



Summary of Physiological Responses to Firefighting

- **Cardiovascular** (Increased HR and BP, Decreased SV, Increased Arterial Stiffness)
- **Hematological** (Decreased Plasma Volume, Hemoconcentration, Procoagulatory)
- **Thermoregulatory** (Elevated Core Temperature, Dehydration)
- **Respiratory** (Increased Breathing Rate and Oxygen Consumption)
- **Metabolic** (High Oxygen Cost, Increased Lactate, Fatigue)
- **Immune/Endocrine** (Increased Leukocytes and Hormones)
- **Nervous** (Sympathetic Surge and Increased Adrenaline)
- **Muscular** (Increased Oxygen Use and Heat Production)

# *Sudden Cardiac Death (SCD)*



Case control study using NIOSH fatality data of firefighter LODDs ( $\leq 45$  years; Yang et al. 2014)

- Hypertension increased risk x12
- Cardiomegaly (heavy heart) increased risk x5
- Hx of CVD increased risk x 7
- Smoking increased risk x 3.5
- Of SCD deaths, 63% were obese

**NOTE: Among non-cardiac deaths, obesity was STILL a significant predictor of LODD**

# Firefighter Fatality Statistics



## MMWR™

Morbidity and Mortality Weekly Report

Weekly

April 28, 2006 / Vol. 55 / No. 16

TABLE. Number and percentage of fatalities among career and volunteer firefighters, by cause/contributing cause — United States, 1994–2004

Cause/Contributing cause	Career		Volunteer	
	No.	(%)	No.	(%)
<b>Heart attack*</b>	<b>142</b>	<b>(39)</b>	<b>306</b>	<b>(50)</b>
Stress/Overexertion	138	(97)	301	(98)
Other	4	(3)	5	(2)
<b>Motor vehicle–related trauma</b>	<b>44</b>	<b>(12)</b>	<b>160</b>	<b>(26)</b>
Vehicle collision/crash	30	(68)	116	(73)
Struck by vehicle	12	(27)	33	(20)
Other vehicle-related (e.g., crushed by or fell from a vehicle)	2	(5)	11	(7)
<b>Asphyxiation</b>	<b>74</b>	<b>(20)</b>	<b>45</b>	<b>(7)</b>
Caught/Trapped	56	(76)	31	(69)
Other (e.g., lost inside a structure or exposed to smoke)	18	(24)	14	(31)
<b>All other†</b>	<b>108</b>	<b>(29)</b>	<b>99</b>	<b>(16)</b>
Caught/Trapped	32	(30)	19	(19)
Fall	8	(7)	15	(15)
Exposure (e.g., to smoke)	9	(8)	14	(14)
Stress/Overexertion	16	(15)	14	(14)
Structure collapse	8	(7)	3	(3)
Other	35	(32)	34	(34)
<b>Total</b>	<b>368</b>		<b>610</b>	

\* For example, myocardial infarction or arrhythmia.

† Includes deaths caused by burns, cerebral vascular accidents, drownings, electrocution, heat exhaustion, and trauma.

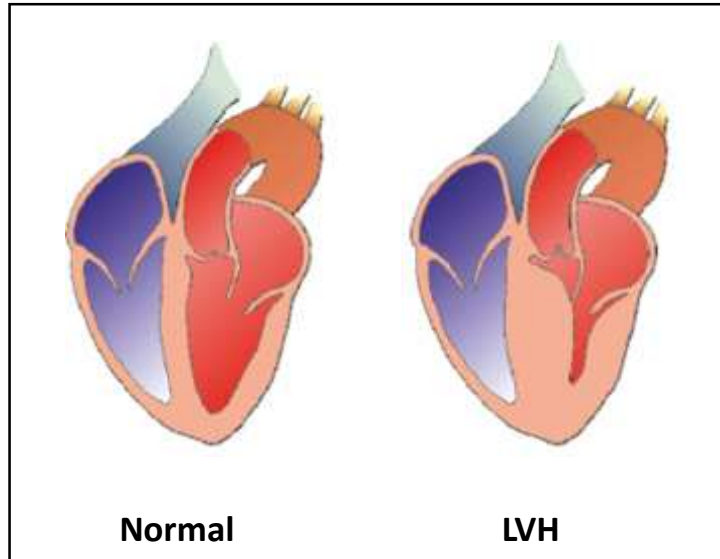
For every cardiac LODD,  
an estimated

17

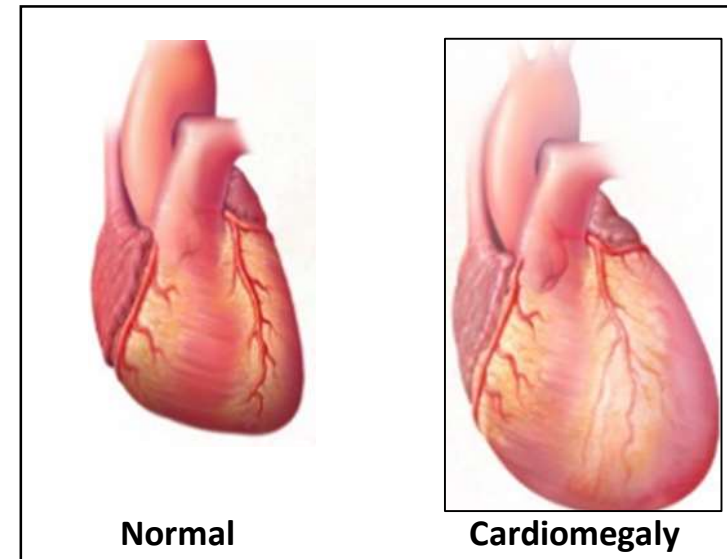
non-fatal cardiac events occur  
on duty each year.

# Structural Changes

## Left Ventricular



## Cardiomegaly



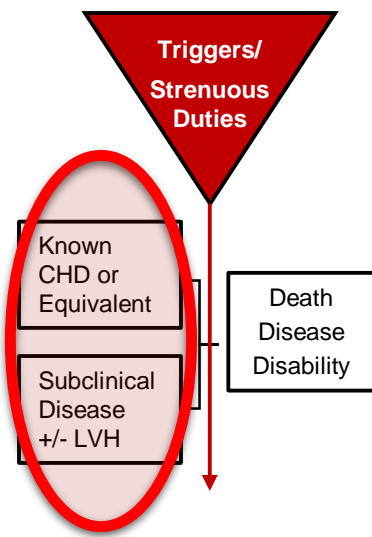
**Associated with increased susceptibility  
to arrhythmia**



# Cardiomegaly/Left Ventricular Hypertrophy

Risk factors:

- Hypertension – heart must work harder to pump against a high pressure
- Obesity – heart must work harder due to an increase in circulating blood volume (obesity is also associated with hypertension)
- CHD – narrowed arteries cause the heart to work harder to deliver adequate blood flow



# Left Ventricular Hypertrophy

**Results from 3 retrospective studies that examined autopsy data for duty-related cardiac fatalities**

Evidence of LVH at autopsy:

- 76% (n = 52; 25 autopsies\*) (Kales et al., *New Engl J Med*, 2003)
- 57% (n = 87) (Geibe et al., *Am J Cardiol*, 2008)
- 70% (n = 87; age ≤45 years) (Yang et al., *Am J Cardiol*, 2013)

**LVH has been shown to be an independent predictor of cardiac death**

\*left ventricle described in 25 autopsies



# Exposures

## **“Toxic Soup” of Known & Unknown Carcinogens**

- CO
- Formaldehyde
- Metals
- Flame retardant (PCBEs)
- Benzene
- PAHs
- NO<sub>2</sub>
- Glutaraldehyde
- Toulene
- Zylenes
- Styrene

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



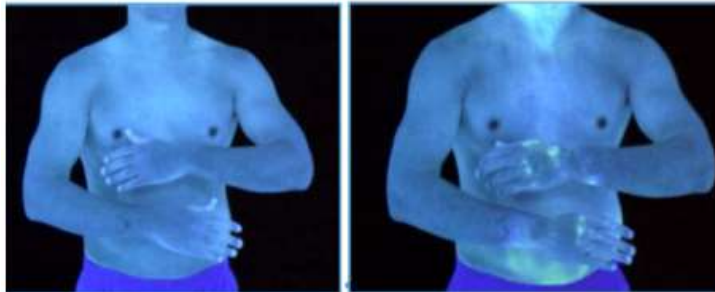
# Exposures: Dermal Absorption

Before

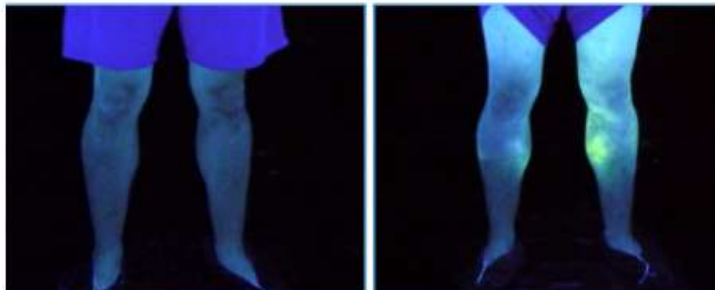
After



Polycyclic Aromatic Hydrocarbons (PAH) contamination high on wrist, neck, forehead, and back



The neck and groin areas are particularly vulnerable (NIOSH 2013)



Jeff Stull, RTI  
study commissioned by IAFF





**NATIONAL CANCER INSTITUTE**

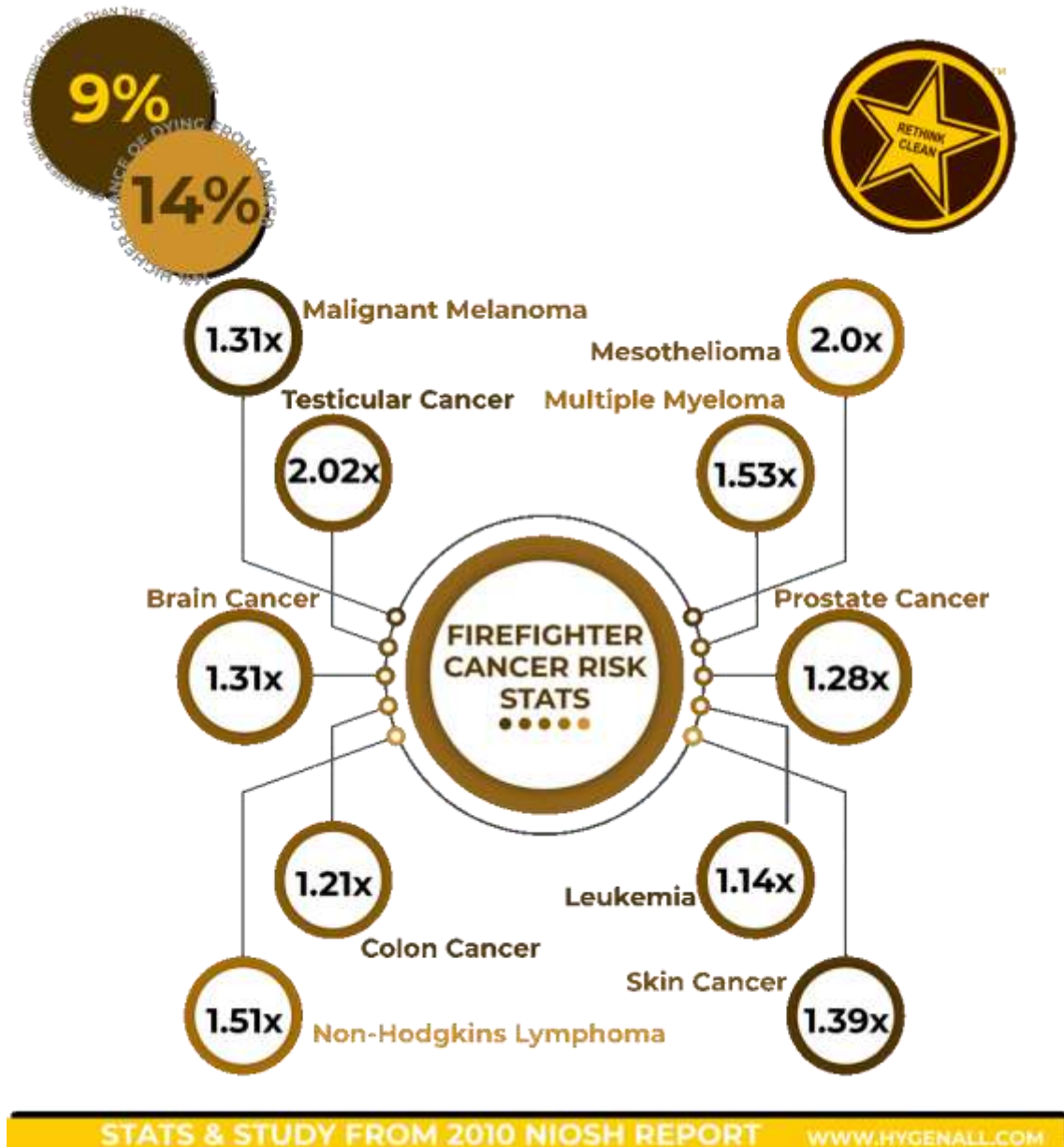
**Surveillance, Epidemiology, and End Results Program**

## **Lifetime Risk of Developing Cancer:**

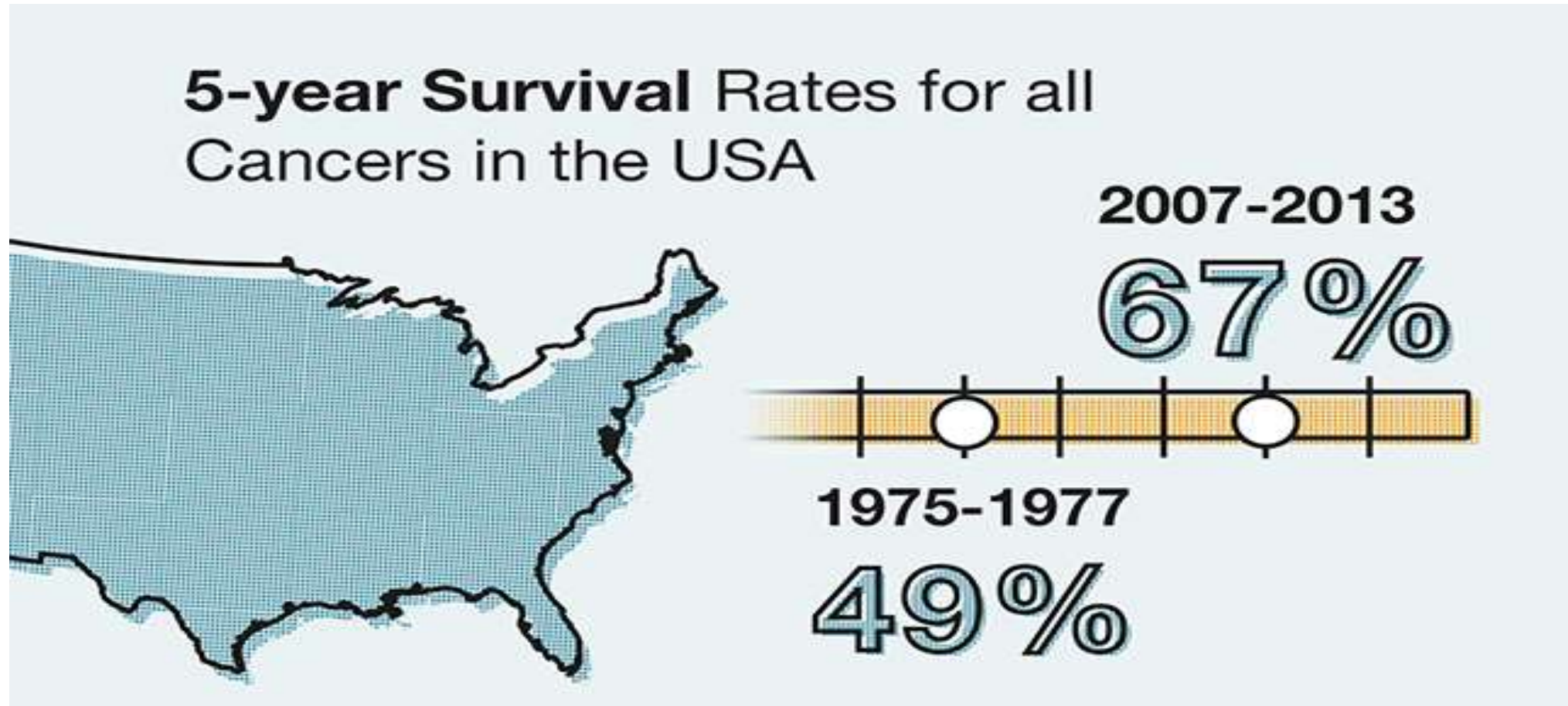
Approximately 39.3 percent of men and women will be diagnosed with cancer of any site at some point during their lifetime, based on 2014-2016

# Elevated Risk.....It's Real!

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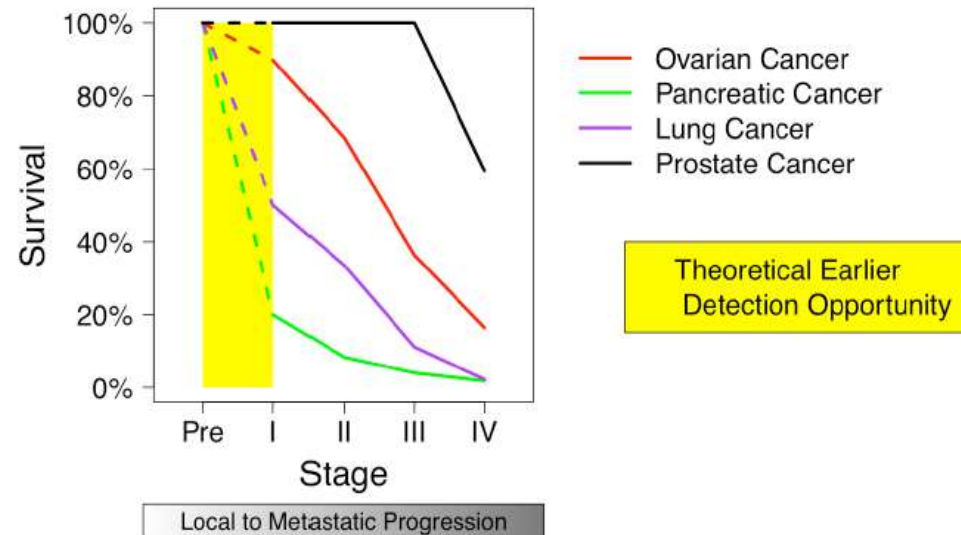


# Cancer Treatments



# Cancer: Early Detection is Key

Relative 5-year survival correlated with stage at diagnosis.<sup>8</sup>



Ref: Surveillance, Epidemiology, and End Results Program (SEER), 1973-2006. Division of Cancer Control and Population Sciences, NCI. Bethesda, MD. 2006.

- **Colon cancer:** 91% 5 year survival if caught early, 11% if it has already spread (Horner et al., 2009)
- **Prostate cancer:** 100% 5 year survival if caught early (ACS, 2009)
- **Breast cancer:** 98% 5 year survival if caught early, 15% survival in later stages (ACS, 2009; Cancer Research UK)
- **Bowel cancer:** 9 of 10 will survive 5 years if caught early (Cancer Research UK)



“Your worst  
day is our  
everyday”

*~Into the Fire (2005)*

# Suicide

- Recent survey, nearly half of firefighters report having considered suicide
- 15.5% reported attempting suicide
- Women in protective services (fire, law enforcement, EMS) had the highest rate of suicide of any occupation studied
- 1.9-8.7% in general population attempt suicide

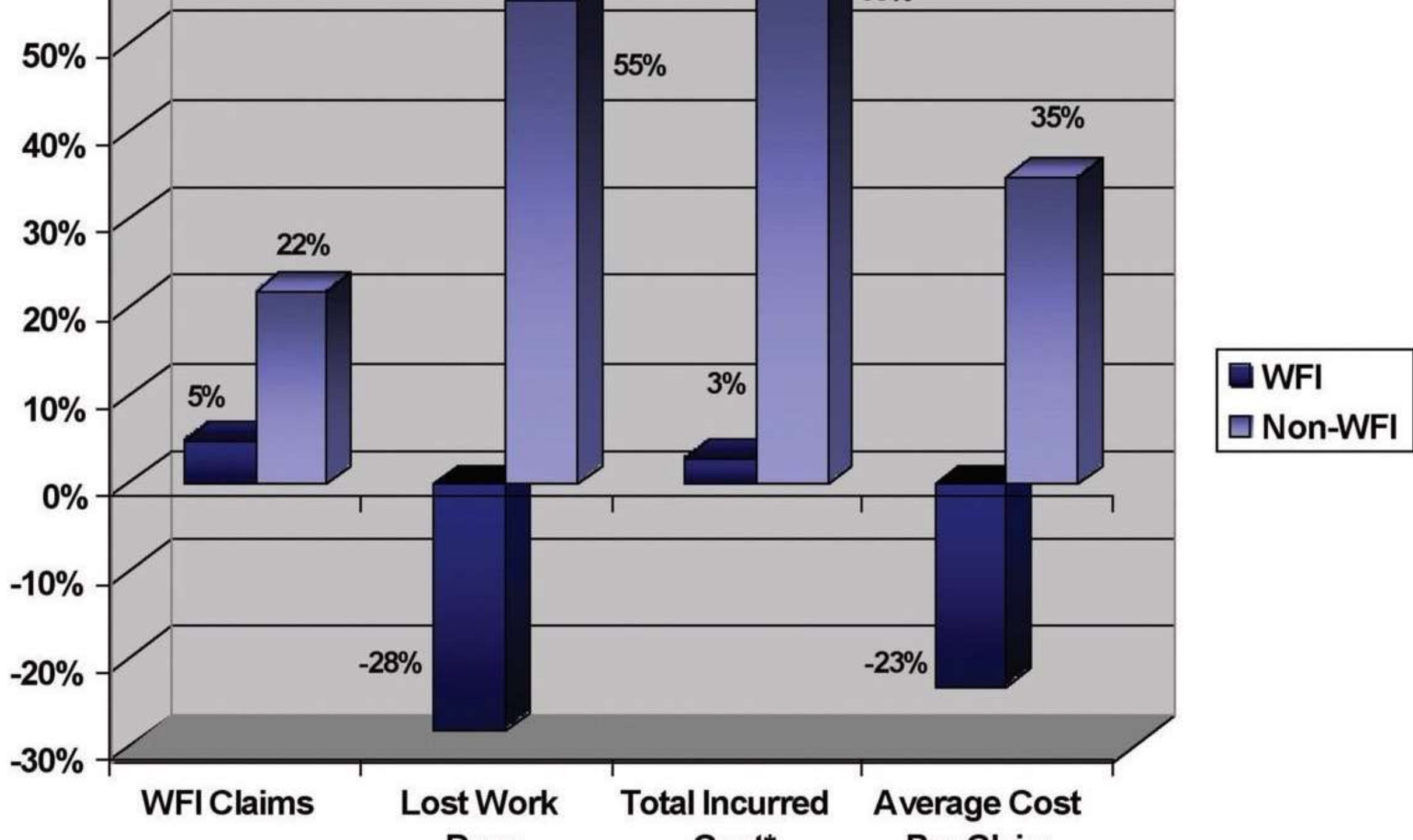


	Implementing WFI					Not Implementing WFI			
	Claim Date	WFI Claims	Days Lost	Total Incurred Cost*	Average Cost Per Claim	Non-WFI Claims	Days Lost	Total Incurred Cost*	Average Cost Per Claim
PRE	1991	401	4213	\$1,582,424	\$7,645	344	3689	\$2,243,993	\$6,699
	1992	407	4753	\$1,951,752	\$7,571	339	3899	\$2,155,654	\$6,553
	1993	429	5759	\$2,418,216	\$7,626	347	3431	\$2,402,384	\$6,900
	1994	436	6085	\$3,576,916	\$8,146	359	3220	\$2,385,562	\$6,697
	1995	438	6326	\$3,600,762	8,247	342	4441	\$2,702,118	\$7,279
	1996	434	6895	\$4,236,084	\$8,321	372	4189	\$2,764,044	\$6,724
	1997	488	6580	\$4,329,490	\$9,299	356	3878	\$2,401,968	\$7,060
	Totals	3033	40,611	\$21,695,644	\$56,845	2,459	26747	\$17,055,723	\$47,912
POST	1998	386	3351	\$2,458,116	\$6,233	371	3515	\$2,536,780	\$7,278
	1999	400	3834	\$2,627,379	\$6,177	387	4672	\$3,104,697	\$8,167
	2000	435	4716	\$2,891,569	\$6,391	442	5823	\$3,476,799	\$8,517
	2001	452	4847	\$3,075,236	\$6,115	464	6404	\$3,806,243	\$8,856
	2002	498	4725	\$3,688,405	\$7,175	428	6335	\$4,080,519	\$10,054
	2003	531	4702	\$3,871,945	\$7,061	449	7208	\$4,919,355	\$11,146
	2004	508	5496	\$3,663,493	\$7,073	482	7431	\$5,067,383	\$10,590
	Totals	3210	31671	\$22,276,143	\$46,225	3,023	41388	\$26,991,766	\$64,608
	Percent Change	5%*	-28%	3%*	-23%	22%	55%	58%	35%

\* p<.05

\*\*All Costs are adjusted in 2001 dollars

This appears to be a positive return on investment with getting most of the initial costs back the first year and then getting a positive ROI of at least 1:2 for year two. Therefore, every one dollar spent on firefighter wellness, via implementation of WFI, results in an almost immediate return of over two dollars in occupational injury/illness costs.









“Because when we hit the fire ground, your risk factors become my risks.”

*~ Firefighter Steve Mast*

# Are We Getting Physicals?

	Fully Career		Primarily Career with Volunteers		Primarily Volunteer with Career		Fully Volunteer	
	2006	2016	2006	2016	2006	2016	2006	2016
All firefighters	69.2%	80.0%	65.0%	74.9%	49.9%	52.5%	46.6%	44.8%
Firefighters who use breathing apparatus only	3.5%	1.2%	5.4%	2.4%	8.0%	3.5%	6.4%	3.1%
Hazmat technicians only	N/A	4.8%	N/A	2.3%	N/A	1.4%	N/A	0.6%
Interior firefighters and drivers only	0.1%	0.2%	1.3%	0.9%	2.4%	2.0%	4.8%	1.5%
My department doesn't require, recommend or provide annual physicals	27.2%	13.9%	28.4%	19.5%	39.7%	40.7%	42.2%	50.0%

# Are We Getting It Right?

	Fully Career		Primarily Career with Volunteers		Primarily Volunteer with Career		Fully Volunteer	
	2006	2016	2006	2016	2006	2016	2006	2016
NFPA 1582	65.7%	37.9%	66.9%	45.7%	62.9%	40.7%	52.8%	37.5%
IAFC/IAFF Wellness Fitness Initiative	12.6%	15.2%	7.2%	13.2%	2.2%	5.7%	2.1%	3.9%
State	12.4%	5.5%	15.5%	6.2%	8.9%	7.6%	9.7%	10.8%
Local	32.6%	16.0%	32.4%	14.9%	30.4%	19.6%	26.4%	19.0%
None	N/A	2.0%	N/A	1.2%	N/A	1.3%	N/A	1.9%
Unknown	N/A	23.5%	N/A	18.8%	N/A	25.1%	N/A	27.0%



# Behavioral Assessment



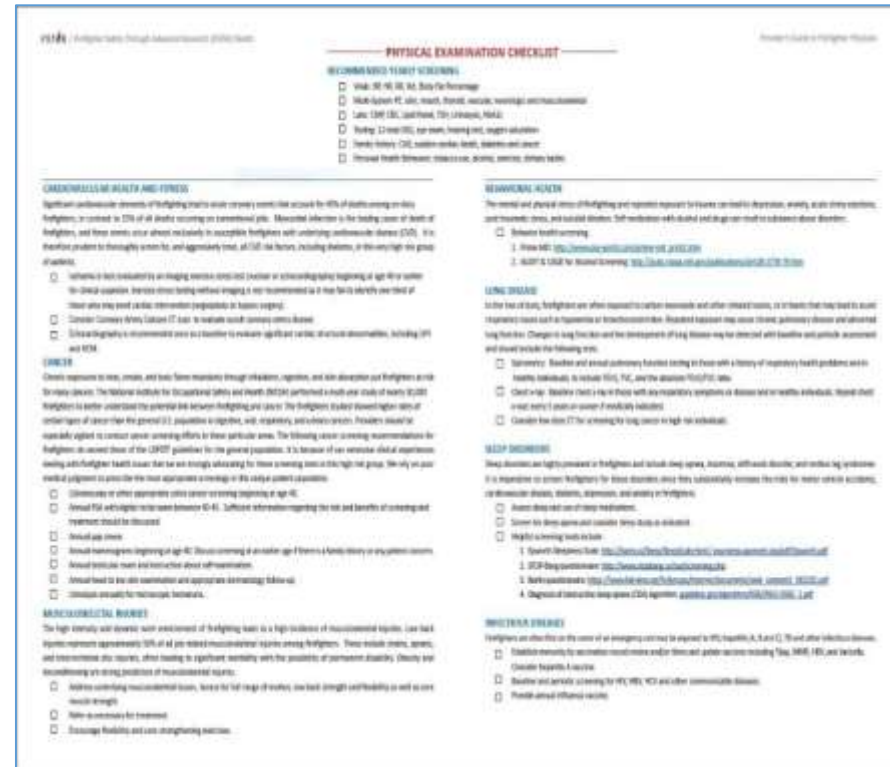
	Fully Career		Primarily Career with Volunteers		Primarily Volunteer with Career		Fully Volunteer	
	2006	2016	2006	2016	2006	2016	2006	2016
Yes	12.0%	17.2%	9.4%	14.3%	8.1%	8.3%	1.4%	6.2%
No	88.0%	82.8%	90.6%	85.7%	91.9%	91.7%	98.6%	93.8%

360 Medical Size-Up Scenario	Analog to Fireground	Solution
No Medical Evaluation	No size-up	<b>Implement Medical Evaluations</b>
Inappropriately Cleared by HCP Unfamiliar with Stress of FF	Person doing size-up not qualified	<b>Have Medical Evaluations done by HCP familiar with physiological and environmental strain of FF</b>
Medical Evaluation but Findings Not Followed-up On	Size-up done but not used	<b>Implement Health and Fitness Program. Encourage Individual Responsibility</b>
Medical Evaluation, Things Appear Normal	Sometimes things go wrong	<b>Continue to Search for Better Screening Tools</b>

# A Healthcare Provider's Guide to Firefighter Physicals

- Description of the physiological demands of firefighting
- Health Statistics
  - Cardiovascular Events, Musculoskeletal Injuries, Behavioral Health Issues, Cancer
- Review of systems
  - Cardiovascular Health and Fitness
  - Cancer
  - Musculoskeletal Injuries
  - Behavioral Health
  - Lung Disease
  - Sleep Disorders
  - Infectious Diseases
- Clinical recommendations for health monitoring
- References
- Additional Resources

# A Healthcare Provider's Guide to Firefighter Physicals



# Emergency Services Roadmap to Health & Wellness

- NFPA 1582 Q & A
  - General
  - Fire Administration
  - Healthcare Provider
  - Risk/Benefit Manager
- Fire administration responsibilities
- Healthcare provider responsibilities
- Resources for all firefighters, as well as info for specific types:
  - Career
  - Wildland
  - EMS
  - Volunteer
  - Candidate
- Data for city/county officials
- Resources for labor
- Resources for family and friends



# Broward County LODD







### BROWARD SHERIFF FIRE RESCUE

#### 2014-2015 SIGNIFICANT EARLY DETECTION FINDINGS

##### HEART & ARTERIAL DISEASE

Left Ventricular Hypertrophy	37
Cardiac Valve Insufficiency (Follow Up Needed)	2
Decreased Ejection Fraction	2
Carotid Artery Blockages (Severe)	5
Pericardial Effusion	3
Hypertension (Currently Undiagnosed or Uncontrolled)	60
Abnormal EKG (Follow Up Needed to Monitor)	7
Abnormal Stress Test (i.e., BP Response, PVC Patterns)	8

##### AORTA

Aortic Root (Dilated >4 cm)- Currently Being Monitored	6
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##### CANCER & ORGAN DISEASES

Diabetes (Currently Undiagnosed or Uncontrolled)	18
Kidney	22
Liver	55
Pancreatic	1
Spleen Enlargement	8
Spleen Mass	2
Gallbladder Polyps	20
Ovarian Cyst (Follow Up Needed)	1
Uterus	3
Prostate Enlargement	26
Prostate Mass	9
Hypogonadism	44
Thyroid Nodules (Follow Up Needed)(6 Confirmed Thyroidectomy; 6 Confirmed Thyroid Cancer)	55
Thyroid Nodules (Monitor/ No Follow Up Needed)	83
Testicular Mass(Confirmed Cancerous)	1



Visiting Daddy at work today Nov. 15, 2015

PULMONARY/ RESPIRATORY	
Pulmonary Function Test (Less Than 70%)	11
OTHER SIGNIFICANT FINDINGS	
Obesity	79
High Cholesterol/Triglycerides	42
Elevated PSA Blood Levels (Prostate)	13
Low Testosterone (< 200 mg/dl)	68
Abnormal TSH (Thyroid Function)	19
Hepatitis C	2
Complete Blood Count (CBC) Abnormality	11
Significant Thrombocytopenia	4
Aberrant Nevus (Follow Up Needed)	2
Decreased Renal Function (eGFR< 59 mL/min/1.73)	2
Severe Bilateral Hearing Loss	3
Positive Fecal Occult Stool Test (Follow Up Needed)	3
<b>TOTAL NUMBER OF SIGNIFICANT FINDINGS:</b>	<b>737</b>

Total Number of Patients Seen: 634

## 2017 AGGREGATE DATA SIGNIFICANT FINDINGS

Number of First Responder Patients 11967

### MASSES/SUSPICIOUS CANCER

Gallbladder	33
Liver	44
Kidney	92
Spleen	40
Bladder	11
Prostate	14
PSA (Prostate Specific Antigen) increase over 1 Year	122
Testicular	34
Ovarian	28
Uterine	92
Pancreas	22
Thyroid	193
Thyroid Suspicious Nodules being monitored	679
<b>TOTAL</b>	<b>1404</b>

### CARDIOVASCULAR DISEASE

Elevated LDL/HDL ratio (Heart Disease Risk)	511
*Stage 2 Hypertension (Stroke Risk)	187
*Abnormal ECG/Stress Test (Abnormal Rhythm)	495
*Carotid Stenosis >50% (Stroke Risk)	54
Hypertrophy (Thickening/enlargement of the Heart)	120
*Severe Heart Valve Dysfunction	90
*Bicuspid Aortic Valve	16
*Pericardial Effusion	3
*Abdominal Aorta Aneurysm (>4)	8
*Decreased heart function (low EF)	16
<b>TOTAL</b>	<b>1500</b>

### PULMONARY FUNCTION

*Abnormal Pulmonary Function Test (Spirometry)	228
<b>TOTAL</b>	<b>228</b>

### CRITICAL ABNORMAL BLOODWORK

HAZMAT (Heavy Metals and Cholinesterase)	36
Positive Hepatitis C	7
*Diabetes, Elevated A1c >8.1 (Diabetes)	148
Decreased WBC (At risk for viral infections and Leukemia)	290
Chronic Kidney Disease/ Renal Failure (low eGFR)	168
<b>TOTAL</b>	<b>649</b>

**TOTAL CRITICAL ABNORMAL FINDINGS: 3863**

Number of First Responder Patients 11967

\* IN NFPA 1582 Guidelines



# *Cardiovascular and Pulmonary Testing*

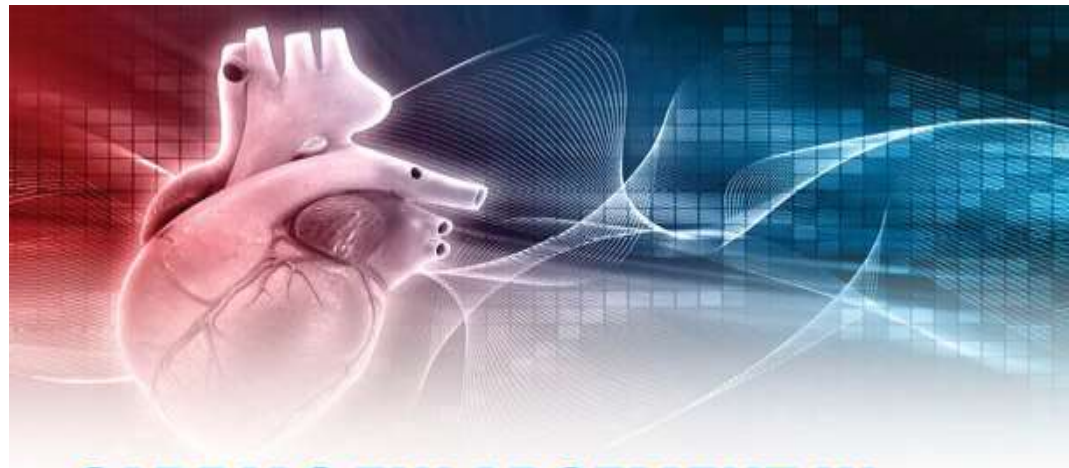
- **Cardiac Treadmill Stress Test**
- **Resting EKG**
- **Pulmonary Function Lung Capacity**
- **Metabolic Syndrome Analysis**
- **Body Composition Analysis**



## *Fitness Assessments*

- **Functional Fitness Testing**
- **Muscular Strength, Endurance, and Flexibility Evaluation**
- **Cardiovascular**
- **Stretching Programs**
- **Fitness Recommendations and Goals**
- **Injury Reduction Training**
- **Personal Fitness Rx**
- **Nutritional and Diet Needs Analysis**

# Cardiovascular Structural Changes



## CARDIAC ENLARGEMENT IN U.S. FIREFIGHTERS

*Findings and Recommendations from Non-Invasive  
Identification of Left Ventricular Hypertrophy/  
Cardiomegaly in Firefighters*

July 19, 2017



© 2017 National Fallen Firefighters Foundation



# Fuel 2 Fight Study

- Baseline assessment consisted of data from 89 personnel (3 Stations of BSO's 22 Stations).
- Of those assessed – **85.9%** were in the **overweight or obese** category – a rate not only higher than the general US population, but also higher than established estimates in the fire service in general.
- 40% of firefighters had a waist circumference greater than 40", which places them at a high risk for heart disease.
- The test sampling of 3 BSO fire stations was strictly voluntary yet all employees assigned to these stations chose to participate.
- Average weight loss was 4lbs during the study compared to the average firefighters 3 pound weight gain over the same timeframe.
- Firefighters advised the study was instrumental in them making lifestyle changes in their eating habits and exercise programs.
- Departmental Level Assessment shows that **48.8% of BSOFR is high risk/obese** (almost half of the Department!



# Data Behind the Program

- There have been a total of 1952 **open** and **closed** claims excluding presumption claims under F.S. 112.18 heart claims.
- Indemnity payments have been issued in the amount of \$1,498,053.22
- Medical payments have been issued in the amount of \$6,947,146.58
- As it relates to presumption claims under F.S. 112.18 we have 150 **open** claims.
- Indemnity payments have been issued in the amount of \$3,306,155.09
- Medical payments have been issued in the amount of \$10,149,665.71

**BROWARD SHERIFF'S OFFICE**



**BESITY  
EIGHT  
LOSS**

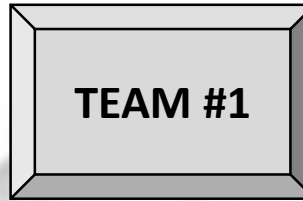
**Program**



TOTAL WEIGHT



Target  
Weight loss  
as a Team  
(20 members)  
454lbs



BRUNDZA, AARON P  
CARVAJAL, JAVIER  
CHANDLER, CHRISTOPHER  
CONNOLLY, ROBERT  
KRUPIN, JEFFREY  
LEHMANN, KYLE  
PARRA, ROBERT  
PELLECE, SERGIO  
PHIPPS, BRIAN  
REID, JAMES  
SAINTIL, KENCI  
SANCHEZ, NIKKO  
SIEB, RICHARD  
THARP, MARLON  
RIGGIO, MARK  
HACKLER, JAMES  
HERNANDEZ, ANDRES  
PETERS, HOLLY  
WOODWARD, ALISHA  
SCHWITZER, JOSHUA



TARGET WEIGHT  
3,580





**BECOME A TRUE CATALYST FOR CHANGE...**



# BE A BSO EMPLOYEE **WELLNESS CHAMPION!**

ANSWER YOUR CALL TO BE A PART OF THE BSO  
FITNESS PROMOTION FORCE! CONTACT US  
A.S.A.P. TO TAKE ADVANTAGE OF THE SPECIAL  
FITNESS FOUNDATION TRAINING THROUGH  
YMCA AND SPECIALIZED TRAINING EXPERTS.

E-MAIL [DEREK\\_HUGHES@SHERIFF.ORG](mailto:DEREK_HUGHES@SHERIFF.ORG) TO SIGN-UP OR CALL (954) 831-8251  
FOR MORE INFORMATION ABOUT THIS AND OTHER WELLNESS PROGRAMS.

Broward Sheriff's Office is partnering with the Broward Regional Health Planning Committee to improve the well-being of all BSO personnel.

We want to identify fitness-minded personnel from all across the agency who are interested in helping to motivate fellow employees to achieve greater activity levels and physical fitness.

Our goal is to make effective exercise more accessible to our staff at every region of the agency.

You don't have to be a fitness guru to make valuable contributions. Many of you are already helping others. Let us help to coordinate the effort.



# Healthy Food Guidelines: Color Coding System

For simplicity, foods and beverages have been grouped into three distinct categories: healthiest, healthy and unhealthy.



**Healthiest (GO!):** The best choices include vegetables, legumes whole fruits, whole grains, seafood, lean meats, nuts, seeds, unsaturated oils, water, unsweetened teas and low fat dairy without added sugar.



**Healthy (SLOW!):** Moderate foods containing good nutrients, but have higher sugar, saturated fat, sodium or calories. This includes processed foods, refined grains, red meat, whole fat dairy, dried fruits and 100% juice.



**Unhealthy (WHOA!):** Limit highly processed foods with low nutritional value, usually high in saturated fat, hydrogenated oils, added sugar or sodium. This includes most desserts and junk food, added salt, syrups, energy drinks, alcohol, sports drinks and sodas.





**You've come so far to give up now...  
Let's do this together!**

**Join a fun **Weight Loss Challenge** to  
help you reach your weight loss goals.**

*You can win great prizes for reaching your goal weight!*

**In this weight loss challenge you will get:**

- Group support to cheer you on
- A personal fitness coach
- Individualized fitness and nutrition plan
- Helpful tips and information on good nutrition and long term health
- FREE group fitness workouts
- ALL participants will receive great incentives with more opportunities to win *great prizes!*



Space is limited; reserve your spot today!  
Join the **FREE** challenge.

**What do you have to lose?**

To register or for more information, call  
Chief LeDuc 954-831-8291 or [todd\\_leduc@sheriff.org](mailto:todd_leduc@sheriff.org)