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E Cigarettes, Vaping and Chairside Education

A Peer-Reviewed Publication

Written by Jennifer S. Sherry, RDH, MSED, Norine M. Blackstad, and Kasey S. Wheatley, RDH, BSDH

Abstract

The use of nicotine vaporizers (vaping) and e-cigarettes or is one of the newest trends in the adult population. Besides causing harm to the lungs, vaping can have adverse effects on the oral cavity. Despite its negative consequences, the use of these devices is on the rise. Many health care practices are noting an increase in the practice of vaping; however, some professionals may not feel comfortable broaching the subject of its negative effects with their patients. Understanding this issue and having the ability to discuss these issues with patients and their medical care professionals will assist in better health practices.

Educational Objectives

At the conclusion of this educational activity, participants will be able to

1. Discuss the history of e-cigarettes
2. Identify the many contents in e-liquid
3. Understand the health risks associate with vaping
4. Utilize the educational flowchart in a clinical practice setting

Author Profiles

Jennifer S. Sherry, RDH, MSED, is an associate professor in the dental hygiene program at Southern Illinois University Carbondale. She teaches radiology (lecture and lab), head and neck anatomy, and community oral health/community practicum courses. Her research interests include children's health issues and school nutrition programs.

Norine M. Blackstad is a senior in the dental hygiene program at Southern Illinois University Carbondale. After she graduates, she hopes to begin working full time while pursuing a Master of Public Health degree.

Kasey S. Wheatley, RDH, BSDH, is a 2016 graduate of the dental hygiene program at Southern Illinois University Carbondale. Her interest in the vaping topic translated through her contact with college students during her time as a student.

Author Disclosures

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Abstract

The use of nicotine vaporizers (vaping) and e-cigarettes or is one of the newest trends in the adult population. Besides causing harm to the lungs, vaping can have adverse effects on the oral cavity. Despite its negative consequences, the use of these devices is on the rise. Many health care practices are noting an increase in the practice of vaping; however, some professionals may not feel comfortable broaching the subject of its negative effects with their patients. Understanding this issue and having the ability to discuss these issues with patients and their medical care professionals will assist in better health practices.

Introduction

The use of nicotine in any form is directly related to an increased chance of developing multiple types of cancer, heart disease and other consequences.^{1,2,3,4} One form of nicotine delivery are e-cigarettes, devices that allow users to inhale an aerosol (i.e., vapor) containing nicotine and/or other substances.¹ Unlike traditional cigarettes, e-cigarettes are typically battery-operated and use a heating element to heat a liquid, releasing a chemical-filled aerosol.⁵

Statistics and history of e-cigarettes

The first smokeless nontobacco cigarette device was patented in 1967 by Herbert A. Gilbert.⁶ In 2003, Hon Lik, a Chinese pharmacist, was credited with creating the first “modern” e-cigarette.⁷ In 2007, e-cigarettes were introduced to the American market⁸ advertised as a healthier alternative to traditional smoking. Initially, e-liquids were not regulated by the FDA and consumers and health-care professionals were unaware of chemical compositions, or the ultimate health effects of e-cigarettes. According to manufacturers, the vapor produced by e-liquid is made primarily of propylene glycol, flavoring agent, vegetable glycerin, and nicotine.^{9,10} Vapor from e-cigarettes contain nine to 450 times fewer toxic substances than that produced by traditional cigarettes.¹¹ As of today, thousands of brands and flavors are available, giving consumers many choices.

Contents of e-liquid

In 2009, the FDA enacted the Family Smoking Prevention And Tobacco Control Act. Under this act, information provided by the FDA reported on the contents of e-cigarettes.¹² Laboratory analysis of electronic cigarette samples tested positive for “nicotine, as well as varying compositions of flavorings, propylene glycol, glycerin, and other pre/post combustion toxic chemicals.”¹² Table 1 Recent studies have detected the presence of diacetyl in e-liquids. Diacetyl is the main chemical linked to “popcorn lung” (i.e., bronchiolitis obliterans) a condition once

ubiquitous in popcorn factory workers.¹³ Popcorn lung is an irreversible loss of pulmonary function that becomes so severe a lung transplant is required. Potentially, the diacetyl in e-cigarettes can cause swelling of bronchioles leading to permanent loss of proper pulmonary function.

Table 1. Toxic Chemicals Used in E-Liquid⁹⁻¹¹

Diacetyl
Nitrosamine (known carcinogen)
Diethylene glycol (used in antifreeze and toxic to humans)
Anabasine (insecticide)
Myosmine (genotoxic to human cells--i.e, it has been found to harm the DNA found in all cells)

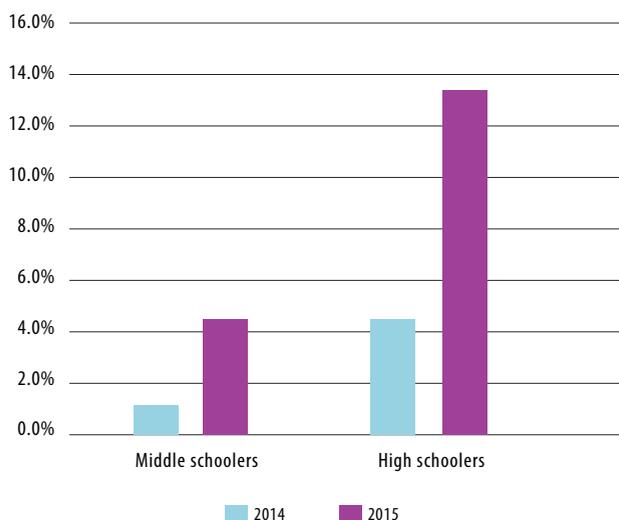
Negative effects on the human body

In addition to pulmonary damage, vaping can negatively affect the epithelial-rich oral cavity. Oral epithelial cells are rapidly shed and regenerated to maintain the normal cellular equilibrium. In 2015, an experiment testing the effects of vapor smoke on these cells was conducted. The research found that vapor, with and without nicotine, was cytotoxic to oro-epithelial cell lines inducing breaks in DNA strands.¹⁴ Users who vaped multiple times per day exposed already damaged epithelial cells to these toxic substances, leading to oral ulcerations, potential mutations and oral cancer. In addition, vaping can make it harder for the body to kill harmful microorganisms, leading to immunocompromise and illness.¹⁵ More specifically, a 2011 study found 6% of patients reported mouth irritation, 8% reported sore throat and dry mouth, and 9% reported mouth ulcers after 4 weeks of vaping. After 8 weeks, 8% reported coughing; after 24 weeks, 8% had throat irritation and 7% dry mouth.¹⁵

Immediate adverse effects of e-cigarettes might be due to the variations of nicotine content of e-cigarette cartridges. Some nicotine content variation exists from 3 mg to 24 mg; however, content can be as high as 100 mg per cartridge.¹⁶ This elevated level can pose an increased risk of nicotine toxicity.¹⁷ There have been reports of severe palatal injuries, oral and nasal damage, as well as respiratory tract burns.¹⁸ Other health consequences that have been documented in past studies include: elevated heart rate and blood pressure, airway inflammation, impaired immunological response, impaired bacterial phagocytosis, ulcerative colitis, lipoid pneumonia, and subacute bronchial toxicity.¹⁹

Adverse health effects of e-cigarettes can also include seizures, disorientation, airway resistance, congestive heart failure, pneumonia, and burns from faulty devices. Another concern is the uncertainty of second and third-hand exposure to the vapor and its effects on nonusers, particularly children.¹⁸ Overall, patients may be more susceptible to other diseases due to decreased immune response.²⁰ A US sample of 6,607 adult smokers completed an online survey in March 2013. Participants viewed e-cigarette use as less likely to cause lung cancer, oral cancer, or heart disease compared to smoking regular cigarettes.²¹ The amount of people who vape has been on the rise, fueled by celebrities who vape such as Katy Perry, Johnny Depp, and Leonardo DiCaprio.¹⁵

Figure 1. Percent of middle and high schoolers who vape¹⁵



The role of the dental hygienist

The dental hygienist is often the first health-care provider to treat the patient in a dental practice. The ability to educate is solely dependent upon the information that is available to the dental professional. Most dental practices are seeing an increase in the trend of vaping; the following flowchart (Figure 2²²⁻²⁶) can be utilized easily and efficiently in a standard recall or new-patient visit. It can be laminated and used chairside to provide comprehensive information on the negative effects of vaping and strategies to recognize that vaping is not a healthy alternative to smoking cigarettes.

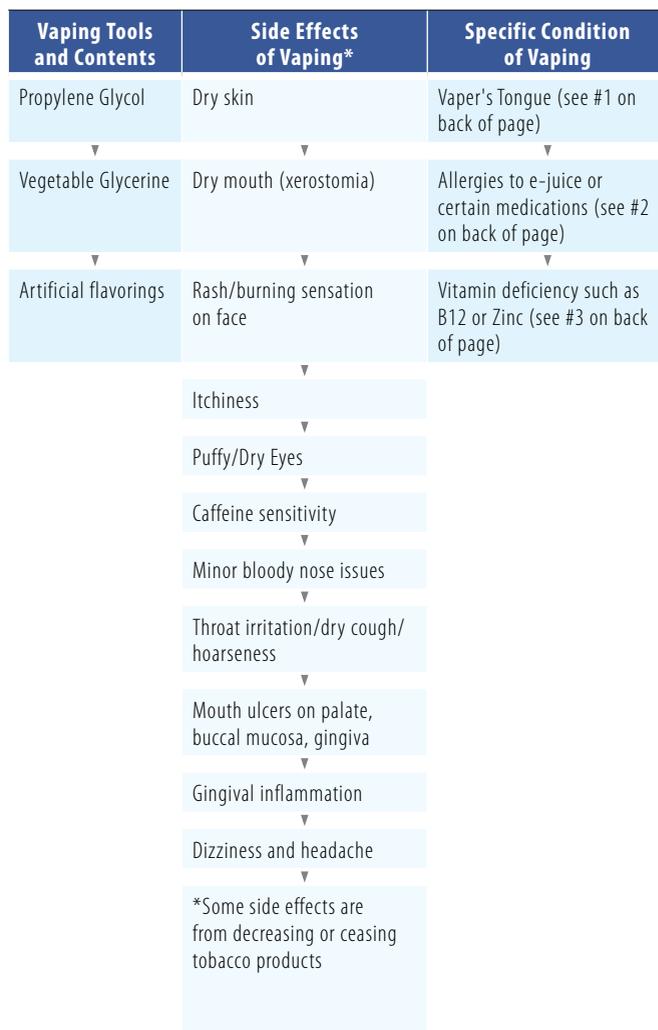
Dental hygienists may want to consider some communication strategies that may assist the patient with understanding the negative effects of vaping. Showing patients the changes within their own hard and soft tissue will be a positive way to reinforce the need to quit vaping. Moreover, the techniques of motivational interviewing and the use of open ended questions will aid the dental hygienist to listen prior to discussing treatment options to assist in decreasing or quitting use of e-cigarettes.

New FDA Regulations of E-cigarettes*

In May 2016, the FDA finalized a rule extending its authority to all tobacco products, including e-cigarettes, cigars, hookah tobacco and pipe tobacco, among others. This historic rule helped implement the bipartisan Family Smoking Prevention and Tobacco Control Act of 2009, allowing the FDA to improve public health and protect future generations from the ill-effects of tobacco use, including restricting the sale of these products to minors nationwide.²⁶ The new ruling will include the following youth access restrictions:

- Not allowing products to be sold to persons under the age of 18 years (both in person and online);
- Requiring age verification by photo ID;
- Not allowing the selling of covered tobacco products in vending machines (unless in an adult-only facility); and
- Not allowing the distribution of free samples.²⁶

Figure 2: Vaping: The Dental Hygienist’s Educational Tool²²⁻²⁶



Preventing misleading information and claims by tobacco product manufacturers, being able to evaluate how products are fabricated, and communicate potential risks are all goals of the FDA.²⁶ Another important part of this ruling is to ensure that importers and/or retailers of newly-regulated tobacco products are following the same mandates that other products are utilizing. These are the following updates in the provisions and requirements of the FDA:

- Registering manufacturing establishments and providing product listings to the FDA;
- Reporting ingredients, and harmful and potentially harmful constituents;
- Requiring premarket review and authorization of new tobacco products by the FDA;
- Placing health warnings on product packages and advertisements; and
- Not selling modified risk tobacco products (including those described as “light”, “low”, or “mild”) unless authorized by the FDA.³¹*This final ruling goes in effect on August 8, 2016.

Conclusion

Since there is limited information that dental professionals can use regarding the ill effects of vaping, more current studies, literature, and regulations are imperative. The FDA should conduct further research about contents of e-liquid and how it can affect not only the oral cavity, but overall health in general. The conversations must be initiated by the dental professionals and more collaboration with medical groups will be beneficial. Bridging the gap between the dental and medical professions will only assist in better health practices by our mutual patients. Unfortunately, health-care professionals still do not know the long-term effects that patients will experience if they make the choice to vape.

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Questions

1. According to which association, are e-cigarettes devices that allow users to inhale an aerosol containing nicotine or other substances.
 - a. American Dental Hygienists' Association
 - b. Food and Drug Administration
 - c. Centers for Disease Control and Prevention
 - d. National Institutes of Health
2. E-cigarettes are usually operated by a(n):
 - a. Electrical outlet
 - b. Match
 - c. Battery-operated device
 - d. None of the above
3. What year was the first smokeless nontobacco cigarette patented?
 - a. 1946
 - b. 1967
 - c. 1988
 - d. 1992
4. E-cigarettes were introduced to the American market in what year?
 - a. 1967
 - b. 1987
 - c. 2007
 - d. 2010
5. Vapors from e-cigarettes contain nine to _____ times lower toxic substances in the body than smoke inhalation from a regular cigarette.
 - a. 200
 - b. 300
 - c. 450
 - d. 1,000
6. Since the new adoption of an FDA ruling regulating e-cigarettes, what age does a person have to be to purchase any product of this type?
 - a. 16
 - b. 18
 - c. 21
 - d. 25
7. What is the primary element of the vapor liquid for e-cigarettes?
 - a. Propylene glycol
 - b. Flavoring agent
 - c. Vegetable glycerin
 - d. All of the above
8. What tobacco-specific components are in e-liquid?
 - a. Anabasine and myosmine
 - b. DNA and genotoxins
 - c. Vegetable oil and acid
 - d. None of the above
9. What substance has been found in e-liquid?
 - a. Benadryl
 - b. Caffeine
 - c. Popcorn
 - d. Diacetyl
10. What is the condition caused by vaping that can decrease pulmonary function?
 - a. Popcorn lung
 - b. Atherosclerosis
 - c. Arthritis
 - d. Eczema
11. Death to epithelial cells is known as:
 - a. Embolism
 - b. Cytotoxicity
 - c. Calculus
 - d. DNA
12. Vaping causes which the following side effects:
 - a. Xerostomia
 - b. Sore throat and ulcers
 - c. Mouth and throat irritation
 - d. All of the above
13. In middle and high school populations, use of e-cigarettes is:
 - a. increasing
 - b. decreasing
 - c. waning
 - d. The article did not discuss this data
14. Other side effects of vaping can be:
 - a. Hyperactivity
 - b. Caffeine sensitivity
 - c. Rash or burning sensation of the face
 - d. B and C
15. What is a taste ailment that can occur when using the same vaping flavor over a long period of time?
 - a. Widow's beak
 - b. Vapor's tongue
 - c. Vapor's skin
 - d. Conjunctivitis
16. What year did the FDA enact the Family Smoking Prevention and Tobacco Control Act?
 - a. 1989
 - b. 1999
 - c. 2009
 - d. none of the above
17. What vitamin deficiency (vitamin that is found in meat, fish, and dairy products) can occur when vaping?
 - a. Niacin
 - b. B6
 - c. B12
 - d. E
18. Which of the following is a potential carcinogen found after passing e-liquid through a heated coil?
 - a. Nitrosamine
 - b. Nitroglycerine
 - c. Trinitro-toluene
 - d. Nitrium
19. Nicotine content in e-cigarettes can vary from:
 - a. 5mg-15mg
 - b. 3mg-24mg
 - c. 3mg-15mg
 - d. 5mg-24mg
20. Preventing misleading information and claims by tobacco product manufacturers are goals of the:
 - a. DEA
 - b. EPA
 - c. FBI
 - d. FDA

E Cigarettes, Vaping and Chairside Education

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2. Identify the many contents in e-liquid
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4. Utilize the educational flowchart in a clinical practice setting

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The PennWell Corporation is designated as an Approved PACE Program Provider by the Academy of General Dentistry. The formal continuing dental education programs of this program provider are accepted by the AGD for Fellowship, Mastership and membership maintenance credit. Approval does not imply acceptance by a state or provincial board of dentistry or AGD endorsement. The current term of approval extends from (11/1/2015) to (10/31/2019) Provider ID# 320452

RECORD KEEPING
 PennWell maintains records of your successful completion of any exam for a minimum of six years. Please contact our offices for a copy of your continuing education credits report. This report, which will list all credits earned to date, will be generated and mailed to you within five business days of receipt.

Completing a single continuing education course does not provide enough information to give the participant the feeling that s/he is an expert in the field related to the course topic. It is a combination of many educational courses and clinical experience that allows the participant to develop skills and expertise.

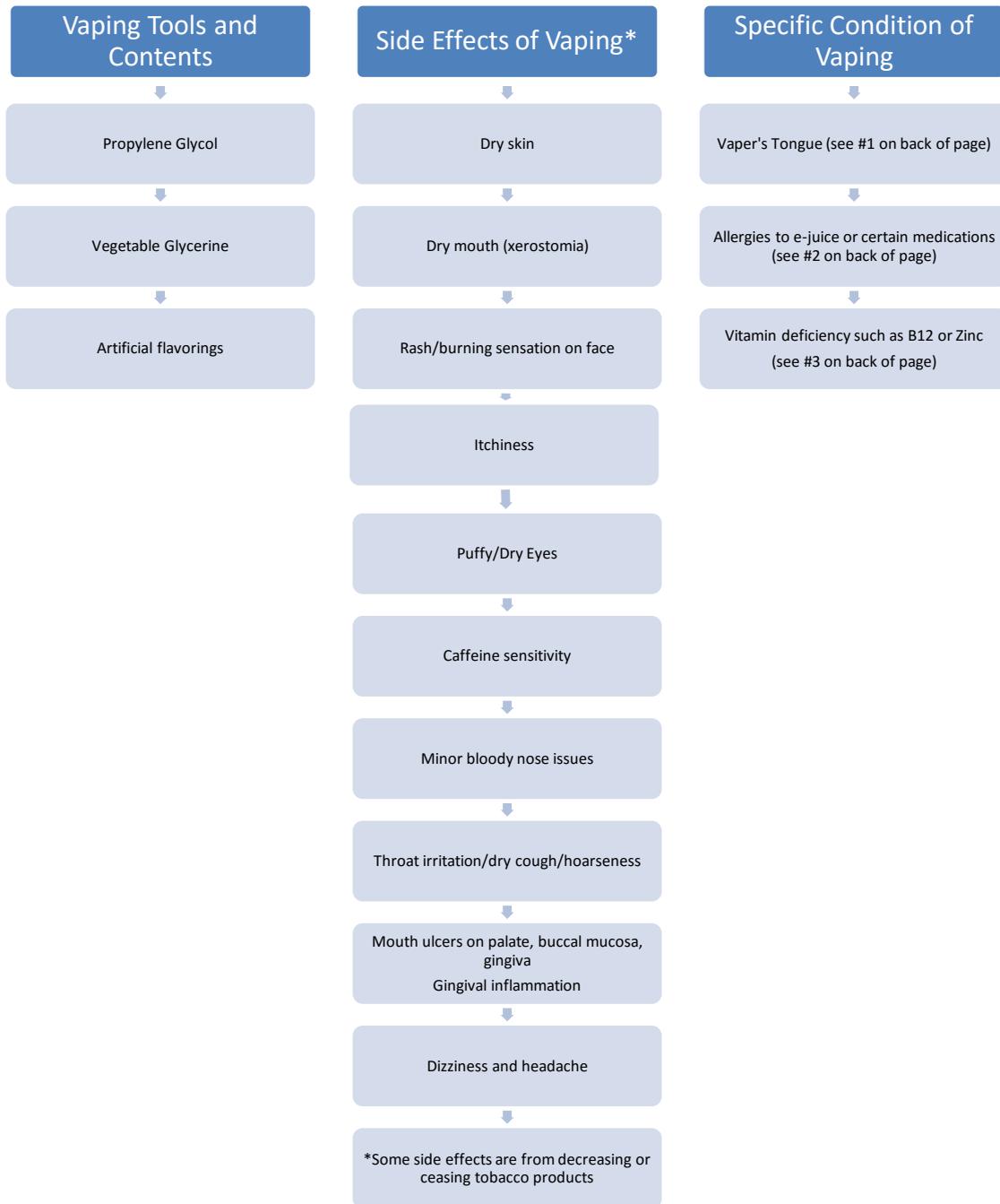
CANCELLATION/REFUND POLICY
 Any participant who is not 100% satisfied with this course can request a full refund by contacting PennWell in writing.

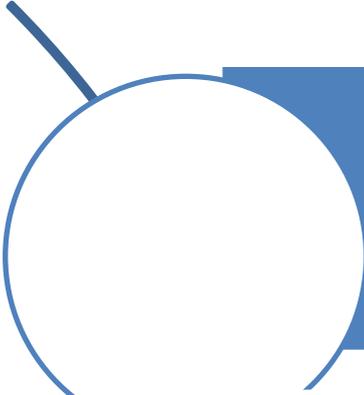
IMAGE AUTHENTICITY
 The images provided and included in this course have not been altered.

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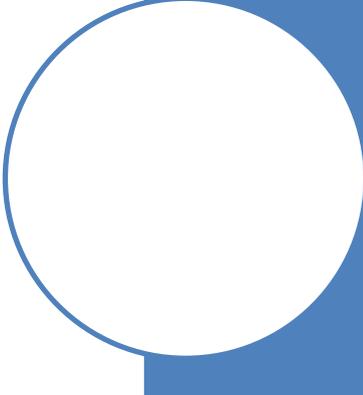
VAPE1216DIG

Vaping: The Dental Hygienist's Educational Tool

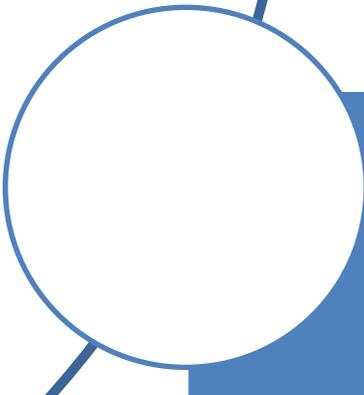




#1 Vapor's Tongue—Taste ailment that can occur when use same vaping flavor too long; recently switched from smoking; can cause dehydration and/or fatigue, xerostomia, damage to taste buds



#2 Allergies to e-juice or certain medications— Patients who are allergic to Propylene Glycol, Vegetable Glycerine or artificial flavorings; taking the following medications: Thyroid drugs, Captopril (ACE inhibitor), Griseofulvin (Antifungal), Lithium (Manic Depression), Penicillamine (removes excessive copper), Procarbazine (cancer drug), Rifampin (bacteria fighter use in TB cases) or some cancer drugs could have ill effects to vaping products



#3 Vitamin deficiency such as B12 (found in meat, fish, and dairy products) or Zinc (found in Red meat, Poultry, Oysters, Fortified cereals, Whole grains, Beans and Nuts)

The best suggestion would be to encourage patients to stop utilizing tobacco products through evidence-based methods (counseling and medications) through the ADHA's "Ask, Advise, Refer" program or the individual state's Quitline, if available.