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## Firefighter Fitness-for-Duty Medical screening: A Peer Review Quality Improvement Pilot

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FIREFIGHTER FITNESS-FOR-DUTY MEDICAL SCREENING: A PEER REVIEW  
QUALITY IMPROVEMENT PILOT

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May 2013



## THE GRADUATE COLLEGE

We recommend the doctoral project prepared under our supervision by

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entitled

Firefighter Fitness-For-Duty Medical Screening: A Peer Review Quality Improvement Pilot

be accepted in partial fulfillment of the requirements for the degree of

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## ABSTRACT

Despite the overwhelming evidence that sudden cardiac death is the most frequent cause of firefighter fatalities, many fire departments do not have a program to measure or maintain basic firefighter fitness and health. This project evaluated and compared medical screening outcomes of four industrial fire brigades within a multinational oil and gas corporation and introduced a quality improvement plan. The goal of this project was to apply the evidence and measure outcomes to determine the most effective way to ensure that firefighters in a corporate setting are healthy. This was accomplished by utilizing established guidelines in developing an educational program followed by monthly indicators looking for improvement in quality and increased rate of recommendations for restricted duty. The results of this project were mixed but did show an initial rate increase of 1.4% of restrictions placed by clinicians providing screening exams, and the overall quality of the exams showed significant improvement by the third month. However, there was insufficient time to see if these improvements were sustainable. Recommendations for future study are to continue the pilot quality improvement peer review process for another six months and incorporate an annual physical fitness evaluation pilot that would include endurance, strength and flexibility assessments as recommended by the 2008 joint taskforce for the International Association of Firefighters (IAFF) and International Association of Fire Chiefs joint Labor Management Wellness-Fitness Initiative and National Fire Protection Association Standards (NFPA 1582).

## DEDICATION

First and foremost I dedicate this to my husband for his amazing patience, tolerance, support and understanding, without which, this would not have been possible.

Fireman run toward what others run away from, ready to battle elements, heat, rappel from buildings, drop down into small spaces or do whatever they can to rescue those in need. This work is also dedicated to Deputy Chief Danny Perazzo, a true hero. It was an honor to work with him to develop a firefighter fitness testing program. It is because of his leadership and willingness to try something new that our first responders develop improved skills, empowerment to think outside the box and continue to strive for excellence.

I would also like to thank Dr. Nancy Menzel, my committee chairperson for her skillful editing, recommendations and tireless hours spent reading and re-reading this paper. It is her voice I hear in my head when writing, wishing I had a smidge of her talent. Thank you also to Dr. Susan VanBeuge for her suggestions and encouragement to reach beyond my zone of safety; and Dr. Pramen Shretha for his insight into how business and health can merge.

Last, but not least, I'd like to thank the other DNP students in this program for the after-hours and late night consults, support, encouragement, laughter and friendship.

*“You may not have saved a lot of money in your life, but if you have saved a lot of heartaches for other folks, you are a pretty rich man”.*

*Seth Parker*

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## CHAPTER 1

### INTRODUCTION AND PROBLEM STATEMENT

Since most adults spend the majority of their waking hours at work, physical demands of the job and the environment can affect their health (Davis & Souza, 2009; Hulshof, Verbeek, Van Dijk, Vander Weide, & Braam, 1999, p. 361;). This is especially true for firefighters. A core activity of occupational health services is to provide periodic health monitoring and fitness-for-duty evaluations that include firefighter or fire brigade screening exams. This project evaluated and compared the effectiveness of firefighter fitness-for-duty assessments within four different clinical sites and implemented a quality improvement pilot for a multinational oil and gas corporation.

It is estimated there are more than one million firefighters in the United States including firefighters in industry (Zapatka, 2005). Cardiovascular disease (CVD) has been listed as the cause in 45% of on-duty fatalities among firefighters in the United States (Kales, Soteriades, Chistoodias & Christiani, 2003). The Centers for Disease Control and Prevention (CDC) (April 28, 2006) reported that from 1994 to 2004, 610 volunteer and 368 career firefighters died while on duty from heart attacks, the leading cause of fatality in both groups.

The National Fire Protection Association (NFPA) and the National Institute for Occupational Safety and Health (NIOSH) reported that 44% of on-duty firefighter fatalities during the period 1995 – 2004 were due to sudden cardiac death (Centers for Disease Control and Prevention [CDC], 2007). NIOSH was able to investigate 308 of the 440 deaths, finding that 134 of the 308 firefighters or 44% of those victims had documented prior coronary artery disease (CDC, 2007, p. 6). Sometimes the first



symptom of heart disease is sudden death, as was the case of James Fixx, the author of *The Complete Book of Running*, who died suddenly at age 52 (Altman, 1984). The lesson of the 2007 NIOSH report is that the deaths of the 134 firefighters with a history of coronary artery disease might have been prevented had medical professionals limited their firefighter activities.

Firefighting is demanding work that requires agility, strength and stamina (Kales et al., 2003). In the United States, the current regulatory standard related to firefighter fitness-for-duty is found in the Occupational Safety and Health Administration (OSHA) Standards for General Industry<sup>29</sup> Code of Federal Regulations Part 1910. The Fire Brigade Standard (29 CFR 1910.156) simply states that the fire brigade members should be physically capable of performing duties assigned to them during emergencies (Occupational Safety and Health Administration [OSHA], 2008). Occupational health providers have discussed that this standard was put in place specifically for companies that have a subset of employees assigned to fight fire while waiting for a municipal fire department to arrive on scene (Fernandez & Walker, 2011). OSHA's fire brigade standard is not very specific, as it does not address or recommend a frequency or type of screening evaluation. Other non-regulatory standards for firefighter fitness can be found through the National Fire Protection Association (NFPA), the U.S. Fire Administration (USFA), the 2008 joint taskforce for the International Association of Firefighters (IAFF) and International Association of Fire Chiefs joint Labor Management Wellness-Fitness Initiative (Joint Taskforce) and NIOSH. All of these agencies recommend periodic medical screenings, some with more recommendations than others.

Firefighter physical screening assessments traditionally include medical and work histories, physical exams, cardiovascular assessments, pulmonary function testing and biological testing (National Fire Protection Association [NFPA], 2007). There is, however, no definitive single approach to evaluating fitness for duty. The overwhelming goal of these evaluations is to detect any underlying medical condition(s) that would place the firefighter at increased risk for injury, illness or a catastrophic medical emergency that could lead to their death or disability and/or to the death or disability of those around them.

Occupational health services are delivered in different ways to a variety of workers in diverse work settings (Thomas, 2011) that include not only industry but also cities, counties, state and federal offices as well. Due to the differences among industries, the variety of work and the uniqueness of the workers, a one-size-fits-all approach to occupational evaluations is not reasonable, but there should be similarities. NFPA 1582, “Standard on Comprehensive Occupational Medical Program for Fire Departments,” lists specific medical requirements as well as qualifying and disqualifying conditions. This comprehensive document that NIOSH supports lists detailed recommendations for medical and fitness evaluation programs for firefighters.

Quality improvement is not an end goal but a continuous process. Labeled as audits, it has been a major part of business for many years. Audits measure and evaluate program performance using a quantitative approach (Corn & Lees, 2010), which is what clinical indicators provide as well (Mainz, 2003), except the measurement of monitoring is being done by the clinician providing the service and not by someone else. Clinical indicators are tools used as reminders (Hughes, 2008) for tracking the number of times

something is ordered or used and to monitor compliance (Love, Dowell, Salmond, & Crampton, 2004). According to Mainz (2003), monitoring healthcare quality is impossible without the use of clinical indicators.

Performance and quality improvement programs in occupational health are not the same as hospital programs because of the different patient populations (well versus sick), range of conditions, settings and different outcomes of interest (work productivity versus recovery) but are similar when considering the effectiveness of services (Pransky, Benjamin, & Dembe, 2001). Programs that allow for active participation, empowerment and ownership are more likely to lead to continuous innovation and improvement (Doherty, Chopra, Nsibande, & Mngoma, 2009; Schmittl, Grumbach, & Selby, 2010; Sollecito & Johnson, 2013). The primary goal of this project was to improve practice by utilizing established guidelines, achieved through an educational program, monthly quality indicators and tracking the rate of recommended restrictions for firefighting duties

#### **Problem Statement**

Firefighter activities, such as performing fire suppression and rescue, can result in cardiovascular stress and hyperthermia (CDC, 2007; Hostler et al., 2010; Kales et al., 2003). Firefighters with low aerobic capacity have a 90% greater risk of myocardial infarction than those who are aerobically fit (Peate, Lundergan, & Johnson, 2002). Many firefighter on-duty deaths and injuries may be prevented if associated medical conditions are detected early and managed aggressively. Providing quality screening evaluations for firefighters can be complex, requiring the clinician to be aware of the demands of the job and the strong evidence that smoking, hypertension, hypercholesterolemia, previous coronary artery disease and low endurance correlate with on-duty firefighter fatalities (Kales et al., 2003). Allowing clinicians to participate in measuring the effectiveness of

their practice should provide a more comprehensive quality assessment to determine the risk of injury and illness and the potential for sudden death that would affect not only the firefighter, but also those around them as well.

### **Problem Recognition**

Approximately 70% of all fire departments nationwide, including industrial, volunteer and municipal fire departments, do not have a program to measure or maintain basic firefighter fitness and health (CDC, 2007). Sudden cardiac death is still the most common cause of on-duty death among firefighters, occurring at higher rates than those found among police or emergency medical personal (United States Fire Administration [USFA], 2002). The purpose of fitness-for-duty evaluations is to determine whether or not the employee has the physical capacity to perform the tasks without a threat to safety, health or property (Blink & Schrebststein, 2007).

A multinational oil and gas corporation with approximately 900 firefighters in periodic medical evaluation programs across the United States provides these evaluations at several different clinical sites. One of these clinical sites has a formalized physical fitness-for-duty evaluation program that follows NPFA guidelines, but the components of others are unknown. All medical providers working within this corporate structure use the same occupational evaluation guidelines, software and operational procedures but may demonstrate some differences based on their unique local practices.

Many large businesses operating in the United States that make, manufacture or refine hazardous materials are required through a consent decree with the appropriate city, county, state, or federal agency to maintain a fire brigade to mitigate untoward events. Some businesses support fire departments with full-time staff, but most rely on

volunteers willing to train on their off time for increased compensation and benefits. Mandatory participation in the fire brigade may be required if there aren't enough volunteers. Usually, firefighters share a common bond demonstrated by a spirit of mutual support (Cerroni, 2012) with a "get it done" attitude, but mandatory participation can create different viewpoints toward fitness-for-duty among organizational leaders and individual fire brigade members.

### **Project Question**

Would an educational program and implementation of a quality improvement program for health care practitioners who provide medical screening for firefighters within these varied clinical sites enhance the quality and consistency of the exams?

### **Purpose/Mission Statement**

The purpose of this project was to evaluate whether or not an educational program, followed by monthly peer reviewed quality indicators had an effect on the quality of the exams, by measuring and comparing the rate of firefighters restricted from firefighting activities.

The goal of this project was to apply the evidence and measure outcomes to determine the most effective way to ensure that firefighters in a corporate setting are healthy. A multifactorial approach is needed since firefighting and emergency medical service physical demands at times can be on a scale similar to that of high level athletes. Periodically looking at the process for evaluating fitness-for-duty, measuring outcomes and reviewing current programs are needed to determine the best approach.

Within this chosen corporate setting, physicians, nurses and ancillary clinical staff provide pulmonary, cardiovascular, audiometric, biometric testing, physical exams and follow-up recommendations. To determine whether or not increasing staff knowledge

regarding the NFPA 1582 standard, I devised an educational program. This program includes: (a) the physiological, psychological and environmental demands on firefighters; (b) listing of medical conditions that might disqualify a firefighter; and (c) appropriate follow-up for medical conditions and prescriptive rehabilitation related to fitness.

For the past few decades, clinical quality indicators have been used in continuous quality improvement programs (Campbell, Braspenning, Hutchinson, & Marshall, 2002). The development of clinical indicators and standards provides a systematic quantitative method for assessing quality of care by using performance measures. Weiner (2009) suggests that the discrepancy between current and desired performance levels can be remedied by increasing the degree that organizational members perceived a change is needed (p.7). A peer review process should help educate and enlighten nurses and staff about recommended and required exam criteria.

## CHAPTER 2

### REVIEW OF THE LITERATURE

I searched Medline, Cochrane, and, EBSCO's databases, as well as the OSHA, Cal/OSHA websites and Google Scholar using the search terms occupational surveillance, occupational exams, firefighter fitness-for-duty, firefighter fitness, quality improvement and quality improvement in occupational health.

#### **Occupational Health Surveillance Evaluations and Effectiveness**

Literature related to quality improvement and occupational health is sparse. Studies related to occupational health surveillance exams included two meta-analyses and ten primary sources. Thomsen, McClain, Rosenman and Davis (2007) reported that although surveillance of occupational disease and injuries had improved over the past decade, it still remains inadequate. They go further describing occupational surveillance as limited and fragmented with underreporting of occupational injuries and illnesses being the primary issue, as well as variability in recognition by healthcare providers of the etiology of work-related injury or illnesses.

Hulshof et al. (1999) conducted a meta-analysis of 52 studies related to occupational health services concluding there is a need for improved data driven research with less descriptive studies to move toward developing evidence-based occupational healthcare. Pransky et al. (2001) agreed, suggesting future research in this area should focus on identification of performance assessment and validity of quality indicator measures to establish a clear and consistent relationship with quality improvement measures and outcomes

Haight, Thomas, Smith, Bulfin, and Hopkins (2003) completed a 30-year literature review looking for a scientifically supported method to measure health and safety programs, finding little objective research measuring intervention activities and health and safety program outcomes. Ruotsalainen et al. (2006) reviewed 8,687 articles from general and specialized biomedical journals from 2000 to 2001, finding only 148 related to occupational health interventions and only 3% of those were on quality of care.

Occupational health services in the United Kingdom are similar to those in the United States. Robson et al. (2006) conducted a systematic literature review investigating the effectiveness of an occupational health and safety management system. These researchers went through eight bibliographic databases, finding 23 articles meeting their criteria and 13 meeting quality criteria. Only one was found to be of high methodological quality, with the remainder having moderate limitations. Their research found that the studies done were, for the most part, related to implementation of programs, and few looked at results or outcomes. However, those with results suggested that interventions did decrease lost time injury rates and increase workplace productivity.

. The research reviewed demonstrates the need for occupational surveillance programs to provide more integrated services that include quality improvement measures and outcome tracking. Kauppinen and Toikkanen (1999) suggest the use of comparative statistics for surveillance exams, as this may reveal gaps in the identification of occupational diseases and stimulate dialog for the appropriateness of practices that is ultimately the cornerstone of quality improvement.



## **Firefighter Fitness-for-Duty**

A plethora of literature exists regarding the hazards of firefighting that relate to exposure to toxic agents such as carbon monoxide, hydrogen cyanide and particulate matter, as well as heat, noise and fatigue. Firefighters have increased risk for cardiovascular events due to the surge of sympathetic nervous system activity and continued increased heart rate due to the physical demands of firefighting (Barnard & Duncan, 1975; Hurley, Glasser & Phelps, 1980; Kuorinka & Korhonen, 1981). There is strong evidence of increased risk of death from heart disease among firefighters (Choi, 2000) due to increased physical load from their protective equipment with psychological and physiological stressors causing strain on those who are not physical fit to perform their duties (Byczek, Walton, Contrad, Beichelt & Samo, 2004).

Leffer and Grizzell (2010) implemented a wellness program in Howard County, Maryland involving 252 firefighters applying the 2007 NFPA standard resulting in a 40% reduction in OSHA recordable injuries during the first year and a 60% reduction in the second year. These researchers also documented firefighter weight loss during this intervention period, indicating a potential to decrease modifiable cardiac risk factors among firefighters by applying these standards.

Scanlon and Ablah (2008) conducted a survey of volunteer firefighter's representing 79 fire departments in New York, finding firefighters expressed a need to learn more about cardiovascular risk factors and recommending that fire departments take a more active role in helping firefighters improve their health. Angerer, Kadlez-Beghardt, Delius, Raluca and Nowalk (2008) compared the cardiovascular and thermal strain of actual firefighting activities to the medical evaluations, finding the maximum

heart rate during fire suppression activities was 66% higher than aerobic exercises in 84% of subjects. They conclude that medical examinations should include exercise stress tests that produce heart rates similar to those required in a real emergency and limited only by exhaustion or age-predicted maximum heart rates.

Reviewing literature regarding the quality of firefighter fitness-for-duty evaluations nets few results. Kales et al. (1998) analyzed results from 340 medical examinations completed for hazardous material firefighters. They found 10% of the firefighters with elevated blood pressure, 13% with visual acuity issues and 38% with abnormal audiometry, concluding that up to 5% of that cohort should have failed the exam but passed instead.

Huss, Williamson, Alvis, & Hewitt (2011) evaluated 72 employees who participated in hazardous materials releases throughout the United States, finding 74% at risk for metabolic syndrome and 72% overweight or obese. They also found new cases of hypertension, pre-hypertension, and pre-diabetes and one newly diagnosed non-insulin dependent diabetic. In these evaluations, the authors point out the value in identifying health conditions early to ensure immediate treatment to prevent further disease progression. The Soteriades et al. (2005) prospective cohort study of 332 firefighters found normal weight firefighters gained 1.1 pounds and firefighters with a BMI of over 35 gained 1.9 pounds per year of active duty over a five-year period of time. Drew-Nord, Hong, and Froelicher (2009) stressed that quality cardiopulmonary assessments are crucial to detect and treat any underlying cardiovascular disease and ensure firefighter fitness-for-duty.

A literature search of physical fitness programs that successfully predict fitness for firefighting activities revealed seven relevant primary studies. Adams, Yanowitz, and Chandler (1986) conducted a 14-week study involving 55 firefighters comparing 25 enrolled in an exercise program and 26 maintaining their normal lifestyle. These researchers concluded that a regular exercise program is beneficial for improving exercise capacity and job performance.

Kales et al. (1999) correlated higher rates of morbidity in firefighters to low predicted maximal oxygen consumption (VO<sub>2</sub>max), higher age, lower pulmonary function, increased cholesterol and greater BMI. This suggests multiple risk factor models are helpful in identifying firefighters with poor health and increased coronary heart disease risk. Garver et al. (2005) compared the working conditions, physical fitness and exercise training programs of an industrial fire department to a municipal fire department, finding that both demonstrated similar high degrees of physical fitness and similar blood lipid concentrations, blood pressure levels and cardiac risk factors. These researchers recommended that fire departments schedule on-duty times for exercise and offer well-equipped facilities.

Researchers in the United Kingdom collected data on 398 full time and 48 part-time firefighter recruits participating in training finding increased injuries associated with lower endurance measured by VO<sub>2</sub>max (Wynn & Hawdon, 2011). Peate, Lundergan, and Johnson (2002) found there was no association between the firefighters' self-perception of their physical fitness and their aerobic capacity as measured by VO<sub>2</sub>max.

Louhevaara et al. (1993) studied the cardiac strain of a job-related test drill, maximal oxygen consumption (VO<sub>2</sub>max) and the age of 59 male firefighters, concluding

that a test drill could accurately rate physical work capacity. These researchers concluded that there is a need for practical methods to rate the physical work capacity of firefighters to avoid untoward events. Punakallio, Lindholm, Luukkonen, and Lusa (2012) examined specific lifestyle factors and aerobic capacity in firefighters over thirteen years, finding that regular exercises four to five times a week was the best predictive factor for continuing high aerobic capacity. Inversely, they found that regular smoking and excessive alcohol intake were risk factors for decline in aerobic capacity or endurance.

This review demonstrates that multiple risk factor models are helpful in identifying firefighters with low endurance, poor health and increased coronary heart disease risk. Higher rates of morbidity in firefighters have been linked to low VO2max, higher age, lower pulmonary function, increased cholesterol and greater BMI, pointing to the need for comprehensive screening that includes physical fitness assessments with adherence to NFPA standards.

### **Quality Improvement**

A search for research studies of quality improvement in outpatient settings found five primary studies relevant to this project. One study by Love, Dowell, Salmond, and Crampton (2004) analyzed 129,079 claims for general accident-related back pain that was managed by 2,679 general practitioners in New Zealand. They used quality indicators to measure the percentage of cases referred to physiotherapy and specialist assessment, finding most of these referrals were made by chance. The authors recommended performance indicators be used across entire populations of practitioners instead of focusing only on those who are extremely high-referring.

Within a large medical center in Boston, Roberts et al. (2009) implemented a quality improvement program aimed at provider adherence to chronic obstructive pulmonary disease and asthma guidelines. Every month they collected data and provided feedback to the supervising physicians, along with confidential scorecards to the individual providers. Within two years, they documented significant improvement in guideline adherence.

Hughes (2008) describes the rationale behind measuring quality improvement as the principle that good performance reflects good quality practice and that comparing performance between providers and organizations will encourage better quality. Finally, Bundy (2010) reported that she found statistically significant improvement in provider compliance related to the use and completion of a written asthma action plan following educational in-service.

Summarizing, the use of quality indicators, measuring provider adherence to guidelines and comparing performance results between providers and organizations may improve compliance that should positively affect outcomes.

## CHAPTER 3

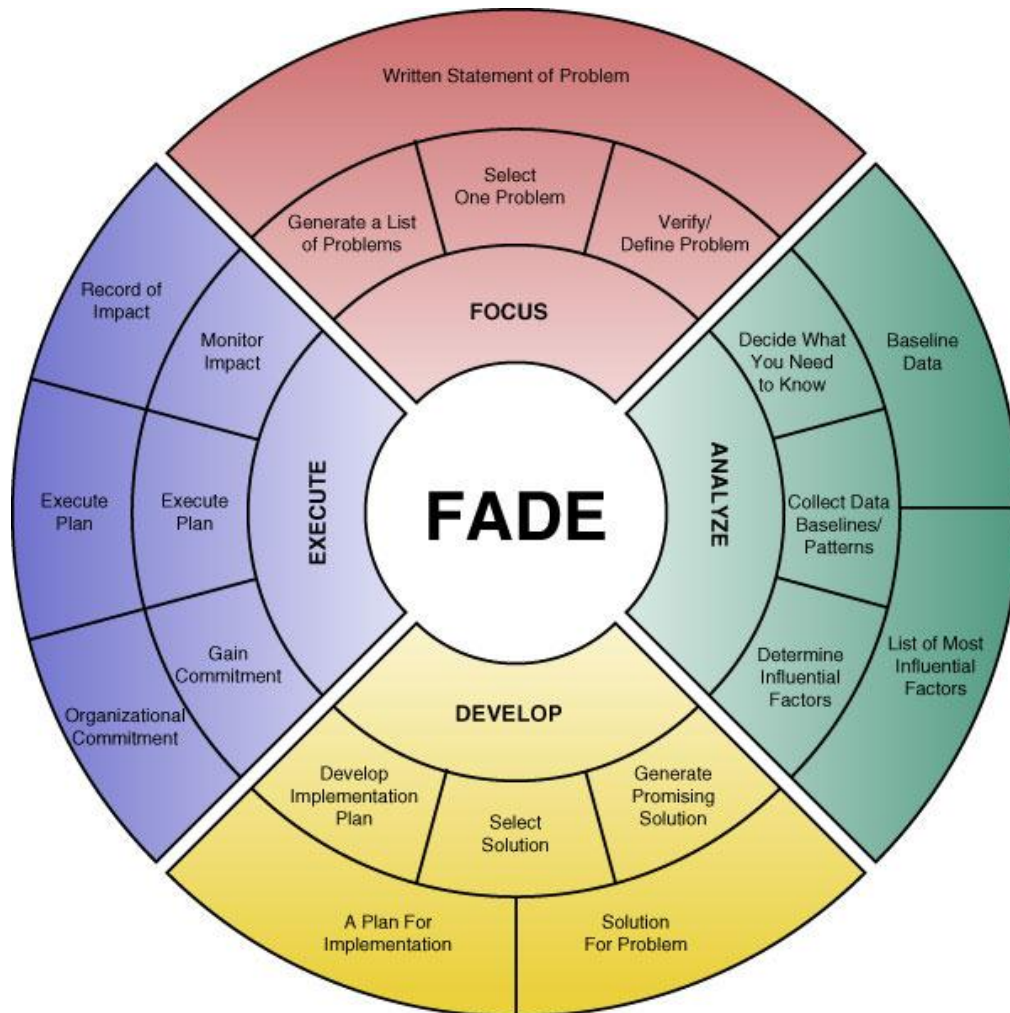
### THEORETICAL UNDERPINNINGS

Change is something organizations, professional practice and even families anticipate will be met with resistance of some kind (Borkowski, 2009; Northouse, 2010; Sollecito & Johnson, 2013). In 1867 Florence Nightingale wrote “she who perpetuates the ‘blunders of her predecessors’ is often called an experienced nurse” (Skretkowitz, 2010, p. 98) and goes on to encourage nurses to focus not on “how it has always been done,” but to use observation and promote change in patient care. Kurt Lewin in the 1940’s developed a three-step process model, known as Unfreeze – Change – Refreeze, to explain the forces and direction of change that is still used today (Borkowski, 2009).

This project used Lewin’s conceptual model of change to: (a) reduce the restraining forces (Unfreeze) by emphasizing the inconsistency between current and desired performance by stressing outcomes; (b) increase dissatisfaction (Change) by encouraging participation and empowerment; and (c) embracing the change (Refreeze) by sharing what is learned. Allowing and encouraging participation in the project gives stakeholders the opportunity to accept and buy into change (Borkowski, 2009). If the clinicians understand how this quality improvement pilot can benefit them, they are more likely to embrace the change (Weiner, 2009)

The FADE Model of quality improvement, developed by the Organizational Dynamics Institute in Wakefield, MA (<http://www.patientsafetyed.duhs.duke.edu>) and published by The Joint Commission (Davis, 2000) was utilized in this project. This model contains four broad cyclic steps: (a) Focus, to define the problem and verify the process for improvement; (b) Analyze, involves collecting and analyzing data to establish a baseline, identify root causes and point toward possible solutions; (c) Develop, includes

development of action plans for improvement that include implementation, communication and measuring/monitoring; and (d) Execute, that comprises implementation of the plan on a pilot basis and installing an ongoing process to ensure success.



*Figure 1.* Graphic model of FADE process, used with permission from the Department of Community and Family Medicine; Duke University Medical Center (January 14, 2013) ([http://patientsafetyed.duhs.duke.edu/module\\_a/methods/fade.html](http://patientsafetyed.duhs.duke.edu/module_a/methods/fade.html))

## CHAPTER 4

### PROJECT PLAN

The short-term objectives for this project were twofold. The first was to measure, analyze and understand the current practice used to ensure that firefighters in this corporate structure are physically fit for duty. The second short-term objective involved implementing an educational program with a pilot quality improvement process related to these evaluations. The long-term objective was ensuring the health of the firefighters, employees and community through a continuous quality improvement program.

My project involved four oil refinery occupational health clinics and their associated fire brigades located throughout the United States. To understand the current fit-for-duty physical fitness testing conducted at each site, I sent a survey to the fire chiefs responsible for these brigades. Looking at the effectiveness of past screening exams, I conducted a retrospective analysis from 2006, 2008 and 2011 to measure the frequency of firefighter exams that resulted in recommended restrictions. A one-hour educational program was provided to the clinicians working within these clinical sites followed by a three-month pilot peer review quality improvement program, using an indicator that had been reviewed by five expert clinicians and monthly tracking of exams resulting in recommended work restrictions.

After receiving approval from the corporation through their Human Research Ethics Committee and the University of Nevada, Las Vegas Institutional Review Board the educational program session was scheduled with invitations and informed consent forms sent to the clinicians working within the clinics involved. The retrospective review



was initiated and the surveys with informed consent forms were sent to the Fire Chiefs for the respective sites.

The educational program session was conducted via on-line meeting on October 8, 2012 with a pre- and post-test for those participating. Following the initial educational program, two nurses volunteered to participate in the monthly peer review. The next week, as a trial, the three of us by way of an on-line meeting evaluated five randomly selected firefighter exam records using the quality indicator for grading. These records were selected from the pool fire brigade periodic and initial exams completed by the four clinical sites during the month of September, 2012.

The first week of each subsequent month (November, December and January), I generated an Excel report to list the fire brigade exams (both periodic and initial) conducted the previous month within the four clinics. Each of the exams was assigned a random number and selected for review by alternating each month choosing five records assigned higher numbers and the next month the lower numbers. Patient identifying information was removed from the records selected for review; they were copied and mailed to the peer review nurses, with the quality indicators, at the beginning of each month. The same records were sent to the two peer review nurses for inter-rater reliability as agreement may vary on line items incorporated in the quality indicator. Completed indicators were faxed back, and the copied records destroyed. Individualized score cards were disseminated to the clinicians each month providing them with their overall scores and pertinent comments from the indicators. Cumulative score cards were provided to the clinical managers responsible for those sites without the clinicians name or identification, just the overall score and any pertinent comments from the indicators.

The retrospective review of firefighter exams associated with restrictions was completed in October for the four clinical sites reviewing 2006, 2008 and 2011 records. The purpose for this review was to establish a baseline rate to factor changes in staffing over time. A monthly analysis of firefighter exams associated with restrictions was undertaken for October, November and December (2012) looking for an increase in the restrictions that may indicate improvement in the quality of the evaluations provided.

### **Evaluation Plan**

This project was aimed at improving the quality of the medical screening exams for firefighters and to evaluate how physical fitness testing was being conducted. Kales et al. (2003) suggested that untimely deaths can be prevented by restricting firefighters from strenuous duties when certain cardiovascular risk factors are noted. Therefore, measuring the number of firefighters placed on restricted duty related to firefighting tasks as a result of past and present fitness and screening evaluations should indicate the effectiveness of the program. SPSS and Excel were used to measure frequencies and tabulate results.

Using the FADE system, Focus is related to firefighter fitness-for-duty assessments, listing the problems as

- Physical fitness assessments are being conducted differently at different sites within the same corporate structure.
- Clinical staff may or may not be aware of the NFPA 1582 standards and research done by NIOSH (1998 – 2003).

The Analyze portion includes collecting the data related to

- the methods utilized to assess firefighter physical fitness
- the clinician's baseline knowledge of the standards
- The frequency of recommended work restrictions based on firefighter screening exams.

The Develop section of FADE involves generating solutions for the problems identified and confirmed in Analysis. This project involved the development and delivery of an educational program, followed by a pilot peer review quality improvement plan, considered the Execute part of FADE. After execution, the model prompts a reassessment (back to Focus) to verify the process has been improved and to continue to generate a longitudinal perspective of cycling within the circle to reassess, analyze, develop and execute.

## CHAPTER 5

### RESULTS

The first objective of this project was to measure, analyze and understand the current practice used to ensure that firefighters in this corporate structure were physically fit for duty. To understand what the different fire brigades were using to measure physical fitness, I sent an e-mail invitation with a consent form to the four Chiefs responsible for the four fire brigades. Two consent forms were returned, but only one questionnaire was returned. The one questionnaire returned indicated as a fire brigade they assessed firefighter flexibility only and deferred to the medical screening to determine strength and physical fitness assessments. Therefore answering the question of how physical fitness and endurance testing of firefighters is conducted is still unknown, but it appears that a program is not in place.

The second objective of this project was to try to improve the quality of firefighter fitness for duty screening through an educational program for the clinicians performing these screening exams, followed by monthly quality improvement indicators. Although 18 clinicians met the inclusion criteria for participating in this project only eight (44%) participated in the educational program. The pre and post test scores showed an average of 35.75% improvement with a range of zero to 71.

The post testing showed overall improvement, but particularly with question six that covered VO2max (endurance testing) assessments (Table 1). The Joint Task Force of the International Association of Firefighters and International Association of Fire Chiefs created a joint Labor Management Wellness-Fitness Initiative (WFI) in 1997, revised in 1999 and 2008 (Joint Task Force). The intent was to improve firefighter

function, on-duty effectiveness and overall quality of life, while reducing morbidity and mortality related to firefighting (<http://www.iaff.org/HS/Well/wellness.html>). This organization recognizes VO2max testing as an objective, clinical measure to define the limits of cardiopulmonary function (Drew-Nord et al., 2011).

Table 1

*Pre and Post Test Details*

	N	Pre-Test*	Post-Test*
Question 1	8	87.5%	87.5%
Question 2	8	85.7%	100%
Question 3	8	37.5%	100%
Question 4	8	87.5%	100%
Question 5	8	25%	87.5%
Question 6	8	12.5%	100%

\*The percentage of correct answers

Prior to implementing this project, based on the retrospective review, the average rate of recommended firefighter task restrictions placed by a clinician within these four clinic sites as a result of a screening exam was approximately 2.2% (Table 2). The percentage rate of restrictions associated with screening exams in the three months following the implementation of this project was 3.6%, (Table 4) an increase of 1.4%.

Table 2

*Retrospective Review*

Clinic	Year	Screening Exams (N)	Restrictions (N)
Clinic A	2006	82	0
Clinic A	2008	141	3
Clinic A	2011	144	3
Clinic B	2006	29	0
Clinic B	2008	27	0
Clinic B	2011	21	0
Clinic C	2006	68	6
Clinic C	2008	59	1
Clinic C	2011	65	5
Clinic D	2006	143	5
Clinic D	2008	152	0
Clinic D	2011	96	0
Totals		1027	23 (2.2%)

Table 3

*Number of Restrictions Resulting from Screening Exams during the Project Period*

Clinic	Month	Screening Exams (N)	Restrictions (N)
Clinic A	October	4	0
Clinic A	November	6	0
Clinic A	December	7	1
Clinic B	October	3	0
Clinic B	November	0	0
Clinic B	December	0	0
Clinic C	October	6	0
Clinic C	November	10	1
Clinic C	December	0	0
Clinic D	October	5	0
Clinic D	November	7	0
Clinic D	December	7	0
Total		55	2 (3.6%)

The results of the monthly chart review were mixed. Although the same documents were sent to the two volunteer nurse reviewers, their responses were very different but seemed to become more aligned as the project progressed, with the last month almost identical in their grading (Table 4). It was expected that when reviewing a chart, a correct response could be “no” and “n/a.” However, some of the differences were significant with one reviewer indicating a “yes” and another “no” on basic indices such as was an HbA1c done. After the first month it was apparent that some of the

questions on the peer review tool became somewhat problematic, primarily surround the screening PFT (Table 5).

Table 4

*Monthly Chart Review*

	Month	N	M %	Mdn %	Mode %	SD	Kurtosis	Skewness
Reviewer 1	October	5	85	83	83	6.36	0.207	0.368
Reviewer 2	October	5	93.2	100	100	9.31	-3.33	-0.608
Reviewer 3	November	5	91.8	95.2	94	6.49	-0.43	-0.24
Reviewer 4	November	5	95.2	94	94	5.01	-0.61	-0.51
Reviewer 1	December	4	94	94	100	6.92	-6	0
Reviewer 2	December	4	90.5	94	100	12.36	-0.6	-0.98

*Note: Percentage of meeting all items on the indicator.*



Table 5

*Results of Peer Review*

	N	Missing	Yes	No	N/A	SD
1. Record was legible	28	0	100%			.000
2. Signed by Provider	28	0	82.1%		17.9%	.780
3. Questionnaire reviewed by clinician	28	0	67.9%	17.9%	14.3%	.744
4. Routine medications were noted	28	0	92.9%	7.1%		.262
5. Diagnosis provided	28	0	96.3%	3.7%		.192
6. Health risks were identified	28	0	75%	25%		.441
7. NFPA disqualifying conditions were noted	28	0	14.3%	46.4%	39.3%	.701
8. HbA1c was performed	28	0	7.1%	21.4%	71.4%	.621
9. Current smoking was noted	28	0	78.6%	21.4%		.418
10. Hx of CAD noted	28	0	14.3%	71.4%	14.3%	.544
11. Recommended restrictions documented	28	0	14.3%	85.7%		.356
12. Extremities were evaluated	28	0	100%			.000
13. Screening PFT was performed	28	1	63%	37%		.492
14. Calibration check the day of PFT documented	28	1	18.5%	11.1%	70.4%	.802
15. The PFT had minimum 3 with reproduced results	28	1	63%	3.7%	33.3%	.953
16. Was a VO2max calculated?	28	1		44%	55.6%	.506
17. Health risks and recommendations communicated to the patient	28	0	82.1%	17.9%		.390
18. Exam results communicated in understandable language to the patient	28	0	89.3%		10.7%	.630

The measured outcomes for this project did not indicate that there was a difference between clinicians who actively participate in measuring the effectiveness of their practice showing increased quality improvement compared to the clinicians who receive scorecards (passive participation) (Figure 2).

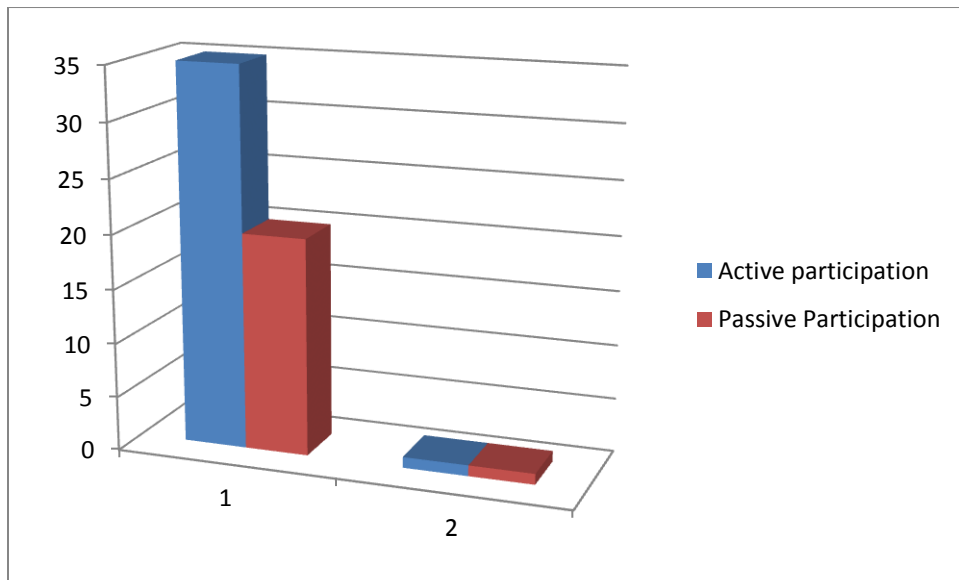


Figure 2. 1 = Number of screening exams conducted during this pilot. 2= the number of restrictions associated with those exams.

## CHAPTER 6

### DISCUSSION

Sollecito and Johnson (2013) describe an organization whose goal is to continuously improve as having a “culture of excellence” achieved through: (a) emphasizing the customer, (b) optimizing the system and creating synergy, (c) understanding the causes of variation and importance of measurement, (d) teamwork, and (e) communication and feedback (p. 63-64). This project was a pilot quality improvement initiative attempting to incorporate these goals. Although the project tracked data for only three months, there was a modest overall improvement in the frequency of recommended work-restrictions associated with screening exams.

The educational program discussing and encouraging VO2max assessments was clearly understood by the participants as demonstrated by the 87.5% improved post-test score, but not considered in any of the charts reviewed. To protect firefighters from potentially life-threatening cardiac situations at work, it's imperative to evaluate physical fitness and endurance. VO2max is an inexpensive, simple, valid tool to assess endurance and track improvement in cardiovascular training programs (Drew-Nord et al., 2011). Without this type of evaluation tool, screening exams are looking for absence of disease, but not fitness-for-duty. It takes time to make changes, especially within a corporate structure. Perhaps if the pilot program had lasted for six months or longer, clinicians may have consider using a VO2max to determine fitness, especially with those patients who were marginal, demonstrating hypertension, smoking, and hypercholesterolemia.

Although there was an increase in the rate of restrictions associated with screening exams after implementing this pilot quality improvement project, it is not

possible to assess whether it was the Hawthorne Effect or the result of more unfit employees or whether there will be a change in practice that is sustainable. Change is difficult and influenced by a number of complex factors, such as motivation, understanding and time (Cohen et al., 2004). A key argument for continued quality improvement is not only the direct impact on quality as a net gain to the consumer, but as workers become more involved, they also become more empowered through participation in decision making (Sollecito & Johnson, 2013). The clinicians participating in the peer review process stated they developed a new understanding of firefighter fitness-for-duty screening and felt it changed the way they approach routine exams.

Fryar, Hirsch, Eberhardt, Yoon, and Wright in the April, 2010 report for the CDC describe that 45% of adults age 20 and over living in the U.S. have hypertension, hypercholesterolemia or diabetes, with 3% of adults having all three chronic conditions, many not diagnosed. Huebner, Wojcik, Rosamilia, Jorgensen, and Milano (2004) conducted a cohort mortality study of two petrochemical plants finding 1.17-2.8 standardized mortality rates associated with hypertension and heart disease. Coombs (1998) looking at morbidity of 5,000 petroleum workers and 15,000 retirees from 1979 to 1990 from the Caribbean found ischemic heart disease responsible for 24.73% of the deaths. Although, there is no target number of restrictions associated with screening exams, based this data, a restriction rate of at least 2%-3% would be expected.

As discussed earlier, the “Peer Review Tool” had some issues that were not initially recognized during the validity review. Quality indicators describe the performance that should occur for a particular type of patient that is consistent with evidence-based standards of care (Mainz, 2003). A simple to fix issue with the third

question became evident during the initial training session with the volunteer peer reviewers. This question asked if the associated questionnaire had been reviewed and signed by the clinician. Unfortunately the forms utilized for this specific exam type did not have a space or area for the clinician to sign, hence the conflicting results.

There was some controversy with regard to the questions surrounding the screening pulmonary function test (PFT). PFT is the cornerstone of occupational respiratory evaluation programs and the most common diagnostic test used for measuring lung function (Townsend, 2011). OSHA and the Joint Task Force (2008) recommend medical and fitness evaluation of firefighters that includes PFT screening (<http://www.iaff.org/hs/Resi/pulmonary%20function%20tests.htm>). The goal of this screening is to monitor changes over time and to treat abnormalities before they become clinically significant (Miller et al., 2005). Question number 14 states “The spirometer was calibrated the day of the screening, according to the equipment manufacturer’s specification.” Daily calibration check has been recommended by the American Thoracic Society, the European Respiratory Society and strongly endorsed by the American College of Occupational and Environmental Medicine . The issue with the indicator was that some PFT results printed the date of the last calibration check and others did not, creating conflicting results. This also created some anxiety on the part of the reviewers, as they knew the daily check was completed and documented in a log, resulting in marking the indicator “n/a.” It is not required that the last daily calibration check be printed on the test results, but it is recommended.

Although most of the results from this project were as expected, some were surprising. This student expected to find that none of the clinical sites had an established

method to test physical fitness, although that is still unknown. The lack of participation in returning the questionnaires was surprising. It's unknown if the reason for non-participation was related to lack of time, issues surround psychological safety within a competitive corporate structure or they just didn't want to be bothered.

Threats and barriers pertaining to this project involved lack of participation and perhaps empowerment to make change. Attribution theory, a concept from social psychology, explains that people are sometimes more concerned with perception than reality (Borkowski, 2009). Attribution is a manner of explaining an event or behavior (Harvey & Martinko, 1995), for example a car speeds by on the freeway, one might think they are in hurry to get somewhere. We attribute work place outcomes to internal and external variables, with corresponding emotional responses that affect behavioral motivation (Borkowski, 2009). After repeated perceived failures, people often become passive and unmotivated, developing what has been termed "learned helplessness" (Harvey & Martinko, 1995). Borkowski (2009) specifically describes organizational policies and management behaviors responsible for inhibiting employee motivation. Therefore, some may perceive asking for participation in a new quality improvement pilot within a culture that does not favor individual inventiveness as threatening or uncomfortable.

The goal of a fitness-for-duty exam or evaluation is to ensure that the worker are able to safely perform the essential physical, psychological and cognitive requirements of their job without risk to self, co-workers or the environment. If the evaluation pertains only to the presence or absence of pathology and does not measure the actual physical fitness of the individual, how are we, as clinicians verifying their fitness-for-duty? This

purpose of this project was to determine whether or not firefighter physical fitness was being evaluated and to enhance the quality and consistency of the exams being conducted through an educational program followed by a quality improvement pilot. With only one of four Fire Chiefs responding to the survey, indicating that physical fitness evaluation is conducted by the medical evaluators, it is still unknown what method is used in the other clinical locations involved in this project. But, because the quality indicator showed that VO2max (endurance testing) was not considered in the medical evaluations, it may be assumed that physical fitness and endurance are not being evaluated.

The answer to the project question of whether the quality of screening exams for firefighters would improve following an educational program and implementation of a quality improvement pilot is mixed. There was some indication of improvement: (a) The rate of restrictions associated with screening exams increased by 1.4% compared to previous years; and (b) The quality of the exams showed significant improvement in the last month of review. But overall, there was insufficient time to see if these improvements were sustained. Recommendations for future study are to continue the pilot quality improvement peer review process for another six months and incorporate an annual physical fitness evaluation pilot at one of the sites that would include VO2max, strength and flexibility assessments as recommended by The Joint Taskforce.

Research has long supported the concept that evidence based practice (EBP) leads to a higher quality of care, improved patient outcomes, reduced healthcare costs and greater job satisfaction (Porter-O'Grady, 2009). But, despite this, only a small percentage of clinicians consistently use this approach to care, due to resistance from colleagues, managers and nursing leaders (Melyn & Finout-Overholt, 2012). One of the

roles of a Doctor of Nursing Practice (DNP) trained clinician is to utilize skills toward evaluating, integrating and implementing EBP) (Chism, 2013), in order to foster a climate that supports best practices for optimal patient outcomes.

In occupational health, there can be a wide diversity of practice between individual practitioners, as quality assurance has historically been in the form of audits looking at quality of care through cost effectiveness and legal compliance only (Hattingh & Acutt, 2008). We owe it to the firefighters and all of the people we come in contact with to provide the best care possible, to think outside the box, to question practice, use EBP and consistently measure outcomes to evaluate our practice.



## APPENDIX A: QUESTIONNAIRE FOR FIRE CHIEF

### Fit-For-Duty Fire Brigade Questionnaire/ Survey

Date \_\_\_\_\_ Name of Chief or Deputy Chief completing form \_\_\_\_\_

Organization or Site \_\_\_\_\_

*This survey is intended to collect information pertaining to how physical fitness testing for Fire Brigade participation is being conducted. The information given here will be shared with MOH leadership as part of a nursing capstone project regarding quality improvement of fire brigade exams and fitness for duty.*

Questions	Yes	No	Partial	N / A
<i>(I would like a copy of the results of this survey when completed)</i>				
<b>1. Our fire brigade conducts annual fitness for duty evaluations, which include strength, endurance and flexibility testing</b> <b>Comments:</b> _____ _____ _____				
<b>2. Our fire brigade conducts physical fitness testing periodically, which includes strength and flexibility only.</b> <b>Comments:</b> _____ _____ _____				
<b>3. We test physical fitness when entering the brigade only.</b>				
<b>4. Our fire brigade does not conduct physical fitness testing.</b>				
<b>5. If the answer to # 1 was Yes:</b> <b>Please provide a sample or list what activities are tested:</b> _____ _____ _____ _____				
<b>6. If the answer to #2 was Yes:</b> <b>Please provide a sample or list what activities are tested:</b> _____ _____ _____ _____				

<b>7. As Fire Chief or his/her representative, how do you feel about your current program?</b>	<input type="checkbox"/> Confident <input type="checkbox"/> Adequate <input type="checkbox"/> Needs Improvement

Other comments (or concerns):

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## APPENDIX B: PEER REVIEW TOOL

### Quality Improvement Indicator: Periodic Fire Brigade Exams

*Purpose: "To identify any medical condition which would prevent an employee from safely participating in emergency response activities such as fire, medical or confined space response and hazardous waste operations."*

Date of Exam/Encounter \_\_\_\_\_ Clinician Providing the Exam \_\_\_\_\_

Reviewer \_\_\_\_\_ Date of Review \_\_\_\_\_

Criteria	Yes	No	N/A
<b>Clinical Records Documentation</b>			
1. The record is legible	X		
2. Clinicians entries are dated, signed and indicate title.	X		
<b>Assessment</b>			
3. Health Questionnaire has been reviewed and signed by clinician.	X		
4. Current medications and allergies are noted on record.	X		
<b>Diagnosis</b>			
5. The Assessment/ diagnosis are appropriate and based on history, physical exam and clinical findings.	X		
6. Health risks and needs are identified	X		
7. Identification of the presence of any disqualifying medical condition was noted and reported ( See NFPA 1582 list)	x	x	x
8. Is there a note documenting a review for Type I diabetic patients - one year hx of HbA1c < 8, and have been monitored twice a year. Type II show 3 month hx of HbA1c < 8 twice in the last year. (NFPA 1582)	X only for diabetics		
9. Was there an assessment of current smoking, hypercholesterolemia, and hypertension noted?	x		
10. Is there documentation of any history or Coronary Artery Disease or prior occlusive condition?		x	
11. Are any restrictions from firefighting tasks recommended?	x	x	
12. Were the extremities assessed?	x		
<b>Associated Procedures</b>			
13. A screening PFT was completed (NFPA 1582 – 7.7.4.1-3)	x	x	
14. The spirometer was calibrated the day of the screening, according to the equipment manufacturer's specifications. (ATS/ERS Spirometry Standard, 2005)	x		
15. A minimum of 3 and maximum of 8 FVC attempts are documented with at least two reproduced able results. (ATS/ERS Spirometry Standard, 2005)	x		
16. Was a VO2max calculated, either during medical screening or physical fitness testing?	x	x	x
<b>Follow-Up</b>			
17. Health risks and recommendations are communicated to the patient.	x		
18. Examination results were provided to the patient in understandable language	x		

Comments:

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*Note: Target Organ Systems Any system with a condition that might produce an incapacitating condition, primarily Musculoskeletal, Cardiovascular and Respiratory.*

## APPENDIX C: DETAILED TIMELINE

<i>Due Date</i>	<i>Category/Objective</i>	<i>Task</i>	<i>Status</i>
9/24/12	<b>Project Approval</b>	<p>1. Once IRB approval has been obtained – schedule one hour educational program session. Invite clinicians from the</p> <ul style="list-style-type: none"> <li>• Clinic A</li> <li>• Clinic B</li> <li>• Clinic C</li> <li>• Clinic D</li> </ul> <p>At the end of the class ask for two volunteers willing to review five (5) charts once a month and complete a quality improvement indicator. Keep those two volunteers an extra 20-30 minutes to review the process.</p> <p>2. Start retrospective review of firefighter fitness-for-duty screening exams conducted at the above clinical sites for the years 2006- 2008 -2011. (This will be aggregate data only listing the number of screening exams and the number of work restrictions associated with those exams. )</p>	
October 1-5	<b>Fitness-for-duty (FFD)</b>	Send questionnaire to Fire Chiefs, give deadline for return of 2 weeks.	
	<b>QI Pilot</b>	Start peer review process. October, November, and December	
Monthly : October, November, December	<b>Review results</b>	<p>1. At the beginning of each month send 5 (five) screening exam records to the two volunteer clinicians for review. Identifying information will be removed, known only to the student researcher.</p> <p>2. Continue to monitor at the end of the month the number</p>	

		<b>of screening exams and the number of restrictions associated with these exams, looking at only the four clinical sites listed.</b>	
January 2013	<b>Evaluate results</b>		

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# VITA

## JULIE C. ROCHEFORT RN, MSN, NP-C

### SUMMARY OF QUALIFICATIONS

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Advanced Practice Nurse with over 25 years of nursing experience.  
Project planning and execution  
Leadership in Occupational Health Nursing Organizations

### EDUCATION

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2011 – 2013 Current student in Doctorate of Nursing Practice  
Program at University of Nevada, Las Vegas/Reno (combined  
program)

2004 – 2006 UCLA School of Nursing – Adult Nurse Practitioner  
Program – Occupational and Environmental Health Specialty.  
*Masters of Science in Nursing*

1996 - 1998 California State University - Dominguez Hills  
*Carson, Ca*  
*Bachelor of Science in Nursing*

1986 AA in Nursing from El Camino College

### PROFESSIONAL EXPERIENCE

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**1997 - present ExxonMobil Medicine and Occupational Health**  
Torrance, Ca 90504  
*Occupational Health Nurse / Adult Nurse Practitioner*

1996-1997 IMC Healthcare - Continental Airlines  
*Occupational Health Nurse*

1995 - 1996 Little Co of Mary Hospital Emergency Department  
*Clinical Supervisor*

1995 - 1996 Torrance Memorial Emergency Department  
*Staff Nurse*

1987 - 1995 Daniel Freeman Marina Emergency Department  
*Charge Nurse with Extended Responsibility*

### PROFESSIONAL PRESENTATIONS

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Presented at California State Annual Conference, Walnut Creek,  
CA October 14, 2011, "State of the State. How are we doing?"

Presented at AAOHN National Conference, Anaheim, CA, April

2010, *“Navigating the Guidelines Superhighway”*.

Presented at Tri-Association Annual Conference, Long Beach, Ca February 2009, *“Is this what I wanted to be when I grew up”, History of Nursing and where we may want to be.*

Presented at California State Occupational Health Nurses Annual Conference, San Diego, Ca October 2008, *Orthopedic exams for foot and ankle.*

Provide annual Bloodborne Pathogens Training for ExxonMobil Clinical Sites and Fire Brigade members annually since 2000.

American Heart Association Certified CPR and First Aid Instructor

Wrote the Benzene Surveillance Guidelines for CSAOHN practice Guidelines in 2000.

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#### PROFESSIONAL MEMBERSHIPS

Past President of California State Occupational Health Nurses. 2003 – 2005

Past President-elect of California State Occupational Health Nurses 2001-2003

Past President of California Harbor Area Association of Occupational Health Nurses 1999 – 2001; 2002-2012

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#### OBJECTIVE

To make a difference in the lives of the patients, colleagues and the community.

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#### INTERESTS AND ACTIVITIES

Hiking - fishing - enjoy time with my family

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#### VOLUNTEER EXPERIENCE

Habitat for Humanity

St. Joseph's Center

Feral Cat Rescue

Tecate Mission – Tecate Mexico

