabolized quickly

- Metabolized to cotinine, primarily in the liver
- Half-life
  - Nicotine = 2hr
  - Cotinine = 16 hr
- Elimination occurs through the kidneys
  - Affected by: renal function, gender, ethnicity and genetics
- Decrease in metabolism or elimination leads to higher levels for longer periods of time
- Accumulates in breast milk, detected in blood and urine


Key Points:

- Cotinine is the major metabolite of nicotine. Cotinine half-life is much longer than nicotine and can be detected in urine and saliva.
- The rapid metabolism of nicotine to inactive compounds underlies tobacco users’ need for frequent, repeated administration of nicotine.
- Nicotine and other metabolites are excreted in the urine. Urinary excretion is pH dependent; the excretion rate is increased in acidic urine.
- Nicotine accumulates in breast milk and can be detected in the blood and urine of infants of nursing smokers. Although effects on the brain may be minimal since nicotine is metabolized after ingestion.
- People of African and Chinese descent metabolize more slowly than Caucasians

Background Information:

Nicotine is metabolized extensively in the liver and to a lesser extent in the kidney and lung. Approximately 70–80% of nicotine is metabolized to cotinine, an inactive metabolite, and about 4% is metabolized to nicotine-oxide. The metabolism of nicotine to cotinine is a two-step process likely involving CYP2A6 and aldehyde oxidase. Cotinine is further metabolized to 3'-hydroxycotinine, which undergoes renal elimination.
Time-Course of Nicotine in the Body

- Nicotine accumulates over 6-8 hours and plateaus
- Rapid drop off during sleep
- Consistent with short half-life
- Drives need for rapid re-dosing
- Significant marker of dependence

**Key Points:**

- Smoking involves intermittent dosing and rapid elimination.
- There is a peak and trough variability from 1 cigarette to the next.
- Nicotine levels plateau during the day but fall off rapidly during sleep.
- A huge craving first thing in the morning is indicative of a high level of dependence.
Background Info: Although they may not consciously think about it, but many smokers are able to alter their nicotine delivery in a number of ways. This is done to maintain a constant level of nicotine in the body in order to prevent withdrawal symptoms, maintain pleasure/ arousal, and modulate mood (e.g. handle stress, anxiety) (Benowitz, 2008). Smokers may do this by smoking or dipping (e.g. spit tobacco) more frequently, smoking more intensely (e.g. inhaling deeper or longer), or by obstructing the vents (with fingers or lips) on “light” cigarettes, thereby increases the amount of nicotine delivered. These methods are considered “finger tip control”. In a way then, the market brand of “lite” cigarettes is not useful in helping smokers titrate or reduce their smoking. Nicotine dependence will unconsciously change the smoker’s behavior to try to maintain a constant level of nicotine in the body.
In a small group work together to describe
- How nicotine is absorbed from each type of product (cigarettes, smokeless, e-cig)
- How the absorption affects dependence

Use every day language

Ask participants to use the blank page labeled ‘Characteristics of Nicotine” in the Handout section to answer the questions as a group.

Ask a spokesperson from each group to read their description.
Key Point:

- Now let’s address social and cultural factors.

Activity:

- **ASK:** From your own knowledge and experience what might some of these factors be?
Vignette: Jerri S.

“I have been smoking since I was 13 years old when lots of my friends started. We all smoke Newport Lights. My partner doesn’t smoke anymore but most of my friends and co-workers still do. Every time I try to quit I get irritable and moody, and I always want to smoke when I see a cigarette. I guess it helps that I cannot smoke at work. I want to be able to quit so that I can save money to go to college.”

Activity:

- **Ask** a group member to read the vignette
- **Then ASK:** What are some of the social factors that may contribute to Jerri’s initiation and maintenance (continued use) of cigarette smoking? What are some other sociological factors?
- Factors that are associated with smoking should include:
  - Smoking with friends
  - Identification with a specific brand
  - Craving when seeing a cigarette
- Factors that may support quitting:
  - Not smoking at work
  - Desire to save money for college
  - Partner no longer smoking
- Allow brief discussion then move to the next slide
Social Determinants of Health

The community, environmental or political influences that exist prior to individual choice or that influence individual choice are referred to as the social determinants of health.

Dahlgren & Whitehead, 1993

Key Points:

- **Social determinants of health** include community, social, environmental and political factors that either exist prior to an individual’s choice or that influence that choice.
Inequities

- Caused by unfair social policies and practices
- Due to lack of health promotion resources or increased exposure to risk factors

Health Inequity

- When the underlying cause of tobacco-related differences in use, health consequence from, or access to treatment is socially produced or avoidable

Key Points

- Inequities occur when certain individuals are denied the opportunities for health
- This can be caused by the factors listed above (*top bullets*)
Key Points:

• Disparities in tobacco use have, in part, stemmed from inequities in the way tobacco control policies and programs have been adopted and implemented to reach and impact the most vulnerable segments of the population that have the highest rates of smoking (e.g., those with lower education and incomes).

• If we consider this in a public health context the third box in this picture would lower the fence to improve access for all. For treatment the implication is that treatment services may need to be tailored.
**Socio-Demographic Factors**

<table>
<thead>
<tr>
<th>Annual Household Income</th>
<th>Education</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 35,000</td>
<td>0-12 yrs (no diploma)</td>
</tr>
<tr>
<td>35,000-74,999</td>
<td>GED</td>
</tr>
<tr>
<td>75,000-99,999</td>
<td>High School Diploma</td>
</tr>
<tr>
<td>≥ 100,000</td>
<td>Some college</td>
</tr>
</tbody>
</table>

**DON’T FORGET ABOUT GENDER, AGE, and ETHNICITY**

Socio-demographic factors are among the strongest predictors of smoking

Wang et al, 2018

**Key Points:**

- Disparities are evident in smoking rates broken down by socio-demographic factors, which are among the strongest predictors of smoking. Education and Household Income level are among the most important.

- As education and income levels rise, smoking rates fall. This is true across all ethnic/cultural groups and this relationship has been consistent despite lower smoking prevalence rates over time.
Social Influence

The direct or indirect effects of one person on another

- Persuasion
- Communication
- Imitation
- Norm-setting
- Modeling
- Influencing beliefs
- Attitudes
Peers have significant influence on smoking

- Peers is defined as friendships, romantic relationships, and social networks
- Biggest impact during adolescence, particularly younger adolescence
  - 99% of people who smoke start before age 26
  - 88% of people who smoke start before age 18
  - Girls > boys influenced by peer group

Key Points:

- Nearly all smokers started when they were young, and evidence shows that peer influence plays a significant role in determining who smokes and who doesn’t.
- In 2012, the surgeon general of the U.S. Public Health Service reported that 99 percent of people who smoke start before age 26, and 88 percent of smokers begin by age 18.
- **Smoking risk increases as the number of significant others who smoke increases.**
- **Peer smoking** has been considered the most consistent risk factor for adolescent smoking. For both boys and girls, the risk of smoking is greater if a majority of their friends also smoke. However, this risk is higher for girls (Odds Ratio = 46) than it is for boys (Odds Ratio = 27) when compared to adolescents who have a limited number of friends who smoke.
- Peer influence continues into adulthood
Parents and older siblings also have significant influence on smoking.

This figure shows that if one lived with parents that never smoked, they are less likely to smoke themselves.
Role of Parental Smoking

Children who have a parent who smokes are more likely to smoke and to be heavier smokers

BUT...

When parents quit smoking, their children become less likely to start smoking and more likely to quit if they already smoke

Key Points:

• **Parental smoking** status is associated with two times the risk of the adolescent smoking themselves.
• Fortunately, parental quitting is also associated with the child (who has become a smoker) quitting.

Bricker, 2009; Bricker, 2005; Audrain-McGovern et al., 2006; Farkas 1999; White & Smith, 2010
Environmental Factors

- Co-workers, friends & family who smoke increase likelihood of smoking; decrease chances for quitting
- Social non-acceptability of smoking
- Presence of nonsmoker/smoker partner
- Access to cigarettes and smoking environments:
  - Household smoking bans related to smoking cessation
  - Work-place bans related to greater quit attempts
  - Role of built environment

Biener, 2010; Gilpin, 1999; Rodriguez, 2013; Duncan, 2014; King, 2014; Christakis and Fowler, 2008

Key Points:

- Social factors also include environmental factors.
- The likelihood of smoking increases when those around the smoker also smoke (e.g. coworkers, friends, family members).
- Access to cigarettes and smoking environments at home, work, and social situations also increases the likelihood of smoking.
- The social acceptability of smoking influences prevalence rates. Public health tobacco control practices of recent years (e.g. cigarette taxes, the “Tips for Smokers” campaign, etc.) have all arguably raised awareness and decreased the acceptability of smoking which leads to lowering overall smoking rates. Often smokers will suggest that feeling “embarrassed” about their smoking is a motivator to quit smoking.
- These same environmental factors can increase the likelihood of cessation – people follow the norms of their group, including quitting.

Background Info: The proportion of US households with smoke-free home rules increased from 43% in 1992-93 to 83.0% in 2010-11. Recent research has shown that compared to people who do not have a household smoking ban, those who do have a household smoking ban are more likely to remain non-smokers or to have quit smoking.
Role of Built Environment

- Absence of Smoke-free Regulations
- Tobacco Marketing
- Tobacco Retailers
  - Are tobacco products nearby?
  - Is the person allowed to smoke anywhere?

Is it easy to find a place to smoke?

Biener L, et al. (2010); Gilpin EA, et al. (1999); Duncan et al., 2014; Yu et al., 2010

Key Points:
- Research has shown that neighborhoods with high ethnic/racial minority concentrations or low SES tend to have greater number of tobacco retailers.
Cultural Factors: Examples and Trends

Key Points:

- The next few slides provide examples of the impact of tobacco use in various cultural groups. They are meant to be examples only and cannot describe all unique factors for the wide range of groups in the US.
Subpopulations

Lesbian, Gay, Bisexual & Transgender
- ~11%-50%
  - Range of smoking rates reflective of other factors such as social stress, targeting by tobacco industry, other drug/alcohol use

College students
- 21% (full-time) v. 34.4% (part-time)
- Should also consider two vs. four year school setting

Key Points:

- These numbers provide just a sampling of the variation of smoking rates when we begin to look at subgroups.
- Some of this is explained by the educational, economic, or stress levels of some of these groups.
- The wide variation of smoking rates in the LGBT communities, for example, highlights the interrelationship among many social factors.
- The 2017 National Health Interview Survey found that 20.3% lesbian/gay/bisexual respondents smoked versus 13.7 heterosexual/straight respondents.
- A recent article by Buchting et al. (2017) reported that transgender adults reported higher past 30-day use of any cigarette/cigar/e-cigarette product (39.7% vs 25.1%) and current use of cigarettes (35.5% vs 20.7%), cigars (26.8% vs 9.3%), and e-cigarettes (21.3% vs 5.0%) compared with cisgender adults (all p-values ≤0.003).
- Rates have decreased for college students, from 32.6% (full time students) in 2002 to 21% in 2013. There was also a decrease for part-time students, from 45.8% (2002) to 34.4% (2013).
- Truth Initiative posts research and fact sheets on many aspects of tobacco use.

References:
Subpopulations

- Chronically ill/mobility impaired
  - ~11-48%
  - Should consider disease type, stage, and perception of the link of the disease to smoking

- Military:
  - Average 24.5%
  - Range 17.2 – 31.9%
  - Should consider military branch, rank, etc.

Key Points:

- The 2017 National Health Interview Survey found that respondents who reported “yes” to any disability/limitation had a higher rate of combustible tobacco (22.4% vs. 16.1%) use compared with those who reported no disability/limitation.

# Ethnic Differences: Acculturation

**Influenced by:**
- Years living in the US
- Immigrant status
- Language preferences
- 1st, 2nd, 3rd US generation
- Ethnic subpopulations (e.g. Dominican vs. Puerto Rican; Chinese vs. Vietnamese)


## Key Points:

- **Culture and acculturation play a large role in many health behaviors including smoking.** When considering acculturation, consider number of years living in the US, Immigrant Status, language preference, or 1, 2, or 3rd generation.

- **In addition, it is important to know subpopulations within a cultural group.** The smoking prevalence rates differ within the heterogeneous group of Latinos or Asians. Puerto Rican vs. Dominicans differ on many attitudinal and behavioral factors that influence smoking behavior. Similarly, Chinese vs. Vietnamese cultural factors vary which influence smoking rates within these groups as well.
Ethnic Differences: Acculturation and Gender

- **Smoking**
  - Rates for females increase
  - Rates for males stay the same

- **Quitting**
  - Rates for males increase
  - Rates for females stay the same


- In general, however, **acculturation and gender combined influence both smoking and quitting behaviors**. Although this pattern has not been discovered in all ethnic subpopulations, it has been found among Latino and Asian cultures.
## Ethnic Differences: Quitting

### Quit attempts
- Minorities make more attempts than Caucasians¹

### Successful quit rates (% of lifetime smokers who have quit smoking)
- African American- 37.5%; Hispanics- 42.9%; Caucasians- 50%²

### Prior use of nicotine replacement therapy
- African American- 22%; Latinos- 22%; Asians- 22%; Caucasians- 31%³

### Receipt of physician advice to quit smoking
- Non-Hispanic black- 46.9%; Hispanic- 38.7%; non-Hispanic white- 52.6%⁴

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**Key Point:**

- For an unknown reason, there are ethnic differences in quit attempts, quit success rates, use of medication for smoking cessation, and receipt of physician advice to quit smoking. As a clinician it is important to know of these trends, and try to answer questions that can facilitate a smoker from an ethnic background to successfully quit.

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¹ US Department of Health and Human Services, 1998; Giovino, 2002; Fu et al, 2008; Danesh, 2014
² Giovino, 2002
³ Danesh, 2014
⁴ Danesh, 2014
Ethnic Differences: Social Influences

Perception of cigarettes and nicotine dependence & role of tobacco use in cultures
- American Indian cultures: may associate tobacco with medicinal, religious functions
- Chinese groups may use tobacco as gifts

Social marketing influences
- African Americans, Latinos – have been target of intense industry marketing

**TAKE HOME MESSAGE:**
Know your community and the role smoking plays in their lives

**Key Points:**

- Even despite ethnic differences, individual differences in beliefs, attitudes, knowledge, etc. of smoking and quitting are important to understand. For example, some cultures may associate tobacco with a sacred use or for gift giving (e.g. Native Americans, Asians). Other cultures may not be fond of telling others what to do with their cigarette when they are in their house, etc.

- As we saw earlier, developing countries have an increasing rate of tobacco use. This is partially because of the lack of tobacco control policies in those counties and/or lack of marketing strategies that educate and bring awareness. Similarly, marketing strategies can be used to entice smokers to start smoking, etc. These are more prevalent in developing countries.

*Text box is animated to appear after clicking:*
- Taking time to understand the role that tobacco plays in the lives of clients and their communities will help to guide the type of assistance that is needed.
Practice Session 2

In a small group work together and develop 2-3 key questions that you might ask a client to help you understand the social influences in their life.

Ask participants to use the blank page labeled ‘Exploring Social Influences” in the Handout section to record the questions as a group.

Ask a spokesperson from each group to read their description.
Psychological Factors

Key Points:

• Psychological factors are an equally important component to the “biopsychosocial model” of nicotine dependence and can influence smoking initiation, maintenance, and quitting behaviors.

• These factors include the role of cognitive thoughts, attitudes, personality, psychosocial stressors, emotions, and psychiatric comorbidity on tobacco use and its maintenance.

• Psychological factors are often one of the reasons that makes breaking nicotine dependence so very difficult.
Vignette: Marta H.

“I have been clean and sober for three weeks now. I want to try and stop smoking too because I can feel how nicotine is ruining my life like the other drugs did. My counselor and sponsor both say it’s too soon for me because I have a lot going on. On the other hand, the cigarettes do help me think clearer and maintain my weight. Well, no matter what, I think I WILL try to quit the cigarettes too. I mean if I can cut the alcohol, I can quit smoking.”

Activities:

• **ASK** a participant to read the vignette

• **ASK and DISCUSS:** From this vignette, what are some possible psychological factors that contribute to Marta’s nicotine dependence and maintenance?
  - Association of alcohol and cigarettes
  - Concern about weight
  - Lack of support from the counselor and sponsor

• **ASK and DISCUSS:** What psychological factors may contribute to her ability to quit?
  - Success in quitting alcohol
  - View of nicotine ruining her life
Psychological Effects:
- Stimulation/arousal
- Relaxation/reduce stress
- Mood regulation
- Appetite suppression
- Weight management
- Pain management
- Reduces anxiety/social facilitation

Cognitive Effects:
- Enhanced memory
- Enhanced attention
- Increased speed of processing

“Improvements” may be result of relief from withdrawal symptoms

Heishman, 1999

Key Points:

- Briefly review the effects listed on the slide.
- Cognitive effects reported by smokers, such as enhanced memory, attention, and processing speed may only result from a relief of withdrawal symptoms.
- Experiencing such a strong positive response in such a short amount of time leads to continued use (i.e. positive reinforcement).
Triggers, Pleasurable Feelings, and Smoking

- Tobacco is often used with other activities
- Becomes paired with and linked to a wide range of activities, situations, circumstances, and emotions

Key Points:

- The psychological benefits of tobacco use become intricately linked with everyday activities. Tobacco dependence is a combination of avoiding withdrawal symptoms AND receiving positive reinforcements from smoking.
- With repeated smoking, certain situations or events (e.g. triggers) can become a strong cue to smoke because they have become associated with the pleasurable effects of smoking.
- For example, when experiencing a negative emotion, a smoker may learn that by smoking he or she can alleviate that negative emotion. Additionally, a person who nearly always smoked with the same people, or in the same situations (e.g. at a bar, after eating, with coffee), may still experience strong urges to smoke when faced with these triggers because they have been paired with the act of smoking and with pleasurable feelings.
- Due to this process, typically these triggers (e.g. events, places, people, emotions, and things) often lead to relapse.

- Think of it this way: Let’s say someone smokes 1 pack of cigarettes each day. One pack contains 20 cigarettes; each cigarette takes 10 puffs to smoke. Each day, s(he) takes 200 puffs a day, leading to numerous associations and triggers (i.e., on work break, after eating, getting in the car, waiting for a bus).
Key Points:

- It helps tobacco users to become aware of how their thoughts and emotions can influence their behavior. **How you think can influence how you feel and subsequently your behavior.** The thought, “I am so stressed” can influence your mood, feeling sad or overwhelmed, which may in turn result in smoking.

- The act of smoking itself can later influence your thoughts, making them even more negative- “Why am I smoking? I will never quit”, which once again influences our mood and then behavior. **This “vicious cycle” can make the smoker feel worse or more anxious, making it more difficult to quit if smoking makes the smoker temporarily feel better or more calm.**

- On the other hand, thinking positively and managing emotions can also influence smoking behaviors, hopefully leading to quitting. For example, the thought “I am going to quit for my kids” may lead to feelings of confidence and motivation, which may then lead to eventual quitting behaviors.

- This cycle of thoughts, emotions, and behaviors forms the foundation of cognitive-behavioral therapy (CBT), which is often used to help a patient quit smoking once they have made a commitment to quit.
Key Points:

- The attitudes and beliefs of an individual influence smoking initiation and quitting.
- Some key variables consistently associated with smoking behaviors among both adolescents and adults are: perceptions of smoking, intentions to smoke or quit, self-efficacy to refuse smoking and self-efficacy to quit smoking, perceived health, and risk perceptions.
- Specifically, positive attitudes toward anti-tobacco policy or negative attitudes about smoking is associated with not smoking. Adolescents with greater intentions to not smoke are likely to not smoke and those with greater refusal self-efficacy are more likely to not smoke. Similarly, greater motivation to quit and greater self-efficacy or confidence to quit is associated with quitting.
- Greater beliefs in smoking-related risks or a person's perceived vulnerability to the health risks of smoking is associated with not smoking, but greater beliefs in the benefits of smoking or the pleasures of smoking is associated with smoking.
- Risk perception is also associated with quitting behaviors such that greater perceived vulnerability has been associated with a greater likelihood of quitting and greater perceived benefits of quitting is also associated with a greater likelihood of quitting. Regarding perceived health, despite smoking, smokers are likely to perceive their health just as highly as non-smokers.
Some personality characteristics have been associated with tobacco use

- Impulsivity
- Hostility
- Neuroticism
- Low agreeableness
- Low conscientiousness

Borrelli, 2010; Chang, 2006; Epstein, 2000; Lipkus, 1994; Song, 2009; Terracciano, 2004; Unger, 1999

Key Points:

- Certain personality characteristics have also been associated with smoking status. Cross-sectional data have shown current smokers to be more impulsive, extraverted, hostile, and neurotic and have lower levels of agreeableness and conscientiousness. One study that followed smokers over 20 years found that at follow-up, those who continued to smoke were more hostile and impulsive compared to those who had quit (Lipkus et al., 1994).
<table>
<thead>
<tr>
<th>Psychosocial stressors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Childhood abuse (e.g. verbal, physical, sexual)</td>
</tr>
<tr>
<td>Socioeconomic stress</td>
</tr>
<tr>
<td>Nonspecific stress (daily stressors)</td>
</tr>
</tbody>
</table>

Key Points:

- **Psychosocial Stressors** are often named the top reason why smokers initiated smoking and continue to smoke.
- Three types of stressors associated with smoking:
  1. Childhood abuse predicts increased rates of regular smoking and lifetime smoking;
  2. Socioeconomic stress (living in low-income household and in economically deprived areas; paternal SES); and
  3. Nonspecific stress (daily stressors). These stressors may deal with school performance, grades, sibling stress, etc. For example, conflict with parents and poor school performance related to increased smoking. Recent research by Brown et al (2009) suggest that low-tolerance for distress is related to early relapse in adult smokers.

**REFERENCES:** Falba, 2005; Freund, 1992;
Psychiatric Co-Morbidity and Smoking

Key Point:

• We will now look at the impact of psychiatric disorders on tobacco use initiation, maintenance and cessation.
Mental illnesses and smoking frequently occur together

- ~30% of adult smokers have any mental illness (AMI)
- ~3 out of 10 cigarettes smoked by those with AMI
- ~4.4 out of 10 cigarettes smoked by those with AMI or substance use disorder
- Smoke with greater intensity, have more difficulty quitting, and higher relapse rates


Key Points:
- Smoking prevalence among people with psychiatric disorders and substance use disorders exceed those in the general population by **two- to fourfold**.
- Smoking can be considered a flag for potential mental illness or substance use disorder.

Background Information: ~20.9 million American adults, or about **9.5%** of the U.S. population age 18 and older in a given year, have a mood disorder – this includes major depressive, dysthymic and bi-polar disorders (Kessler et al, 2005). ~40 million American adults ages 18 and older, or about **18.1%** of people in this age group in a given year, have an anxiety disorder (Breslau, 2004). According to the 2005 National Survey on Drug Use and Health ~**9.1%** of the population aged 12 and older (22.2 million people) reported Dependence or Abuse of Illicit Drugs or Alcohol (SAMHSA, 2005). Several explanations have been proposed for the high prevalence of smoking in individuals with co-morbid psychiatric or substance use disorders. First, there may be intrinsic factors (e.g, shared genes, abnormalities in brain reward pathways) that predispose individuals with psychiatric or substance use disorder to smoke. Second, nicotine may be used by psychiatric and substance use disorder patients to self-medicate psychiatric symptoms.
The following text is quoted directly from Quick Stats report:

“During 2014–2016, 37.2% of adults aged ≥18 years with serious psychological distress were current smokers, followed by 27.6% of those with mild to moderate psychological distress and 14.0% of those with no psychological distress. Among adults aged 18–44 and 45–64 years, the percentage of adults who were current smokers increased with the level of psychological distress. Among adults aged ≥65 years, the percentage who were current smokers was less among adults with no psychological distress than among adults with mild to moderate or serious psychological distress”
Possible Explanations for High Co-morbidity

- Nicotine mask symptoms associated with mental illness
- Constituents of tobacco smoke reduce blood levels of psychiatric medications leading to compensatory smoking
- Likely started smoking at a young age making more susceptible to continued use
- Tobacco industry marketing to populations with AMI
- Often lack health insurance, have limited coping strategies, experience worse withdrawal symptoms, and lack information and access to treatment
- Mental health facilities are beginning to address tobacco use

CDC, February 8, 2013; 62. pp 1-7

Key Points:

- This CDC report offers some thoughts on why smoking rates are so high in persons with mental illness.
Schizophrenia and Smoking

- Highest prevalence of smoking among mental illnesses
- Smoke more intensely resulting in higher cotinine levels
- Higher levels of positive/negative symptoms than nonsmokers with schizophrenia
- Former smokers have fewer negative symptoms than current smokers
- **No evidence** for significant changes in psychotic symptoms with smoking cessation or reduction


**Key Points:**
- Schizophrenia Affects 1% of the adult population. Positive symptoms- delusions, paranoia, hallucinations; Negative symptoms- amotivation, disorganization, poverty of speech; Cognitive symptoms- disturbance of attention, working memory

**Background Information:**
- A preliminary report found high smoking rates (92%) in first-episode schizophrenic patients with no history of using anti-psychotic medications. This suggests that smoking in this population is related to pathophysiological features of the illness and not efforts to alleviate side effects of medication by smoking.
- The temporal sequence of smoking preceding the onset of psychotic symptoms is unlikely to suggest a causal connection between smoking and the onset of SZ because a large percent of patients with SZ are non-smokers (8-42%), and smoking cessation does not appear to lead to significant changes (either worsening or improvement) in psychotic symptoms.
Depression and Smoking

- Bi-directional relationship between smoking and depression
  - Baseline depressive symptoms among nonsmokers predicts smoking
  - Baseline smoking predicts onset of depressive symptoms
  - Daily smoking doubles the risk for major depression
  - Smoking onset by age 13 years is associated with more episodes and earlier onset of major depression
- The same nAChR neural pathway is involved in the regulation of depression and anxiety symptoms

Glassman et al, 1990 & 1993; Picciotto et al., 2015

Key Points:

- One of the most widely associated co-morbidity with smoking is major depressive disorder, although just depressed mood, and often subclinical depressed mood, is also highly associated with smoking behaviors. In fact as many as 40-60% of people experiencing depression and depressed mood also currently smoke.
- The role of nicotinic acetylcholine receptors (nAChR) in depression is an active area of research, with strong indications that because this network is activated by nicotine it may help to explain the strong correlations between smoking and depression.
Depression and Smoking

- Those with current and past depressed mood symptoms are motivated to quit.
- Severity of nicotine withdrawal and cravings may be stronger during cessation attempt.
- Successful cessation does not increase symptoms.
- Sustained abstinence is associated with reduction in depression symptoms.
- Medications are safe and effective.
- Psychological mood management likely an important addition to traditional tobacco treatment.

Key Points:
- Recent research by Brown et al (2009) suggest that low-tolerance for distress is related to early relapse in adult smokers.

- It is possible that reemergence of major depressive symptoms may occur – but this has been questioned.

- Individuals with a history of depression, who are not actively depressed at treatment initiation, may experience depressed mood as tobacco treatment progresses.

- It is helpful at treatment onset to have clients identify the Sx of depression that are typical for them (ex: irritability, low mood, fatigue, change in interest, sleep and appetite changes) that typically occur at the onset of a depressive episode. With this data, both you and the client can rapidly identify the onset of a depressive episode and initiate appropriate contact with a mental health provider.
Bipolar Disorder and Smoking

- Likely to be heavy smokers, more dependent, and less likely to quit
- Bidirectional relationship
- Associated with more severe depressed mood, rapid cycling, and increased suicidal ideation
- Less evidence on the relationship between smoking and mania or hypomania

Key Points:
- Between 30-70% of individuals with BD smoke
- Much more research on effective treatment options for BD and smoking is needed

Background
- Bipolar disorder is also known as manic depression. It occurs in about 1% of the population. In this disorder, people alternate between depression and mania. Manic and depressed periods may last for months or days. In many people with bipolar disorder the depressed periods last longer than the manic periods.
- What is mania? Mania is the opposite of depression. Manic people are constantly active and uninhibited. They are unable to control their impulses and are often unable to keep themselves from acting in risky situations. Just like depression is not just the “blues”, mania is not just a normal “good energetic mood”. People experiencing mania tend to get themselves in trouble in one way or another or do things that seem out of the ordinary.
Panic Disorder

- Smoking is predictive of onset of panic attacks, but not vice versa
- Contributes to cessation difficulty
- Severity of disorder associated with more severe withdrawal symptoms

Obsessive-Compulsive Disorder (OCD)

- ~7 to 24% smoke
- Lowest prevalence rate among anxiety disorders
- Reasons for lower occurrence unclear

Key Points:

• A panic attack is a period of intense fear which happens unexpectedly and abruptly and includes physical symptoms such as sweating, racing heart rate, shaking, feeling short of breath, chest discomfort, dizziness, and fears such as fear of losing control, going crazy, dying. This is not just feeling anxious and is very distressing.

• The more severe the panic disorder, the more severe nicotine withdrawal symptoms.

References:

Amering, 1999; Baker-Morrisette, 2004; Breslau, 2004; Himle, 1988; McCabe, 2004; Zvolensky, 1999
**Background Information**: Smoking prevalence in panic disorder varies widely across studies, ranging from 19.2% to 56%. Two longitudinal studies indicate that daily smoking is predictive of the onset of panic attacks, but not vice versa. Most recently, a third study prospectively examined the bidirectional relationship between smoking, nicotine dependence (ND), and anxiety disorders in adolescents and young adults. Prior regular smoking and ND were associated with an increased risk for new onset of panic attacks. However, the authors could not conclusively rule out the potentially less common pathway of pre-existing panic attacks or disorders influencing the later development of ND. Additional research is needed to explore these pathways, including possible mediators to explain the progression from one disorder to the other and moderators that determine when and whether the progression occurs.

In particular, as persons with panic disorder generally believe negative affect-related cues (e.g., restlessness, bodily agitation) are personally dangerous and experience high levels of anxiety when exposed to interoceptive cues, they would presumably be motivated to smoke in response to anxiety-related distress as a way of coping with such affective disturbances.
## Anxiety Disorders and Smoking

### Post-Traumatic Stress Disorder (PTSD)

| ~53 to 66% of combat veterans with PTSD smoke | ≥ 5 adverse childhood events have greater risks for: |
| ~44% of women with PTSD related to physical/sexual assault smoke | - Early onset smoking |
| Severity of PTSD symptoms associated with heavier smoking and worse withdrawal symptoms | - Ever smoking |
| | - Heavier smoking |
| | **PTSD, not trauma-exposure alone, predict smoking behavior and nicotine dependence** |


### Key Points:

- Heavier smoking and more severe withdrawal Sx are experienced by those with PTSD.
Alcohol Use Disorder (AUD) and Smoking

- Commonly used together
  - Typically begins in adolescence
  - Associated with increased risk for other substance use
- Smoking urges or the act of smoking becomes the conditioned response to alcohol cues
- Bidirectional relationship
  - AUD risk significantly higher in smokers
  - Heavy smokers have a 4-fold risk of AUD
  - Experimental/less heavy smokers have a 2-fold risk of AUD

**Key Points:**
- Moreover, in a population of smokers in alcohol treatment, urges to smoke increased during exposure to alcohol versus water
- These data are consistent with a learning theory explanation of the association between drinking and smoking urges and use; that is, with repeated pairing of these behaviors, smoking urges (and smoking) become a conditioned response to alcohol cues which serve as unconditioned stimuli.

**REFERENCES:** Grucza, 2006; Gulliver, 1995; Gulliver, SB, 2000; Mitchell, 1995; Perkins, 2001; Cooney, 2003; Rohsenow, 1997
Cocaine Dependence and Smoking

- >80% smoke cigarettes
- At risk for:
  - More severe cocaine use
  - More legal problems
  - Cocaine use by intravenous or smoked routes
- Significant reductions in smoking if cocaine use stopped
- Stimulation of nicotinic receptors may enhance the rewarding effects of cocaine

Budney, 1993; Horger, 1992; Patkar, 2000; Roll, 1996

Key Points:

Background Information:
Horger and colleagues found that nicotine potentiates cocaine self-administration in rats, suggesting that the stimulation of nAChRs can enhance the rewarding effects of cocaine. Studies in mice found that pre-treatment with the nAChR antagonist mecamylamine or deletion of the β2 subunit of the high-affinity nAChR with the use of transgenic mice can reduce conditioned place preferences to cocaine but not morphine. In humans with nicotine and cocaine dependence, an acute dose of nicotine enhances cue-induced cocaine craving, while a single pre-treatment dose of the nicotinic receptor antagonist mecamylamine reduces cue-induced cocaine craving. Because nAChRs are present on mesolimbic DA neurons and nAChR stimulation augments DA release and metabolism, the blockade of nAChRs may modify DA responses induced by cocaine administration, thereby altering the reinforcing properties of cocaine. This may have implications for the development of treatments for cocaine dependence based on nAChR systems.
## Comparison of Nicotine with Other Drugs

<table>
<thead>
<tr>
<th></th>
<th>Nicotine</th>
<th>Other Drugs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Psychoactivity</td>
<td>Subtle</td>
<td>Intense</td>
</tr>
<tr>
<td>Compulsive Use</td>
<td>Steady</td>
<td>Intermittent</td>
</tr>
<tr>
<td>Health Risks</td>
<td>Substantial</td>
<td>Moderate</td>
</tr>
<tr>
<td>Relapse Rates</td>
<td>Rapid</td>
<td>Rapid</td>
</tr>
<tr>
<td>Craving</td>
<td>Strongest?</td>
<td>Strong</td>
</tr>
<tr>
<td>Tolerance</td>
<td>Acute/Chronic</td>
<td>Acute/Chronic</td>
</tr>
</tbody>
</table>

### Key Points:

- Ask for participant input on take away message from this slide

- In a study in which addicts who were smokers were asked which drug would be the hardest to give up, most said nicotine!

- Nicotine is insidious as the psychoactivity is exerted in a more subtle way, but leads to very strong craving, and nicotine use carries with it substantial health risks.
Summary: Biological Factors

- Biological factors contribute to the establishment and maintenance of dependence
- Nicotine affects
  - Acetylcholine receptors or “nicotinic” ACH receptors
  - Reward pathway
  - Memory and behaviors
  - Brain structure and function
    - Neurotransmitters (e.g. dopamine)
    - Synaptic connections
- Smoking delivers nicotine via lungs to brain in 7-10 seconds
- Nicotine produces other physiological effects

Key Points:

- Each of the factors that have been covered are summarized in the following slides to help participants review
- Do not read each slide
- Invite any remaining questions
## Summary: Social Factors

Social factors contribute to the initiation and maintenance of smoking. Social factors include:

- Demographics (age, ethnicity, socioeconomic status, etc.)
- Peers have the greatest influence
- Parental/family history of smoking
- Home/work environments
- Cultural factors influence beliefs and social norms about tobacco use

### Key Points:

- Invite any remaining questions
Psychological factors contribute to the initiation and maintenance of smoking and include:

- Perceived psychological and cognitive benefits
- Attitudes about smoking/quititng, personality, stress, and emotions
- Strong correlation with the use of alcohol and other substances
- High prevalence among persons with mental illnesses

**Key Points:**

- Invite any remaining questions
Tobacco dependence is “a chronic disease with remission and relapse.”

“Nicotine dependence warrants medical treatment as does any drug dependence disorder or chronic disease.”

Fiore et al, 2008

Key Point:

- Read quote from Michael Fiore
You are giving a short presentation to a group of clients

Use the Tobacco Dependence Cycle to give an overview of how tobacco use starts and is maintained

Activity:

- It is recommended that the instructor first model how this may be conducted
- The graphic on the following slide may be used to help guide the presentation
- Participants work in small groups with one taking the role of the TTS to describe the Tobacco Dependence Cycle. The Tobacco Dependence Cycle is in the Handout section
The Tobacco Dependence Cycle

Key Point:

- There is a full size version of this in the Handout section.
- It may be used as a tool to discuss tobacco dependence with clients.