



Ultrasound Testing in the Fire Service:

A Medical Guide for Fire Department Personnel

There is a lot of misinformation regarding ultrasound testing and frequency of testing in the fire service. This guide was written by physicians with over 30 years combined experience providing NFPA 1582 health and wellness exams throughout the country, and who are actively involved in helping to create new medical guidelines for firefighter health and safety. While this article does not cover every medical scenario, our goal is that after reading this article, you will be able to better understand which ultrasounds may benefit your department, which ultrasounds to avoid, how often to perform them, and how to avoid the common mistakes made by health care vendors and fire departments when creating an ultrasound program.

While it is easy to get caught up in the glimmer and glamour of marketing hype surrounding full body yearly ultrasounds, the reality is that this is completely unnecessary, and at times detrimental to the health and wellness of your firefighters. Reasons for performing full body ultrasounds may differ, but we believe a big one is the convenience and simplicity of performing the same ultrasounds on every fire department member every year. It is much more difficult and time consuming to create an individualized program for your fire department that takes into account not only firefighter age, but also medical issues, budget constraints and best current medical practices. It also takes a lot more work to keep track which firefighter has had which ultrasounds done, and when do they need it repeated.

The shotgun approach is rarely the correct approach in medicine. This can lead to several problems, including:

- Wrong testing that is not medically indicated, leading to liability, worry, risk due to additional medical procedures and time away from work.
- High false positive rates – being told there is a problem when there in fact is not.
- High false negative rates – being told everything is ok, when in fact there is a problem.
- Waste of fire department resources.

However, as we show below, there is a correct and best way to incorporate ultrasounds into your health and wellness program that is based on medically sound research.

The best example we know relates to how fire departments service their trucks. You don't bring your truck in every year and tell the mechanic to service everything at once. You understand each system in your truck, such as the engine, different fluids, brakes, transmission, tires, filters, belts, electronics, hoses, etc. has a recommended service interval that should be followed for maximum protection, and they are all different. These intervals also differ based on the age and mileage of the truck, and whether it has been operated in normal or severe conditions. You realize doing these services more frequently



than recommended will not result in a better performing truck but will result in a waste of time and money. As each of these systems has their own service interval recommendations, so do different ultrasound tests. Some ultrasound tests, much like blinker fluid, can be discarded and never thought of again.

Fire Departments are ordering ultrasounds to presumptively screen for cancer. However, we'd like everyone to take a step back and think through this reasoning. There has been a lot of misinformation in the last few years regarding the fire service and cancer rates. So much so that in 2010 Dr. Daniels, who led the largest cancer study of U.S. Firefighters to date for the National Institute for Occupational Safety and Health (NIOSH), and the Firefighter Cancer Support Network put out a cancer fact sheet to address these misconceptions.

The NIOSH study found that firefighters do have a greater risk for certain, but not all types of cancer. What are the true statistics? In the general population, the lifetime risk for males of developing cancer is 39% and the chance of dying from cancer is 22%. Overall, firefighters have a 9% higher risk of being diagnosed with cancer, and a 14% greater risk of dying from cancer than the general U.S. population. The cancers most responsible for this are respiratory (lung), GI (oral cavity, esophageal and large intestine), and kidney.

The key here is to realize that while firefighters do have higher cancer risks than the general population, and their risks are significantly higher for some specific types of cancer, some other types of cancer, such as thyroid cancer, are rare, and firefighters have the same risk as the general population. Doesn't it make sense then to spend your money on cancers that occur more often instead of the rare types of cancer?

Here is some food for thought as we discuss the pros and cons of different ultrasound tests: **The value of a screening test depends, not on its ability to detect disease, but on its ability to improve a person's outcome, considering both the duration and quality of life.**

Very important - Keep in mind that best medical practices dictate that every ultrasound should be read and interpreted by a radiologist, a physician who has extensive experience and training in ultrasounds. A copy of the results of each and every ultrasound, signed by the radiologist himself should be given to the firefighter and shared with their family doctor. Ultrasound technicians are not trained to read and interpret ultrasounds. Not only is this against the law in every state in the United States, it is very bad medical practice full of potential liability for you and your department. Just as you would not let a new recruit inspect and sign off on lifesaving equipment without the proper training, do not spend money on fire department ultrasounds that are not reviewed by a radiologist, and where a signed report is not given to each firefighter.

Armed with this knowledge, let's explore the different types of ultrasounds, and how useful they really are. **We will first list a brief summary of each ultrasound and our recommendations, followed by a more detailed discussion of each ultrasound.**



Brief Summary of Firefighter Ultrasound Recommendations

Thyroid Ultrasounds:

Bottom line: Not recommended for male or female firefighters of any age.

Recommended instead: Thyroid Stimulating Hormone (TSH) blood test, physical examination of the thyroid gland and review of symptoms by a healthcare professional that would indicate thyroid problems.

Prostate Ultrasounds:

Bottom line: Not recommended for male firefighters of any age.

Recommended instead: Prostate Specific Antigen (PSA) blood test

Carotid Artery Ultrasound:

Bottom line: Not indicated, unless you have symptoms or multiple risk factors. They may be beneficial in certain age populations with certain risk factors, but not for everyone.

Recommended instead: Physical exam to assess for carotid bruit, review of health history form and family history by a healthcare professional

Testicular Ultrasounds:

Bottom line: Not recommended for male firefighters.

Recommended instead: Monthly testicular self-exam.

Abdominal Ultrasounds:

Bottom line: Recommended for firefighters ages 40 or older every 5 years

Pelvic Ultrasounds:

Bottom line: Not recommended for regular risk individuals, may or may not be useful in high risk individuals. Individual should discuss with their primary care physician or OBGYN.

Echocardiograms (heart ultrasound):

Bottom line: Recommended one time on new recruits or firefighters younger than 40, and every 5-10 years on firefighters 40 or older.

Aortic Aneurysm Ultrasound:

Bottom line: Recommended as a one-time test for firefighters aged 50 and older



Detailed Summary of Firefighter Ultrasound Recommendations

Thyroid Ultrasounds:

Bottom line: Not recommended for male or female firefighters of any age.

Recommended instead: Thyroid Stimulating Hormone (TSH) blood test, physical examination of the thyroid gland and review of symptoms by a healthcare professional that would indicate thyroid problems.

The serum (blood) TSH test is the primary screening test for thyroid dysfunction. When used to confirm clinically suspected thyroid disease in patients referred to an endocrinologist, the serum TSH test has a sensitivity of about 98% and a specificity of about 92%. What that means is the TSH blood test is extremely accurate in diagnosing thyroid abnormalities. Thankfully, this test is already included in the blood work panel recommended by NFPA 1582.

Thyroid cancer is rare, with a mortality rate of 0.0007%. **Over the last 10 years, you would have been 4 times more likely to die from a lightning strike than from thyroid cancer.** Thyroid cancer also has the same rate of occurrence in the general and firefighter populations. So if you were to screen every firefighter in the United States, you could possibly prevent 7 thyroid cancer deaths. These statistics have been confirmed by the U.S. Preventative Services Task Force. Keep in mind these deaths could also have been prevented as we mentioned above, with a TSH blood test, good medical exam and review of the health history form. There is no reason to spend the additional money for an ultrasound when there are other less expensive tests that are just as, if not more reliable.

So as you can see, thyroid cancer is not a very common type of cancer. This backs up our own medical experience performing over 50,000 exams personally. Then you also have to take into account the harm that false positive (being told you have cancer when you really don't) ultrasounds cause, including unnecessary worry, surgery and injury.

The U.S. Preventative Services Task Force (USPSTF) looked at ultrasound testing in asymptomatic individuals and concluded that **screening for thyroid cancer results in more harm that outweighs any potential benefits.** The USPSTF found inadequate evidence that screening for thyroid dysfunction in asymptomatic adults leads to clinically important benefits and they do not recommend regular thyroid ultrasounds in people without symptoms. For more detailed reading regarding thyroid ultrasound testing, please visit www.uspreventiveservicestaskforce.org.



Prostate Ultrasounds:

Bottom line: Not recommended for male firefighters of any age.

Recommended instead: Prostate Specific Antigen (PSA) blood test

We always get a chuckle when speaking to a fire chief who tells us he either wants to start performing prostate ultrasounds or are already getting them done through another medical vendor at their fire department. What we have found is that what other vendors call a “prostate ultrasound” is really not one at all. **Let’s be clear, a real prostate ultrasound such as you would get from a urologist or in a hospital setting, in looking for prostate cancer, involves taking an ultrasound probe the size of your thumb and inserting it into your anus with adequate amounts of lubrication.** It is then manipulated around to get a good picture of the prostate gland. This usually requires some sort of sedative for the patient, and a bowel cleanse prior. If this has not been your experience, we’re sorry to say you have been misled.

As you can see, it would be extremely difficult if not impossible to schedule prostate ultrasounds to be performed on-site as part of an NFPA 1582 health and wellness program. And the other thought is why would you even want to? Who would want to donate their office to be used for this procedure? Something else to consider is that unfortunately, prostate ultrasounds do not screen for early prostate cancer.

There is a perfectly good blood test that accurately screens for prostate cancer, the Prostate Specific Antigen (PSA) test. It is the gold standard test for screening for prostate cancer and can be drawn with the regular blood work.

Carotid Artery Ultrasound:

Bottom line: Not indicated, unless you have symptoms or multiple risk factors. They may be beneficial in certain age populations with certain risk factors, but not for everyone.

In order for the typical layperson to fully comprehend the complexity in deciding whether an ultrasound is warranted or not, from a medical perspective, we present some guidelines from the medical community.

*Joint guidelines issued by the **American College of Cardiology Foundation, American Heart Association, American Stroke Association and other healthcare groups** suggest that carotid duplex US may be considered for asymptomatic patients who have peripheral artery disease, coronary artery disease, atherosclerotic aortic aneurysm, or at least two risk factors for stroke including high blood pressure, high cholesterol, tobacco smoking, a first-degree relative with atherosclerosis that developed before age 60 or a family history of ischemic stroke.*

*According to the **Society for Vascular Medicine guidelines**, carotid duplex US may be beneficial for assessing stroke risk in individuals who are 55 years of age or older with cardiovascular risk factors such as a history of high blood pressure diabetes, smoking, high cholesterol, or known cardiovascular disease.*

The take home message here is that determining who needs a particular ultrasound is not as easy as “everybody should just get every ultrasound every year”. From the guidelines above, it becomes clear fairly quickly that most firefighters, such as young healthy individuals less than 50, or individuals with no risk factors would never benefit from performing a carotid ultrasound once, much less every year. You also need to consider false positives (being told there is a blockage when there is not), and the stress, worry, and potential risks from further workups. So why do it then? So why order this test on everyone? Wouldn't that money be put to better use ordering tests that can actually make a difference?

If a fire department really wanted to offer this service, and could not be talked out of it, our general recommendation might be to offer it to members 50 and older, perhaps every 3-5 years.

Testicular Ultrasounds:

Bottom line: Not recommended for male firefighters.

Recommended instead: Monthly testicular self-exam.

While firefighters have double the risk of developing testicular cancer compared to the general population, it is still a relatively uncommon disease. Testicular cancer accounts for approximately 1% of all cancers in men and it is the most common malignancy in men aged 15 to 34 years. The National Cancer Institute (NCI) estimates that 9,560 new cases of testicular cancer will be diagnosed in men, and 410 men will die of this disease in the United States in 2019. Based on 2018 census data, there are 45.2 million males ages 15-34 in the United States, which give you a 0.02% risk of being diagnosed with testicular cancer, and a 0.0009% risk of dying from testicular cancer.

The NCI found screening would be very unlikely to decrease mortality substantially because therapy is so effective at virtually all stages of disease. Also, while a *testicular ultrasound* is an excellent way to spot the disease, it's not necessary unless there is a specific reason to worry about it, especially since most testicular cancers are first detected by the patient, either unintentionally or by self-examination.

Abdominal Ultrasounds:

Bottom line: Recommended for firefighters ages 40 or older every 5 years

Abdominal Ultrasounds are probably the most complex studies to grasp in terms of the number of organs involved, and what the capabilities and limitations of this study are. An abdominal ultrasound looks at the liver, pancreas, gallbladder, kidneys, adrenal glands, stomach and spleen to detect cancers and other diseases. The cancers in the abdominal area that are more prevalent in firefighters include colon cancer, rectal cancer and renal (kidney) cancer.

Colon and Rectal cancer - Abdominal ultrasound is not an appropriate screen for colon or rectal cancer, the screening gold standard for these cancers is colonoscopy. If negative, colonoscopies are usually repeated every 10 years. There is no other on-site test that can be performed that beats a regular colonoscopy for detecting colon or rectal cancer. **Just as there is scientific data that recommends a colonoscopy every year if it is negative, there is no scientific data that recommends yearly ultrasounds.**

Kidney and Adrenal cancer - Abdominal ultrasound is better at identifying kidney or adrenal masses. These tumors tend to be slower growing and unlike pancreatic cancer have high survival rates. Other issues with the kidney such as swelling, kidney stones, and kidney cysts can be identified. Bladder and kidney cancer can also be caught with a urinalysis or standard blood tests which are recommended by NFPA 1582.

Pancreatic cancer - While firefighters don't have a higher incidence of pancreatic cancer its aggressiveness and low survivability make it a concern for firefighters. Studies show that abdominal ultrasounds are not accurate in identifying the pancreatic cancer.

Studies that are useful for identifying pancreatic cancer include endoscopic ultrasound (where the ultrasound probe is inserted into the esophagus and the patient's stomach), computerized tomography (CT) scans, magnetic resonance imaging (MRI) and, sometimes, positron emission tomography (PET) scans. Regular abdominal ultrasounds are not indicated in the diagnosis of pancreatic cancer.

Liver and gallbladder cancer - Liver and gallbladder cancer are rare. Most liver cancers are metastases (come from) from other places in the body. However, much more common, and identifiable by abdominal ultrasound are conditions like fatty liver, cirrhosis and gallstones. Having said that, many of these conditions can also be discovered through physical examination, a good health history form, and blood tests.

Stomach cancer – Stomach cancer is difficult to diagnose in early stages because most people do not have any symptoms. To diagnose stomach cancer, Esophagogastroduodenoscopy (EGD)

is the diagnostic imaging procedure of choice however, a double-contrast barium swallow may also be done first. An abdominal ultrasound is not indicated in the diagnosis of stomach cancer.

To summarize, there are currently no recommendations for preventive screening with abdominal ultrasounds for the general populations or for firefighters. As fire department physicians we see some value in periodic abdominal ultrasound specifically for visualization of the liver and kidneys. Our current recommendation is to have this done every 5 years in firefighters over 40 years of age. Keep in mind that in individuals where something is found, they are then referred to their primary care physician or a specialist for further workup and monitoring, so there may be limited benefit in rescreening firefighters who have already been identified with an abnormality previously and who are now under the care of their physician.

Pelvic Ultrasounds:

Bottom line: Not recommended for regular risk individuals, may or may not be useful in high risk individuals. Individual should discuss with their primary care physician or OBGYN.

A sad but true fact - there is no consistently reliable screening test to detect ovarian cancer. Most women with ovarian cancer are diagnosed with advanced-stage disease (Stage III or IV). This is because the symptoms of ovarian cancer, particularly in the early stages, often are not acute or intense, and present vaguely (National Ovarian Cancer Coalition-NOCC).

The following tests are available and the NOCC states they should be offered to women, especially those women at high risk for the disease:

- **Pelvic Exam:** Women age 18 and older should have a mandatory annual vaginal exam. Women age 35 and older should receive an annual rectovaginal exam (physician inserts fingers in the rectum and vagina simultaneously to feel for abnormal swelling and to detect tenderness).
- **Transvaginal Sonography:** This ultrasound, performed with a small instrument placed in the vagina, is appropriate, especially for women at high risk for ovarian cancer, or for those with an abnormal pelvic exam. Please keep in mind that much like the prostate ultrasound, this ultrasound above is transvaginal, that is the probe is inserted into the vagina. If you are getting, or a medical vendor offers you an ovarian cancer screening ultrasound, make sure it is transvaginal and not merely a transabdominal ultrasound, where the probe is on the lower abdomen. That is not a medically recommended test in this situation.

- **CA-125 Test:** This blood test determines if the level of CA-125, a protein produced by ovarian cancer cells, has increased in the blood of a woman at high risk for ovarian cancer, or a woman with an abnormal pelvic examination. While CA-125 is an important test, it is not always a key marker for the disease. Some non-cancerous diseases of the ovaries can also increase CA-125 levels, and some ovarian cancers may not produce enough CA-125 levels to cause a positive test. For these reasons the CA-125 test is not routinely used as a screening test for those at average risk for ovarian cancer.

There are no recommended screening tests for ovarian cancer for women who do not have symptoms and are not at high risk of developing ovarian cancer. **In studies of women at average risk of ovarian cancer, using Trans Vaginal Ultrasounds and CA-125 for screening led to more testing and sometimes more surgeries, but did not lower the number of deaths caused by ovarian cancer.** For that reason, no major medical or professional organization recommends the routine use of Trans Vaginal Ultrasounds or the CA-125 blood test to screen for ovarian cancer in women at average risk

Echocardiograms (heart ultrasound):

Bottom line: Recommended one time on new recruits or firefighters younger than 40, and every 5-10 years on firefighters 40 or older.

Echocardiograms, when used in a medically appropriate manner can be useful in diagnosing medical conditions in firefighters. An echocardiogram looks at the structure and function of the heart. It can detect things like left ventricular hypertrophy (enlargement of the heart), heart valve issues and congestive heart failure. **Echocardiograms by themselves do not detect coronary artery disease.** They need to be paired with an exercise or chemical stress component, such as a stress echogram (treadmill protocol plus echogram) or a nuclear stress test. **There is currently no recommendation for annual screening with echocardiograms for the general population or for firefighters.**

Having said that, as firefighter physicians we recommend screening for two specific age groups, for two very different reasons.

Young firefighters - Like young athletes, younger firefighters can have heart defects from birth that have never been detected. Think of the high school athlete that suddenly collapses during football practice and dies. Because of these potential structural heart defects, we recommend a **one-time** baseline echocardiogram for all candidate firefighters and firefighters under 40 years old. This will rule out heart defects that can cause sudden death in younger firefighters.



Older firefighters - Once a firefighter reaches 40 years of age, different problems occur. They can show changes in the heart structure and heart function that are due to other risk factors such as high blood pressure, obesity, alcohol, smoking, genetics and sedentary lifestyle. Because of this we recommend an echocardiogram **at 40 years of age** to look for any of these issues. This can be **repeated every 5 to 10 years** depending on the firefighter and their specific risk factors. This should be at the discretion of the examining medical provider. Performing this test every year is not indicated by any firefighter medical standard.

Aortic Aneurysm Ultrasound:

Bottom line: Recommended as a one-time test for firefighters aged 50 and older

Abdominal Aortic Aneurysms (AAA) are something you either have or do not have. They do not occur suddenly out of the blue. AAA's happen when the normally sturdy elastic wall of the abdominal aorta gets thin and weak, causing it to bulge outward like an old inner tube. The vessel is normally about 2 centimeters (0.8 inches) across. A bulge 3 centimeters (1.2 inches) or more in diameter is considered an aneurysm. The National Center for Biotechnology Information (NCBI) found that 4% to 8% of older men and 0.5% to 1.5% of women aged 65 years and older have an abdominal aortic aneurysm. AAA's are usually not symptomatic, but the concern here is the risk of death from ruptured AAA is 80% to 90%. Over one-half of all deaths attributed to a ruptured aneurysm take place before the patient reaches hospital.

Harvard Medical School recommends that men 65 to 75 who have ever smoked could consider a one-time screening test for an AAA. The bar is fairly low: even minimal past smoking—any amount over 100 cigarettes—is enough to raise your risk. Men who had a relative with an AAA are also more likely to develop an aneurysm.

Because AAA's are so fatal, and considering the prevalence of smoking and smoke exposure in the firefighting community, we recommend considering a one-time screening for firefighters over the age of 50-60. Repeating this test yearly is not medically indicated or recommended, and in our opinion a waste of resources that could be put to better use elsewhere. Misinterpreting these kinds of ultrasounds can result in a life or death scenario. This is another reason to make sure these studies are read by certified radiologists, not untrained technicians.

Every time we present the above information to fire chiefs, this is the point in the discussion where they look at us and say "So how the heck are we supposed to put all this together to get the best program for our members?" The good news is you don't have to! Your medical vendor should be able to incorporate the information we presented above, age of the fire department members, budget, and timeline to develop a customized health and wellness program for your department based on sound medical data.



The other discussion we have prior to developing a plan of action is based on fast vs. slow killers in the fire service, and how to prioritize testing for each one. Fast killers are medical emergencies such as a heart attack or abdominal aortic aneurysm, and slow killers would encompass most cancers. There is definitely a priority of which you test first, and that will be the topic of our next article, so stay tuned.

We understand there is a lot of information out there regarding ultrasounds in the fire service, and often times it is conflicting. Other recommendations may come from a “Well that sounds good and seems like the right thing to do” mentality, but lack the scientific support to back up those claims. Our findings and recommendations presented here are based on the latest medical research and studies, as well as our 30+ years of combined experience as Fire Department Medical Directors. As physicians, our priorities are to educate the general public, base our NFPA 1582 medical programs on sound medical data, treat your budget with the respect it deserves, and do no harm. While it would be easier and more profitable to recommend an all-encompassing yearly ultrasound program, that goes against all the current medical data and recommendations.

We hope this has been a useful article in helping you make an educated decision regarding ultrasound testing in the fire service. We realize this is just a brief summary and overview of ultrasounds in the fire service, and there is no way to cover all aspects of this topic in such a short article. If you have questions related to ultrasound testing in your fire department, please feel free to call or email. We welcome any and all questions.

For more medically relevant firefighter health and wellness articles, please visit <http://www.firedepartmentdoctors.com/Learning-Center.html>

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SiteMed is the largest physician owned company providing NFPA 1582 health and wellness exams in the United States. Dr. Fernandez and Dr. Walker have been providing NFPA Health and Wellness Exams for over 15 years. They have personally performed over 50,000 1582 firefighter, HAZMAT, Police, EMS and fire brigade exams, and have over 30 years combined experience with NFPA 1582 and OSHA standards. They have lectured on the local, state and national level on NFPA 1582 Health and Wellness, and are involved in helping to create new medical guidelines for firefighter health and safety. They welcome all comments and questions at lwalker@sitemed.net and gfernandez@sitemed.net.