Welcome to the NVFC’s Webinar Series.

Today’s webinar is “Why Everyday Health Decisions are Important in Reducing Cancer Risks for Firefighters.”
The National Volunteer Fire Council (NVFC) is the leading nonprofit membership association representing the interests of the volunteer fire, EMS, and rescue services. The NVFC serves as the voice of the volunteer in the national arena and provides invaluable resources, programs, education, and advocacy for first responders across the nation.

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Our Presenter: Sara Jahnke, PhD

Director & Senior Scientist
Center for Fire, Rescue & EMS Health Research
with the National Development & Research Institutes - USA
Firefighting: The Perfect Storm

Soteriades et al., 2013
For every cardiac LODD, an estimated 17 non-fatal cardiac events occur on duty each year.
Causes of CVD

![Diagram showing the causes of cardiovascular disease (CVD) including genetics, lifestyle factors, and environmental triggers.]

Soteriades et al., 2013
Cardiac Deaths are Not Random
## The Data: Cancers Related to Firefighting

<table>
<thead>
<tr>
<th>Type of Cancer</th>
<th>Meta-analysis LeMasters et al. (2006)</th>
<th>Cohort Study Daniels et al. (2013)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SRE(^a) (95% CI)</td>
<td>SMR(^b) (95% CI) All SIR(^c) (95% CI) First</td>
</tr>
<tr>
<td>Bladder</td>
<td>--</td>
<td>1.18 (1.05-1.33)</td>
</tr>
<tr>
<td>Brain</td>
<td>1.32 (1.12-1.54) Possible</td>
<td></td>
</tr>
<tr>
<td>Buccal Cavity and Pharynx</td>
<td>1.23 (0.96-1.55) Possible</td>
<td>1.40 (1.13-1.72)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.39 (1.19-1.62)</td>
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<tr>
<td></td>
<td></td>
<td>1.41 (1.20-1.66)</td>
</tr>
<tr>
<td>Colon</td>
<td>1.21 (1.03-1.41) Possible</td>
<td></td>
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<tr>
<td>Intestine</td>
<td></td>
<td>1.30 (1.16-1.44)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.21 (1.09-1.33)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.29 (1.16-1.43)</td>
</tr>
<tr>
<td>Kidney</td>
<td>1.29 (1.05-1.58)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.27 (1.09-1.48)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.24 (1.04-1.48)</td>
<td></td>
</tr>
<tr>
<td>Leukemia</td>
<td>1.14 (0.98-1.31) Possible</td>
<td></td>
</tr>
<tr>
<td>Liver, Gall Bladder, Biliary</td>
<td>1.30 (1.06-1.57)</td>
<td></td>
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<tr>
<td></td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>Lung</td>
<td>1.10 (1.04-1.17)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.12 (1.04-1.21)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.13 (1.04-1.22)</td>
<td></td>
</tr>
</tbody>
</table>
"Toxic Soup" of Known and Unknown Carcinogens

- CO
- Formaldehyde
- Metals
- Flame retardant
- Benzene
- PAHs
- NO2
- Glutaraldehyde
- Toulene
- Zylenes
- Styrene

Note: Short duration but high intensity believed to be particularly dangerous

Routes of Exposure

- Inhalation on the fireground
- Dermal absorption, especially in areas with thin skin (e.g. wrist, neck)
- Secondary exposure/contaminated dust from particulates post incident
- Semi-volatile off gassing of gear?
Modifiable Risk Factors

Obesity
  - Fitness
  - Nutrition

Alcohol Use

Tobacco Use

Sleep

Exposures
Document Review
- Medical records
- Depositions – department liabilities (e.g. physicals, mitigation, culture)
- SOGs/SOPs
- Exposure records

**Case Summary**
**Workers Compensation Claim**

- **Name**: XXXX
- **Department**: XX Fire Department
- **Diagnosis**: Esophageal Adenocarcinoma
- **Age at Diagnosis**: 53
- **Age at Death**: 54
- **Ethnicity**: White
- **Tobacco**: Never
- **Alcohol**: No alcohol
- **Obesity Status**: BMI 31.8, worked out 3x week
- **Elevated Risks, Studies**: Daniels, Tsai
- **Exposures Linked to Dx**: PAH, Asbestos, Styrene, Benzene
## Obesity and Cancer

<table>
<thead>
<tr>
<th>Type of Cancer</th>
<th>Increased Risk</th>
<th>Type of Cancer</th>
<th>Increased Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Esophageal</td>
<td>2x</td>
<td>Meningioma (Brain)</td>
<td>50%</td>
</tr>
<tr>
<td>Gastric Cardia</td>
<td>2x</td>
<td>Colorectal</td>
<td>30%</td>
</tr>
<tr>
<td>Liver</td>
<td>2x</td>
<td>Pancreatic</td>
<td>1.5x</td>
</tr>
<tr>
<td>Kidney</td>
<td>2x</td>
<td>Gallbladder</td>
<td>60%</td>
</tr>
<tr>
<td>Multiple Myeloma</td>
<td>10-20%</td>
<td>Thyroid</td>
<td>10%</td>
</tr>
</tbody>
</table>

National Cancer Institute
Chronic low-level inflammation

Fat Cells Produce Adipokines (e.g. Leptin)

Insulin Resistance

DNA Damage

Stimulate/Inhibit Cell Growth

??
Definition of Obesity

**BMI (kg/m²)**
- Overweight = BMI > 25 and < 30
- Class I = BMI > 30 and < 35
- Class II = BMI > 35 and < 40
- Class III = BMI > 40

**Body Fat Percentage**
- Men, BF% > 25
- Women, BF% > 30

**Waist Circumference**
- Men WC > 40 inches
- Women WC > 35 inches
Obesity and Body Composition of Firefighters

12.0 METS*

Overweight and Obesity Prevalence: Men

Firefighter Data from Poston et al., 2011: FIRE Study. Range in the published literature, BMI ≥ 25: 73-88%
Overweight and Obesity Prevalence: Women

Fire & Emergency Services

US Overweight Prevalence = 66.9%*
*NIDDK, 2020

US Obesity Prevalence = 40.4%*
*Flegal et al. JAMA 2016
Is BMI a Perfect Indicator of Body Composition?

Ronnie Coleman, Mr. Olympia x 8
Height= 5’11”, Weight= 295
BMI=41.1

Approximate BMI > 40.0
Reasons for the Obesity Epidemic

Nutrition Environment in the fire house
- Irregular eating patterns and unpredictable schedules
- Portion size, meal planning, and traditions
- Processed carbohydrates and sugar

Metabolic impact of shift work

Lack of support for physical activity in some departments

Time constraints for healthy behaviors

Behavioral health concerns
Food in the Firehouse
Firehouse Environment

- Irregular eating patterns
- Traditions
- Food availability
Meals as Bonding

“...just eating with them on those days I put on some weight and it’s very difficult to do that because part of the fire service family is built around that kitchen table. That’s where it takes place. That’s where real problems are solved.”

“Yeah, at some stations, everybody just brings their own food in...You know, they have problems in their groups and they don’t seem to cook up as much...just like guys that don’t get along together.”
**Best Potato Soup** - Feeds 6-8 people or 4-6 firefighters

- 4 Cups potatoes, diced but unpeeled
- 1/4 LB butter
- 2 Cups finely diced yellow onions
- 1/2 Cup flour 1 Quart warm water
- 1/4 Cup chicken bouillon
- 1 Cup potato flakes
- 4 Cups half and half
- 1/2 tsp. Tabasco sauce
- Salt, Pepper, Garlic powder and Dried Basil to taste

Sauté onions in melted butter for 10 minutes in large kettle. Add flour to onions and butter and cook for 5 minutes, stirring until flour is absorbed. In a separate container combine, water, chicken bouillon, potato flakes, and seasonings. Stir until no lumps remain. Add to onion mixture, 1 cup at a time. Add half and half, stirring until smooth and lightly thickened. Reduce heat and simmer for 15 minutes. In a separate pan, the potatoes should be covered with water and brought to a boil, and simmered for 20 minutes. Drain potatoes and add to soup to complete. If too thick for taste, milk may be added to thin down. Serve with chopped green onions and cheese 1 sprinkled on top. Cook time approx. 40 minutes
Evidence Based Dietary Advice

Focus on diet quality
Avoid or limit processed food
Limit sugar intake
Stay hydrated
Fruits and vegetables are good
Eat healthy fats
Take care of your gut health

- People who plan to eat a health, low-cal meal
- People who wish this was REALLY pie
Less you sleep

• Appetite is controlled by hormones
  • Leptin – signals sense of fullness, high levels tell you to stop eating
  • Ghrelin – signals hunger

• Van Cauters and colleagues
  • Randomized to 8-8.5 hours of sleep or 4-5 hours of sleep
  • 1 week
  • Given same food and physical activity
  • By 2nd day of short sleep, people with short sleep feel ravenous – lost hunger control

More you eat

Less able to manage calories
Van Cauters and colleagues
- 2 different conditions
- Within subjects design
- 4 nights of 8-8.5 hours of sleep
- 4 nights of 4-4.5 hours of sleep
- Physical activity held constant
- Free access to food
- Same individuals ate 300 more calories each day on short sleep days – 1,000+ calories over the course of the experiment
- Chronic deprivation ~70,000 extra calories/year
- 10-15 lbs weight gain/year
Van Cauters and colleagues

- Same design as last study
- Last day provided buffet with bonus snacks with desserts and salty snacks
- 4-hour period of buffet
- Sleep deprived individuals ate an average of 330 additional calories of snacks after meal
- May be due to increased circulating endocannabinoids
- Cravings for sweets, carb heavy foods and salty snacks increases 30-40% when sleep is reduced
- Pair with less motivation for physical activity
- Breakdown of impulse control?
Alcohol & Cancer

- **Head & Neck**: 50+ grams of alcohol/day (~3.5 drinks) have 2-3x risk
- **Breast**: women who drank 45+ grams of alcohol/day (~3 drinks) have 50% higher risk
- **Colorectal**: 50+ grams of alcohol/day (~3.5 drinks) have 50% higher risk
- **Liver**: primary cause particularly hepatocellular carcinoma
- **Esophageal**: independent risk factor particularly for esophageal squamous cell carcinoma

National Cancer Institute
Alcohol: Proposed Mechanisms

- Metabolizing Ethanol: Acetaldehyde
- Impaired Absorption of Nutrients
- Fermentation

→ Damage to DNA & Proteins
→ Malnutrition
→ Damaging Chemicals (nitrosamines, asbestos, hydrocarbons)
Definitions: According to Scientists

1 drink = 12 fl oz of regular beer = 5 fl oz of table wine = 1.5 fl oz shot of 80-proof spirits (whiskey, gin, rum, vodka, tequila, etc.)

about 5% alcohol

about 12% alcohol

about 40% alcohol
Definitions: According to Scientists

WHAT IS BINGE DRINKING?

CONSUMING ALCOHOL UNTIL THE BLOOD-ALCOHOL CONCENTRATION LEVEL IS 0.08% OR MORE.

THIS USUALLY MEANS FIVE OR MORE DRINKS IN A SINGLE OCCASION FOR MEN AND FOUR OR MORE DRINKS FOR WOMEN, GENERALLY WITHIN ABOUT TWO HOURS.
Heavy Drinking
• 53% career
• 39% volunteers

Binge Drinking
• 56% career
• 45% volunteers

About 10% of firefighters reported driving while intoxicated in the past month.
Alcohol Use: Reasons

**Shift Schedule:** “One thing that's different with us, though, I mean we work ten days a month, so we got a lot of days that we don't work the next morning. That's one reason why - maybe that's my excuse, I don't know.” Firefighter, Career

**Camaraderie:** “I use it as an excuse to unwind on the four days, you know what I mean? You get together in a big group, go out, have a drink, tell war stories, laugh about stuff we did. Just act - act like exactly we did at the station, except do it with beer - with a drink.” Firefighter, Career
Alcohol Use: Reasons

**Tradition:** “They (firefighters) all seem to be social and if you look back throughout the history of the fire service when my great grandfather was on up through the ranks what's union hall if there wasn't an open bar or a party somewhere.” Chief, Career

**Stress Management:** “The stress of the job...when you get off...you want something that will help you unwind.” Firefighter, Career
Sleep & Alcohol

• Alcohol = artificial sedating
  • Fragments sleep
  • Most awakenings are not remembered
  • Often not recognized

• Suppresses REM sleep
  • Metabolizing alcohol creates aldehydes and ketones
  • Aldehydes prevent pulsating beat of brainwaves

• Excessive alcohol use – no dream sleep that then builds up
“Your worst day is our everyday”
~Into the Fire (2005)
A Complex Interplay

- Chronic Repeated Exposure to Trauma
- Acute Exposures (e.g. LODD, terrorist attack)
- Environmental Exposures
- Sleep/Circadian Rhythm Disruption
- Injury/Disability
- Home/Life Stressors

- Cancer
- Cardiovascular Disease
- Vicarious Trauma
- Depression
- Anxiety
- PTSD
- Suicidal Ideation
- Substance Use/Abuse
- Epigenetic Changes

- Resilience & Post Traumatic Growth
What Works Well?

- Camaraderie
- Dark humor
- Social support
- Debriefing
- Family support
- Sharing experiences
- Fire service identity
Until it doesn't...
<table>
<thead>
<tr>
<th>Variable</th>
<th>Levels of Harassment &amp; Discrimination</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low (n=603)</td>
<td>Medium (n=578)</td>
</tr>
<tr>
<td>Demographic Characteristics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (years; M±SD)</td>
<td>40.3±9.2</td>
<td>40.4±8.9</td>
</tr>
<tr>
<td>Race (% White, Non-Hispanic)</td>
<td>86.3</td>
<td>88.7</td>
</tr>
<tr>
<td>Marital Status (% Married, domestic partnership, or civil union)</td>
<td>56.0</td>
<td>58.7</td>
</tr>
<tr>
<td>Sexual Orientation (% Heterosexual)</td>
<td>79.8</td>
<td>81.3</td>
</tr>
<tr>
<td>Education (% At least some college or higher)</td>
<td>95.0</td>
<td>97.2</td>
</tr>
<tr>
<td>Income (% $50,000 or more)</td>
<td>91.1</td>
<td>91.5</td>
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<tr>
<td>Occupational Characteristics</td>
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<td></td>
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<tr>
<td>Years in the Fire Service (years; M±SD)</td>
<td>13.4±8.1</td>
<td>13.7±8.0</td>
</tr>
<tr>
<td>Rank (% Any firefighter rank)</td>
<td>71.5</td>
<td>67.6</td>
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## Mental Health Impacts: Discrimination & Harassment

<table>
<thead>
<tr>
<th>Current Depression (% in range of concern)</th>
<th>Current Anxiety Sx (MHI Anxiety Score)</th>
<th>Current PTSD (% in range of concern)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low: 15.1%</td>
<td>Low: 16.4 + 6.5</td>
<td>Low: 6.9%</td>
</tr>
<tr>
<td>Medium: 23.6%</td>
<td>Medium: 17.7 + 5.9</td>
<td>Medium: 8.5%</td>
</tr>
<tr>
<td>High: 43.3%</td>
<td>High: 21.1 + 7.6</td>
<td>High: 16.5%</td>
</tr>
<tr>
<td><strong>p&lt;.001</strong></td>
<td><strong>p&lt;.001</strong></td>
<td><strong>p&lt;.001</strong></td>
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### Physical Health Impacts: Discrimination & Harassment

<table>
<thead>
<tr>
<th>Poor Physical Health Days</th>
<th>Injuries in Past Year (% 1 or more)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Low: 2.8 ± 6.7</strong></td>
<td><strong>Low: 36.8</strong></td>
</tr>
<tr>
<td><strong>Medium: 2.9 ± 6.7</strong></td>
<td><strong>Medium: 44.1</strong></td>
</tr>
<tr>
<td><strong>High: 4.0 ± 7.3</strong></td>
<td><strong>High: 56.3</strong></td>
</tr>
</tbody>
</table>

\[ p < .001 \]
“Tobacco is the leading cause of cancer and death from cancer.”

~ National Cancer Institute

“There is no safe level of tobacco use.”
~ National Cancer Institute
Tobacco & Cancer

Lung
Larynx
Mouth
Esophagus
Throat

Bladder
Kidney
Liver
Stomach
Pancreas
Colon

Rectum
Cervix
Acute Myeloid Leukemia

Mouth
Esophagus
Pancreas
Cigarette Use Among Firefighters

Tobacco Use Among Firefighters in the Central United States

C. Keith Hadlock, MD,1 Nattinee Jenjarin, MD,2 Walker S.C. Panton, MD,1,3,4
Brianna Tolley,1 and Sara A. Lohnes,1 MD

Background This study provides a comprehensive, population-based examination of smoking among both career and volunteer firefighters.

Methods Data are from a population-based cohort study of randomly selected career (N = 11) and volunteer (N = 11) departments comprised of 167 male firefighters.

Results: Unadjusted rates of smoking were 13.6% for career and volunteer firefighters, respectively. Smoking rates were less than a comparable occupational group (military personnel) and adult males in the states represented. Officers were more likely to have engaged in an arrest (OR: 3.5, P = 0.019), have an elevated CRP, alcohol problem (OR: 1.5, P = 0.019), and more likely to report adverse effects to smoking (OR: 4.5, P = 0.019) compared to non-officers in officers.

Conclusions Smoking among firefighters is associated with other significant health and safety risks. High rates of tobacco use suggest the fire service is an important target for intervention. Thus, despite some questions against smoking in the fire service, the need to maintain high levels of health and fitness related to smoking rates, a significant proportion of firefighters continue to use tobacco products.

KEY WORDS: firefighters; fire service; tobacco; smoking; cigarettes; cigars; smokeless

INTRODUCTION

Firefighters are a vital component of our nation’s emergency and disaster response system and are charged with protecting the citizens and property in the communities they serve. The nature of this profession makes firefighting a physically and mentally demanding occupation.

Unadjusted Rates of Current Smoking

13.6% for Career Firefighters

17.4% for Volunteer Firefighters
Rates of Smokeless Tobacco Use

SLT Users Were:
- Younger
- Had fewer years in the Fire & Emergency Services
- A small percent (15.7%) used because of departmental restrictions on smoking
May be due to interruption of circadian rhythms

Suppression of melatonin at night

World Health Organization – Shift work is “Probable Carcinogen”
• Irwin et al.
  • Healthy young men
  • Single night of 4 hour sleep
  • 70% decrease in natural killer cells in immune system

• Shift work found to increase risk of breast cancer, prostate cancer, cancer of the uterus, colon cancer

• Sympathetic nervous system turned on leads to inflammation

• Who routinely sleeps less than 6 or 7 hours a night?
  • Diminishes immune system
  • Doubles risk of cancer
Cancer Research...where are we headed next?
Cancer Research...where are we headed next?

NFR National Firefighter Registry
Cancer Research...where are we headed next?
Cancer Research...where are we headed next?
Modifiable Risk Factors... where are we headed next?
Q&A Session
Post-webinar thoughts or questions?

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Or contact Caroline Stachowiak at: caroline@nvfc.org
THANK YOU!

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