THE TRUTH ABOUT VAPING

Manica Isiguzo, MD
WHAT IS VAPING?
Using an e-cigarette
WHAT IS AN E-CIGARETTE?
WHAT IS AN E-CIGARETTE?

- A device that produces an aerosol by heating a liquid that contains nicotine
- E-Liquid - flavorings and other chemicals
- Users inhale this aerosol
- Bystanders breathe in aerosol that user exhales
E-Cigarette

- **Battery**: Powers the device
- **Atomizer**: Heats the e-liquid into an aerosol
- **Cartridge**: Stores the e-liquid
- **Mouthpiece**: Allows user to inhale the aerosol
E-Cigarette

- Resemble
  - Regular cigarettes
  - Cigars
  - Pipes
  - Pens
  - USB sticks

E-Cigarette
E-Cigarettes

- E-cigs
- E-hookahs
- Mods
- Vape-pens
- Vapes
- Tank systems
- Electronic nicotine delivery systems (ENDS)
IS AN E-CIGARETTE A TOBACCO PRODUCT?
E-cigarettes represent an evolution in a long history of tobacco products in the United States
WHY ARE WE DISCUSSING THIS TODAY?
E-cigarette use among youth and young adults is now a public health concern.

Why are we discussing this today?
E-CIGARETTE USE AMONG YOUTH

Growth in E-Cigarette Use

- High School Students
- All Students
- Middle School Students

Percentage of youth who use e-cigarettes


Source: National Youth Tobacco Survey 2011–2018
Notes: In 2014, changes were made to the e-cigarette measure to enhance its accuracy.
E-Cigarette Use Among Youth

2011
- Girls: 1%
- Boys: 2%

2015
- Girls: 13%
- Boys: 19%
Use higher among high school students than adults
In 2018 - 1 in 5 high school students reported using e-cigarettes
Most commonly used tobacco product among youth today

WHY ARE WE DISCUSSING THIS TODAY?
Why are we discussing this today?

- Acute lung injury and deaths
- Growing concern about the long term health effects of aerosolizing nicotine and other chemicals in vaping devices
  - additives, heavy metals, ultrafine particles include toxins and carcinogens
The popularity of vaping may be renormalizing smoking behavior.

Crucial that the progress made in reducing cigarette smoking among youth not be compromised by the initiation and use of e-cigarettes.
Most commonly cited reasons for using e-cigarettes

- Curiosity
- Flavoring/taste
- Low perceived harm compared to other tobacco products
- Look “cool”

### E-CIGARETTE USE AMONG YOUTH

<table>
<thead>
<tr>
<th>Flavors Used by E-Cigarette Users Aged 12-17</th>
<th>%</th>
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<tbody>
<tr>
<td>menthol</td>
<td>85%</td>
</tr>
<tr>
<td>alcohol</td>
<td></td>
</tr>
<tr>
<td>candy</td>
<td></td>
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<tr>
<td>fruit</td>
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<tr>
<td>chocolate</td>
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<td>sweets</td>
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EVALI

- Increased youth exposure to nicotine
- Besides nicotine, e-cigarette aerosol contains other harmful substances
  - Carcinogens, toxins, lung diseases
- Serving as a gateway for initiation on conventional cigarettes
- Exposure to secondhand aerosol
- Injuries due to e-cigarette devices

POTENTIAL HARMs OF E-CIGARETTES
EVALI

- E-cigarette- or vaping-associated lung injury
- Confirmed case
  - recent use of an e-cigarette product
  - breathing illness
  - infection ruled out
  - other common causes of illness ruled out
CDC DATA – OCT 15TH 2019

- 1,479 cases of e-cigarette- or vaping-associated lung injury - EVALI
- 33 deaths
  - Age range 17 – 75 years
- Alaska remains the only state unaffected by the outbreak
Department of State Health Services (DSHS) - 147 cases
One death has been reported in Texas
21 other possible Texas cases
SYMPTOMS

- non-specific
- cough, shortness of breath and chest pain
- nausea, vomiting and fatigue
- duration of symptoms – may take several days to several weeks to appear
NATIONAL SURVEILLANCE DATA ON CLINICAL FEATURES

- 339 patients - data submitted to CDC
  - 95% initially experienced respiratory symptoms such as cough, chest pain or shortness of breath
  - 77% have gastrointestinal symptoms such as abdominal pain, nausea, vomiting and diarrhea
  - 47% required transfer to ICUs
  - 22% required mechanical ventilation
339 patients
- 80 were aged younger than 18 years
- 56% were cared for in the ICU
- 29% were intubated and required mechanical ventilation
1,043 patients - data on age and sex:

- 70% male
- 80% aged younger than 35 years
- 15% are aged younger than 18 years
SUBSTANCES USED

- 573 patients with available information on substances used in e-cigarettes in the 90 days before symptom onset
  - 76% reported using tetrahydrocannabinol (THC)-containing products with or without nicotine-containing products
  - 32% reported exclusive use of THC-containing products
  - 58% reporting using nicotine-containing products, with or without THC-containing products
  - 13% reported exclusive use of nicotine-containing products.

“Although THC-containing products appear to be implicated in these injuries, the specific exposures responsible for the lung injuries have not been identified, nor have nicotine-containing products been excluded as a possible cause.”

Based on testing of samples:
- Does not appear to be one product or substance involved in all the cases
- There may be more than one cause to this outbreak
“FDA at this time has still not identified a specific product or substance that has been definitively linked to the respiratory illnesses in this outbreak”

Mitch Zeller, JD, director of the Center for Tobacco Products at the FDA.
CDC RECOMMENDATIONS

- CDC recommends against the use of e-cigarette or vaping products that contain THC and advises people to reconsider use of all e-cigarette or vaping products until the investigation into the outbreak has concluded.
EMERGING DATA

- Chronic vaping can cause the same lung changes seen in smokers of traditional cigarettes - nicotine
- Increased cardiovascular risk - nicotine
- Known Carcinogens being identified in E-liquids
• 30 year old female
• Otherwise healthy
• Present with shortness of breath
• Vaping marijuana
• Rapidly progressive respiratory failure
• Required advanced life support
• 70 days on ECMO - got a lung transplant
NICOTINE

- A psychomotor stimulant drug
- Primary psychoactive and addictive constituent in the smoke of cigarettes and e-cigarettes
- Determines smoking dependence
E-liquids contain nicotine in widely variable concentrations.

Factors influencing amount of aerosolized nicotine available for inhalation:
- Concentration on liquid nicotine
- Power of the device being used (battery voltage, heater resistance)
- User behavior – puff duration and inter puff interval
- Large variability in plasma nicotine concentration
Highly addictive

Can harm the developing adolescent brain

As addictive as heroin and cocaine

Nicotine affects brain development, which continues to age 25.
Adolescence (10-19 years) - a developmental period associated with increased vulnerability to nicotine addiction

Nicotine use during adolescence - disrupts the formation of brain circuits that control attention, learning and susceptibility to addiction
Substantial evidence - nicotine negatively influences adolescent brain development.

The brain undergoes significant neurobiological development during adolescence - sensitive to neurobiological insults such as nicotine.
Adolescents and nicotine exposure
- Deficits in attention and cognition
- Mood disorders
- Increase in drug seeking behavior
Adolescent exposure to nicotine has both acute and long-term effects on attention and memory.
NICOTINE – ATTENTION AND COGNITIVE DEFICITS

- Negative impact on brain development
  - Working memory
  - Attention span
NICOTINE – ATTENTION AND COGNITIVE DEFICITS
Adolescent nicotine exposure in rats induces lasting synaptic changes in the prefrontal cortical regions critical for normal attention, memory and cognition. This causes impairments in attentional and cognitive function.
Musso et al. (2007)

- Adolescent users of cigarettes - decreased prefrontal cortex activation during attention tasks
- Duration of smoking was directly correlated with the extent of reduction in prefrontal cortical activity
Adolescent smokers have chronic impairments in the accuracy of their working memory (e.g. in processing information from 2 sensory modalities simultaneously).

Impairments more severe with an earlier age of onset of smoking.
Students who smoke e-cigarettes
  ▶ Risking your grades
  ▶ Potentially risking your future careers
Early onset of smoking is associated with a shorter time to first onset of an anxiety disorder (Jamal et al. 2011)

Positive association between adolescent smoking, particularly through a nicotine pathway, and anxiety in early adulthood (Moylan et al. 2013)

Permanent problems with impulse control – failure to fight an urge or impulse that may harm oneself or other
Meta-analysis of existing studies (Moylan et al. 2012)

Consistent evidence that tobacco use among adolescents increases their risk of anxiety disorders
Drug addiction is the loss of control of drug use
Disease of the brain reward centers (Dackis and O’Brien 2005)
Nicotine affects the development of the brain’s reward system

- Nicotine addiction
- Makes other drugs such as cocaine and methamphetamine more pleasurable
Weiss et al. (2008) reported a mechanistic link among early nicotine exposure (younger than 16 years) and adult nicotine addiction.
Studies reveal that for most long-term tobacco users, initial use begins before 18 years of age.
The younger a person is when exposed to nicotine, the greater the risk of addiction.
Smoking is a major cause of death from cardiovascular disease

- nicotine - potential initiating factor in the atherogenic process
- nicotine induces the production of various inflammatory mediators involved with atherosclerotic pathogenesis
E-cigarette aerosol is not harmless “water-vapor”

Several chemicals - carbonyl compounds and volatile organic compounds

No standards, considerable variation in the nature of ingredients

Concerns regarding the safety of inhaling e-cigarette flavorings and the chemicals generated when these are heated

Little is known about the long term health effects of inhaling these substances into the lungs
Recent devices - larger battery, capable of heating liquid to a higher temperature, potentially releasing more nicotine, forming additional toxins

Kosmider et al. (2014)
- At high temperatures, exceedingly high levels of formaldehyde – a carcinogen - are present
- Formed through the heating of the e-liquid solvents – propylene glycol and glycerin
- Formaldehyde
  - Embalming fluid, glue
- Benzene
  - Known carcinogen linked to leukemia
- Diacetyl
  - Popcorn lung
- Metal particles
  - Nickel, tin and aluminum

E-CIGARETTE AEROSOL
- Can be readily customized by their users
- Often used to deliver drugs other than nicotine
Lack of device regulation

Battery failures and explosions – house and car fires, injuries and even death
E-CIGARETTE DEVICE INJURIES

Texas Man Died After Vape Pen Explosion Severed Artery in Neck: ME

William Eric Brown died due to "penetrating trauma from exploding vaporizer pen," according to the medical examiner.

By Scott Gordon
Published Feb 5, 2019 at 11:52 AM | Updated at 5:31 PM EST on Feb 5, 2019

Vape explodes and blinds 14-year-old kid in NYC mall, blast caused by battery explosion – TomoNews

By ave40 12/22/2017
An e-cigarette exploded inside this man’s mouth

By Alexandra Klausner

January 17, 2017 | 10:13am | Updated

North Port man badly burned in vape pen explosion

E-CIGARETTE DEVICE INJURIES
- Incidents of young adults and children ingesting the liquid in the cartridges
- Acute nicotine poisoning can cause seizures, death
- JUUL is a brand of e-cigarette that is shaped like a USB flash drive
- JUULs have very high level of nicotine
- 1 JUUL pod contains as much nicotine as a pack of 20 regular cigarettes!
The harmful chemicals in e-cigarettes and even bacteria can be spread through the aerosols.

Particularly vulnerable to children because of their developing lungs.
“Those who fail to learn from history are doomed to repeat it”

- Winston Churchill, 1948
Tobacco has been growing wild in the Americas for 8000 years.

2000 years ago - began to be chewed and smoked during cultural or religious ceremonies.

First European to discover smoking was Christopher Columbus.

1531 - tobacco was cultivated for the first time in Europe (at Santo Domingo).

1600 - tobacco use had spread across Europe and England.

1700 - smoking had become more widespread and a tobacco industry had developed.
Earliest known instance of smoking link to ill health in 1602
- Anonymous English author published an essay stating illnesses often seen in chimney sweepers were caused by soot and that tobacco may have similar effects

1795 - Sammuel Thomas von Soemmering of Maine (Germany) reported that he was becoming more aware of cancers of the lip in pipe smokers

1798 - US physician Benjamin Rush wrote on the medical dangers of tobacco

1920s - First medical reports linking smoking to lung cancer began to appear
- Many newspaper editors refused to report these findings as they did not want to offend tobacco companies who advertised heavily in the media

1950s and 1960s - Major medical reports confirmed that tobacco caused serious diseases

HISTORY OF TOBACCO INDUSTRY
1953- tobacco industry faced a crisis of cataclysmic proportions
Smoking had been categorically linked to the dramatic rise of lung cancer
Smoking caused lung diseases, cardiac diseases, leading to death
Major, peer-reviewed medical journals as well as throughout the general media
CEOs came together in December 1953 to map a strategy

- John W. Hill - the president of the nation's leading public relations firm, Hill & Knowlton

- Hill understood that simply denying emerging scientific facts would be a losing game
  - seizing and controlling science rather than avoiding it
  - companies should now associate themselves as great supporters of science
  - demand more science, not less

- Declare the positive value of scientific skepticism of science itself
  - strategy - support and amplify the views of skeptics of the causal relationship between smoking and disease
  - tobacco industry research funding to academic scientists to draw new skeptics
Goal, according to Hill, would be to build and broadcast a major scientific controversy.

Message for public - issue of the health effects of smoking remains an open question.

Doubt, uncertainty, and the truism that there is more to know would become the industry's collective new mantra.

Hill had quit smoking himself.

HISTORY OF TOBACCO INDUSTRY
Hill & Knowlton produced a compendium of statements by physicians and scientists who questioned the cigarette-lung cancer link

- Called for new research
  - implied that existing studies were inadequate or flawed
  - made the industry seem a committed participant in the scientific enterprise rather than a self-interested critic
Tobacco Industry Research Committee

Public announcement of the committee - full-page advertisement run in more than 400 newspapers across the country

“frank statement”

“We accept an interest in people's health as a basic responsibility, paramount to every other consideration in our business. We believe the products we make are not injurious to health. We always have and always will cooperate closely with those whose task it is to safeguard the public health”
It is an obligation of the Tobacco Industry Research Committee at this time to remind the public of these essential points:

- There is no conclusive scientific proof of a link between smoking and cancer.
- Medical research points to many possible causes of cancer.
- The millions of people who derive pleasure and satisfaction from smoking can be reassured that every scientific means will be used to get all the facts as soon as possible.
Tobacco companies falsely denied, distorted and minimized the link between cigarette smoking and disease, even though they internally recognized its existence.

1964 Surgeon General’s report concluded that smoking cigarettes causes death and disease.

1971 television interview, the president of Philip Morris still denied the health risks.
Tobacco companies falsely denied that they manipulate the level of nicotine in their products to create and sustain addiction, and have been since at least 1954.

In 1994, the CEO of R.J. Reynolds testified in a public hearing held by Congress that the company does not "add, or otherwise manipulate nicotine to addict smokers" or "do anything to hook smokers or to keep them hooked."
Tobacco companies concealed evidence and publicly denied that nicotine is addictive

- 1982, the National Institute of Drug Abuse confirmed that nicotine is addictive
- 1997 Time magazine, the president and CEO of Philip Morris was quoted as saying "If [cigarettes] are behaviorally addictive or habit forming, they are much more like ... Gummi Bears, and I eat Gummi Bears, and I don't like it when I don't eat my Gummi Bears, but I'm certainly not addicted to them."
Tobacco companies falsely marketed and promoted low-tar and light cigarettes as less harmful than regular cigarettes to keep people smoking and sustain revenues.
Tobacco companies internally acknowledged that secondhand smoke is hazardous to nonsmokers, yet still gave false and misleading public statements denying the fact.

1986 Surgeon General’s report concluded that exposure to secondhand smoke is a health hazard to nonsmokers.

1987, Philip Morris released a series of advertisements trying to convince public that secondhand smoke is not harmful.

HISTORY OF TOBACCO INDUSTRY
Traditional cigarette companies own large parts of the vape and e-cigarette market.
They are fighting against regulation using their old playbook.
Prevalence of cigarette smoking continued to grow in the early 20th Century

- development of new forms of tobacco promotion
- ability of the tobacco industry through its power and wealth to influence the policies of political parties

Later in the twentieth century, smoking became less popular

- Rapid increase in knowledge of the health effects of both active and passive smoking.
- People also became aware of the tobacco industry’s efforts to mislead the public about the health effects of smoking

The first successful lawsuits against tobacco companies over smoking-related illness happened in the latter part of the 20th Century
Smoking prevalence rates have declined in the traditional markets of North America and Western Europe.

Tobacco industry has re-focused its promotional efforts onto the less developed and emerging nations in Africa, Asia, the Middle East, the former Soviet Union and Latin America.

- Weak regulatory environment in these countries.

If current patterns continue, tobacco use will kill approximately 10 million people every year throughout the world by 2020.

- 70% of these deaths will occur in less developed and emerging nations.
E-cigarettes introduced as aid to stop smoking
- Not FDA approved for this indication
- No scientific evidence on the effectiveness as aid to quit smoking
- Project a risk free image in their marketing
- Offer enticing candy-like flavors that appeal to our youth
- Marketing - “cool” factor
- Incorporating e cigs into smoke free policies
- Preventing access to e cigs by youth
- Regulation of e cig marketing likely to attract youth
- Educational initiative targeting youth and young adults

**ACTIONS WE CAN TAKE**
If you use tobacco, it is never too late to stop
- Free help options are available
  - Teen.smokefree.gov
  - 1-800-QUITNOW
- Talk to your parents and healthcare provider
- Potential risks to your long-term health outweigh any enjoyment in the moment
We have worked too hard over the past 50 years to reduce smoking rates among young people to let the tobacco industry now profit off of getting them hooked on nicotine e-cigarettes.